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MUSHROOM TO OZONIDES

MUSHROOM. The edible fungus of this name is known botanically as *Agaricus campestris* or *Psalliota campestris*. It grows in short grass in the temperate regions of all parts of the world. Many edible fungi depend upon minute and often obscure botanical characters for their determination, and may readily be confounded with worthless or poisonous species; but that is not the case with the common mushroom, for, although several other species of *Agaricus* somewhat closely approach it in form and colour, yet the true mushroom, if sound and freshly gathered may be distinguished from all other fungi with ease. It almost invariably grows in rich, open, breezy pastures, in places where the grass is kept short by the grazing of horses, herds and flocks. Although this plant is popularly termed the "meadow mushroom," it never as a rule grows in meadows. It never grows in wet boggy places, never in woods, or on or about stumps of trees. An exceptional specimen or an uncommon variety may sometimes be seen in the above-mentioned abnormal places, but the best, the true, and common variety of the table is the product of short, upland, wind-swept pastures. A true mushroom is never large in size; its cap very seldom exceeds 4, at most 5 in. in diameter. The large examples measuring from 6 to 9 or more in. across the cap belong to *Agaricus arvensis*, called from its large size and coarse texture the horse mushroom, which grows in meadows and damp shady places, and though generally wholesome is coarse and of inferior flavour. The mushroom usually grown in gardens or hot-beds, in cellars, sheds, etc., is a distinct species known as *Agaricus hortensis*. On being cut or broken the flesh of a true mushroom remains white or nearly so, the flesh of the coarser horse mushroom changes to buff or sometimes to dark brown. To summarize the characters of a true mushroom—it grows only in pastures; it is of small size, dry, and with unchangeable flesh; the cap has a frill; the gills are free from the stem; the spores brown-black or deep purple-black in colour, and the stem solid or slightly pithy. When all these characters are taken together no other mushroom-like fungus—nearly a thousand species grow in Britain—can be confounded with it.

The parts of a mushroom consist chiefly of stem and cap; the stem has a clothy ring round its middle, and the cap is furnished underneath with numerous radiating coloured gills, free from the stem. The cap is fleshy, firm and white within, never thin and watery; externally it is pale brown, dry, often slightly silky or floccose, never viscid. The cuticle of a mushroom readily peels away from the thick flesh beneath. The cap has a narrow dependent margin or frill; this originates in the rupture of a delicate continuous wrapper, which in the infancy of the mushroom entirely wraps the young plant. The gills underneath the cap are at first white, then rose-coloured, finally brown-black. A point of great importance is to be noted in the attachment of the gills near the stem; the gills in the true mushroom are, however, usually more or less free from the stem, they never grow boldly against it or run down it; they may sometimes just touch the spot where the stem joins the bottom of the cap, but never more; there is usually a slight channel all round the top of the stem. When a mushroom is perfectly ripe and the gills are brown-black in colour, they throw down a thick dusty deposit of fine brown-black or purple-black spores; it is essential to note the colour. The stem is firm, slightly pithy up the middle, but never hollow; it bears a floccose ring near its middle; this originates by the rupture of the thin general wrapper of the infant plant.

Like all widely spread and much-cultivated plants, the edible mushroom has numerous varieties, and it differs in different places and under different modes of culture in much the same way as our kitchen-garden plants differ from the type they have been derived from, and from each other.

Many instances are on record of symptoms of poisoning, and even death, having followed the consumption of plants which have passed as true mushrooms; these cases have probably arisen from the examples consumed being in a state of decay, or from some mistake as to the species eaten. It should always be specially noted whether the fungi to be consumed are in a fresh and wholesome condition, otherwise they act as a poison in the same way as any other semi-putrid vegetable. Many instances are on record where mushroom-beds have been invaded by a growth of strange fungi and the true mushrooms have been ousted. When mushrooms are gathered for sale by persons unacquainted with the different species mistakes are of frequent occurrence. A very common spurious mushroom in markets is *A. velutinus*, a slender, ringless, hollow-stemmed, black-gilled fungus, common in gardens and about dung and stumps; it is about the size of a mushroom, but thinner in all its parts and far more brittle; it has a black hairy fringe hanging round the edge of the cap when fresh. Another spurious mushroom, and equally common in dealers' baskets, is *A. lacrymabundus*; this grows in the same positions as the last, and is somewhat fleshier and more like a true mushroom; it

has a hollow stem and a slight ring, the gills are black-brown mottled and generally studded with tear-like drops of moisture. In both these species the gills distinctly touch and grow on to the stem. Besides these there are numerous other black-gilled species which find a place in baskets—some species far too small to bear any resemblance to a mushroom, others large and deliquescent, generally belonging to the stump- and dung-borne genus *Coprinus*. The true mushroom itself is to a great extent a dung-borne species, therefore mushroom-beds are always liable to an invasion from other dung-borne forms.

Sometimes cases of poisoning follow the consumption of what have really appeared to gardeners to be true bed-mushrooms, and to country folks as small horse mushrooms. The case is made more complicated by the fact that these highly poisonous forms now and then appear upon mushroom-beds to the exclusion of the mushrooms. This dangerous counterfeit is *A. fastibilis*, or sometimes *A. crustuliniformis*, a close ally if not indeed a mere variety of the first. A description of one will do for both, *A. fastibilis* being a little the more slender of the two. Both have fleshy caps, whitish, moist and clammy to the touch; instead of a pleasant odour, they have a disagreeable one; the stems are ringless, or nearly so; and the gills, which are palish-clay-brown, distinctly touch and grow on to the solid or pithy stem. These two fungi usually grow in woods, but sometimes in hedges and in shady places in meadows, or even, as has been said, as invaders on mushroom-beds. The pale clay-coloured gills, offensive odour, and clammy or even viscid top are decisive characters. Besides the foregoing the difference in the nature of the attachment of the gills near the stem, the absence of a true ring, and of a pendent frill will be noted. The colour, with the exception of the gills, is not unlike that of the mushroom. In determining fungi no single character must be relied upon as conclusive, but all the characters must be taken together. Sometimes a beautiful, somewhat slender, fungus peculiar to stumps in woods is mistaken for the mushroom in *A. cervinus;* it has a tall, solid, white, ringless stem and somewhat thin brown cap, furnished underneath with beautiful rose-coloured gills, which are free from the stem as in the mushroom, and which never turn black. It is probably a poisonous plant, belonging, as it does, to a dangerous cohort. Many other species of *Agaricus* more or less resemble *A. campestris*, notably some of the plants found under the subgenera *Lepiota, Volvaria, Pholiota* and *Psalliota;* but when the characters are noted they may all with a little care be easily distinguished from each other. The better plan is to discard at once all fungi which have not been gathered from open pastures; by this act alone more than nine-tenths of worthless and poisonous species will be excluded.

In cases of poisoning by mushrooms immediate medical advice should be secured. The dangerous principle is a narcotic, and the symptoms are usually great nausea, drowsiness, stupor and pains in the joints. A good palliative is sweet oil; this will allay any corrosive irritation of the throat and stomach, and at the same time cause vomiting.

In Paris mushrooms are cultivated in enormous quantities in dark underground cellars at a depth of from 60 to 160 ft. from the surface. The stable manure is taken into the tortuous passages of these cellars and the spawn introduced from masses of dry dung where it occurs naturally. In France mushroom-growers do not use the compact blocks or bricks of spawn so familiar in England, but much smaller flakes or "leaves" of dry dung in which the spawn or mycelium can be seen. Less manure is used in these cellars than is generally seen in the mushroom-houses of England, and the surface of each bed is covered with about an inch of fine white stony soil. The beds are kept artificially moist by the application of water brought from the surface, and the different galleries bear crops in succession. As one is exhausted another is in full bearing, so that by a systematic arrangement a single proprietor will send to the surface from 300 lb. to 3,000 lb. of mushrooms per day. The passages sometimes extend over several miles, the beds sometimes occupying over 20 m., and, as there are many proprietors of cellars, the produce of mushrooms is very large. The mushrooms are not allowed to reach the fully expanded condition, but are gathered in a large button state, the whole growth of the mushroom being removed and the hole left in the manure covered with fine earth; the beds remain in bearing for six or eight months. The equable temperature of these cellars and their freedom from draught is one cause of their great success and to this must be added the use of natural virgin spawn.

The fairy-ring mushroom or champignon, *Marasmius Oreades*, is more universally used in France and Italy than in England, although it is well known and frequently used both in a fresh and in a dry state in England. It is totally different in appearance from the pasture mushroom, and, like it, its characters are so distinct that there is hardly a possibility of making a mistake when its peculiarities are once comprehended. It has more than one advantage over the meadow mushroom in its extreme commonness, its profuse growth, the length of the season in which it may be gathered, the total absence of varietal forms, its adaptability for being dried and preserved for years, and its persistent delicious taste. It is by many esteemed as the best of all the edible fungi found in Great Britain. Like the mushroom, it grows in short open pastures and amongst the short grass of open roadsides.

The fairy-ring mushroom is about one-half the size of the pasture mushroom, and whitish-buff in every part, the gills always retaining this colour and never becoming salmon-coloured, brown or black. The stem is solid and corky, much more solid than the flesh of the cap, and perfectly smooth, never being furnished with the slightest trace of a ring. The buff gills are far apart, and in this they greatly differ from the somewhat crowded gills of the mushroom; the junction of the gills with the stem also differs in character from the similar junction in the mushroom. The mushroom is a semi-deliquescent fungus which rapidly falls into putridity in decay, whilst the champignon dries up into a leathery substance in the sun, but speedily revives and takes its original form again after the first shower. To this character the fungus owes its generic name (*Marasmius*) as well as one of its most valuable qualities for the table, for examples may be gathered from June to November, and if carefully dried may be hung on strings for culinary purposes and preserved without deterioration for several years; indeed, many persons assert that the rich flavour of these fungi increases with years. Champignons are highly esteemed for flavouring stews, soups and gravies.

A fungus which may carelessly be mistaken for the mushroom is *M. peronatus*, but this grows in woods amongst dead leaves, and has a hairy base to the stem and a somewhat acrid taste. Another is *M. urens;* this also generally grows in woods, but the gills are not nearly so deep, they soon become brownish, the stem is downy, and the taste is acrid. *Agaricus dryophilus* has sometimes been gathered in mistake for the champignon, but this too grows in woods where the champignon never grows; it has a hollow instead of a solid stem, gills crowded together instead of far apart, and flesh very tender and brittle instead of tough. Another small and common species, *M. porreus*, is pervaded with a garlic flavour; a third species, *M. alliaceus*, is also strongly impregnated with the scent and taste of onions or garlic. Two species, *M. imprudicus* and *M. foetidus*, are in all stages of growth highly foetid. The curious little edible *Agaricus esculentus*, although placed under the subgenus *Collybia*, is allied by its structure to *Marasmius*. It is a small bitter species common in upland pastures and fir plantations early in the season. Although not gathered for the table in England, it is greatly prized in some parts of the Continent.

In the United States and Canada many hundred species of edible fungi occur, many of which are highly prized for their delicious flavour. In the moister districts, especially in the eastern States and Provinces, numerous choice species are found in abundance, including several of the best-known Old World mushrooms, as the meadow mushroom (*Psalliota campestris*), the fairy ring (*Marasmius Oreades*) and the chanterelle (*Cantharellus cibarius*). However, owing to the wide prevalence of the deadly amanita or death angel (*Amanita phalloides*), the fly mushroom (*A. muscaria*), and other dangerously poisonous species, extreme caution must be exercised in gathering native mushrooms for the table. Because of the frequency of fatal cases of mushroom poisoning, sometimes 30 a year in New York city and vicinity, wild mushrooms should never be eaten, even in the smallest

quantities, until their identification as wholesome species has been determined with absolute certainty. Poisoning by the deadly amanita, even when it is eaten in minute quantities, has been almost invariably fatal despite all medical treatment. Recently, however, an antiphallinic serum, prepared by the Pasteur Institute of Paris, has proved so effective as a remedy that the French government requires by law each *département* to keep a supply of it available for use by physicians.

There are, however, many wholesome wild species, of excellent quality and flavour, that are readily distinguishable from the noxious kinds. Among the easily recognized edible species are the shaggy mane (*Coprinus comatus*), the inky cap (*Coprinus atramentarius*), the oyster mushroom (*Pleurotus ostreatus*), the honey agaric (*Armillaria mellea*) and the parasol mushroom (*Lepiota procera*), regarded by many authorities as the best edible mushroom. Besides the foregoing all morels, coral fungi and puff balls, if used when fresh, are edible. *See* FUNGI; MOREL; PUFF BALL; TRUFFLE.

See W. G. Smith, *Mushrooms and Toadstools* (1879); W. Falconer, *Mushrooms; How to Grow Them* (1891, 1925); M. C. Cooke, *Edible and Poisonous Mushrooms* (1894); G. F. Atkinson, *Edible and Poisonous Mushrooms* (1903); N. L. Marshall, *The Mushroom Book* (1905, 1923); R. L. Castle, *Mushrooms* (1910); E. L. T. Cole, *Guide to the Mushrooms* (1914); W. B. McDougall, Mushrooms (1925); W. S. Thomas, *Field Book of Common Gilled Mushrooms* (1928).

MUSHROOMS, COOKERY OF. Edible mushrooms contain some nitrogenous food and about 90% water. Eaten with other foods they are of great service in the diet on account of their flavouring properties. It is dangerous to eat mushrooms which have been gathered by anyone who has not studied the different kinds.

Among the most familiar kinds are the common meadow mushroom (*Agaricus campestris*); button (immature) mushrooms employed chiefly for garnishing purposes and as an addition in high-class dishes; and truffles (underground fungi).

To prepare ordinary mushrooms for cooking, pick over and wipe with a flannel dipped in salt. Peel and remove stalks where necessary. The latter may be used for flavouring stews, soups, sauces, etc.

Mushrooms may be grilled (broiled) and served with maître d'hôtel or plain butter, etc.; baked in the oven under glass (or in a shallow dish); stewed in a casserole with other foods, *e.g.*, Italian pastes, rice, or in a well-flavoured sauce; or, they may be used in stuffings for turkey, poultry and game; they are also employed for garnishes in making galantines, etc.

Stewed Mushrooms.—Place the mushrooms in a stewpan with 2 oz. of butter, salt, a squeeze of lemon juice and a blade of mace. When cooked, stir in a white liaison of flour and butter blended together. Stir well and serve either as an entrée, or on toast as a savoury. This dish may be varied by adding other ingredients and may be served as a cream by adding a sauce of cream and beaten-up eggs.

Fried Mushrooms.—These are frequently added as an addition to a mixed grill. Frying should be done in a frying pan and not in a deep pan of fat. It is best to use good margarine or butter.

Grilled Mushrooms.—Large mushrooms should be chosen for grilling. Grease the gridiron before cooking. Place flesh side uppermost on the gridiron.

Stuffed Mushrooms.—Good-sized mushrooms are needed for stuffing. Any well-flavoured forcemeat can be used though certain flavours blend better with mushrooms than others, *e.g.*, game. To stuff, remove the stalks and pile the forcemeat in the centre of each mushroom. Squeeze lemon juice over and cover with buttered paper or place under glass. Bake in the oven for half an hour.

Mushroom Ketchup.—Sprinkle salt freely over large meadow mushrooms and leave them to stand for a few hours, then mash them in a mortar and set aside for 48 hours. Stir from time to time. Press through a colander and place in a pan. Boil up, skim carefully and simmer for an hour. Strain into a pan and leave until the next day. Then strain again leaving the sediment at the bottom of the basin and add one ounce of black peppercorns, a blade of mace, half an ounce of allspice, one quarter of an ounce of ginger and half an eggspoonful of grated lemon rind to each quart of liquor. Boil up and reduce to half the quantity. Bottle and store in a dry place.

MUSIC. The Greek μουσική (*sc.* τέχνη) from which this word is derived was used comprehensively for all the arts of the Nine Muses. Contrasted with γυμναστική (gymnastic) it included the culture of the mind as distinguished from that of the body. Thus the singing and setting of lyric poetry formed but a small, if a central, part of a "musical" education which ranged from reading and writing to the sciences of mathematics and astronomy besides all the arts of literature. The philosophers valued music both in the ancient general sense and in our restricted sense, chiefly as an educational element in the formation of character; so that we obtain little light from them on the pure aesthetics of the Greek art of musical sounds.

1. INTRODUCTION

The present article deals mainly with the musical art-forms matured by European civilization since the 14th century. More ancient music is discussed frankly as beyond our power of appreciation except in the light of prehistoric origins. Our Western art of music stands in the unique position that its language has been wholly created by art.

Music owes but little to nature in the form of acoustic science, and still less to the sounds that occur outside works of art. It is already a mature musical art that selects the acoustic facts, just as in painting it is art that determines the selection of optical facts. Wise critics have, since Ruskin's day, abandoned the attempt to settle *a priori* how much of nature an aesthetic system ought to digest; and music differs only in degree from literature and the plastic arts as to independence of nature.

Yet the difference is often important. Perspective existed as a science before it was taken up by painters, and as a human experience before it became a science. The naïve Western spectator has seen enough of it in pictures to make him resent its neglect, whether in modern art or in the masterpieces of China and Japan. In music the nearest analogy to perspective is the system of tonality developed by the great composers from Alessandro Scarlatti to Wagner. (*See* HARMONY.) Every step in its evolution has been fiercely contested; and even twenty years after the end of Wagner's long career not every responsible musician was ready to admit Wagnerian tonality as a legitimate enlargement of the classical system.

If we set aside language and the organized art of music, the power of distinguishing sensations of sound is no more complex than the power of distinguishing colours. On the other hand sound is the principal medium by which most of the higher animals both express and excite emotion; and hence, though until codified into human speech it does not give any raw material for elaborate human art, it suffices for bird-songs that are as long prior to language as the brilliant colours of skins, feathers and flowers are prior to painting. Again, sound as a warning or a menace is an important means of self-preservation; and it is produced instantly and instinctively.

All this makes musical expression a pre-human phenomenon in the history of life, but is unfavourable to the early development of musical art. Primitive music could mysteriously re-awaken instincts more elemental than any that could ever have been appealed to by the deliberate process of drawing on a flat surface a series of lines calculated to remind the eye of the appearance of solid objects in space. But the powers of music remained magical and unintelligible even in the hands of the supreme artists of classical Greece. We may be perfectly sure that if the Greeks had produced a music equivalent to the art of Palestrina, Bach or Beethoven, no difficulty of deciphering would have long prevented us from recovering as much of it as we have recovered of Greek literature. Some enthusiasts for Oriental lore assure us that long ago the Chinese knew all about our harmonic system but abandoned it after they had exhausted it. This need not worry us. The Oriental aristocrat conceals in his politeness a profound contempt for our efforts to patronise his culture; and that contempt is justified when we show such ignorance of our own music as to suppose that a music of similar calibre could have utterly

disappeared from a living nation whose most ancient plastic art and literature commands our respect and rewards our study. When we trace the slow and difficult evolution of our harmonic system we cease to wonder that it was not evolved sooner and elsewhere, and we learn to revere the miracle that it was evolved at all.

2. NON-HARMONIC AND GREEK MUSIC

Music before the rise of a harmonic system is of two kinds, the unwritten or extemporaneous, and the recorded or scientific. At the present day the music of races that have not acquired Western harmony often pleases us best when it seems most extemporaneous. Tradition can go far to fix the forms and even the details of a performance that may, without the aid of words or dance, last for hours. With words or dance, music becomes more capable of being fixed by writing; but the first musical problems are as far beyond conscious reasoning as the origins of language. Birds solved them before human beings; and folk-music can show real beauty when the systematic music of its day is arbitrary and uncouth. Moreover, folk-music, together with the present music of barbarous races and Oriental civilization, can give us materials such as anthropology uses in reconstructing the past from its vestiges in the present.

For us the music of ancient Greece is by far the most important branch of musical archaeology. Unfortunately the approach to this most difficult subject has been blocked by lack of co-ordination between scholarship and musicianship; and the ascertained truth is less instructive to the general reader than the history of opinions about it. These opinions begin to be interesting when they are expressed by musicians whose music we can understand. The natural tendency of such musicians was to suppose that Greek music was like their own; and each advance in knowledge is marked by disillusion. The first difficulty presented by ancient Greek writers was sufficiently disconcerting. The Greek terms for "high" and "low" were found to be reversed. Our own meaning seems founded in nature; and science confirms it. Our "high" or "acute" notes demand tense vocal cords and correspond to vibrations of "high" frequency. A great 16th century composer, Costanzo Porta, inferred a mystery here, and argued that the Greeks had mastered the art of a totally invertible polyphony, such as Bach afterwards displayed in two fugues in *Die Kunst der Fuge*. Porta accordingly wrote a 4-part motet (*Vobis datum est cognoscere mysterium*) which could be sung upside down: and his contemporary Vincentino composed 4-part motets in each of the three Greek *genera*, diatonic, chromatic and enharmonic. (*See* Hawkins's *History of Music*, i. 112, *seq.*) They are as good as any other music written on *a priori* principles, and the enharmonic motet may be commended to some of our modern experimenters in quarter-tones. But they represent as much knowledge of Greek music as we possess of the inhabitants of Mars.

The truth must be sought by other methods and by far the most promising is the study and comparison of the present scale of nations, whether barbarous or cultured, who have not come into contact with the classical harmony of the West.

A readable account of musical origins may be found in Parry's *Evolution of the Art of Music*. Following the researches of A. J. Hipkins and A. J. Ellis, Parry illustrates the fact that most of the primitive scales, notably the pentatonic scales prominent in Scottish and Chinese music, are built around the interval of a downward 4th (as from C to G) which was probably the first melodic interval to become fixed in the human mind as being simple enough but not too wide. A scale would begin to form by the accretion of other notes near the bottom of this interval. Now take another 4th with similar accretions below the former, either conjunctly (as G to D below the C–G) or disjunctly (as F–C). The resulting scale will either fill or include an octave, it does not matter which; for the filled octave of the conjunct tetrachord contains in another position the notes of the included octave of the disjunct tetrachords, as can be seen in the combined series C, A, G, E, D, C, A, G. And the octave was recognized from the outset as a limit after which a musical series repeats itself.

The Greeks had three *genera* of scale: the diatonic, the chromatic and the enharmonic. Of these the diatonic divides the tetrachord most evenly, as E, D, C, B:A, G, F, E. This gives us our diatonic scale in what Palestrina would call the Phrygian mode. The Greeks found that all its notes could be traversed (as a knight's move can traverse our chessboard) in a series of intervals which they called concords. (They thought of them only as successions, not combinations of sound.) These were the 4th (in the ratio 4:3); the 5th (3:2); and the octave (2:1). (Our own "perfect concords" are in these ratios.) Scales with chromatic tetrachords (E, C♯, C♮, B:A, F♯, F♮, E) could also be traversed by the concordant intervals, but not so easily. The enharmonic tetrachords, which only the most accomplished singers could sing, were beyond the reach of perfect concords; and for us they would need a special notation, as E, C, B′, B ; A, F, E′, E♮; where B′ and E′ signify something like quarter-tones above the B♮ and E♮. Yet this difficult scale was said to be the oldest of all; which seems not unlikely when we observe that it gathers three notes closely to the bottom of the tetrachord, leaving a gap of a major 3rd from the top. Eliminate the quarter-tones, and there remains a pentatonic scale E, C, B:A, F, E, which is more likely to be the earliest filling out of the downward 4th than the scales in which the auxiliary note is a whole tone away. And if this nucleus had the prestige of a mystic antiquity musicians would feel a pious pride in mastering the difficulty of filling it up like the other genera.

If authorities on Greek music would abandon their habit of writing scales and reckoning intervals upwards, their results, whether correct or not, would become much more lucid. For, as Parry points out, it is only our harmonic system which makes us think of scales as normally rising; and when a musician applies the term "cadence" to chords that rise from dominant to tonic he contradicts the literal meaning of the word.

Until the most recent times classical scholars have ruthlessly closed the door upon all hope of further light from the comparison of Greek data with the phenomena of extant non-harmonic folk-song and Oriental scales. If such a comparison is to have any meaning we must assume that the now universal phenomena of modes existed in ancient Greece. Modes, as far as non-harmonic melody is concerned, are various cross-sections of a standard scale. Thus, Scottish music shows very clearly five pentatonic modes. Adding the 8ve to complete the scale, these are, 1. C, A, G, F, D, C; 2. D, C, A, G, F, D; 3. F, D, C, A, G, F; 4. G, F, D, C, A, G; 5. A, G, F, D, C, A. In the article HARMONY the ecclesiastical modes of pure polyphony are given with their fondly-imagined Greek names. Pre-harmonic music without modes is contrary not only to our Western prejudices but to the whole trend of anthropological research. In these circumstances classical scholars, under the guidance of D. B. Monro, crushed all hopes by deciding that the Greeks had no modes at all, but that either their ἁρμονίαι or their τονόι (the terms, whatever they mean, are not synonymous) were mere transpositions of the three genera into various pitches, just as our "keys" are transpositions of our pair of major and minor modes.

When Monro published his *Modes of Ancient Greek Music* in 1894, musicians had learnt too well the lesson that Greek music must not be expected to make sense. They would never dispute a point of classical scholarship; and it did not occur to them that Monro might be just so innocently familiar with modern music as not to realize that he might as well impute high-church tendencies to Alcibiades because of "the splendour of his liturgies" as impute to the ancient Greeks a system of keys related by mere transposition. But musicians only thought that even the most unprejudiced anthropological comparison of extant scales could prevail no more than Macfarren's Victorian assumptions could do in a dispute with Monro. Fortunately in 1916 Mr. G. H. Mountford, in a degree thesis, satisfied classical scholars that Monro was in error and that the Greek modes were modes in the universal and proper sense of the term.

Miss Kathleen Schlesinger has found, by experiments with a monochord, a means of producing modes on mathematical principles. Certainly the Greeks did measure musical intervals mathe-



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EUROPEAN MUSICIANS, 16TH–20TH CENTURY

1. Giovanni Pierluigi da Palestrina (1525/6–1594), Italian
2. Georg Friedrich Händel (1685–1759), German
3. Johann Sebastian Bach (1685–1750), German
4. Joseph Haydn (1732–1809), Austrian
5. Wolfgang Amadeus Mozart (1756–91) Austrian
6. Ludwig van Beethoven (1770–1827), German
7. Niccolo Paganini (1784–1840), Italian
8. Franz Peter Schubert (1797–1828), Austrian
9. Frédéric François Chopin (1810–49), Polish
10. Robert Alexander Schumann (1810–56), German
11. Franz Liszt (1811–86), Hungarian
12. Richard Wagner (1813–83), German
13. Johannes Brahms (1833–97), German
14. Pablo Martin Sarasate (1844–1908), Spanish
15. Johann Strauss, The Younger (1825–99), Austrian
16. Maurice Ravel (1875–), French
17. Claude Achille Debussy (1862–1918), French
18. Richard Strauss (1864–), German
19. Giacomo Antonio Puccini (1858–1924), Italian
20. Igor Stravinsky (1882–), Russian

matically on a string; certainly Miss Schlesinger's system is among the very first things that could have happened in that way; and its results produce many phenomena that ought to have occurred in ancient Greek music. There is, for instance, a remarkable passage in Plato's *Republic* (VII., 531) where Socrates gibes at the pedantries of the merely practical musicians who spend hours in arguing whether this and that note are too near to allow another note between them. And Miss Schlesinger's various scales comprise between them notes quite close enough to explain how the practical musician could get into difficulties about what was obvious to the philosopher. Miss Schlesinger has, moreover, tuned a pianoforte on the basis of her theory, and the result is acoustically very interesting. So much then, for *a priori* theory and practical experience. If Miss Schlesinger's results are not Greek they ought to have been.

The other line of approach is through the experience of setting the choruses of Greek tragedy to a modern music which confines itself to a strict representation of the metre and sets strophe and antistrophe to the same melody. The composer should not attempt Greek modes, on whatever theory, or he will achieve nothing better than an effect of singing "We won't go home till morning" on the supertonic of a minor key and with a beat missing. Instead of thus warping his imagination the composer should translate all that modern culture enjoys in Greek poetry into a music that he can enjoy; restricting himself mainly to one note to a syllable and, while making his instrumental accompaniment as beautiful as he likes, straying into no by-paths of musical tone-painting other than the most natural symbolisms. The Greek rhythmic forms prove musically fascinating, and there is full scope for fine melody within them. The strict correspondence of strophe and antistrophe causes difficulties which reveal much. Even a unisonous accompaniment, such as the Greeks had, can glide over a difference of punctuation or indeed a running on of the sense between strophe and antistrophe, as at the end of the enormous first chorus of *Agamemnon;* and the technique of such compromises closely resembles that of Schubert and Brahms in strophic songs, and has the subtlety of Greek simplicity. Aristophanes, in the *Frogs,* laughs at the interlinear θραττο θραττο θραττ (or "plunketyplunk") of the Aeschylean lyre. The passage seems to indicate something more extensive than a merely connective tissue; but exaggeration is not unknown in comedy.

More difficult and therefore still more instructive are the occasional contrasts of sentiment between strophe and antistrophe. In another chorus in *Agamemnon* the pretty ways of a lion-cub are to be sung to the same music as the tale of disaster that befell the man who adopted it when, on growing up, it behaved as might be expected. The highest point of pathos in the first chorus, one of the supreme things in poetry, is the moment where the description of the sacrifice of Iphigeneia turns into a reminiscence of her singing in her father's halls and then runs on into the antistrophe, with the words "The rest I saw not, nor will I tell." After which the same music has to express the pious hope that the queen who now approaches shares the wishes of the chorus for the welfare of the land she holds in trust.

From Plato we learn that musicians degraded themselves by imitating the roaring of lions and the whistling of winds. But what was the Greek criterion for the singing voice? Certainly very different from ours; for Aristotle says that certain high-pitched modes (but what is "high" in this context?) are suited to the voices of old men. An age-limit is the only criterion the heartless modern critic has for the voices of old men. Be this as it may, the safest inference from it is that every educated Greek was expected to sing well as an integral part of the art of speaking well. Perhaps our modern contrast between the singing and the speaking voice did not exist. Nowadays it is not uncommon to find a high soprano speaking normally around the A or G below the treble staff.

(*See* also ARISTOTLE; ARISTOXENUS; EUCLID; PYTHAGORAS.)

3. HARMONIC ORIGINS

The latent harmonic sense of the Greeks is shown in the fact that their diatonic scale was amenable to the Pythagorean science of harmonic ratios. And we cannot suppose that no notice was taken of the combined sounds resulting from reverberation in halls and caverns, or from striking several strings of the lyre at once. Yet the fact remains that outside the orbit of our own Western music of the last six centuries we know of no harmonic system that has advanced beyond drones below the melody and cymbals (our Authorized Version is right in reading "tinkling cymbal") or bells above it.

Music, as we now understand it, consists in the interaction of three elements as inseparable (but not as interchangeable) as the three dimensions of Newtonian space. The Greeks knew two, rhythm and melody, which are as ancient as human consciousness and evidently have their meaning for some other animals. But non-harmonic melody is a very different thing from melody that implies harmony. (*See* MELODY exs. 1 and 2 with their discussion.) When we hear an unaccompanied folk-song we involuntarily think of it as the top line of a series of harmonies. If it is really pre-harmonic it will prove unamenable to that interpretation, and then we shall think it quaint. Neither the quaintness nor the harmonic interpretation ever entered into its intention. Life is too short for Western musicians to devote much of it to the violent mental gymnastics of thinking away the harmonic ideas that have made Western music enjoyable throughout five centuries. We may perhaps widen our experience by going back another two centuries; for it was agreed by all the musicians in Vienna that a concert of "Gothic" music was their most interesting musical experience of the year 1928.

In the article HARMONY the main steps are indicated by which mediaeval musicians advanced from doubling melodies in 4ths and 5ths (as the unoccidentalised Japanese are said to be doing now) to an aesthetic system of polyphony that demands complete independence in its melodic threads and forbids consecutive 5ths and 8ves as barbarous. The details of this evolution are abstruse; but two main issues may be mentioned here. Polyphony could not have been established without fixed scales and a repository of known melody for composers to work upon.

The scale was set in order in Graeco-Roman times by Ptolemy the astronomer, who flourished A.D. 130 and from whose time the history of the "ecclesiastical modes" becomes continuously traceable until the records of music are secured by the art of printing.

The necessary repository of melody was supplied by the ancient plain-songs of the church, many of which claimed to have come uncorrupted from the music of Solomon's temple and certainly had a continuous history reaching back to early Christian services in the catacombs of Rome. In A.D. 384 a large body of these "tones" was set in order by St. Ambrose. According to a tradition accepted, after some "historic doubts," by good authorities, St. Gregory revised and enlarged the Ambrosian collection; and the whole corpus of Gregorian music undoubtedly familiarizes Roman Catholics of to-day with a music enormously more ancient in its origin than any harmony. This music forms the principal melodic foundation of Palestrina's polyphony; but by his time it had become corrupted, and we must look to the Solesmes edition of 1904 for the text and method of singing plain-song in the perfection it is held to have attained shortly after the death of St. Gregory. The essential difference between the Ratisbon tradition (which we may loosely call Palestrinian) and that of Solesmes is that the Palestrinians impatiently curtailed the flourishes of the plain-song much as Palestrina did with the Gregorian themes he used in polyphony; whereas the Solesmes method restores the free speech-rhythm which makes the flourishes (or melismata) possible in a rapid delivery. Some of these melismata are very extensive, and the Palestrinians (who gradually developed the modern organist's habit of providing each note of a Gregorian melody with a separate chord) had some excuse for mistaking them for corruptions of style.

The Gregorian tradition did not stand alone. There was an ancient Visigoth (or "Spanish") tradition; and there are the traditions of the Eastern Church. Professor J. J. W. Tillyard has shed much light on Byzantine music (*q.v.*), including a promising opening in the deciphering of the earliest *Neumae,* diacritical signs above the words, supposed to indicate musical notes.

He uses the method of interpreting the past from vestiges of primitive usage in the present. Controversies as to the number of modes, whether 8 or 12, raged till late in the 16th century. The *Dodecachordon* of Glareanus settled the question in favour of twelve, as its name implies. Meanwhile composers developed polyphony by ear and got no help whatever from the theorist. Quite independent of modes and entirely practical was the hexachord scheme (*see* HEXACHORD) developed in the 11th century by Guido d'Arrezzo (*q.v.*).

The general reader may learn something of the hexachord system very pleasantly from the music-lesson in *The Taming of the Shrew*. Hortensio's gamut says "Gamut am I, the ground of all accord . . . D sol re, one clef [*i.e.*, sign, or key], two notes have I: E la mi: show pity or I die." "Gamut" is a survival of Greek tradition; for the bottom note of the Greek scale was identified with the bass G, and this "ground of all accord" is an octave below the Ut of the hard hexachord. Hence it is Gammaut. D is Sol in the hard hexachord $\begin{Bmatrix} G, A, B, C, D, E \\ Ut\ Re\ Mi\ Fa\ Sol\ La \end{Bmatrix}$ and Re in the natural hexachord $\begin{Bmatrix} C, D, E, F, G, A \\ Ut\ Re\ Mi\ Fa\ Sol\ La \end{Bmatrix}$. It has two names but only one position or "clef," unlike B which has to be flattened in the soft hexachord (F to D). (Morley writing in 1597, calls a flat the B clef.) E is La in the hard hexachord and Mi in the natural hexachord.

Between Fa of the natural hexachord and Mi of the hard hexachord a dissonant tritone 4th exists. It gave great trouble to mediaeval musicians, who assigned it to the devil. *Mi contra Fa est Diabolus in Musica.*

To the early harmonic and contrapuntal processes alluded to in the article HARMONY some details must be added. The famous unwritten songs of the aristocratic troubadours or *trouvères* of the 12th and 13th centuries undoubtedly set the fashion in melody, and probably set it in the direction of *Sumer is icumen in;* that is to say, in the Ionian mode (that *modus lascivus* that is identical with our major scale) and in a lilting trochaic rhythm



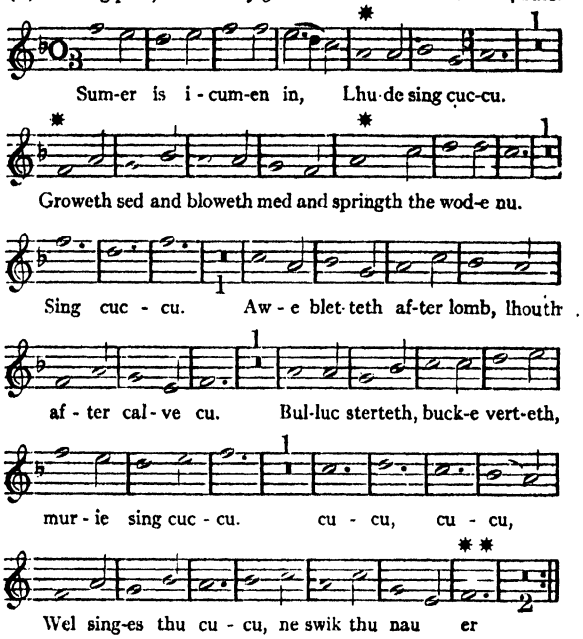
Sumer is icumen in contains no technical feature that has not been found in other compositions of its period, but nothing within two centuries of it achieves either its euphony or its easy handling of canon in four parts on a canonic bass in two. Its consecutive 5ths which sound licentious to us were in its own day the sole justification of the scheme.

It confirms other evidence that the imperfect concords (3rds and 6ths) must have obtained squatter's right in music in spite of theorists; for a very early practice known as ghimel or gymel consisted in singing in 3rds. This is not merely doubling, for the 3rd must oscillate between major and minor according to its position in the scale; and this adjustment requires an advanced harmonic system. When scholars tell us that singing in 3rds was traditional in Britain before the Roman Conquest, we must demur, especially when they tell us (in *Grove's Dictionary of Music and Musicians*, 3rd edition) that we must not expect to find written records of "so simple a process." Similarly we must not expect to find ancient Greek written records of so simple a process as steam locomotion. Still, let us not be unduly sceptical as to the extent to which popular licence and unrecorded extemporisation could advance beyond all the theoretic lore that scribes will record.

The troubadours disdained both the practice of accompaniment (which they left to their servants) and the art of scientific or written music. Not until the time and work of Adam de la Hale, surnamed the Hunchback of Arras (*c.* 1230–1288) can we trace the development of the troubadour into the learned musician. Nearly a century later, when literature is unbending from its universal Latin and becoming truly universal by becoming vernacular, we find the poet Machault, who stands with Petrarca among Chaucer's masters in the technique of verse, producing music that marks a technical advance discoverable by grim toil of expert analysis. But so far we may pardonably dismiss all such

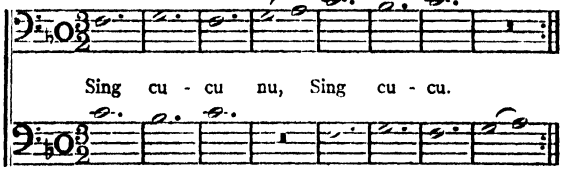
Ex. 1. *Sumer is icumen in.*

(A) Leading part, followed by 3 other voices at distances of 4 bars.



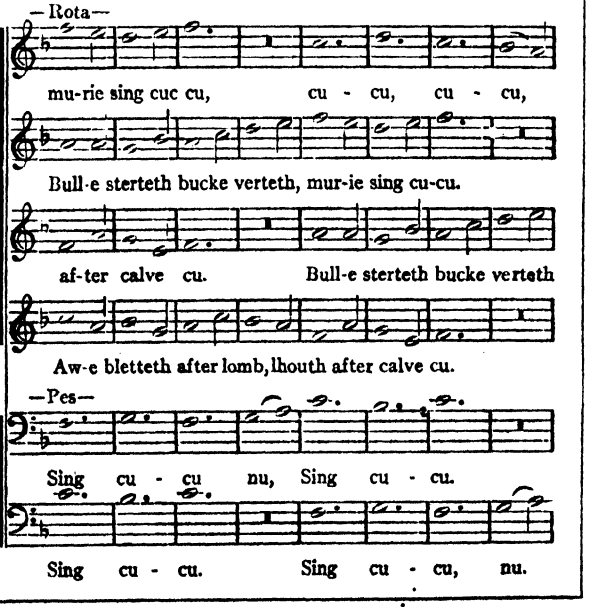
Repeat ad infinitum; each voice ending at ✱✱.

(B) The Pes



Repeat so long as the upper voices are singing

(C) Bars 33–40 in score. (The reader may with pleasure and profit make his own score of the whole, or, still better, sing it with five friends, from the above.)



archaic work (except *Sumer is icumen in*) with Burney's sly comment on the earliest piece of recorded music known to him: "It is not of such excellence as to make us greatly regret the loss of such music; though the disposition of those who were pleased by it may have been a great blessing to them." When music is too archaic or inaccessible to give us aesthetic data more may be learned from the disposition of those who were pleased by it than from its recorded technical data.

Before the middle of the fifteenth century music had passed for ever out of the stage at which we need know other things of the composer than his music. As early as 1437 an Englishman, John Dunstable, had acquired a European reputation. The Golden age of the 16th century had no use for archaic music, and Morley in his *Plaine and Easie Introduction to Practickall Musicke* quotes Dunstable much as we might now quote Bach if all Bach's works were lost except for traces of contemporary hostile criticisms and awe-inspired laudations. To call Dunstable the "inventor of counterpoint" is no better than to call Cadmus the inventor of the alphabet. But he is the earliest composer whose polyphony is in direct line with that of the golden age; for Dufay the first important master of the Netherlands, where the true polyphonic tradition was for long thought to have originated, is now known to have died in 1474, twenty-one years after Dunstable. And when Dr. Walker, in his *History of English Music* praises a motet by Dunstable for its extraordinary distinction of style, he is indulging in no pious fancies but is describing permanently intelligible aesthetic values. By the end of the 15th century counterpoint was substantially fixed, practice was still imperfect and aims were uncertain, but skill was increasing and in the 16th century we leave archaic music behind.

4. THE GOLDEN AGE

From this point onwards the history of music is best studied in the masterpieces of the art. Each period has its own art-forms. Articles relevant to the Golden Age are HARMONY, Section 3; INSTRUMENTATION, Section 11; CONTRAPUNTAL FORMS; COUNTERPOINT; MADRIGAL; MASS; MOTET; with the biographies and critical notes on PALESTRINA; VICTORIA; LASSO; TALLIS; MORLEY; BYRD. *See* also AICHINGER, ALLEGRI, ANERIO (G. and F.); ANIMUCCIA; ARCADELT; BATESON; BENNET (J.); BULL; DESPRÉS (Josquin); ECCARD; FARRANT; GABRIELI (A. and G.); GENET (of Carpentras); GIBBONS; GUERRERO; HANDL (Gallus); HASLER; ISAAC (Heinrich); MARENZIO; MORLEY (Thomas); OBRECHT; OKEGHEM; SWEELINCK; TAVERNER; WEELKES, WILBYE.

The external history of music is not so easily brought into true relation with the art as popular legends would have it. Everybody is familiar with the story of the drying up of polyphony in the foolish ingenuities of Flemish contrapuntists until, at the behest of the Council of Trent, Palestrina wrote the *Missa Papae Marcelli* in a pure and single style which convinced the authorities that polyphonic music could be devout. The facts are not quite so simple. Undoubtedly there was a great deal of barren ingenuity in the work of the lesser Flemish masters; and the great Obrecht himself had written masses in which the liturgical text is drowned beneath five other texts which each voice sings to other plain-chants and themes of old songs. The secular tunes thus freely introduced were not always sung as *canti fermi* too slow to be recognized. Recognition sometimes even led to the singing of the original words. One old song, *L'homme armé*, became the string round which every possible ingenuity crystallized in the composition of the Mass. There is no reason to doubt that the state of church music both deserved and received the serious attention of the Council of Trent.

On the other hand, not all Flemish music was silly, and many of the quaintest "canonic" devices were really nothing but harmless cryptography applied to music that was composed on purely artistic lines. Burney discovered this when, with his usual *flair* for good illustrations, he quoted some dry ingenuities from Okeghem (or Okenheim) and followed them by the wonderful *Deploration de Jehan Okenheim* by that master's great pupil Josquin des Prés who is the first unmistakably great composer and who has been well named "the Chaucer of music." No listener can fail to recognize, from anything like a competent performance, the spontaneous beauty and poetic depth of this music, throughout which, while the other voices sing an elegy in French, the tenor intones in Latin the plain-chant of the Requiem beginning on a note a *semitone lower* than the liturgical pitch, and continuing in the wailing melodic mode thus produced. Burney had the wit to see that the "canon" *ung demiton plus bas* did not mean that some other part was to answer the tenor in canon, but was merely the "rule" for reading the cryptogram, the tenor being written at the normal pitch.

Many Flemish devices are well calculated to give coherence or climax to a large composition. One voice may wander up and down the scale with a single figure and a single motto-text while the other voices tell their whole story in polyphony. For instance, declaim the words *Miserere mei Deus* in monotone rising one step just for the first syllable of *Deus*. Start on the fundamental note of the scale, and at intervals repeat the phrase a step higher each time. After reaching the 5th degree go down again. Josquin's *Miserere* is a setting of the whole 51st Psalm, woven round a tenor part entitled *Vagans* and constructed on this plan. It is one of the first mature masterpieces in the history of music. Palestrina's art is too subtle for rigid Flemish devices; but once, in one of his finest motets, *Tribularer si nescirem* he uses Josquin's *Miserere* burden in exactly Josquin's way. Lasso is thoroughly Flemish in both sacred and secular music; and in a motet on the resurrection of Lazarus he makes a soprano *Vagans* cry *Lazare, veni foras* from the beginning of the narrative until the chorus reaches these words, and joins in with them in triumphant polyphony.

We must not, then, be misled by the ecclesiastical tradition that condemns Flemish music wholesale. In any case the concern of the church authorities was liturgical rather than artistic. The bishops would have been for the most part glad enough to see Church music restricted to the note-against-note style of Palestrina's litanies, *Stabat Mater*, *Improperia* and last book of *Lamentations*. A very sublime style it is, and Tallis's Responses, in their authentic form, are a noble illustration of it. But, as Dr. Jeppesen (*The Style of Palestrina and the Dissonance*) has clearly shown, Palestrina's *Missa Papae Marcello* shows special signs of being a deliberate demonstration that a high degree of polyphony can be reconciled with clear choral delivery of the words. Certainly the ecclesiastical authorities did not long succeed in preventing the use of secular themes in church music.

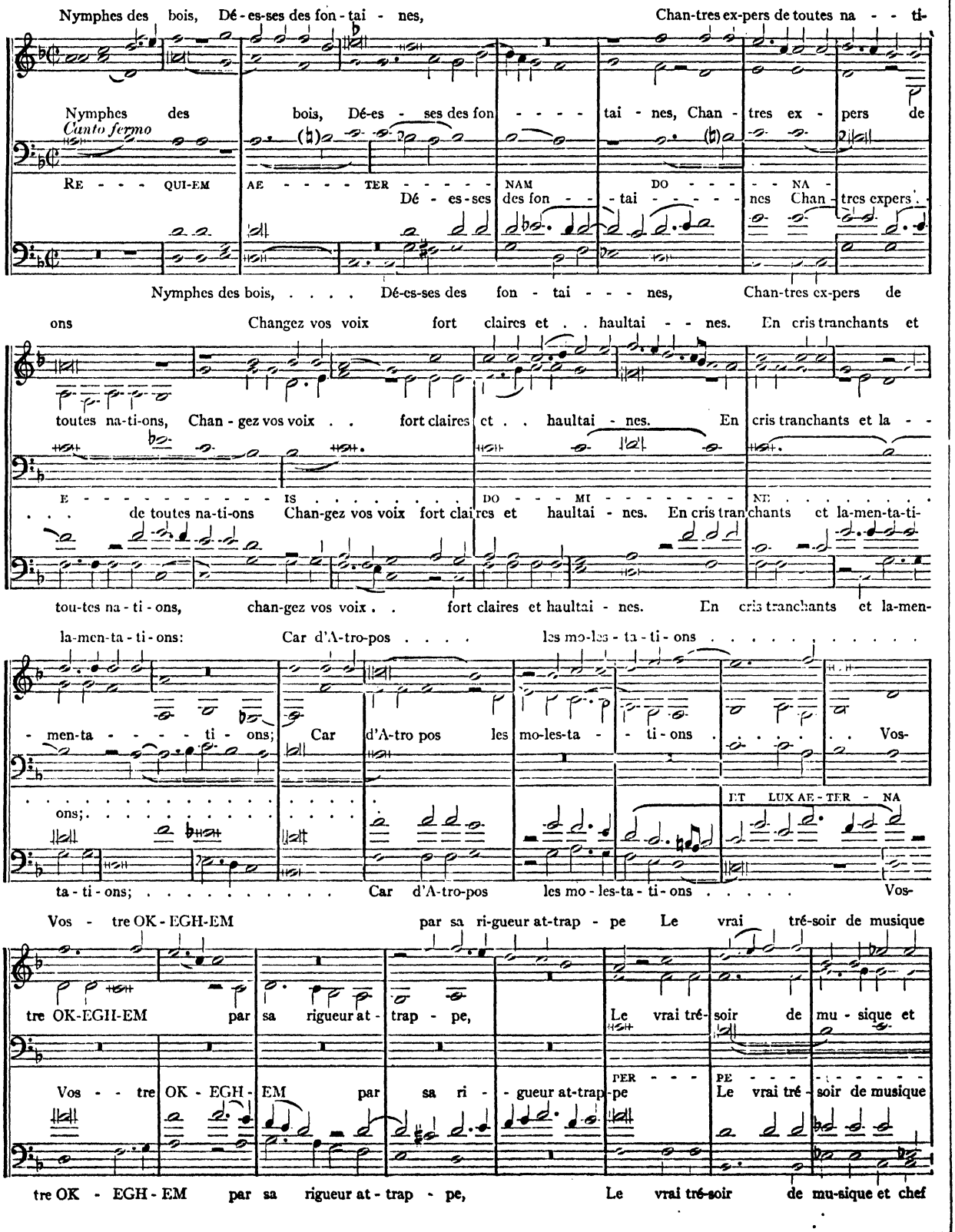
Many great musicians of to-day have a musical culture which ignores the Golden Age; and a knowledge of Palestrina is still considered, as it was in the days of Bach and of Beethoven, rather an out-of-the-way specialty. This is like a culture based on Latin and sceptical of Greek; good as far as it goes, but limited and cocksure like an 18th century gentleman's artistic impressions of the Grand Tour. An illustration of the most perfect style of the Golden Age is appended to the article MOTET.

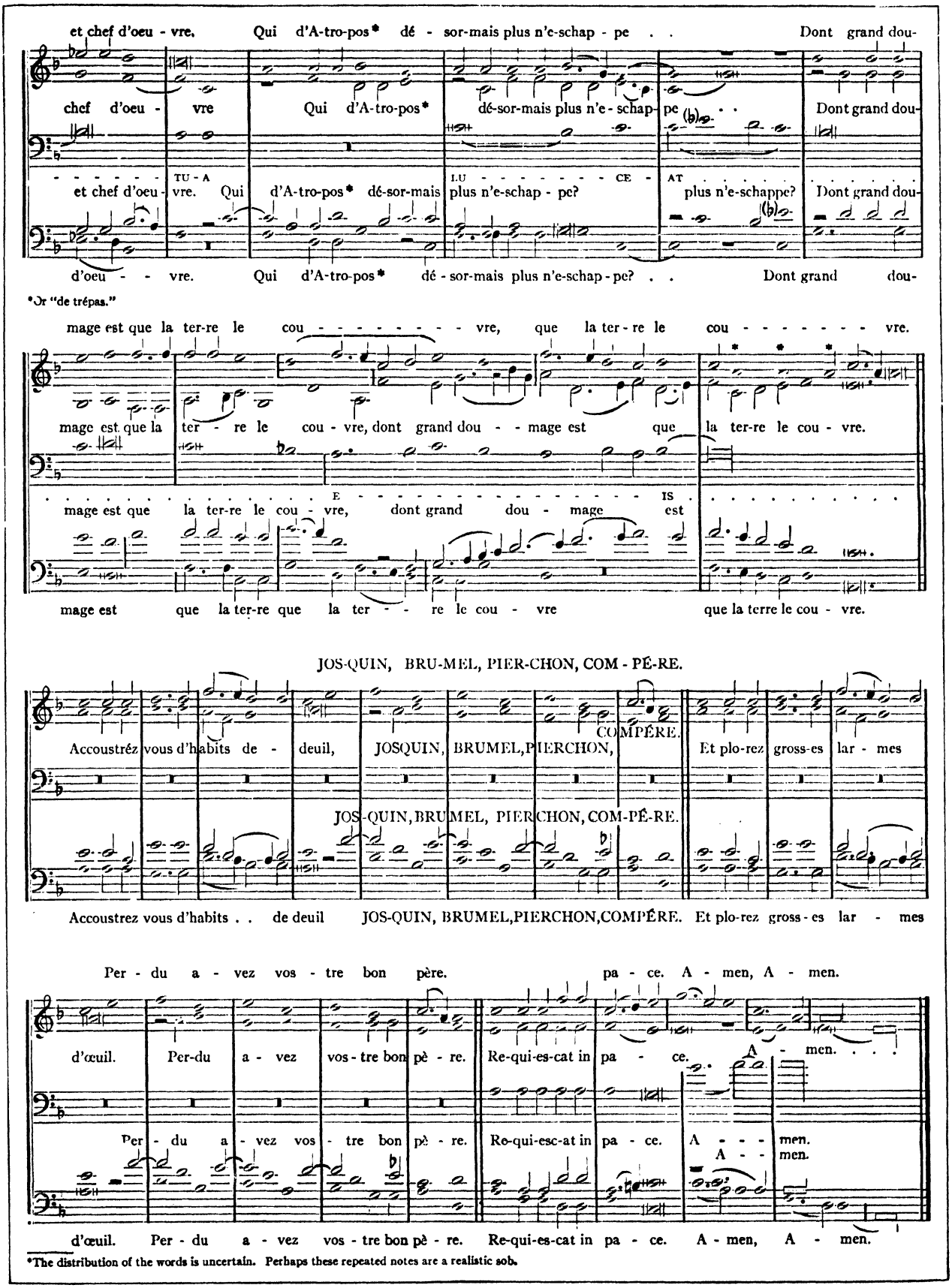
5. THE MONODIC REVOLUTION AND ITS RESULTS

Until Palestrina's art attained its height, the path of progress in music for the best part of two centuries was that of purity. It was not the free and bold spirits but the idlers and dullards who broke rules and disliked contrapuntal forms. The Hispano-Roman style of Victoria and Palestrina was not everything. It was not secular (though Palestrina's madrigals make him as supreme in that form as in church music), and it was not, like our glorious English polyphony, experimental or racy of the soil. But it was metropolitan, and the boldest of our Tudor composers would have been no such fool as not to hold it supreme. But already before the death of Palestrina a new music was groping towards the light; and for this music the path of progress was no more that of purity than the path of omelette-making is that of the conservation of egg-shells.

Eve's apple was not more fatal to man's earthly paradise than the rise of instrumental music and dramatic solo declamation was to the hope of continuing the Golden Age of music into the 17th century. The revolution did not consist in this detail or that. To

Ex. 2. *La Déploration de Jehan Okenheim*, for soprano, male alto, two tenors and bass
(Barred according to the main rhythms.)
Phrygian mode transposed.
by JOSQUIN DES PRÉS





*The distribution of the words is uncertain. Perhaps these repeated notes are a realistic sob.

say that Monteverdi "invented" the dominant 7th, or that anyone else invented it, or that any such invention could revolutionize music, is like saying that Shakespeare revolutionized drama by inventing strange oaths. The important point is not the technical names of the details but their meaning. When Lasso was young some experiments in chromatic music had been made by Cipriano de Rore, and were eagerly imitated by Lasso. But what is Lasso's object in being the first person to write such an out-of-the-way note as A♯? Simply to express the words *"novum melos."* Very different from such intellectual playthings is the purpose of the powerful discords of Monteverdi's madrigal *Cruda Amarilli* and of the monodic lament of Ariadne which drew tears from the spectators of his opera *Arianna.*

The article MONTEVERDI contains further remarks on his importance and on his coincidence in place and time with the creators of the violin. (*See* also OPERA.) The Palestrina style henceforth became the rightful privilege only of those composers who, either having mastered it before monody arose, or, like our own Orlando Gibbons, living in regions too remote for it to penetrate, could still compose polyphonically from impulse and not from asceticism. Orlando Gibbons did, in fact, try some monodic experiments which are poor enough.

An impulsively eclectic composer is another matter; and in uncouth, illogical Germany a giant such as Schütz could almost fill the century before the birth of Bach and Handel, with a life's work ranging from the pure polyphony of his Venetian master Gabrieli to the exploitation of all his "astute friend" (*scharfsinniger Freund*) Monteverdi's new principles in most gigantic efforts in mixed vocal and instrumental polyphony. From Schütz we can extract no such system as that which makes Monteverdi a favourite subject in musical history; but in Schütz's chaos the elements may at any moment come together in some strange work of art that fits into no historical or technical scheme but speaks clearly to us through its own coherence. Schütz's "astute friend" always knows what he is doing and whither his work is leading; but, except in a madrigal here and there, which was not his proper business, he does not produce a convincing work of art so often as Schütz who seems to have no proper business at all. It is to the astute, logical Italians that we must look for the progress and consolidation of musical art in general during the 17th century; but we must not let the enthusiasm of historians make us think that such a century of progress was a period of great music. The historians themselves are apt to neglect the intrinsic values of the 17th century compositions and to estimate them merely for their tendency towards something that was to take convincing shape later. The early 17th century was, in fact, musically not unlike what we have so far experienced of the 20th; the eyes of musicians and music-lovers were at the ends of the earth prophesying Wagner, when all that the whole century could finally achieve was the *da capo* form of aria.

Monteverdi and his fellow monodists had, in no mood of caprice, moved in the one direction that was universally important for music; yet their formless declamation soon palled, and its method survived only by becoming codified into the formulas of RECITATIVE, which are happy idealizations of Italian speech-cadence, and which survive as dramatic idioms in all music even at the present day. The "invention" of recitative has been ascribed to this or that monodist, with as little room for dispute as when we ascribe the invention of clothes to Adam and Eve. Any vocal music which, whether from inability or from disinclination, avoids organizing symmetrical melody, will be called recitative. When Wagner was still a subject of controversy, critics on both sides used to say that *Das Rheingold* was all recitative.

Two tendencies converged to make music become formal after the "first fine careless rapture" of monody was spent. First, the dramatic stage, with baroque scenery in magnificent development as early as 1667, in Cesti's *Pomo d'Oro,* greatly encouraged the ballet; so that when serious musicians cultivated the stage they also cultivated dance-music. This, however, was less important than the rise of the violin. Monteverdi had already understood its importance; and one symptom of the decadence of polyphony had been the growing habit of solo-singers to sing the top parts of madrigals with all manner of ridiculous flourishes. Persons less legendary than King Cole felt the fascination of the "tweedle-dee" of the fiddle; the great Dutch polyphonist Sweelinck (*q.v.*) used to adorn his organ works with passages of *imitatio violinistica;* and the last quarter of the 17th century saw the brilliant work of Biber with his queer abnormal violin-tunings, and the sober classical *sonate da chiesa* and *sonate da camera* of Corelli (*q.v.*). Artistically as well as morally this development of the violin was healthier than that of the voice, wherein coloratura singing tended to become an acrobatic monstrosity though it had first been regarded as a means of emotional expression. A talent for the violin was no danger to a boy; but a beautiful voice put a boy in deadly peril in an age when all the great opera-singers were *castrati.* Even Haydn had a narrow escape in his youth.

And yet there is, on the whole, more beauty than decadence in the vast mass of solo vocal music produced between 1630 and 1760. That period takes us from the advent of mature instruments and instrumentalized music to a time beyond the death of Handel. Except for the device of the ground-bass (*see* VARIATIONS) the first form that emerged from chaos organized itself on a method of balance between a solo voice and a group of instruments, together with a development of melodic form by means of a firmly-established classical key-system. The result was the classical aria, one of the most effective art-forms ever reduced to the capacity of normal musicians. It entirely destroyed the dramatic character of opera for a whole century; but this has been lamented with unnecessary vehemence. With the exception of the early monodic works and of Purcell's *Dido and Aeneas,* opera before Gluck is not an art-form at all; it is merely a name for the spectacular conditions under which the 18th century public could be induced to listen to a string of thirty arias by one composer who could either handle no other forms or find no listeners for them. The article ARIA shows the intimate connection of this form with that of the CONCERTO. Other art-forms developed in the 17th century for use in the 18th are discussed under CANTATA, OPERA, ORATORIO, SONATA, SONATA FORMS, and SUITE. Matters of style and texture are discussed in CHAMBER-MUSIC, HARMONY and INSTRUMENTATION. The articles on monodic composers include CACCINI, CAVALIERE, CESTI, PERI and MONTEVERDI, besides ARTUSI and BANCHIERI who wrote against Monteverdi's earlier works with well-grounded demonstrations of their subversive effect on pure polyphony. The survival of polyphony in grimy and pompous decadence is represented by Pitoni, and later and more as a renascence by LOTTI. Early violin music is represented by BIBER and CORELLI.

The short career of PURCELL (*q.v.*) ends twenty years after the death of Schütz and ten years after the birth of Bach and Handel. Almost any random quotation from Purcell might be by a composer of the calibre of Bach or Handel. Purcell is one of the greatest contrapuntists that ever lived; one of the greatest inventors of themes; one of the greatest masters of declamation; and a completely mature master of early orchestration. And his fellows in the English music of the Restoration, Pelham Humfrey, Child and Blow were no mean spirits. Burney devotes an entire plate in his *History of Music* to examples of "Dr. Blow's crudities"; and later historians need look no farther afield for examples of intelligent prophesy. But our Restoration music lacks one thing; and that is power of composition. Purcell, in small dance-forms and short lyrics, is unsurpassable. But his only chance of getting through a sustained movement is when he writes on a ground-bass. In this fascinating forlorn hope of English music we see the fruit of nearly a century of bold endeavour ripening a generation too soon. Parry ascribes the patchiness of Purcell to the subtle humour of Charles II. in sending his best chorister to learn from Lully, the master of the French ballet-opera, how to write English church music. But Lully is not patchy, and Purcell's music is a crazy-quilt, purple with foreshadowings of the music of the future.

6. BACH, HANDEL AND THE NEAPOLITAN SCHOOL

If all music between 1685 and 1759 were annihilated except the

work of Bach and Handel, the ordinary music-lover would miss nothing but a large collection of decorative and decorous violin music and a still larger collection of arias; and to most of these favourite *gemme d'antichita* the mid-19th century editor has contributed much of their lusciousness. For us the age of Bach and Handel is the age of nobody else in music. But the contemporaries of Bach and Handel thought of Handel as a fashionable opera-writer who with advancing years developed choral music as a pious fad; while nobody thought of Bach except people within coaching-range of Saxony where Bach was known as a wonderful organist and an impracticably deep scholar. The polyphony of Bach and Handel stands almost alone in an age when polyphony was utterly unfashionable. It was inculcated as a staple subject in musical education; but to carry it into mature art was to discuss Latin grammar in the drawing-room. The opportunities and the difficulties of early symphonic orchestration alike arose from the neglect of polyphony after 1750. Apart from Bach and Handel, that neglect can be traced much further back; and it characterized musical connoisseurship much later; so that Burney could say of Philipp Emmanuel Bach that wherever he got his beautiful and natural style from it was not from his father, for that eminent organist, though profoundly versed in all devices of canon and fugue, was so fond of crowding all the harmony he could into both hands that he must inevitably have lost melodic grace.

The vast and accurately-perfected aesthetic system of Bach and the improvisatorial opportunist eclecticism of Handel are discussed in the articles on those masters, and also under the headings of ARIA, CANTATA, CONCERTO, CONTRAPUNTAL FORMS, COUNTERPOINT, FUGUE, HARMONY, INSTRUMENTATION, ORATORIO, SONATA FORMS and SUITE. But, while this information covers the aesthetic values of the period, it tells us little of its historic trend. We must not look for light from the "spirit of the age" as shown in its politics or even in its religious history. Palestrina writes, from habit and preference, a devout music which neither Luther nor the Council of Trent could blame as representing the spirit of the age; and Bach achieves the ideal Lutheran music while Voltaire is at the court of Frederick the Great.

The music that pleased the contemporaries of Bach and Handel was that which continued, not too elaborately, the Neapolitan tradition founded by Alessandro Scarlatti. Lully (an Italian by birth) took this tradition to France, and transformed Italian opera by encouraging the French taste for the ballet. Rameau, greatest of classical French composers and epoch-making theorist, carried on the Lully tradition in opera, and joined forces with the exquisite school of clavecinistes, whose leader, Couperin, was admired and imitated by Bach in his suite-forms. Italian violin music and concertos in the Neapolitan style were produced by composers who were also great players. The enormous industry of Bach and Handel was nothing unusual. Arias could be written as easily as letters, and distributed by thirties in operas. Oratorios and church music, though less fashionable, were more highly organized; mainly because they kept choral music in being. And thus the Neapolitan tradition of choral music passes straight into the polyphony of Mozart, quite independently of Handel and wholly ignoring Sebastian Bach, of whom Mozart knew not a note until he was grown up. Meanwhile cultured Europe was unvexed by doubts as to who were the immortals. The Handel-Bononcini rivalry had been little more than a nine-days' wonder. Six years after Handel's death, the seven-year old Mozart in London dedicated his violin-sonatas to Queen Charlotte in the hope that under Her Majesty's protection "je deviendrai immortel comme Haendel et Hasse." Graun would probably have been the third name of European repute; and Telemann, the most voluminous composer of his voluminous day, was a great figure in his own country. As for Bach—everybody in London knew Mr. J. C. Bach, of the Bach and Abel concerts, and report said that his father had been a great musical scholar.

Behind the dignified musical history, but not (like Sebastian Bach) aloof from it, vital forces were at work in comic music-drama. This was admitted by way of *intermezzi* between the acts of serious operas. One of these intermezzi, *La Serva Padrona* by Pergolesi (known in the 19th century by his conventional *Stabat Mater* for two-part female chorus) not only broke from its moorings, like many other intermezzi, but found its way to Paris where it created a furore of popular success and precious disputation dividing musical Paris into *Buffonnistes* and *Anti-buffonnistes*. Except for the untimely blossom of English opera in the hands of Purcell in the previous century this is the only moment at which opera after Monteverdi and before Gluck (with all respect to Rameau) becomes a genuine art-form instead of a concert on the stage.

Biographical articles dealing with the following named composers who belong to this period: the violin writers CORELLI, GEMINIANI and TARTINI: the clavier writers COUPERIN and D. SCARLATTI (the Paganini of the harpsichord and a most unclassical son of the founder of classical tonality); the opera writers (which meant the all-round musicians) DURANTE (Francesco), GALUPPI (who certainly never wrote Browning's "sixths diminished, sigh on sigh"!), LEO (Leonardo), PERGOLESI and SCARLATTI (Alessandro). RAMEAU is equally important in three capacities as a master of French opera, a livelier master of instrumental music, and an epoch-making theorist. German beginnings of serious and comic music-drama were sumptuously inaugurated at Hamburg by KEISER (*q.v.*) whose influence is traceable in Handel's first opera *Almira*.

7. THE RISE OF DRAMATIC MUSIC AND THE SONATA STYLE

The fashionable distaste for polyphony was a mere negative force in the early 18th century. The positive force was, as in the monodic revolution a hundred and fifty years earlier, an impulse towards drama. Unlike the monodists who, when they rejected polyphony had no power of composition beyond the single musical sentence, the 18th century musicians could easily cover ten minutes with a well-balanced form; and the problem of making such forms dramatic was no longer confined to the monodist's problem of making them rhetorical. On the contrary, the rhetoric had to be demolished; for the action of drama is not the action of rhetoric.

The distaste for polyphony was no unfavourable condition for the rise of dramatic music; it was the inverse aspect of a growing sense of contrast in various textures cheap and valueless in themselves. The rest of the story is told in the articles, INSTRUMENTATION, HARMONY, OPERA, SONATA FORMS, and GLUCK, BEETHOVEN, HAYDN, MOZART.

It is inadequate to call Gluck a "reformer" of opera. Music itself was not dramatic before Gluck made it so. Hence it is a mistake to separate Gluck's "reform" from the whole process of the development of the sonata style. Lastly, we miss the whole meaning of that style unless we realize that as soon as it arose the purely instrumental music became more dramatic than any drama. At the same time it also became more powerfully architectural than any earlier music. The art comprised in the works of Haydn, Mozart, and Beethoven constitutes one unbroken aesthetic system, more universal in emotional range than any art since Shakespeare, and as perfectly balanced as the arts of ancient Greece. Until the end of the 19th century it would have seemed a paradox to maintain that Beethoven's work belonged to the same aesthetic system as Haydn's and Mozart's; for critics were slow to escape from the habit of estimating works of art by the face-value of their subjects and the dignity of their language. And the language of Haydn and Mozart corresponds with that of the comedy of manners, while Beethoven is the most tragic composer that ever lived. Nevertheless the huge expansion which music underwent at Beethoven's hands was no revolution, and the popular idea of Beethoven as a revolutionary artist is based on two errors; first, the commonplace habit of seeking parallels between the works of genius and the personal eccentricities of their authors; and, secondly, the inadequacy of orthodox doctrine on musical forms. This inadequacy results from the fact that the doctrines are contemporaneous with the compositions and are accordingly hostile to all but the easiest conventions. A proper grammar of a classical art requires something of the attitude of

the unjustly-despised Byzantine scholars who sacrificed aesthetic pleasures in humble devotion to the task of securing the texts. It is when the languages are dead that they live for ever and suffer no corruption.

We need not expect scholarship in the orthodoxies that were current as to musical forms used in the lifetime of the classics themselves. (*See* FUGUE for a demonstration of the irrelevance of traditional doctrine on that art-form.) Still more impertinent is our orthodoxy on sonata-forms. It ignores the differences between Haydn and Mozart which are as radical as any innovation Beethoven introduced; and, having thus cut away all ground for appreciating Beethoven, treats him as the central symphonic classic, and also as a stupendous revolutionary. This result is correct as far as it goes: central classics can be stupendous revolutionaries. But correct pious opinions are the healthier for facts that can give us a right to them; and the beginning of the 19th century was unfortunately the beginning of an age of humbug in musical education. (*See* CHERUBINI, who, however, has other claims to our respect.) One consequence is that many a musical revolt purports to revolt against the classics when its nearest contact with classical forms has been the perky generalizations of textbooks by writers who regarded the great masters as dangerous, and who deduced their rules from the uniform procedures of lesser composers. Now these procedures were often derived from one or two popular works by the greatest men: thus Beethoven himself produced one model sonata (op. 22)—if its "first subject" had only been long enough. And if Mozart's great C major quartet had not such a subversive introduction it might (and did) serve as a jelly-mould for all the quartets of Spohr. Take another jelly-mould from Spohr, and you have classical tradition.

But now comes the fundamental difficulty in all attempts to distinguish the classical from the pseudo-classical. Every individual work must be judged on its own merits. No generalizations are trustworthy. Many movements by Mozart are as alike as peas. But, being alive, they are not as alike as buttons. With Mozart and Haydn the individuality of each work is all-important for the critic, and if he neglects this all that he says about the common form is superficial. On the other hand, the materials of Beethoven's work developed so rapidly that he seems to be driven to invent a new technique for almost each composition. Hence the external differences become obvious; and unless the critic penetrates to the common form he is lost.

With the symphonic classics we enter the period when these considerations become important; for there is no gulf between that period and our own. No musical art known to Haydn has suffered, like the art of Bach, a period of total eclipse; nor, on the other hand has it had preserved a character that Haydn could have understood. Not much light is shed on Haydn and Mozart by calling them court composers, and little more on Beethoven by calling him a child of the French Revolution. In an age of court patronage Bach the theologian had been inspired to write warlike music not more by ancestral memories than by scriptural texts of war in Heaven. Mozart and Haydn were restive in the service of courts and their musical language was that of the comedy of manners when it was not racy of the soil. In Paris, where musicians might be expected to know most about the French Revolution, the modest, lovable Etienne Méhul (famous for the biblical opera *Joseph*) produced his prettiest comic operetta *Le Jeune Sage et le Vieux Fou* in the year of the Terror; and on French music the immediate effect of these tremendous days was the rise of a new type of sentimental opera concerning the hairbreadth escapes and sufferings of the political prisoner rescued by the heroic wife. Hence Cherubini's *Les Deux Journées* (*The Water-Carrier*) and Beethoven's *Fidelio*. Genius is the wind that bloweth where it listeth. In Bach's day Beethoven would have been musical interpreter of the Apocalypse; and in this 20th century Bach would be something like Dr. Schweitzer.

When we contemplate the impassable gulf that separates Bach's art not only from Haydn's and Mozart's but from the apparently more kindred spirit of Beethoven, we find it hard to realize that contemporaries were unaware of any catastrophic development. In the case of choral music a little study shows us that its forms and language remained Neapolitan. Haydn's and Mozart's masses are flamboyant Neapolitan music; and Michael Haydn, who was merely decorative as an instrumental composer, was rightly thought by his brother to be the better man at church music. Again we regard Philipp Emmanuel Bach as bridging the gulf between his father's and the new art; but Philipp Emmanuel was writing quite mature sonatas in the year of his father's B minor Mass and his last set of sonatas was produced in the year of Mozart's *Don Giovanni*. Clementi, born in the year after Bach's death, was an infant prodigy of eight when Handel died; he had developed an extraordinarily massive and genuine pianoforte technique (more powerful than beautiful) when he encountered Mozart in a musical tournament, and he survived Weber, Beethoven and Schubert. Nothing can be gained by a further attempt to summarize this "Viennese" period. We may call it the period of the sonata and of Mozartean comic and French romantic opera. More particular information is given in the following technical and categorical articles: HARMONY (on Key-relations); INSTRUMENTATION; MELODY; OPERA: ORATORIO; OVERTURE; RONDO; SCHERZO; SONATA FORMS; SYMPHONY; VARIATIONS, and the biographies ABEL (K. F.); BACH (C. P. E.); BEETHOVEN; BENDA; BOCCHERINI; CHERUBINI; CLEMENTI; DITTERSDORF; DUSSEK; GLUCK; HAYDN (J. and M.); MOZART; PUCCINI; SCHUBERT; SPOHR; WEBER.

8. THE ROMANTIC PERIOD

Romance brings us to the composers who developed lyric music in the forms of songs and short pianoforte pieces. Schubert, Weber, Spohr, Mendelssohn and Schumann would be the romantic composers in this sense, and many contemporaries would have added Cherubini to the list, for they thought of him not as the martinet who directed the Paris Conservatoire but as the composer of *Les Deux Journées*.

But this list traverses another sense of the term which opposes the romantic to the classical. The classical is in this connection identified with both formalism and mastery. Mendelssohn and Spohr chose romantic subjects to no purpose; their mastery was unromantically slick (there is no other word for it) and Spohr's forms were more thoroughly ascertained than anybody else's except those of Mozart's brilliant pupil, J. N. Hummel. Mendelssohn's forms were free; but he never got into difficulties, so how could anybody recognise his freedom? Philipp Emmanuel Bach's vein of sentimental rhetoric was not only typically romantic but enabled him to write some genuinely lyrical songs. Schubert was another romantic writer who influenced Mozart at an impressionable time of his boyhood. Every thrilling modulation in Beethoven's music was romantic, and so were the double-bass passages at the beginning of Cherubini's overture to *Les Deux Journées*.

The romantic period is more interesting than this generalization. There is a real line of cleavage, other than mastery, which ranges Spohr and Mendelssohn on one side and Schubert, Schumann and Chopin on the other. Beethoven's vast enlargement of the art of tonality and the concentration of his later polyphony had made music ready for lyric forms which he himself adumbrated in a few of his bagatelles for pianoforte and some sporadic good things in his songs. Mendelssohn and Spohr took up song-writing and produced in that line masterpieces for the drawing-room. We ought not to despise the drawing-room. Schubert became the supreme master of song, and Schumann achieved greatness there as in his pianoforte lyrics; but you might as well think of Keats and Shelley as writers for the drawing-room.

Another line of cleavage separates Schubert from Schumann and Chopin as fundamentally as it separates him from Mendelssohn and Spohr. When Schumann and Chopin handle the large classical forms they show obvious weaknesses. Schumann makes an effective new artificial sonata form out of his stiff antithetic epigrammatic style, as a man might construct a landscape in mosaic. Chopin merely shows that he has taken the sonata forms uncritically from Hummel, though the first two movements of the B flat minor sonata are almost as happy in their classical form as the Ballades are in Chopin's unique way. But Schubert's large

forms have only the weaknesses of youth, and their positive qualities and tendencies set him above all schools and indicate that if he had lived we should not so readily have closed a historic chapter with Beethoven. The mastery that Schubert lacks is not anything that Spohr could have supplied. Younger composers with new worlds to conquer could with some truth accuse Spohr of playing with classical forms as one might play chess; but they could never have so accused the Schubert that died young or the Schubert that might have reached old age.

We do not know what Mendelssohn might have achieved if he had lived longer. His influence on the musicians he knew personally was wholly stimulating and good. But he too, seemed able to play chess with symphonies, oratorios and songs with and without words, while other composers were grappling in their music with real life, perhaps confined to one narrow art-medium like Chopin, or, like Schumann, deserting lyrics for larger forms or some artificial hypothesis, or, like young Berlioz, kicking right and left against all teaching and all criticism while dreaming new wonders of orchestral sound, and correctly dreaming the practical means to them also.

Meanwhile a greater than Berlioz was arising, a dreamer of new sense as well as of sound. Mendelssohn and Schumann saw only the beginning of Wagner's development, and could not feel very sure that this voluble and stormy reformer of music-drama was really likely to achieve anything better than the tinsel of the astute Meyerbeer who dominated the world of cosmopolitan opera. The early style of Wagner is indeed an alloy of many metals besides iron and potter's clay; but even in the 'forties his work marks the eclipse of the first romantic period and the dawn of another and greater epoch.

The art-forms peculiar to the Romantic period have no definite names, though composers began to use many literary titles, such as Ballade, Romance (already used by Mozart for slow movements in sonata-form), Nocturne and the like. Dance-rhythms, especially those of Poland, were brought into prominence in the pianoforte music of Chopin. Mendelssohn's invention of the song without words was very successful, but the notion is too facile to lead far, or always, even in Mendelssohn's hands, to justify its existence. Fantastic titles, used in the 18th century by the French clavecinistes, assumed great prominence in the pianoforte works of Schumann who created a new type of long connected cycles of epigrammatic little pieces. The articles PROGRAMME MUSIC and SONG concern this period vitally. Relevant biographical articles are CHOPIN, MENDELSSOHN, SCHUBERT, SCHUMANN, SPOHR, WEBER; while the crowd of pianoforte composers whose brilliance on that instrument obstructed all wider musical prospects, include the respectable HUMMEL, the less respectable STEIBELT, the flimsy WOELFL and the Irish writer of beautiful pre-Chopin nocturnes, FIELD (John).

9. THE WAGNERIAN DEVELOPMENT AND THE RENASCENCE OF CLASSICAL FORM

Wagner formulated his principles of music-drama long before he matured his musical style. It is impossible to understand the musical history of the second half of the 19th century until we frankly admit that the composers of instrumental music saw in Wagner not only the subversive operatic theorist and erotic dramatist but the composer who was popular because of the salvation-army religiosity of the end of the *Tannhäuser* overture and the downright vulgarity of the entr'acte before Act III in *Lohengrin*. His theories and methods might be controversial, but these lapses never were.

Strange to say, Wagner received something like recognition from the doyen of classical champions, Spohr, whose attitude to Beethoven had been merely condescending, but who saw in *Der Fliegende Holländer* and *Tannhäuser* interesting, if faulty, works which well deserved painstaking production at his theatre at Cassel. Schumann too, after joining in the general hostility towards *Tannhäuser*, frankly recanted and praised its many noble features. Personally he and Wagner did not get on so well; he found Wagner too talkative and Wagner found that Schumann had nothing to say. Later on when Wagner was in exile, *Lohengrin* found a powerful champion in Liszt at Weimar.

Liszt presented another problem to sober musicians. Wagner himself at first saw nothing in Liszt but the virtuoso who, when asked for music, would give you a fantasia on *Robert le Diable*. On the other hand, persons who became bitterly hostile to all the musical tendencies that Liszt fostered went out of their way to declare that no such wonderful interpretations and technique as Liszt's pianoforte playing had ever before been heard on any instrument or orchestra. All Liszt's gestures were superb, from his monumental immobility at the pianoforte to his princely and often really self-sacrificing generosity to other musicians. And at the age of 37 he made the most superb of all his gestures in giving up playing in public. And so the one incontrovertible power of his art became a legend and his actual activity became the championship of unorthodox artists. He took to composing on a more ambitious scale than that of the marvellous pianoforte virtuoso; and became himself the leader of a new development of romantic music. Although he took little pleasure in counterpoint he had none of Berlioz's clumsiness in harmonic texture; and his orchestration, in which his first efforts had the secret assistance of Raff, was always brilliant and novel, though it never caught the Berliozian fire or plumbed the Wagnerian deeps. Liszt realised no more than Berlioz the true musical purport of the new ideas which his symphonic poems and Berlioz's symphonic-dramatic phantasmagorias were putting forward under all kinds of literary and pictorial names. While the new romantic composers purported to be devoting instrumental music to the illustration of literature (*see* PROGRAMME MUSIC) they were really struggling with a new musical time-scale.

As we have already seen in the present article and in the discussion of HARMONY, musical history may be traced in terms of the time-limit over which the listener's memory is brought into play. In the 16th century that limit is from accent to accent; by the end of the 17th century it ran from phrase to phrase. The great architectural forms of Bach could stretch it easily to six minutes, and, in extreme cases to ten. The rise of the dramatic sonata style did not greatly enlarge the time-scale; for there are few well-constructed sonata-movements that exceed a quarter of an hour, though on no smaller scale could Beethoven have prepared the famous harmonic collision that gave such offence in the first movement of the Eroica symphony. Now this ten-minute time-scale obviously compelled musicians to handle the action of an opera by means of conventions. (*See* OPERA.) It is less obvious that it also produced a similarly conventional artifice in the relation of sonata-forms to their emotional content. A design may complete itself in ten minutes while raising emotional issues that cannot be dealt with in less than forty. And so the sonata-forms are grouped in from two to four (rarely more) movements as artificially as the musical sections of classical operas. Wagner's enormous achievement in music-drama consisted essentially in giving music the same time-scale as that of the drama. As with all first solutions of an art-problem he achieved an extreme case, for his drama became cosmically slow. But from *Das Rheingold* onwards every Wagnerian opening instantly, and without any introductory gestures, lays down the lines of its vast time-scale, to the utter bewilderment of his contemporaries who continued to expect *Das Rheingold* to show its pattern on Beethoven's time-scale, just as Beethoven's contemporaries had heard seven *pianissimo* bars on the chord of E flat, not as that vaulted vacancy appears in the middle of the andante of the C minor symphony, but as it would have sounded if it were intruded into an andante by Mozart.

Nobody else before Richard Strauss achieved Wagner's mastery of his new time-scale; and few, if any, of his contemporaries, whether hostile or friendly to him, realised its existence. Liszt was trying, in his symphonic poems, to make a music that filled its half-hour or forty minutes continuously; but his first effort of the kind, *Ce qu'on entend sur la montagne*, spends the first twenty of its forty minutes in a series of introductions, and the remaining twenty in retracing the series backwards. And his more successful efforts, such as *Orpheus* and *Les Préludes*, are either essentially lyric or not on the new time-scale at all. He never achieved so

effective a symphonic poem as Schubert had already long ago unwittingly produced in the "Wanderer" fantasia. Musicians who might not have been repelled by new doctrines of musical form found Liszt's style even more demi-mondaine than that of the early works of Wagner; nor did Liszt show any tendency to purify it. Moreover he rivalled Meyerbeer in the efficiency of his press-bureau by which he made propaganda, often in his own fluent French, more generously for others than for himself.

Meanwhile another musical development was arising, conscious of its continuity with the past, and, like Judaism as defined by Mathew Arnold, tinged with emotion in the morality of its aesthetic principles. Joachim, as great an interpreter on the violin as Liszt on the pianoforte, at first found in Liszt a congenial friend, until he saw his compositions. These horrified him, and the horror completed an estrangement already begun by his dislike of the atmosphere of Liszt's press-bureau. He and his younger friend Brahms were united not only in general musical taste but in personal devotion to the heroic widow of Schumann, who, after her husband's tragic and lingering death, was bringing up a large family on the proceeds of her concerts. These three artists soon came to regard the musical atmosphere of Weimar, where the *Lisztianer* gathered around their master, as unhealthy. In the correspondence and mutual criticism of Brahms and Joachim the word *Lisztisch* became synonymous with "devilish"; and indeed it is true that any characteristic Lisztian and many Wagnerian idioms would have a disgusting effect if intruded into Brahms's music. To-day we can be wise after the event and find matter for regret in the drastic out-spokenness of Joachim and Brahms which elevated matters of taste into questions of artistic honour. If Liszt could have been contented with *sachlich* criticism on definable issues of technique without requiring attestations of sympathy and enjoyment, and if Joachim could have resolved matters of taste into questions of artistic proportion, the neo-classical and neo-romantic musicians would have joined forces instead of condemning each other. Similar economies might be effected in nature if lions could be converted to vegetarianism.

The controversy was unequal, in two compensating ways. Wagner had a tremendous, if acrid, fluency in prose and did not care where his vitriol might alight. Moreover, Wagnerian and Lisztian music was much easier to write about, whether in attack or defence, than music which had no literary aspect. Brahms, like Wagner, needed and found friends who adored his music, but he hated the idea of a press-bureau and snubbed anybody whose compliments aroused the least suspicion of flattery. These drawbacks had their own compensation. It might be difficult to write as interestingly about Brahms as about Wagner; but Wagner, whether in exile or enthroned at Bayreuth, had Wagnerian music-drama as his whole province, while Brahms reigned over the whole of the rest of music, instrumental, choral and lyric. If criticism came to persecution, on the whole the neo-classics had the worst of it; for Brahms had no equals since Joachim gave up composition, and the position of a champion of classical forms was easily confused with that of a persecutor of the prophets of progress. As a matter of fact, Brahms was no anti-Wagnerian and was annoyed when his friends bracketed Wagner with Liszt.

But, apart from the clash of flying inkpots, the recognition of Brahms was assured by two facts; first the propaganda of his work not by words but by consummate and authoritative performance, and second, the very fact that his music required an experienced love of music for its understanding. A man might become an enthusiastic Wagnerian or even a well-equipped conductor of Wagner's music and be as the brutes that perish about symphonic orchestration, choral music, chamber-music, songs and all pianoforte music except Chopin. But it was long before any musician could venture to tackle Brahms's music on any basis except that of the most comprehensive musical culture and technique. Brahms lived long enough to become worshipped unintelligently; and after his death (in 1897) the reaction was more evident than the fashionable worship had been. There are signs that the reaction is over by now.

The Wagnerians felt deeply that their propaganda was incomplete for lack of a master of purely symphonic music. This they found in Bruckner (*q.v.*). Brahms was appalled by the clumsiness of Bruckner's forms, and the most official Wagnerians admitted the frequent lapses of their symphonic master. On the other hand Bruckner's Nibelungen-tetralogy openings to his symphonies obviously dwarfed the terse themes of Brahms. By the time Brahms and Bruckner had come into their own, the public had long lost all sense of form in its appetite for bleeding gobbets of musical butcher's-meat hacked from the living body of Wagnerian music-drama and served up in concert rooms as *Waldweben, Karfreitagszauber* and *Walkürenritt*. After this it was pedantry to quarrel with any symphonic composer's form so long as his openings were vast enough. Brahms was no pedant; obvious weakness of form and style did not deter him from being the first to recognize Dvořák (*q.v.*); and he was drastic in his rebuff of anybody who thought to flatter him by talking against Wagner.

The song-writer Hugo Wolf (1860–1903) became recognized too late to be made use of as a lyric-pawn in the Wagner-Bruckner party politics of music. As far as his theory of song can be summarized, it consists in the application of Wagnerian declamation to lyric poetry. If his practice were not better than this essentially prose theory of verse-rhythm (*see* RHYTHM) and the perky censorship of classical musical declamation that goes with it, Hugo Wolf's art would not have survived his short and ailing life. But it is deeper than the theories on which it is supposed to rest and its apparent revolt from lyric melody only partly conceals a powerfully organized lyric form, and does not at all conceal a great gift of characterisation.

10. NON-GERMAN MUSIC OF THE 19TH CENTURY

While these great issues were being debated in Germany, the music of other countries was awakening from long sleep or outgrowing infancy and provinciality. France had, since Rameau, been remarkably content to have its music dominated by foreigners. Before Rameau, French opera was established by the Italian Lully. After Rameau it was reformed by the Austrian Gluck. Early 19th century French classicism was dominated by the Italian Cherubini. Another Italian, Rossini, was in the prime of his life absorbed by Paris; and the result was *Guillaume Tell*, with its rich orchestration and grandiose forms. But the crown of French opera was imposed on it by the German Jew Meyerbeer. The pretensions of the native French composers were more modest, except for the volcanic eruptions of that typical Gascon Berlioz. The popularity of Gounod (1818–1893) rested on the same misunderstanding of the meaning of art as the vogue of Doré in the capacity of an illustrator of the Bible. *Faust* was a success. Another development, more improvisatorial, uncertain of its style, but fundamentally sincere, was initiated by the Belgian, César Franck (1822–1892) (*q.v.*). From him, and not from the more prolific and facile Saint-Saëns, originates the main stream of modern French music. His style has too much affinity with Liszt to please the musicians who continue to regard Liszt as the author of all modern musical evil; but he achieved mastery in a wide range of forms all his own and he never wrote for effect.

In Italy music since Rossini was long contented to imitate the things in which Rossini was imitable. These were the mechanical cultivation of *bel canto* and the use of a full orchestra to support the voice in a thick unison of the melodic instruments, with a brassy dance-rhythm in the rest, and the big drum and cymbals to mark the rhythm. The genuine melodic inventiveness of Bellini and Donizetti did little to improve the other categories of the art; but in Verdi (1813–1901) a new genius was arising together with the Risorgimento. In *Rigoletto*, *Il Trovatore* and *La Traviata* Verdi's dramatic sincerity triumphs over the defects of a musical texture which still clings to traditional squalor, though strokes of genius occur unpredictably in the orchestration of many passages. In *Aïda* the style silences all cavil; and in *Otello* (written at the age of 74) and Falstaff (written at the age of 80) Verdi creates a new kind of opera, Wagnerian in its perfect continuity and dramatic movement, but utterly independent of Wagner's style and method.

Bold prophets in Beethoven's time had been heard to say that a great musical future was in store for Russia The fulfilment of

this prophecy was long delayed, for when Rubinstein averred that Michael Glinka (1803–1857) was the equal or the superior of Haydn and Mozart he expressed an opinion which could have occurred only to a Russian, and then only as a patriotic paradox. Rubinstein himself achieved only a weak cosmopolitanism in his voluminous compositions, though his pianoforte playing remained, for all its waywardness, till near the end of the century, as the most monumental power of interpretation on that instrument since Liszt. The first composer to make a genuinely Russian music recognized over the whole civilized world was Tchaikovsky (1840–1893), whose symphonies were held by some critics to have eclipsed those of Brahms. This was the eclipse of drama by melodrama. The true merits of Tchaikovsky are now eclipsed by the rising reputation of his less immediately successful contemporaries. Moussorgsky (1835–1881) had the posthumous fortune to have his two great operas *Boris Godunov* and *Khovantschina* revised by Rimsky-Korsakov (1844–1908) the most brilliant contemporary master of pure orchestral colour and texture. This was unquestionably good fortune in so far as it speeded these unconventional works on their way into the wide world; but something like indignation has accompanied the more recent study of Moussorgsky's original scores, with the discovery that besides altering clumsinesses Rimsky-Korsakov constantly meddled with features in his friend's style that were far beyond his comprehension.

The 19th century was over before any musician on the continent could be persuaded that there were composers in England. Schumann had repeated St. Gregory's pun about Angles and angels when he hailed Sterndale Bennett as "ein englischer Componist"; but the trials of English musical life dried Bennett up. All who knew and loved him denied hotly that his music reflected Mendelssohn's; and perhaps, to-day, a leisurely study of it might vindicate his independence. Macfarren (1813–1887), who succeeded Bennett in his educational offices, was a widely-cultured musician whose influence for good was frustrated by his violent conservatism which co-existed with a fatal readiness to be led by faddists. (*See* HARMONY.) The renascence of English music began in the work of Parry (1848–1918) and Stanford (1852–1924). They put an end to the provincial absurdities of our British oratorio tradition, and consistently set great literature in a way that revealed to contemporary poets that the antithesis between musical and general culture was false. They also had wide and deep influence as teachers of composition.

Still, recognition of English music on the continent was rare and capricious. Englishmen wrote church music for the stage, stage music for the church, organ music for the orchestra, and, as far as we had any orchestral ideas at all, orchestral music for the organ. The one famous English composer who could be understood on the continent as saying intelligible things in fit terms, was Sullivan, with his Savoy operas. And his serious colleagues and critics urged him with owlish solemnity to produce no more light masterpieces but to go on with his serious and luscious Golden Legends and Martyrs of Antioch and generally to consummate the final merging of English music into "The Lost Chord." We may thankfully hope that that chord is now lost for ever; but the Savoy operas live, and might, without delay to their popularity, have risen to the position of great music if Sullivan had had enough steadfast love of music to finish those parts of his work to which the public did not listen; if for example, he had provided his operas with better orchestral introductions' than the perfunctory pot-pourris of their favourite tunes which he calls overtures and which are quite as long as artistically-decent overtures would have been.

It is customary to explain the failure of all but the most recent British music by saying that the native art was crushed by the ponderous genius of Handel. It is a great pity that the united ponderosity of Handel and the middle-weight Mendelssohn could not avail to dam the output of oratorios by composers who might have become good song-writers or even acquired some knowledge of orchestration beyond that of choral accompaniment. The complaint of foreign domination is nonsense. No nation has had its music so long and so completely dominated by foreigners as France; and French music has always remained exclusively French and has made thoroughly French artists of the foreigners who dominated it. The traces of foreign influence on English music have always been the echoes of individual phrases or mannerisms. While we have echoed, as the fashions change, Mendelssohn, Brahms and Debussy, we have learnt no technical lessons from them. Such mechanical echoes show no foreign domination, but are the best proof of an inveterate provincialism and the kind of ignorant and irritable independence that goes with it. Since music ceased to be an integral part of an Englishman's culture (about the time of William and Mary) our musicians, as a rule, began its serious study far too late. The language of music cannot be begun at the age of 19 like courses in law or medicine. Our universities have played a considerable part in shaping British musical destinies; but mighty Oxford treads on the tongue of the encyclopaedist who would pursue this topic.

11. MUSIC OF THE 20TH CENTURY

The 20th century inherited the last development of the 19th in the symphonic poems and operas of Richard Strauss (*q.v.*). Much acrid controversy at first raged around the details of his style which dashed through all the traffic regulations of classical part-writing. And nothing was easier than to identify all carping critics with Beckmesser and to accept humbly Strauss's own self-portrait as the hero of *Ein Heldenleben*. The elements that were sensational in Strauss's symphonic poems have become so familiar that we are in some danger of underestimating the importance of these works as real achievements of the problem in which Liszt failed; not the trivial problem of programme-music, but the vital problem of writing purely instrumental music on the Wagnerian time-scale. The power of composition in these works is unquestionable and remains eminent in their facile aftermath, the *Alpen-Sinfonie*, which, designed before the World War, appeared in 1915. But Strauss had eclipsed the fame of his symphonic works by his operas, which began to be important with *Salome* (1905), a setting of Oscar Wilde's play. Then came the long and fruitful partnership with Hugo von Hofmannsthal which is still in being, and has enabled poet and musician to prove the possibility of many different kinds of modern opera, Wagnerian and non-Wagnerian. The purity of the Straussian metal has been strongly alloyed with worldly wisdom in every phase of Strauss's career; in the period of the good boy of the conservatoire; in the romantic symphonic poet of *Tod und Verklärung;* in the timely musical adaptation of Wilde while he was still a new discovery on the German stage; in the seizing of the opportunity presented by Hofmannsthal's *Elektra* after its triumph as a play; and not least in the present phase of naïve melodiousness. Nevertheless *Die Frau ohne Schatten* is perhaps the most noble gesture in music since the World War. From the twilight of *fin-de-siècle* and recent erotic art and from its always selfish and sometimes abnormal sexual preoccupations, *Die Frau ohne Schatten* breaks away with a heroic plea for normal love and life, unassailable by any cavil that does not write itself down as ignoble, musically, Strauss's grandest and most grandly realised opportunity for beauty. As a theatrical spectacle it is a gorgeous pantomime, no more disturbed by its allegorical meaning than *Die Zauberflöte*, which it in some ways intentionally resembles. *Die aegyptische Helena* (1928) descends from this high level into all manner of cleverness in its stage-technique and of facility in its music.

Whatever has been gained in the 20th century music, Strauss presents an almost solitary example of mastery of movement. Elsewhere, neither in academic teaching nor in new musical developments does any sense of movement seem to be cultivated. The vast cosmic movement of Wagner is attempted in Bruckner's fashion, by composers who seem to think that huge dimensions can impress us as huge without any reference to human measurements. The best work of Sibelius shows a true sense of cosmic movement and a real freedom and economy in the forms by which this is expressed. With other modern composers the most curious musical inhibition is that which makes them continue to write

sonata works in the four classical movements with a rigidity unknown to Mozart, Haydn and Beethoven, though the modern matter has no more connection with sonata form than Wagnerian music-drama has with the da capo aria.

This lack of necessity in form is nowhere more conspicuous than in the whole work of Max Reger who is usually regarded as the Brahms of the 20th century. His untimely death happened when he was evidently about to change his style. He was a pupil of the most mechanically-systematized musical scholar of recent times, Hugo Riemann; and anyone who has groaned in spirit at the sight of one of Riemann's instructive editions of a piece of classical music may easily recognise in Reger the traces of Riemann's teaching. Every external feature of the classical art-forms is present without any trace of the classical reasons for it. Everything has been worked out from one detail to the next as if it had been plotted on squared paper ready marked by someone else with points of reference.

Whatever is to be learnt from Reger, it is not the meaning of classical art-forms. And much is to be learnt from Reger. His texture is inevitably thick, for its systematic completeness vetoes the suggestiveness of the highest art. But it is astonishingly sonorous, and its numerous notes are the fewest and most effective for its ponderous purpose. Every instrument is treated according to its natural technique; and while the player who claims that he can read Reger at sight is probably mendacious, he will enjoy his instrument the better for playing Reger well. The fundamental reality of Reger is that he is not only a sincere artist but a consummate rhetorician. But this age must be very ill-informed as to the foundations of music if it elects Reger as its Brahms.

There is at present no Brahms; the 20th century must enlarge its musical experience before another renascence of classical form can either be expected or recognized when it comes. It might be as likely to come from Russia as anywhere; the gigantic geniality of Glazounov is still with us, active in the composition of brilliant classical and symphonic polyphony, and generously stimulating to younger composers; and the efforts of young artists to find out things for themselves may lead to something more fundamental than revolt against academicism or than the still narrower academicisms that young revolutionaries are apt to set up among themselves.

Scriabin's later harmonic system has been touched upon in the article HARMONY, Section 7. At this point we may sum up the lessons of three harmonic revolutions distributed over five centuries of musical history in the generalization that whenever a composer becomes permanently pre-occupied with harmonic ideas his power of composition is in great danger of paralysis. The reason for this lies deeper than the nature of music itself. Similar tendencies in literature reduce the power of sentence-building to that of the first Ollendorfian exercises. Scriabin's Chopinesque but stiff style of composition was fortunately well mastered by him before he doomed himself to discover that the harping on any chord however strange and novel in the long run only produces the effect of a sophisticated dominant seventh. Before his style receded into its theosophical fastnesses Scriabin had achieved in his fifth sonata and in his orchestral *Poème d'Extase* (both inspired by a literary poem from his own pen) works of powerful impulse that could not have been written on earlier harmonic and rhythmic resources.

The chances of producing permanently living work are heavily weighted against the composer who confines his art to things which he alone can understand. The Russian Ballet gives abundant vital occasion for music as long as it deals intelligently with drama, fairy-tale, fable and life; and the young Stravinsky found in it inspiration for music that remains intelligible apart from the spectacle. In *Petrouchka* he still produces rhythms and tones that enhance the moods of a fascinating pantomime; but the concert-goers who profess to enjoy it without ever seeing the ballet show themselves to be of the tribe who will gaze "as ducks that die in tempests" at anything they are told to admire.

Self-deception and dry-rot set in when the designers as well as the composers of the ballet retire into the arbitrary kingdom of abstractions which they call symbolic and which common sense calls nonsense. Opinions will never unite as to where the line should be drawn; but the 20th century will differ from all other periods of human history if a large percentage of its most precious nonsense does not vanish into the limbo of mere nonsense before its generation becomes middle-aged.

The art of Debussy made its mark without any such artifices. Some aspects of it are discussed in HARMONY, Section 8; but Debussy would have indignantly repudiated the resolving of his whole-tone scale as a six-part polyphonic chord, though he himself cannot resist the impulse to resolve it on to a pentatonic scale which is itself constructable as a chord. Debussy's propagandists believed him to be more closely confined to his special system than was the case. Eclecticism was always breaking in without any damage to the aesthetic coherence of the style. It is probable that Debussy's art, discreetly anthologized will remain vital when the work of the more voluminous and hard-headed Ravel will have become no more distinguishable from an echo than Sterndale Bennett is from the echo of Mendelssohn. Independent origin does not settle such questions. Cyril Scott has been called the English Debussy, but he began to form his style before Debussy was known.

One of the eternal questions in aesthetics is the proportion of means to ends. The World War has tragically dictated to all artists a preference of the study of reduced rather than of increased resources; yet performances on the scale of our own Handel Festivals in the Crystal Palace still continue to take place, though the music for an organization of even half that size has never yet been composed. Here, then, is material for a real and strenuous aesthetic discipline; and the zeal of Mengelberg has created in Holland a great vogue for the vast works in which Mahler, while writing for existing conditions, sets himself the task of pioneer-work in the aesthetic and technical principles of music designed for 1,000 performers and upwards. Taste is of secondary importance in such an enterprise, and Mahler is likely to be underrated in countries where naïve sentimentality and boyish grandiosity encounter the inhibitions of a musical culture that thinks itself wiser. Mahler was one of the greatest orchestral and opera conductors that ever lived. On the total value of his compositions tastes may agree to differ, but this century has seen no more strenuous idealist. The main stream of music still flows within the Wagner-Strauss limits and seldom requires 150 instrumental players. Arnold Schönberg's "Gurrelieder" (a large song-cycle for chorus and soli, the great success of which is held to be a hindrance to the spread of his later and more revolutionary gospel) requires an extraordinary orchestra; but the polyphony that requires 50 staves for its notation implies detail rather than mass.

The performance of Elgar's *Dream of Gerontius* at Düsseldorf in 1902, its enthusiastic reception there, and finally the generous speech of Richard Strauss then delivered in its honour, inaugurated the recognition of modern English music on the continent and gave English critics and audiences a not unneeded lesson after their lukewarm reception of it at its inadequate first performance at Birmingham. Elgar's rich and subtle orchestration is not more remarkable than the wealth of his invention of themes. His contemporary, Bantock, is a prolific composer in a style far easier but not less personal and sincere, in which the influence of Strauss and the schematic purity of Rimsky-Korsakov's orchestration may be traced by their technical results but not by mannerisms. Nowhere in Europe is there a more radiant source of musical health.

In Italy the masterful personality of Boïto (1842–1918) developed in the 19th century but his musical ideas anticipate the 20th. He wrote brilliant libretti to Verdi's last works and those of younger composers and achieved extraordinary musical fame by two operas, *Mefistofele* and the posthumous *Nerone*. These have taken their place among the historic documents of musical Italy on the strength of less actual musical content than any other operas in existence. Their aristocratic refinement and *flair* for atmosphere is unquestionable. Very different is the full-blooded efficiency of Puccini (1858–1924) in whose hands Italian

opera advanced in the estimation of a public that was in all countries becoming too experienced in music to be satisfied with perfunctory orchestration and histrionic convention. The razor-edge intellect of the great pianoforte artist Busoni (1866–1924) achieved important results in compositions for the pianoforte, the orchestra and the stage, in spite of the energy he spent in demonstrating how much more cleverly the classics would have been written if they had possessed his advantages. If Casals (*q.v.*) gets his way, the musical awakening of Spain will soon be a leading feature in the history of the modern art.

In England there are encouraging signs that musicians are beginning to think for themselves without confusing between independence of academic tradition and independence of truth. Gustav Holst's interest in oriental subjects is (like Bantock's) no whim for *chinoiseries* but a true expression of the nostalgia of the West for the East. His *Hymn of Jesus* is worthy of its awe-inspiring Byzantine eucharistic text. Vaughan Williams, with less of Holst's wide and clear-sighted exploration of pre-harmonic regions, composes with consistent nobility on a large scale and in a style that it would be an impertinence to try to trace to its various historic origins.

Thus the work of doctrinaires is not all that is happening in modern music; and, in any case, music is in the happy position of existing, like architecture, on practical terms which forbid mere lunacy to flourish unchecked. A large proportion of modern musical developments have been tested by enthusiastic and capable public performers almost before the ink of the manuscript was dry. Immediately before the World War, Rutland Boughton's small-scale Glastonbury festivals of music-drama were a stimulus of incalculable importance in the history of modern British opera; and at the present day on the continent the younger composers of chamber-music have the help of knight-errants in the masterly Amar Quartet which, with Paul Hindemith as viola and his brother as violoncello, spare no pains to secure for the most difficult experiments (such as the quarter-tone works of Haba) a perfect performance. Hindemith himself is one of the boldest and most masterly experimenters, if indeed, he is not the master of them all. It is very significant that his vocal writing, which seems to contradict all previous orthodoxies, stays uncommonly firmly in the vocal memory once it is mastered; whereas many otiose modulations in the Lisztian music of the seventies, such as the part-songs of Cornelius, sink in pitch however much choirs may practice them. The young masters who sternly renounce romance make a romantic gesture in the very act.

Much has been said as to the fructifying or deleterious influence of jazz. The highest class of jazz-band is undoubtedly composed of sensitive artists; but the conductor of a symphony orchestra in a musically not metropolitan town will, if he engages for a symphony concert the gentleman who handles the percussion apparatus of the best local jazz-band, discover that that artist's methods are entirely extemporaneous, and that, except with a drumstick, he has never clashed the cymbals otherwise than flat on to the top of the big drum, and never counted rests in his life. Ordinary jazz-music distributes its rhythmic surprises over the most imperturbable eight-bar ambling trot that ever lulled the rhythmic sense to sleep. Most drugs that begin with a stimulating action end as narcotics.

12. PROBLEMS OF THE FUTURE

The explorers of new musical intervals are hampered by having to deal with classical keyboards and other practical limitations. Perhaps they would do well to investigate Miss Schlesinger's pianoforte-tuning, already mentioned in connection with Greek music; for, whether it be Greek or not, it is scientific and therefore more natural than most of the experiments that composers have yet tried in the way of quarter-tones. But new instruments cannot be so readily produced as in the 18th century. Harpsichords and early pianofortes were *made;* but pianofortes are now *manufactured.* Emmanuel Moór's duplex-coupler pianoforte enormously extends the resources of the instrument without compelling the player to unlearn the classical technique. But its progress is impeded by the commercial difficulty of promoting an improvement that cannot be added as an extra apparatus to existing and standardized pianofortes, and its reputation is damaged by the tendency to expound it as a device that makes existing feats of technique nugatory, a policy that infuriates the pianoforte virtuoso and ignores the great new possibilities of the invention.

Resonators have been invented for many instruments. The claim that by such devices one violin can sound like sixteen ignores the real effect of the choral multiplication of instruments, which consists far more essentially of a change in quality of tone than of a mere increase of volume. No resonators, phonograph discs or loud speakers for wireless transmitters will ever replace the quality of sounds that combine in the ear from the various directions of their dispersed orchestral sources. The listener need only put his hands around his ears while listening to an orchestra in a concert-room, and he will realise that a "gramophone effect" is little more than the result of cutting off the waves that reach the ear from other than the frontal direction.

The main importance of "wireless" lies in the fact that it appeals *viva voce* to millions without producing the phenomena of crowd psychology. Here and there it leads to a revived interest in intimate early pianoforte music that would never satisfy modern ears in the concert-room, and a new fact in musical aesthetics is the beauty of microphonically-magnified tones of very faint instruments such as the clavichord. Wireless is undoubtedly increasing the number of fireside music-lovers; but it needs careful administration to prevent it from a tendency to cut off orchestral music at the source; for many of the new music-lovers prefer tinned music at the fireside to live music in the concert-room. It is urgently necessary that the wealthy supporters of music should be made to see the folly of the notion that good music should be expected to pay its way commercially.

Wireless music may prove less subversive than another revolution by means of the microscopic study of phonographic records. There is nothing to prevent the eventual production of music directly in terms of the track of the phonograph-needle. That is to say, the composer, untrammelled by the technique of instruments, will prescribe all producible timbres in whatever pitches and rhythms he pleases, and will have no more direct co-operation with the craftsman who models the phonographic wave-lines than the violinist may with Stradivarius. The crudest beginnings of this new method of composition will be enormously important; but its highest development will still leave the handling of human voices and instruments supreme as the infinite source of inspired music.

(D. F. T.)

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THE UNITED STATES

The musical history of America does not begin, properly speaking, until the 19th century. To be sure, songs were sung and instruments played upon during the 17th and 18th centuries; but such performances were the casual pastime of the Southern and Middle Atlantic gentry, rather than the expression of a national art. New England, rigidly Puritan, sang psalm tunes, and but few of those. In 1737 Francis Hopkinson, of Philadelphia, published his first song, "My Days Have Been So Wondrous Free"—the first American secular composition.

Colonists, being recruited from the ranks of adventurers, farmers, traders and refugees, had neither the time nor the inclination to cultivate the arts. They were too completely preoccupied with life's exigencies to bother about its adornments. It is hardly surprising, therefore, that music played a negligible rôle in American civilization until such time as the pioneers had conquered their natural and political enemies, and the 13 Colonies, finally emancipated and achieving a measure of peace and economic security, had settled down to the business of becoming a nation. Repeating summarily the musical history of Europe, America's early musical contributions were religious and popular; the former through the hymns of Lowell Mason (1792–1872); the latter through the now-forgotten but once ubiquitous salon pieces of Louis Moreau Gottschalk (1829–69), and the songs of Stephen Foster (1826–64).

To realize what a recent growth American music is, it is necessary only to reflect that such living musicians as Arthur Foote (b. 1853), George W. Chadwick (b. 1854), Edgar Stillman Kelley (b. 1857) and Frank Van der Stucken (b. 1858) were virtually pioneers in musical composition in their native land, their only predecessors of any considerable note being Benjamin J. Lang (1837–1909), John Knowles Paine (1839–1906) and Dudley Buck (1839–1909). Other members of this group were Ethelbert Nevin (1862–1901), Horatio Parker (1863–1919) and Edward MacDowell (1861–1908), the latter being the most gifted composer that America has yet produced. To the same epoch belong also Reginald de Koven (1859–1920) and Victor Herbert (b. Dublin, 1859; came to America 1886; d. 1924), both of whom achieved international fame as composers of light opera.

All these composers, Foote alone excepted, were German-trained, the lack of adequate instruction at home rendering European study almost imperative. The virtual impossibility of obtaining a thorough musical training in America, thus obliging the student to spend his formative artistic years in a foreign country, has been a great handicap to the American composer. Coupled with the want of any authentic background of native folk music, it has been the cause of the slowness of American music to exhibit any distinctive national characteristics. One suggested solution has been to turn for musical inspiration to the American Indian. Of this method Charles Wakefield Cadman (b. 1881) and Arthur Farwell (b. 1872) are enthusiastic champions. Another, of which Henry F. Gilbert (1868–1928) was the best-known advocate, was the exploitation of American negro spirituals and slave songs. In recent years, the popularity of American jazz has suggested this as a third possible foundation for a national musical idiom. In this field George Gershwin (b. 1898) has been most successful.

Other contemporary American composers, whose work follows no definite nationalistic programme, are Howard Brockway (b. 1870), Frederick Converse (b. 1871), Edward Burlingame Hill (b. 1872), Daniel Gregory Mason (b. 1873), Henry Hadley (b. 1874), John Alden Carpenter (b. 1876), John Powell (b. 1882), Emerson Whithorne (b. 1884) and Deems Taylor (b. 1885). The untimely death of Charles T. Griffes (1884–1920) cost America a brilliant talent. To the present-day group belong also Charles Martin Loeffler (b. 1861) and Ernest Bloch (b. 1880), who, though born respectively in Alsace and Switzerland, should be considered American composers.

In the interpretative field of music America has been particularly prolific in famous opera singers. These include—to name a few—Minnie Hauk, David Bispham, Sybil Sanderson, Lillian Nordica, Edyth Walker, Emma Eames, Clarence Whitehill and

Geraldine Farrar. Opera itself, on the other hand, has never been a successful form of American musical expression, principally because the scarcity of permanent companies made it impossible for the would-be operatic composer to gain practical experience.

The growth of symphony orchestras has been extraordinarily rapid. Beginning with the Philharmonic Society of New York (founded in 1842), they have increased in number until in 1927 the country contained nearly 50 of them, the more important being, as a group, without a peer in the world. Pioneers in this work were Leopold Damrosch (1832–85) and Theodore Thomas (1835–1905). The custom of giving concerts especially for children is universal among the larger orchestras, and has had much to do with the rapid growth of musical appreciation in America. An extension of this movement, inaugurated in 1928 by Walter Johannes Damrosch (b. 1862), was the broadcasting of an entire series of educational concerts to schools and colleges throughout the country as far west as the Rocky mountains. Walter Damrosch's greatest services to American music were rendered in connection with the New York Symphony Orchestra and as a conductor of opera, but he was himself a distinguished composer.

In 1928 the future of music in America looked bright. Largely on account of the World War, which drove scores of Europe's finest interpretative artists to migrate to America, the concert centre of the world was then in New York. The country's wealth has made possible the expenditure of lavish sums upon the development of musical resources. American orchestras are the finest to be heard. The Metropolitan Opera Company of New York, and the Chicago Civic Opera Company, offer productions that, in scenic elaborateness and vocal resources, challenge comparison. American conservatories have vastly increased in number and immeasurably improved in quality. Two of them, the Curtis Institute of Music in Philadelphia and the Juilliard Musical Foundation in New York, are richly endowed and offer instruction at the hands of world-famous masters.

Interest in music is wide-spread, its growth augmented by such factors as the broadcasting of symphony concerts, the excellent orchestras of the larger motion picture theatres, and the extensive use of mechanical reproducing devices. The American musician can at last approximate the opportunities for technical training, practical experience and intelligent appreciation that have so long been enjoyed by his European colleagues. A corresponding growth in his self-respect, individuality and artistic stature is virtually inevitable.

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MUSIC, TEACHING OF. As there are three possible parties to any musical transaction, the composer or maker of the music, the performer or reproducer of it, and the listener or appraiser of it, it follows that the art of teaching, as applied to music, naturally falls into three categories: (1) the teaching of the nature of music itself; (2) the teaching of singing or playing some instrument or of conducting; and (3) the teaching of the appreciation of music. This last manifestly should be the same thing as (1) but without the creative incentive.

The teacher and the self-taught in all three categories have obviously one supreme obligation in common, namely, to train the ear with a serviceable exactitude to detect musical tones and to relate them instantaneously with each other into sensible and delightful order, whether together as chords, or in succession as melody, or in a succession of chords, or a combination of melodies, as in harmony and counterpoint.

Teachers of singing, and of playing, have the added task of inducing their pupils to hear the whole, of which what they are singing or playing is a contributory part—to see the whole building of which they themselves are an essential brick. Consideration of the art of teaching as applied to the act of singing and playing lies beyond the present purpose. But it may be noted with satisfaction that in the present day a steadily increasing attention is being given to the crucial matter of ear training. Aural exercises and ear tests are now common in practical examinations, but have yet to become adequate and universal. It is astonishing that they have been so neglected that to-day Doctors of Music can still probably be found who cannot with ease give an instant and accurate account of even a few simple chords as they are played, but would "rather see that done on paper."

Incidentally the teaching of the art of reading music offers problems and interests of its own to teacher and taught alike. It is with some quite good musicians a life-long problem to learn to correlate the efforts of eye and ear and voice (in singing) or fingers (in playing) into one well-synchronised act. In the study of a field of literature, or poetry, through the medium of reading it would be a heavy handicap to any lover of fine thought to have to struggle with the mere problems of reading as he went along, and in music there is no reasonable hope of an effectual national culture without a recognition of the proved need and possibility of teaching small children to read music before they leave school.

At the present day it seems quite exceptional, either in a school or in a place of worship where singing is expected, to find even the melody of the tune supplied to the scholars or the congregations. Indeed it seems probable that if by some magic wand all the "Words only" editions of hymn books and song books in the whole country could be transformed into "Melody editions" for twenty years, a standing, but apparently needless, difficulty would be automatically removed. The present writer met a young airman during the recent war, who, being driven to find relief from war in trying to make melody for himself, had actually to invent a queer and original notation of his own by the use of numerals in which to write down his melodies.

It is interesting here to note that the thousand-year-old Sol-Fa syllables, by which notes are still to this day set down and learnt, were originally the result of an effort by Guido, a monk of Arezzo, to teach music-reading by associating the first syllable of each line of a certain hymn to St. John the Baptist with one of the six degrees of the hexachord. Just as the monastic schools of Europe contributed to the teaching of music much that was based on immediate experience, so also have our own choir schools, attached to the cathedrals, collegiate chapels, and to some churches. Nevertheless, it seems clear that the great hope of a broad basis of music teaching and of general musical culture lies in the ordinary schools of the country, and to some extent also in that choral singing which is so wholesomely associated with the act of worship.

Apart altogether from teaching performance, or mere reading, the art of teaching as applied to music itself seems to have lingered, up to the present, in what are naturally first stages. Just as the first stage of teaching a small child its mother-tongue is naturally that of imitative repetition, so in music the communication of the art from mind to mind has, broadly speaking, continued to dwell, up to the present, in that region where imitation of the practice of admirable composers is urged upon the learner, or where, at the best, the composer's customs and ways are reduced to certain bye-laws (necessarily with many exceptions) treated as laws, or even as high principles, and invested with an authority often pathetically falsified by events. To take a notorious example, the excellent bye-law against the writing of so-called consecutive fifths in similar motion between any two parts (say a tenor and a bass part) is laid down in almost all text-books, and yet it is cautiously set aside by many, and by others freely flouted, obviously not for caprice, but faithfully.

MODERN OUTLOOK

Still, in spite of the conspicuous absence of an accepted way of teaching music on any logical and generally comprehensible basis —an absence, that is, of any *corpus* of teaching based on broad principles which commend themselves to the common sense of all men—good sectional teaching has been evolved, either by following the general course of musical history, or by following merely the particular practice of one period (such as that of the 16th century, for so-called Strict Counterpoint) and sometimes

even of one towering, dominating mind (such as that of Bach, for Fugal Counterpoint). There has consequently been a voluminous and careful output of useful treatises which have done much to help the student, if also often to puzzle him as to the why and wherefore of their inhibitions. These treatises usually still divide musical study into what seem to be arbitrary partitions.

Our leading colleges and academies of music, as well as our university musical faculties, have, up to the present, prescribed courses, both of teaching and of examination in music, broadly under the following six sectional heads:—harmony; counterpoint; fugue and fugal counterpoint; musical form; musical history; composition. The gaps, the overlappings, and the confusions of such a system are glaring, and increasingly disconcerting to teachers and students alike.

To name but one gap, it will be noticed that melody is not itself a fixed subject of tuition at all, though a moment's thought would probably cause 999 out of any 1,000 teachers to admit gladly that if their pupils in all the other sections came to them after a special course in melody, and in the mastery of melodic sense, construction and analysis, their powers to cope with and co-ordinate the rest of their musical studies—including Harmony, Counterpoint, Fugue, Form, and the whole range of Composition —would be measurelessly enhanced.

Again, to name but one of the many overlappings, harmony and counterpoint are practically and admittedly inseparable. It is as impossible to detach harmony from counterpoint as it is impossible to do the simplest cross-word puzzle without thinking both vertically and horizontally. Yet they are definitely divorced for study, though all good teachers help their pupils to the habit of unified thinking.

Finally, to name but one confusion, counterpoint may still be taught by one good teacher (following perhaps Rockstro and R. O. Morris) as a method of acquiring understanding of sixteenth-century musical style, and by another equally good teacher (following perhaps Albrechtsberger via Macfarren) as a mere artificial method of restricted mental exercises under temporary bye-laws. As a result, perhaps in the same music school or university, a student may be counselled in his counterpoint exercises to write gracious melody, mostly consisting of steps of a second and leaps of a perfect fourth or fifth (not because they accord with musical principles, but because Palestrina wrote in that way), and in another room he may be told mainly to restrict himself to one chord in a bar and to write a given number of notes to that chord in each exercise, and he may be allowed to leap diminished fifths and major sixths in the process as he pleases, so long as the one chord is maintained.

Obvious as are all three kinds of drawbacks, present-day teachers of music can at least claim the merit of sending students to consult and emulate the personal perfections of the composers who seem most trustworthy and admirable. But it is clear that we await a new and simpler teaching, more impersonal, more tolerant yet more precise, based on high common-sense.

Three notable factors in to-day's position (1928) as to the general teaching of music throughout the country may here be briefly noted, one of which is new. The first is that the mere technical difficulties of performing music (whether vocally or instrumentally) seem to musical aspirants so numerous and formidable as perpetually to side-track the essential work of the teacher. When a mother says "I wish my daughter to learn music" she naturally means her to learn to play or sing, and to that both time and cost are constantly devoted.

A second formidable factor in the position is the mere technical difficulty, still felt, of teaching music-reading and script. Curwen's excellent adaptation of the ancient solmization and the ingenious French Chevé method of using numerals have helped to ease the situation in schools. But until the books are in the schools and the acts of reading from, and writing on a music-stave can be taken by the children in their stride while they are daily making melody together and enjoying it with disciplined zest, it is hard to see improvement ahead.

The third and hopefully new factor, which may render the present article speedily obsolete, is the sudden vast increase in availability of every kind of good music, and consequently of musical stimulus and enjoyment, by means of wireless and the gramophone. (H. W. D.)

THE UNITED STATES

Music received slight attention in the days of the American colonists. For the improvement of church music, manuals of instruction in singing were prepared early in the 18th century by two Massachusetts ministers, the Rev. John Tufts and the Rev. Thomas Walter. These books and their successors provided the text material for the "singing schools" and "musical conventions" which for years represented the chief activity in music study.

The first well organized effort to provide a more complete musical education was the Boston Academy of Music founded by Lowell Mason in 1833. From about 1840 a considerable number of Americans went abroad to study music, chiefly in Germany. These pioneers, reinforced by many foreigners, were leaders in the marked advance of their profession, especially after the Civil War. Music education was recognized by instructors in music at Oberlin college from 1838 and at Harvard from 1862. The college music department and the independent music school were first exemplified by the foundation of Oberlin conservatory (1865) and the New England conservatory (Boston, 1867). Then followed the Cincinnati Conservatory of Music (1867), Chicago Musical college (1867), Peabody conservatory (1868), College of Music in Cincinnati (1878) and the American conservatory (Chicago, 1886).

The most important music schools have developed along two general lines, either as independent music schools or as college or university departments. In the former the graduate receives a degree or diploma; in the latter music study is credited toward an academic or musical degree. Further additions to the list include the Yale School of Music, University of Kansas, University of Michigan, Vassar, Wellesley and Smith colleges, Combs conservatory (Philadelphia), Northwestern university, Syracuse university, Columbia School of Music (Chicago), Bush conservatory (Chicago), Newcomb college, Detroit Conservatory of Music, MacPhail School of Music (Minneapolis), Cornish school (Seattle), Louisville conservatory, Pittsburgh Musical Institute, Horner Institute (Kansas City, Mo.) and Cleveland Institute.

Four music schools have special endowments. The oldest was founded in 1904 as the Institute of Musical Art of New York; since 1926 it has been called The Institute of Musical Art of the Juilliard School of Music. The bequest of Augustus D. Juilliard (1919) left some millions of dollars for the promotion of musical education and culture, and led to the founding of a music school in New York city (1924). It is now a graduate school for students of unusual talent, with the Institute of Musical Art and an extension department as under-graduate provisions. The Eastman School of Music (1919) at Rochester, N.Y., a department of the University of Rochester, has been endowed with $12,000,000 by George Eastman. The Curtis Institute of Music in Philadelphia (1924) has been endowed with more than $12,000,000 by Mrs. Edward W. Bok.

In 1908 Arthur L. Manchester prepared a report on music education in the United States for the Bureau of Education, dealing with schools and departments of music, not with public schools. The widely varying curricula quoted led the compiler to the conclusion that undue exaltation of the vocational aspects of music had led to the separation of music from general educational thought. An improved condition is shown by the 1928 report of the National Research Council of Music Education, which shows that 85% of colleges and universities now allow entrance credit for music, and 77·5% offer courses in music for credit toward a degree. The organization (1924) of the National Association of Schools of Music is also promoting a more satisfactory state of curricula and credits. Efforts have been made in some States to demand certain standards of attainment for the work of the private music teachers, who flourish in abundance, but State regulation is not yet common. Chief among the teachers' organizations is the Music Teachers National Association, founded in 1876 by Theodore Presser. Many State associations of music

teachers have functioned along similar lines.

Public school music implies the recognition of music education for everyone, as contrasted with its study as a speciality. It began with Lowell Mason's work in the Boston public schools in 1837, an example followed promptly in Buffalo, Pittsburgh, Louisville, Cincinnati, San Francisco and other communities. The text-books were derived from those of the "singing schools." The first provided for public school use were by Lowell Mason and Charles Aiken. *The National Music Course* (Luther Whiting Mason, 1870) was the first of numerous courses providing systematically arranged vocal material for all public school grades. In 1885 the Bureau of Education reported 90 special music teachers in 247 communities. By 1914 the number of communities had risen to 622, of which only 15 had no special supervisor of music. This report indicates decided advances in the education of the music supervisor; the existence of 238 high school orchestras (evidently beginning at Richmond, Ind., under the direction of Will Earhart); the teaching of harmony, music history or appreciation in school; the accrediting of private music lessons outside school; and a higher standard of choral music. The Music Supervisors National Conference was organized in 1907; in 1928 its membership exceeded 5,000.

The literature of musical education has received important contributions in theory from George W. Chadwick, Hugh A. Clarke, Benjamin Cutter, Arthur Foote, Percy Goetschius, Walter R. Spalding, Adolf Weidig and Bernhard Ziehn; in history from Edward Dickinson, Louis C. Elson, Waldo S. Pratt and O. G. Sonneck; in aesthetics and appreciation by Charles H. Farnsworth, Clarence G. Hamilton and Daniel Gregory Mason; in musical education by Frank Damrosch, Carl E. Seashore and Archibald T. Davison; in public school music by Karl W. Gehrkens, T. P. Giddings, P. W. Dykema and Edward B. Birge.

Scholarship is evidenced by *The Musical Quarterly*. Of the magazines devoted to music teaching *The Etude, The Musician, The Musical Observer* and *Singing* are among the most popular. Regular publications of various associations provide a valuable aggregate of educational ideas. Reproducing instruments of player-piano and gramophone types have had considerable place in school-music teaching and offer large supplies of educational material. Organizations deserving mention are the American Guild of Organists (1896), The American Academy of Teachers of Singing (1922), the Associated Glee Clubs of America, the Intercollegiate Musical Council and the National Federation of Music Clubs. The Carnegie Foundation has financially encouraged educational efforts in music, including the church music school at Northwestern university.

The trend of organized music instruction is toward a curriculum which balances performance and general music learning. There is abundant interest in music study and great activity in all its departments. This reflects public as well as professional concern.

(C. N. B.)

MUSICAL-BOX. The modern musical-box is an elaboration of the elegant toy musical snuff-box in vogue during the 18th century. The notes or musical sounds are produced by the vibration of steel teeth or springs cut in a comb or flat plate of steel, reinforced by the harmonics generated in the solid steel back of the comb. The teeth are acted upon and musical vibrations produced by the revolution of a brass cylinder studded with projecting pins, which, as they move round, raise and release the proper teeth at due intervals according to the nature of the music. The revolving motion of the cylinder is effected by a spring and clockwork, and the rate is governed by a fly regulator.

MUSICAL COMEDY, a popular form of theatrical entertainment, developed almost exclusively by the English-speaking peoples.

Clearly it bears little relation to the classical *opera bufa* of Italy. For that had no spoken dialogue, its place being taken by *recitativo secco,* a formal and rhetorical delivery of the words, supported by the lightest accompaniment. Mozart's *Figaro* and Rossini's *Il Barbiere* are good examples of *opera bufa.* Nor has musical comedy any real connection with the German *Singspiel* although in this case spoken dialogue is used instead of *recitativo secco.* In France the *Singspiel* developed into *opéra comique.* But the French comic opera was not necessarily comic, being so called merely to differentiate it from grand opera. But one may look to the *vaudeville,* which dates its popularity from the time of the French Revolution, as being a more direct ancestor of modern musical comedy. But the *vaudeville* was written in verse, and musical comedy employs lyrics only for musical setting, the play itself being carried on by spoken dialogue.

A much closer analogy is to be found in the French *opéra bouffe,* which it may be noted is not to be identified with the Italian *opera bufa.* In the former, spoken dialogue alternates with light music, and in the play itself there are generally topical or satirical allusions. From the *opéra bouffe* and *vaudeville* sprang the operetta; at first, as its name implies, a short opera of one act which was employed to lengthen the evening's entertainment. Gilbert and Sullivan practically founded their operas on the operetta and *opéra bouffe,* but, except at first, they cast them into two acts of sufficient length to fill the bill. On its formal side, the English ballad opera may be considered one of the models for musical comedy. The English ballad operas came into being as a protest against the Italian operas of the 18th century. The English works were even composed in the Italian manner, recitative taking the place of dialogue. But they did not have much success until Gay wrote *The Beggar's Opera.*

The *genre* of musical comedy, then, is in direct descent from the *opéra bouffe* and the *vaudeville* of the French, combined with our own ballad operas, and, as it is known in London and New York, is an expression of a love of boisterous and farcical humour rather than of the high comedy of the operetta. Its humour is broader, more farcical and more eccentric than anything to be found in light French or Viennese opera, and the student will find curious evidence of this in the change which French or Viennese light operas undergo when adapted to the British or American stage as musical comedies. André Messager's *Véronique,* for instance, was first performed in London by a French company (1903) as a light opera. When it was produced, shortly afterwards, in an English version, the comedy part of the florist was developed by Mr. George Graves into that of an eccentric low comedian. The same procedure has been followed in the case of the many Viennese operas by Oscar Straus, Leo Fall, Franz Lehar and others which in more recent years have enjoyed such popularity in England and America. The farce of musical comedy was added, this element being a relic of the old-fashioned Gaiety burlesque. Those burlesques were in themselves more in the nature of what afterwards came to be known as *revue* in London and New York than of the musical comedy of to-day, with its definite plot and sentimental scenes. But it was from the Gaiety burlesque that the Gaiety musical comedy developed, with its music written by Lionel Monckton, Howard Talbot, Ivan Caryll and others.

During recent years the popularity of musical comedy of the older kind has been rivalled by that of the more go-as-you-please type of entertainment known as revue. In Paris, where it had its origin, the revue had a special character of social satire and topical interest. As adapted to the requirements of English-speaking audiences the revue has been a much more miscellaneous affair, a mere *mélange* of songs, sketches, low comedy, ballets and pageants strung together haphazard, although frequently including a strong infusion of the satirical and topical elements and thus recalling its French ancestry. So far as the London stage was concerned George Grossmith, who had taken such a large part in the Gaiety musical comedies, was the first to adapt the revue from France.

Revues became more and more spectacular, and gradually the best of these entertainments included ballets and pageants of great beauty. In a sense, that type of revue was a throw-back to the masque. With the popularity of revue, "syncopated" or "jazz" music found its way to the stage from the variety halls. From revue it gradually crept into musical comedy, and the long continuance of the World War, which automatically put an end to the domination of the Viennese school of musical comedy or light opera, gave this newer musical fashion full scope.

In the United States there is a College Musical Comedy League, founded in 1927 and consisting of various university bodies, one of which, the Hasty Pudding Club, of Harvard university, dates back as far as 1795; others being the Mask and Wig Club of the University of Pennsylvania (1889), the Triangle Club of Princeton university (1893), the Haresfoot Club of the University of Wisconsin (1898), the Blackfriars of the University of Chicago (1904), and the Mimes of the University of Michigan Union (1906).

MUSICAL INSTRUMENTS, MECHANICAL. (*See* BARREL ORGAN; MUSICAL BOX; GRAMOPHONE; PLAYER PIANO; MUSIC FROM ELECTRIC OSCILLATIONS.)

MUSICAL NOTATION, a graphic method of representing sounds to the ear through the medium of the eye. It is probable that the earliest attempts at notation were made by the Hindus and Chinese, from whom the principle was transferred to Greece. The exact nature of the Greek notation is a subject of dispute, different explanations assigning 1680, 1620, 990, or 138 signs to their alphabetical method of delineation. To Boethius we owe the certainty that the Greek notation was not adopted by the Latins, although it is not certain whether he was the first to apply the 15 letters of the Roman alphabet to the scale of sounds included within the two octaves, or whether he was only the first to make record of that application.

Indications of a scheme of notation based, not on the alphabet, but on the use of dashes, hooks, curves, dots and strokes are found to exist as early as the 6th century, while specimens in illustration of this different method do not appear until the 8th. The origin of these signs, known as neumes (*νεύματα*, or nods) (*q.v.*) is the full stop (*punctus*), the comma (*virga*), and the mound or undulating line (*clivus*), the first indicating a short sound, the second a long sound, and the third a group of two notes. The musical intervals were suggested by the distance of these signs from the words of the text. The variety of neumes employed at different times, and the fluctuations due to handwriting, have made them extremely difficult to decipher. In the 10th century a marked advance is shown by the use of a red line traced horizontally above the text to give the singer a fixed note (F=fa), thus helping him to approximate the intervals. To this was added a second line in yellow (for C=ut), and finally a staff arose from the further addition of two black lines over these.

A variety of experiments resulted in the assignment of the four-lined staff to sacred music and of the five-lined staff to secular music. The yellow and red colours were replaced by the use of the letters F and C (fa and ut) on the lines. This use of letters to indicate clef (*q.v.*) is forestalled in a manuscript of Guido of Arezzo's *Micrologus,* dating from the 12th century, in which is the famous hymn to St. John, printed with neumes on a staff of three lines (*see* GUIDO OF AREZZO and HEXACHORD). The use of letters for indicating clefs has survived to the present day, our clef signatures being modified forms of the letters C, F and G, which have passed through a multitude of shapes.

Before the 12th century there is no trace of a measured notation (*i.e.*, of a numerical time division separating the component parts of a piece of music). It was at the time of Franco of Cologne that measured music took its rise, together with the black notation in place of neumes, which disappeared altogether by the end of the 14th century. In the black notation, which led to the modern system, the square note with a tail (𝅗𝅥) is the long sound; the square note without a tail (𝅜) is the *breve;* and the lozenge shape (𝅝) is the *semibreve.* In a later development there were added the *double long* 𝅜 and the minum (𝅗𝅥). The breve, according to Franco of Cologne, was the unit of measure.

The development of a fixed time division was further continued by Philippe de Vitry. It has been noted with well-founded astonishment that at this period double time (*i.e.*, two to the bar) was unknown, but only triple time which was regarded as "perfect"—"because it hath its name from the Blessed Trinity which is pure and true perfection." Vitry championed the rights of imperfect time and invented signs to distinguish the two. The perfect circle ○ represented the perfect or triple time; the half circle ☾ the imperfect or double-time. This ☾ has survived in modern notation to indicate four-time, which is twice double-time; when crossed ☾̸ it means double-time. The method of dividing into perfect and imperfect was described as *prolation.* The addition of a point to the circle or semi-circle (⊙ ☾) indicated major prolation; its absence, minor prolation. The substitution of white for black notation began with the first year of the 14th century and was fully established in the 15th century.

It has already been shown how the earlier form of alphabetical notation was gradually superseded by one based on the attempt to represent the relative height and depth of sounds graphically. The alphabetical nomenclature, however, became inextricably associated with the graphic system. The two conceptions reinforced each other; and from the hexachordal scale, endowed with the solmization of *ut, re, mi, fa, sol, la*—which was a device for identifying notes by their names when talked of, rather than by their positions when seen on a page of music—arose the use of what are now known as accidentals (*q.v.*).

Of these it may here be said that the flat had originated from the necessity of sinking the B of the scale in order to form a hexachord on the note F in such a way as to cause the semitone to fall in the right place—which in the case of all hexachords was between the third and fourth notes. This softened B was written in a rounded form thus: ♭ (*rotundum*), while the original B remained square thus: ♮ (*quadrum*). The original conception of the sharp (*q.v.*) was to cross or lattice the square B, by which it was shown that it was neither to be softened nor to remain unchanged. The flat, which originated in the 10th century, appears to have been of far earlier date than the sharp, the invention of which has been ascribed to Josquin Des Près (1450–1521). The B-sharp was called B *cancellatum,* the cross being formed thus ♯.

The use of key signatures constructed out of these signs of sharp and flat was of comparatively late introduction. The key signature states at the beginning of a piece of music the sharps and flats which it contains within the scale in which it is written. It is a device to avoid repeating the sign of sharp and flat with every fresh occasion of their occurring. The double ♭♭ and the double sharp 𝄪 are conventions of a much later date, called into existence by the demands of modern music, while the sign of the natural (♮) is the outcome of the original B quadration or square B♮. (*See* TONIC SOL-FA and CHEVÉ notations.)

PROPOSED NEW SYSTEMS OF NOTATION

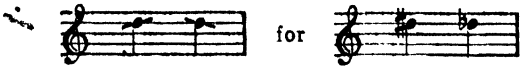
As regards the many new systems of notation which have been proposed during recent times, it must be remembered that although the staff notation (as we call the system of two separate staves of five lines each) was originally invented at a time when the unequal temperament system of tuning prevailed (*see* TEMPERAMENT), yet this old notation developed and is now employed in conjunction with equal temperament, from which it can never really be dissociated. Hence, for practical purposes, and theoretical implications apart, the result is the same, whether we write G sharp or A flat, for instance. For while some musicians still refuse to accept equal temperament save as an unavoidable compromise and you find such declaring that they "never think of the keyboard" when composing, yet the notation which they are compelled to use has no means of showing any finer divisions than equal temperament affords. The existing notation is not capable, for instance, of showing the difference between the real natural major third of the horn and the major third of the tempered keyboard.

It is possible that a means of doing this may be devised in time. If so, it may perhaps follow the system adopted by Anselme Vinée in his *Principes du Système Musical et de l'Harmonie* (Hamelle, Paris, 1909), in which he applies various marks (tiny curves, dashes and crosses) to the notes of the staff notation to indicate these extremely small variations in pitch.

As music became more and more chromatic, the complexities of notation increased tremendously by the multiplication of signs for what was practically the same sound. Thus C sharp, D flat

and B double-sharp have three different signs, but, in equal temperament, only one sound. Hence, during the last quarter of a century or so, many attempts at a simplified form of notation have been made either by improving the old staff system or by the invention of an entirely new system.

H. Orsmond Anderton, a London composer, proposed, in his *Simplified Notation*, a new method of representing the chromatic signs called "accidentals" by substituting a line through the head of the note for the sharp or flat sign; thus D sharp and D flat



A Spanish pianist and composer, Manuel Guervós (1863–1902), invented a system by writing the two staves (pentagrams) now called treble and bass into one "decagrama." He replaced the F and G clef (*see* CLEF) by a C clef resting on his 6th line. A German musical theorist, Hermann Stephani, went further in the reduction of lines. In 1905 he invented a system of notation which was entirely confined to the treble stave, all the higher and lower sounds being indicated by various octave signs. This system he called *Einheitspartitur* (unit-score) and he published in it the overture to Schumann's *Manfred*.

The acceptance of atonal music naturally makes for a system which shall ignore the difference between C sharp and D flat, D sharp and E flat, etc., and one of the chief apostles of that music, Josef Matthias Hauer, has published works with a special kind of atonal notation (Goll, Vienna).

Walter Hampton Thelwall, a London civil engineer, from 1893 onwards gradually evolved a system known as the Thelwall system, which uses two staves of seven lines each, the two staves reading alike, and the system involving a complete acceptance of the dodecuple principle, which divides the octave into 12 equal parts. Thelwall adopted for these the Roman numerals I. to XII. and his thick middle line is always the note VII., *i.e.*, middle C. In order still more to destroy that back-lying feeling of C major, he calls F sharp I. He repeats his seven-line stave for every octave, dotting in the upper staves as required, the octaves all being numbered—the bass octave 4, the tenor octave 5, the treble octave 6, and so on.

An Argentine musical theorist, Angelo Menchaca, invented a new system, an exposition of which was published in 1904 under the title of *Nuevo Sistema teorico grafico de la Musica*, by Pleyel, Lyon & Co., Buenos Aires. In this system the staff is dispensed with altogether and the sign  represents the sound *Sól*. This note sign is written (or printed) in various positions for the various notes; and short and long stems represent the high or low octaves. The length of a note is shown by a point. (A full explanation of the system may be seen in Dent's *Dictionary of Modern Music and Musicians*, 1924, p. 352.)

Ferrucio Busoni (1866–1924) invented a new notation and published Bach's *Chromatic Fantasia* in it (Breitkopf and Härtel). Jean Hautstont, a Belgian composer and theorist (b. Brussels, Dec. 13, 1867), devoted himself to the reform of musical notation, and invented his *Notation Autonome* (Paris, 1907), which he applied in his *Solfège* (Paris, 1913). The system is based on the classification of sounds according to their vibration numbers, taken in conjunction with the physiological development of the human ear. In 1921 a society for publishing music in this notation was formed in Brussels.

In 1915, the Russian composer, Nicolas Obukof (b. Moscow, 1892), produced a work published in a new notation which abolishes the sharp and the flat and thus avoids duplication of signs. He ascribes new names to the notes represented by the black keys of the keyboard, viz., *Lo, To, Ra, Tu, Bi*. These were also derived from the ancient hymn from which the other syllables were derived by Guido of Arezzo. His scale reads *Do, Lo* (C sharp), *Re, Te* (D sharp), *Mi, Fa, Ra* (F sharp), *Sol, Tu* (G sharp), *La, Bi* (A sharp), *Si*. For the ordinary diatonic notes he uses the usual signs. For the sharp he uses the sign X or ⊗.

The English composer, John H. Foulds, has used tertia-tones in his orchestral *Music-Pictures*, op. 33 (1913), and in parts of his *World Requiem*, op. 60 (1923). He marks his two-thirds sharpened tone , and his two-thirds flattened tone .

Ivan Wischegradsky, a Russian composer, who has written much music on the quarter-tone system, has used the following signs: Ascending, one quarter-tone sharp, ; two quarter-tones sharp, ; three quarter-tones sharp, ; descending, one-quarter-tone flat, ; two quarter-tones flat,  three quarter-tones flat, .

Alois Haba, a Czech composer, who has quarter-tone pianos made for him by the firm of Foerster, at Georgswalde, in Bohemia, has written pianoforte pieces and also string quartets on the quarter-tone system. He uses the existing notation for the ordinary tones and semitones, and adds new signs like "accidentals" for the new quarter-tone notes. Thus C raised a quarter-tone is represented by  and C raised three quarter-tones by , D flattened a quarter-tone by  and D flattened three quarter-tones by .

But the best quarter-tone notation will not be one that is founded on the existing notation, which is already too complicated and over-burdened with signs; it will be one much simpler than the old. For our semitonal system we have 39 signs for but 12 sounds. A well-designed quarter-tone system will only need 24 signs for 24 sounds. According to Haba, the new system will give no fewer than 288 new intervals; and 253 new three-note chords, with an infinite number of 4-, 5-, and 6-note chords.

Reform must certainly take the way of simplification, and a new notation is long overdue. The great obstacle is, of course, the cost of replacing the immense amount of music already published in the existing notation.

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MUSIC FROM ELECTRIC OSCILLATIONS. The mathematical theory of electric oscillations was given by Lord Kelvin so long ago as 1853, in a famous Paper in *The Philosophical Magazine* called "Transient Currents." Helmholtz had already shown that the conservation of energy required an electric discharge under certain conditions, even a flash of lightning, to be oscillatory. And the fact that the discharge from a leyden-jar or other condenser consisted of an alternating current was subsequently verified by Feddersen, who photographed the spark in a revolving mirror, and saw that the band to which it was spread out was beaded. The merit of Lord Kelvin's paper was that it recognized the two chief causes of the oscillation, the electrostatic capacity of the condenser, on the one hand, which may be likened to the storage of energy in a spring with elastic recoil, and what he called the electrodynamic capacity of the discharger, on the other, which may be likened to the momentum of a stream of water or other material. These two properties are essential to oscillations. They may be called elasticity and inertia or momentum.

Whatever may be the reason, electricity exhibits these two properties. An electric charge displays the one, an electric current the other. Every detail of the oscillations was worked out by Kelvin, considered as the free and dying out oscillations resulting from the running down of stored energy, on the analogy of a tuning-fork. But whereas the oscillations of matter are to be estimated at the rate of a hundred, or at most a few thousand, per second, the rate of electric oscillation, which is concerned not with matter but with the ether, is to be reckoned in millions a second. Consequently electric oscillations are far too rapid to affect the ear, unless they are rectified and made tractable by some

such device as Fleming's vacuum valve.

Of late it has become possible, by means of valves, to maintain the oscillations continuously, from any convenient source of power, and such oscillations are in common use for wireless telegraphy. When two such circuits are operating in the same neighbourhood, though independently, they produce interference phenomena or beats, corresponding to the difference in their rate of vibration; and then, if the circuits are not too different or far apart in their rate of vibration, the beats may be of audible frequency when they are rectified, and communicated to a telephone or loud-speaker. For instance if one oscillated at 1,000,000 a second, and the other at 999,000, the beats would be 1,000 a second, which corresponds to a note, say C♭, above the treble clef. Any variation in the capacity of one of the circuits, modifying its rate of vibration so as to bring the two nearer together, would lower the pitch of the beat-note, and might abolish it altogether if the two circuits were exactly in tune. The pitch of the beats can in fact be raised or lowered at will. The process of extracting beat-notes is often called "heterodyning," and is well known to wireless operators.

A young Russian, M. Leo Theremin, by constructing the circuits so that the condenser of one of them has an exposed part whose capacity can be varied by bringing the hand near it, found that he could control the pitch of the beat-note in a satisfactory manner by alternately approaching and withdrawing his hand, and that by another device he could vary the loudness by similarly moving the other hand. He thus had what might be called a musical instrument, in which electric oscillations were controlled both in pitch and in loudness by the movement of the two hands, and thus, after a good deal of practice, by skilfully waving his hands, he was able to perform serious music. The surprising thing about his achievement was, not the control of electric oscillations for sound production over an extensive range, but the accuracy with which many of the tones of instruments such as a violoncello or a cornet could be imitated, and the skill with which an essentially continuous series of vibrations could be so managed—by sliding along the scale quietly and then swelling out—as to give the impression of the discontinuous notes required for melody. Eminent musicians did not disdain to express admiration of the performance, and even to consider the possibilities of the instrument for orchestral purposes. (O. J. L.)

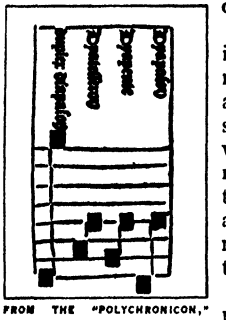
MUSIC PRINTING. Printed music originated soon after the invention of typography and the year 1465 is given as the earliest date of any record of its existence. At first the method was only used for printing the staves in red ink from a woodcut, the notes being written in by hand. Later the staves and notes were engraved separately on wood blocks and printed respectively in red and black. Then followed the practice of cutting both the staves and notes on one block for printing in black. There are no records of music being printed from separate characters before 1473 when a theological work by a German printer named Gerson was issued containing five notes of music evidently so printed. This may be regarded as the foundation of music printing.

In 1482 William Caxton, the first English printer, published a work entitled *Polychronicon,* in which there are a few notes of music, though apparently filled in to the printed stave lines by hand. Wynkyn de Worde, who succeeded Caxton, reprinted this work in 1495, introducing both the notes and stave lines by type characters, so that he must be given the credit of being the first English printer of music from moveable type. The *Mainz Psalter* of 1490 contained type-printed music. In 1500 Ottaviano Petrucci, in Venice, produced music with the staves and notes printed from type by separate operations.

Thenceforward the system of printing the stave lines separately fell into disuse. Pierre Attaignat, in Paris (1529), was the first to print the words of songs under the notes. In 1530 music began to be printed in England with type similar to that used by Petrucci, and it was done in two printings, but in 1539 a London printer named Gough issued music from type characters with the staves and notes printed at one impression. In 1550 Richard Grafton printed in London the *Booke of Common Praier noted,* the musical part being executed in type with red stave lines. From that time printing from type became general and by 1500 it had assumed the appearance of present day music.

Music printed from plates dates from 1525, when Pierre Hautin, a French engraver, cut punches for the notes and stamped them into metal plates, which were finished by engraving. This style of work became general in England and continued to hold the field until about 1710, when music printed from punched plates began to appear.

Lithographic music printing dates from 1799, being first applied by Senefelder, the inventor of lithography, who drew the music direct on stone, or on transfer paper.



FROM THE "POLYCHRONICON," PRINTED BY WYNKYN DE WORDE
SPECIMEN OF THE EARLIEST EXAMPLE OF TYPE-PRINTED MUSIC

Typographical music printing recovered its position with the production of better music type by the English letter-founders and came largely into use for hymnals, song books, and other musical works for which large editions in a cheap form are required. The work of setting-up music type is however very tedious as the staves and notes have to be built up from a large number of small pieces. A fount may contain from 400 to 500 characters.

At the present day the bulk of music printing, at least for sheet music, orchestral parts, etc., is done by lithographic printing, the original plates being made partly by punching and partly by engraving on pewter.

The method of engraving starts with ruling the staves on the plate with a five-pointed rake-like tool, called a "score"; then the spacing between the notes (previously determined by marking-off the manuscript) is set out by a method called "pointing," which is done with a small compass. The character of the notes and their position on the stave are roughly indicated on the plate with a blunt steel point called a "marking pin." During the punching the plate is laid on a stone slab and the punches are held in contact with the plate whilst a smart blow is given with a steel mallet. A set of punches usually consists of 50 to 53 pieces as a rule. Only the heads of the notes are punched, the hooks, ties, etc., being finished by gravers and other engraving tools. All the usual signs are punched and the words of songs are filled in with letter punches. Photo-lithography has been largely used for reproducing out-of-print music, the plates of which have been destroyed. Collotype has been found very effective in reproducing old music in *facsimile.*

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MUSK, the name originally given to a perfume obtained from the strong-smelling substance secreted in a gland by the musk-deer (*q.v.*), and hence applied to other animals, and also to plants, possessing a similar odour. The variety which appears in commerce is a secretion of the musk-deer; but the odour is also emitted by the musk-ox and musk-rat of India and Europe, by the musk-duck (*Biziura lobata*) of West Australia, the musk-shrew, the musk-beetle (*Calichroma moschata*), the alligator of Central America, and by several other animals.

To obtain the perfume from the musk-deer the animal is killed and the gland completely removed, and dried, either in the sun, on a hot stone, or by immersion in hot oil. It appears in commerce as "musk in pod," *i.e.,* the glands are entire, or as "musk in grain," in which the perfume has been extracted from its receptacle. Three kinds are recognized: (1) Tongking, Chinese or Tibetan, imported from China, the most valued; (2) Assam or Nepal, less valuable; and (3) Karbardin or Russian (Siberian), imported from Central Asia by way of Russia, the least valuable and hardly admitting of adulteration. The Tongking musk is exported in small, gaudily decorated caddies with tin or lead linings, wherein the perfume is sealed down; it is usually sent to the merchant by parcel post.

Good musk is of a dark purplish colour, dry, smooth and unctu-

ous to the touch, and bitter in taste. It dissolves in boiling water to the extent of about one-half; alcohol takes up one-third of the substance, and ether and chloroform dissolve still less. A grain of musk will distinctly scent millions of cubic feet of air without any appreciable loss of weight, and its scent is not only more penetrating but more persistent than that of any other known substance. In addition to its odoriferous principle, it contains ammonia, cholesterin, fatty matter, a bitter resinous substance, and other animal principles. As a material in perfumery it is of the first importance, its powerful and enduring odour giving strength and permanency to the vegetable essences, so that it is an ingredient in many compounded perfumes.

Artificial musk is a synthetic product, having a similar odour to natural musk. It was obtained by Baur in 1888 by condensing toluene with isobutyl bromide in the presence of aluminium chloride, and nitrating the product. It is a symtrinitro-Ψ-butyl toluene. Many preparations have been made, and the odour seems to depend upon the symmetry of the three nitro groups.

MUSK in botanical terminology is *Mimulus moschatus.* (*See* MIMULUS.) The musk-orchis is *Herminium Monorchis;* the musk-mallow, *Malva moschata;* the musk-melon, *Cucumis melo;* the musk-thistle, *Carduus nutans.*

MUSK-DEER (*Moschus moschiferus*), an aberrant deer, presenting many peculiar characteristics (*see* DEER). There are no antlers, but in lieu of such weapons the upper canine teeth of the male form projecting tusks. About 20in. high at the shoulder, the musk-deer possesses long limbs, and there is a great development of the lateral pair of hoofs. The ears are large and the tail rudimentary. The greyish-brown hair is long, coarse, and brittle. This animal inhabits the forests of the Himalayas as far west as Gilgit, always at great elevations and preferring thickets of birch, juniper, and rhododendrons. It extends into Tibet, Siberia, and north-western China. In habits the musk-deer is solitary, shy, and nocturnal, but very active; it feeds on moss, grass, and leaves. The deer takes its name from the secretion of a sac, about the size of an orange, beneath the skin of the abdomen, opening in front of the preputial aperture. This contains a dark brown substance of the consistency of "moist gingerbread." It is only present in the male (*see* MUSK). There is an allied species (*M. sifanicus*) inhabiting Kansu, distinguished by its longer, black ears.

MUSKEGON (mŭs-kē'gŏn), a city of western Michigan. U.S.A., on Lake Michigan, at the mouth of the Muskegon river, which expands here into a lake (5 m. long by 1·5 m. wide); a port of entry and the county seat of Muskegon county. It is on Federal highway 31, and is served by the Grand Trunk, the Pennsylvania, the Pere Marquette and electric railways, and lake steamers. The population was 36,570 in 1920 (81% native white) and was estimated locally at over 46,000 in 1928. The 1928 estimate for Greater Muskegon (including Muskegon Heights, an industrial city of 9,514 in 1920, North Muskegon, a residential village, and other adjacent suburbs) was 64,000. Muskegon has a fine land-locked harbour, with traffic amounting to 389,132 tons in 1925, valued at $26,930,550. It is the centre of a summer-resort region; the metropolis of a fine dairying, farming and fruit-growing district; and above all a modern industrial city, with over 200 manufacturing establishments, employing 16,000 workers, and producing an annual output valued at $80,000,000. Among the leading products are automobile motors and castings, phonographs, bowling and billiard equipment, window-shade rollers, piston rings and laboratory-table equipment. The city's public parks cover 1,500 ac. and include 7 m. of lake front. The public schools have an endowment of $3,000,000, given by Charles H. Hackley (1837–1905), a lumber king, and his wife. The assessed valuation of property for 1927 was $62,220,631. Bank clearings for 1927 aggregated $60,154,697. The city operates under a commission-manager form of government. A trading post was established here in 1812, and permanent settlement began in 1834. The first saw-mill was built in 1837. The town was laid out in 1849, was incorporated as a village in 1861, and chartered as a city in 1869. In 1870 the population was 6,002. The lumber industry reached its peak in 1887, with a cut of 700,000,000 bd.ft., and the population at that time was about 24,000. With the depletion of the forests, the population dwindled. The renewed prosperity began about 1900. The name Muskegon is probably derived from a Chippewa word meaning "grassy bog."

MUSKET, the term generally applied to the fire-arm of the infantry soldier from about 1550 up to and even beyond the universal adoption of rifled small-arms about 1850–60. The word originally signified a male sparrowhawk (Italian *moschetto,* derived perhaps ultimately from Latin *musca,* a fly) and its application to the weapon may be explained by the practice of naming fire-arms after birds and beasts (*cf.* falcon, basilisk). The "musket" proper, introduced into the Spanish army by the duke of Alva, was much heavier and more powerful than the arquebus. Its bullet retained sufficient striking energy to stop a horse at 500 and 600 yards from the muzzle. A writer in 1598 (quoted *s.v.* in the *Oxford English Dictionary*) goes so far as to say that "One good musket may be accounted for two callivers." Unlike the arquebus, it was fired from a rest, which the "musketeer" stuck into the ground in front of him. But during the 17th century the musket in use was so far improved that the rest could be dispensed with (*see* GUN). The musket was a matchlock, weapons with other forms of lock being distinguished as wheel-locks, fire-locks, snaphances, etc., and soldiers were similarly distinguished as musketeers and fusiliers. On the disuse, about 1690–95, of this form of firing mechanism, the term "musket" was, in France at least, for a time discontinued in favour of "fusil," or flint-lock, which thenceforward reigned supreme up to the introduction of a practicable percussion lock about 1830–40. But the term "musket" survived the thing it originally represented, and was currently used for the fire-lock (and afterwards for the percussion weapon). To-day it is generally used for military fire-arms anterior to the modern rifle. The original meaning of the word *musketry* has remained almost unaltered since 1600; it signifies the fire of infantry small-arms (though for this "rifle-fire" is now a far more usual term), and in particular the technique of using them (*see* INFANTRY and SMALL-ARMS). A *musketoon* was a short, large-bore musket somewhat of the blunderbuss type, originally designed for the use of cavalry, but afterwards, in the 18th century, chiefly a domestic or coachman's weapon.

MUSKMELON: *see* MELON.

MUSKOGEE (mŭs-kō'gē), a city of eastern Oklahoma, U.S.A., 130 m. E.N.E. of Oklahoma City, near the confluence of the Verdigris, the Grand, and the Arkansas rivers; county seat of Muskogee county. It is on Federal highways 64 and 73; has a well equipped airport (Hat Box Field) controlled by the United States Air Service; and is served by the Frisco, the Kansas, Oklahoma and Gulf, the Midland Valley, and the Missouri-Kansas-Texas railways. Pop. (1920) 30,277 (73% native white and 24% negroes), estimated locally at 40,000 in 1928. It is the seat of United States Veterans Bureau Hospital 90 and the Oklahoma School for the Blind, headquarters of the Indian Agency for the Five Civilized Tribes, and the home of the Oklahoma Free State Fair. At Bacone, 2 m. N.E., is Indian University (Baptist; 1884). Muskogee is the metropolis of a rich agricultural and oil-producing territory. It has large railway shops, yards, and offices; wholesale and jobbing houses; oil refineries, cotton gins and compresses, cottonseed-oil mills, etc. The factory output in 1925 was valued at $8,414,715. Bank debits to individual accounts aggregated $145,441,000 in 1926. The assessed valuation of property for 1927 was $29,999,656. Muskogee was founded about 1870, and became the chief town of the Creek Nation and the administrative centre of the former Indian Territory. The first railway (the "Katy") reached it in 1872. In 1893 the Dawes Commission began to transform the tribal allotments into individual holdings. The city was chartered in 1898, and in 1900 it had a population of 4,154. By 1910 the population was 25,278, a sixfold increase in the decade. The managerial form of government was adopted in 1920.

MUSKOGIAN INDIANS. This group constituted one of the larger speech stocks of native North America, and was typical of and dominant in the South-eastern area of aboriginal culture, comprising the region from the Gulf of Mexico to Tennessee, and from the Carolinas to Louisiana. The Muskogian family com-

prised a series of divisions: 1, Apalachee; 2, Hitchiti, Apalachicola, etc.; 3, Alabama, Koasati, etc.; 4, Choctaw, Chickasaw, Mobile, Pensacola, etc.; 5, Tuskegee; 6, Cusabo, Yamasee and other tribes of the Georgia coast; 7, Miskogi proper. The latter formed the bulk of what was later the Creek confederacy, in which the Hitchiti and other groups were included. The Natchez and Taensa of the lower Mississippi seem to be a remote Muskogian off-shoot; the Calusa and other south Floridian tribes may be. Since the middle of the eighteenth century the historically important tribes have been the Choctaw, Chickasaw and Creek, plus a branch of the latter, the Seminole. With the non-Muskogian Cherokee, these make up the "five civilized tribes," which for three quarters of a century, until 1906, maintained quasi-autonomous governments in Indian territory (Oklahoma), where they had removed under the pressure of American settlement.

Ethnographically the Muskogian or South-eastern culture province included, besides the groups listed, the Chitimacha and Tunica of the lower Mississippi, the Iroquoian Cherokee, the Timucua of central Florida and, in the lower region of Georgia and Carolina, the Yuchi, the Algonkin Shawnee and various eastern Siouan tribes. All these groups were agricultural, planting maize, pumpkins, beans, cane-millet, tobacco, sometimes Jerusalem artichokes, and sunflowers. They gathered hickory nuts and wild fruits, hunted deer and, in the west, bison, and stored nut oil and bear fat. The settlements were straggling; the "town" contained a square, on which were public and religious buildings; "villages" were often outlying. The towns were autonomous and essentially constituted tribes. They united into confederacies, directed by councils; such confederacies might break up and recombine. The most successful, like those of the Creek and Choctaw, grew in population during the colonial period, largely through absorption of smaller or shattered groups. The tribes were divided into matrilineal, totemic clans; chieftainship and office were hereditary, probably in the lineage within the clan. The Natchez and some other groups had superimposed a peculiar class or caste system. Chiefs in these cases were carried in litters, enthroned on raised seats or in arbours, and accompanied in death by sacrificial followers. All the tribes were warlike and in chronic but shifting embroilment with others. They took scalps and slowly tortured prisoners to death in a frame or tied to a post in the town square. Often there was a distinction between civil and military chiefs; the towns entitled to offices of one or the other kind in a confederacy were known as peace and war, that is, white or red.

Economic life was undeveloped as compared with the fairly well organized socio-political institutions. Houses were of logs or poles, wattled, chinked or plastered with mud, the roof of thatch. Bark or thatch houses were also built. Exposed settlements were palisaded, or log forts erected. Pottery was unpainted, basketry of cane splints; simple weaving was done in bark fibres and bison hair, but the principal clothing besides mantles was breech clouts for men and apron skirts for women. Many tribes deformed their heads. There was little property, almost no treasure, and limited trade before the coming of the whites. Ritual was also simple. The most important ceremony was the busk or green-corn festival, a first-fruits and new-fire rite. Purification by emetics was one of the commonest religious observances. There was little that could be called art. Most tribes had a migration legend.

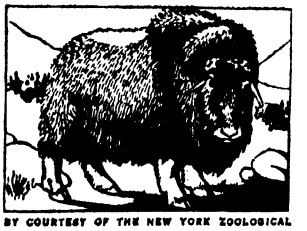
The Muskogian-South-eastern culture extended with variations north into the Ohio valley to the prehistoric Moundbuilders, and north-east to the tribes of Iroquois lineage; it was represented in pallid form among many of the Algonkin groups as far as New England and the Great lakes. The total Muskogian population was about 50,000. At the time of discovery, there may have been 7,000 Creeks (increased to 20,000 by 1832), 3,500 Chickasaw, 15,000 Choctaw, 5,000 Apalachee, perhaps 5,000 Mobile. The first three of these tribes survive in increased numbers, but much mixed with white and negro blood.

See J. Adair, *History of the American Indians*, 1775; W. Bartram, *Travels*, 1791; J. Swanton, *Bur. Am. Ethn. Bull.* 43, 1911; 73, 1922.

(A. L. K.)

MUSK-OX, an Arctic American ruminant of the family Bovidae (*q.v.*), representing a genus and sub-family by itself. The musk-ox (*Ovibos moschatus*) is in some respects intermediate between the sheep and goats on the one hand and the oxen on the other, but is probably more nearly allied to the former than to the latter. The musky odour from which the animal takes its name is not due to the secretion of a gland.

In height a bull musk-ox stands about 5ft. at the shoulder. The head is large and broad. The horns in old males have broad bases, meeting in the middle line, and covering the brow and crown of the head. They are directed at first downwards by the side of the face, and then turn upwards and forwards, ending in the same plane as the eye. In females and young males the horns are smaller, and their bases separated by a space. The ears are small, and nearly concealed in the hair. The space between the nostrils and the upper lip is covered with short hair; the rest of the animal is covered with long brown hair, thick, matted and curly on the shoulders, but elsewhere straight and hanging down, concealing the short tail. There is also a thick woolly under-fur, shed in summer in blanket-like masses. The limbs are stout and short, terminating in unsymmetrical hoofs, the external being rounded, the internal pointed, and the sole in part hairy.



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

THE MUSK-OX OF ARCTIC AMERICA

Musk-oxen are confined to the northern parts of North America; they range over the "barren grounds" between lat. 64° and the shores of the Arctic sea. Northwards and eastwards they extend through the Parry islands and Grinnell Land to north Greenland. The Greenland animal is distinguished by white hair on the forehead. Musk-oxen ranged during the Pleistocene period over northern Siberia and the plains of Germany and France. They have also been found in Pleistocene gravels in England. They are gregarious, assembling in herds of 20 or 30 head, in which there are seldom more than two or three full-grown males; they run with considerable speed, but when attacked normally form a circle with the younger animals in the centre. Musk-oxen feed chiefly on grass. The female brings forth one young in the end of May or beginning of June, after a gestation of nine months. The peculiar musky odour can be perceived from a distance of 100 yards. According to Stefánsson (*The Friendly Arctic*, 1921), they are admirably suited for domestication. The flesh is excellent, the milk equal to that of the domestic cow and the wool of considerable value.

MUSK-RAT or MUSQUASH, large North American rat-like rodent *Fiber zibethicus*, belonging to the mouse-tribe (*Muridae*). Aquatic in habits, this animal is related to the English water-rat and therefore included in the sub-family *Microtinae*. (*See* VOLE.) It is, however, of larger size, the head and body being about 12 in. in length and the tail but little less. It is a heavily-built animal, with a broad head and short limbs, the eyes are small, and the ears project little beyond the fur. The fore-limbs have four toes and a rudimentary thumb, all with claws; the hind limbs are larger, with five distinct toes, united by webs at their bases. The tail is laterally compressed, nearly naked, and scaly. The hair consists of a thick soft underfur, interspersed with longer stiff, glistening hairs, which overlie and conceal the former, on the upper surface and sides of the body. The colour is dark umber-brown, almost black on the back and grey below. The tail and naked parts of the feet are black. The musky odour from which it derives its name is due to the secretion of a large gland situated in the inguinal region, and present in both sexes.



MUSK-RAT (FIBER ZIBETHICUS)

The ordinary musk-rat is one of several species of a genus peculiar to North America. It lives on the shores of lakes and rivers, swimming and diving with facility, feeding on the roots, stems and leaves of water-plants, or on fruits and vegetables which

grow near the margin of the streams. Musk-rats are most active at night, spending the day concealed in their burrows in the bank, which consist of a chamber with numerous passages, all of which open under the surface of the water. For winter quarters they build more elaborate houses of conical or dome-like form, composed of sedges, grasses and similar materials plastered together with mud. Their fur is valuable. (*See* RODENTIA.)

MUSK-SHREW, a name for any species of the genus *Crocidura* of the family *Soricidae* (*see* INSECTIVORA), but generally used of the common grey musk-shrew (*C. coerulea*) of India which commonly frequents human habitations. The head and body, blue-grey in colour, measure about 6 in., and the tail is rather more than half that length.

MUSLIM: *see* ISLAM.

MUSLIN, a light cotton cloth said to have been first made at Mosul, a city of Mesopotamia. Muslins have been largely made in various parts of India, whence they were imported to England towards the end of the 17th century. Some of these Indian muslins were very fine and costly. Among the specialties are *Arni muslin,* made in the Madras presidency, and *Dacca muslin,* made at Dacca in Bengal. Muslins of many kinds are now made in Europe and America, and the name is applied to both plain and fancy cloths, and to printed calicoes of light texture. *Swiss muslin* is a light variety, woven in stripes or figures, originally made in Switzerland. *Book muslin* is made in Scotland from very fine yarns. Mulls, jaconets, lenos, and other cloths exported to the East and elsewhere are sometimes described as muslins.

MUSPRATT, JAMES (1793–1886), British chemical manufacturer, was born in Dublin on Aug. 12, 1793. At the age of 14 he was apprenticed to a wholesale druggist, but after a quarrel with his master he went to Spain to take part in the Peninsular War. Returning to Dublin about 1814, he began the manufacture of chemical products, such as hydrochloric and acetic acids and turpentine, adding prussiate of potash a few years later. In 1822 he went to Liverpool and at first he confined himself to the latter product, but in 1823, when the tax on salt was reduced from 15s. to 2s. a bushel, he erected plant for the manufacture of soda from salt by the Leblanc process. In 1828 he built works at St. Helen's and in 1850 he started new works at Widnes and Flint. In 1834–35, in conjunction with Charles Tennant, he purchased sulphur mines in Sicily, to provide the raw material for his sulphuric acid; but on the imposition of the Neapolitan government of a prohibitive duty on sulphur, Muspratt found a substitute in iron pyrites, which was thus introduced as the raw material for the manufacture of sulphuric acid. He died at Seaforth Hall, near Liverpool, on May 4, 1886.

His eldest son, JAMES SHERIDAN MUSPRATT (1821–1871), studied chemistry under Thomas Graham at Glasgow and London and under Liebig at Giessen, and in 1848 founded the Liverpool College of Chemistry, of which he acted as director. From 1854 to 1860 he was occupied in preparing a dictionary of *Chemistry . . . as applied and relating to the Arts and Manufactures,* which was translated into German and Russian; a new supplement to the German edition, under the title of *Muspratt's Encyklopädisches Handbuch technischer Chemie,* was completed in 1927.

MUSQUASH: *see* MUSK-RAT.

MUSSEL, the name given to certain aquatic bivalve molluscs of the class Lamellibranchia. In its most regular usage it is applied to the marine Mytilidae, of which the edible mussel, *Mytilus edulis,* is the most familiar example, and to the fresh-water genus *Anodonta.* The members of the large fresh-water genus *Unio* are sometimes called mussels.

The marine mussels (*Mytilus, Modiolaria, Modiola*) belong to the sub-order *Mytilacea* of the order Filibranchia. The edible mussel, *Mytilus edulis,* has a wide distribution. It is found on both sides of the Atlantic and in the Mediterranean, and on the eastern Atlantic seaboard its range extends as far south as Rio de Oro in Morocco. Its habitat is towards low-tide mark, where it lives attached to rocks or on consolidated shingle or sand-banks. It is usually found in large numbers, such mussel-beds sometimes covering several acres and containing millions of individuals.

The Mytilidae have an inequilateral shell, the apex or umbo appearing to be displaced to one end when compared with that of a cockle, for example. This is due to the imperfect development of the anterior end of the shell. The foot is provided with a byssus, a bunch of hairs secreted in a glandular cavity of the foot. From this cavity the hairs are extruded and harden on contact with the sea-water, forming a means of attaching the mussel to a rock or stone. This fixation is not, however, permanent; the animal can discard the byssus and anchor itself afresh in a new situation. Such a means of anchorage and the faculty of occasionally changing position are highly important in animals which live, as the Mytilidae do, in the tidal zone where gales tend to shift the sand or shingle on which they live, and where the animal is liable to be swept away from its feeding-ground or buried beneath the debris of the shore.

The edible mussel, *Mytilus edulis,* is of considerable economic importance as human food and as bait for edible fishes. In 1922, 1,888 tons of mussels were delivered at Billingsgate market in London. It is very little eaten in the United States. *M. edulis* is considered of fair size for eating when it is 2in. long, a size attained in three years after the young mussel has settled down. Under favourable conditions it will attain a much greater size. The degree of salinity of the water has a considerable effect on the size of the shell. For example, those mussels which live in the comparatively fresh water of the Baltic sea are often a quarter or one-fifth the size of the North sea forms. Nevertheless, it seems to thrive best in water having a salinity lower than that of normal sea-water. In Great Britain the chief mussel beds are in Morecambe bay (Lancs.) and in the Wash.

There are many genera in the family Mytilidae, which has a wide distribution. They include *Modiolaria, Lithodomus* (the date mussel), which bores into rock, *Modiola* and *Myrina.*

The fresh-water mussels are members of the family Unionidae (order Eulamellibranchia) and include the genera *Anodonta, Unio, Quadrula,* etc. They are mainly found in rivers and lakes. They burrow in the soft mud of the bottom and, living thus in more tranquil conditions than the sea-mussels, have only a weakly developed byssus. The developmental history of these mussels is unique among molluscs, as the young larva (*glochidium*) undergoes part of its development as a parasite on fish. The members of the genus *Unio* and its near allies are of considerable economic importance in the United States, where they are cultivated for their pearly shell, which is used in button-making. At one time the pearls obtained from these animals were widely sought in Europe; but this industry has decayed owing to the introduction of the Orient pearls of Ceylon, etc.

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MUSSELBURGH, burgh of regality, Midlothian, Scotland, 5½ m. E. of Edinburgh by the L.N.E.R. Pop. (1921), 17,110. The burgh, which lies on the south shore of the Firth of Forth, is intersected by the Esk and embraces the village of Fisherrow on the left bank of the river. While preserving most of the ancient features of its High Street, the town, with its fine beach and golf course, has tended to become a suburb of the capital. Loretto School, one of the foremost public schools in Scotland, occupies the site of the chapel of Our Lady of Loretto, which was founded in 1534 by Thomas Duthie, a hermit from Mt. Sinai, and was the favourite shrine of Mary of Guise. The 1st earl of Hertford destroyed it in 1544, and after it was rebuilt the Reformers demolished it again, some of its stones being used in erecting the tolbooth. In the west end of the town is Pinkie House, a Jacobean mansion, with a fine fountain, formerly a seat of the abbot of Dunfermline, but transformed in 1613 by Lord Seton. The painted gallery, with an elaborate ceiling, was utilized as a hospital after the battle of Pinkie in 1547, and Prince Charles Edward slept in it after the fight at Prestonpans (1745). Near the tolbooth stands the market cross. At the west end of High Street is a statue of David Macbeth Moir ("Delta," 1798–1851), born in Mussel-

burgh. A bridge of Roman origin crosses the Esk, and Roman remains have been found near it. The chief bridge, which carries the high road from Edinburgh to Berwick, was built by John Rennie in 1807. The principal industries include paper-making, brewing, the making of nets and wire, confectionery, mats, boat-building, pottery, besides saltworks and seed-crushing works. The fishery is confined to Fisherrow, where there is a good harbour. Race meetings and archery contests are held on the links. About 1 m. south-east is the site of the battle of Pinkie, and 2½ m. south-east, on the verge of Haddingtonshire, is Carberry Hill, where Mary surrendered to the lords of the Congregation in 1567, the spot being still known as Queen Mary's Mount. Musselburgh returns one of the five Edinburgh members to parliament.

MUSSET, ALFRED DE [LOUIS CHARLES ALFRED] (1810–1857), French poet, play-writer and novelist, was born on Dec. 11, 1810 in a house in the middle of old Paris, near the Hôtel Cluny. In the summer of 1827 he won the second prize (at the Collège Henri IV.) by an essay on "The Origin of our Feelings." He took up law and medicine but could endure no profession. He was taken by Paul Foucher to Victor Hugo's house, where he met Alfred de Vigny, Prosper Mérimée, Charles Nodier, Sainte-Beuve, and others. His first original volume, *Contes d'Espagne et d'Italie* (1829), had an immediate success, provoked bitter opposition, and produced many unworthy imitations. This volume contained a fantastic parody in verse on certain productions of the romantic school. This was the famous "Ballade à la lune" with its recurring comparison of the moon shining above a steeple to the dot over an *i*. It was, to Musset's delight, taken seriously.

In December 1830 Musset was just twenty years old, and was already conscious of that curious double existence within him so frequently symbolized in his plays—in Octave and Célio for instance (in *Les Caprices de Marianne*), who also stand for the two camps, the men of matter and the men of feeling—which he has elsewhere described as characteristic of his generation. At this date his *Nuit vénitienne* was produced by Harel, manager of the Odéon. It failed and Musset was disgusted with the theatre.

Musset now belonged, in a not very whole-hearted fashion, to the "Cénacle," but the connection came to an end in 1832. In 1833 he published the volume called *Un Spectacle dans un fauteuil*, and was asked to contribute to the *Revue des deux mondes*. In this he published, in April 1833, *André del Sarto*, and he followed this six weeks later with *Les Caprices de Marianne*. The latter play has perhaps more of the Shakespearian quality—the quality of artfully mingling the terrible, the grotesque, and the high comedy tones—which exists more or less in all Musset's long and more serious plays, than is found in any other of these. Its brilliant dialogue and swiftness of action give it superficially the character of comedy, but throughout there runs the sense of fate.

In 1833 the *Revue* published *Rolla*, a symptom of the *maladie du siècle*. Rolla, for all the strain which is not to be denied of Wertherism, has yet a decided individuality. The poem was written at the beginning of Musset's *liaison* with George Sand, and in December 1833 Musset started on the unfortunate journey to Italy. It is well known that the rupture of what was for a time a most passionate attachment had a disastrous effect upon Musset, who was absolutely and completely struck down by the blow. But it was not so well known until Paul de Musset pointed it out that the passion expressed in the *Nuit de décembre*, written about twelve months after the journey to Italy, referred not to George Sand but to another and quite a different woman. As fiction, the story is told in the two volumes called respectively *Elle et lui* by George Sand, and *Lui et elle* by Paul de Musset.

During Musset's absence in Italy *Fantasio* was published in the *Revue*, *Lorenzaccio* is said to have been written at Venice, and not long after his return *On ne badine pas avec l'amour* was written and published in the *Revue*. In 1835 he produced *Lucie*, *La Nuit de mai*, *La Quenouille de Barberine*, *Le Chandelier*, *La Loi sur la presse*, *La Nuit de décembre*, and *La Confession d'un enfant du siècle*, wherein is contained what is probably a true account of Musset's relations with George Sand. To 1836 belong the *Nuit d'août*, the *Lettre à Lamartine*, the *Stances à la Malibran*, the comedy *Il ne faut jurer de rien*, and the beginning of the brilliant letters of Dupuis and Cotonet on romanticism. *Il ne faut jurer de rien* is as typical of Musset's comedy work as is *Les Caprices de Marianne* of the work in which a terrible fatality underlies the brilliant dialogue and keen polished characterization. In 1837 was published *Un Caprice*, which afterwards found its way to the Paris stage by a curious road. Mme. Allan-Despréaux, the actress, heard of it in St. Petersburg as a Russian piece. On asking for a French translation of the play she received the volume *Comédies et proverbes* reprinted from the *Revue des deux mondes*. In 1837 appeared also some of the *Nouvelles*. In 1839 Musset began a romance called *Le Poète déchu*, of which the existing fragments are full of passion and insight.

In 1840 Musset passed through a period of feeling that the public did not recognize his genius—as, indeed, they did not—and wrote a very short but very striking series of reflections headed with the words "À trente ans," which Paul de Musset published in his *Life*. In 1841 there came out in the *Revue de Paris* Musset's "Le Rhin allemand," an answer to Becker's poem which appeared in the *Revue des deux mondes*. This fine war-song made a great deal of noise, and brought to the poet quantities of challenges from German officers. Between this date and 1845 he wrote comparatively little. In the last named year the charming "proverbe" *Il faut q'une porte soit ouverte ou fermée* appeared. In 1847 *Un Caprice* was produced at the *Théâtre Français*. The word "rebonsoir" shocked some of the old school. But the success of the piece was immediate. In 1848 *Il ne faut jurer de rien* was played at the Théâtre Français and the *Chandelier* at the Théâtre Historique. Between this date and 1851 *Bettine* was produced and *Carmosine* written. The poet died on May 2, 1857.

Alfred de Musset now holds the place which Sainte-Beuve first accorded, then denied, and then again accorded to him—as a poet of the first rank. He had genius, though not genius of that strongest kind which its possessor can always keep in check. His own character worked both for and against his success as a writer. He inspired a strong personal affection in his contemporaries. His very weakness and his own consciousness of it produced such beautiful work as, to take one instance, the *Nuit d'octobre*. His *Nouvelles* are extraordinarily brilliant; his poems are charged with passion, fancy and fine satiric power; in his plays he hit upon a method of his own, in which no one has dared or availed to follow him with any closeness. He was one of the first, most original, and in the end most successful of the first-rate writers included in the phrase "the 1830 period." The wilder side of his life has probably been exaggerated; and his brother Paul de Musset has given in his *Biographie* a striking testimony to the finer side of his character. In the later years of his life Musset was elected, not without opposition, a member of the French Academy. Besides the works above referred to, the *Nouvelles et contes* and the *Oeuvres posthumes*, in which there is much of interest concerning the great tragic actress Rachel, should be specially mentioned. (W. H. Po.; X.)

The biography of Alfred de Musset by his brother Paul, partial as it naturally is, is of great value. Alfred de Musset has afforded matter for many appreciations, and among these in English may be mentioned the sketch (1890) of C. F. Oliphant and the essay (1855) of F. T. Palgrave. *See* also the monograph by Arvède Barine (Madame Vincens) in the "Grands écrivains français" series. Musset's correspondence with George Sand was published intact for the first time in 1904.

See M. Donnay, *Alfred de Musset* (1914); C. Maurras, *Les Amants de Venise: George Sand et Musset* (1916), pp. 316; E. Moroncini, *A. de Musset e l'Italia* (Milan, 1921), pp. 228.

MUSSOLINI, BENITO (1883–), Italian statesman and journalist, was born July 29, 1883, at Dovia, in the commune of Predappio (province of Forli). His father, Alessandro Mussolini, was a blacksmith of internationalist revolutionary and anti-religious opinions, and played an active part in the local Socialist movement, while his mother, Rosa Maltoni, was a school teacher of deep religious convictions; the views of both parents affected young Mussolini in different ways at different stages of his career. He was sent to the Salesan college of Faenza, where he showed considerable intelligence but a passionate, insubordinate spirit. Later he went to the normal school at Forlimpopoli, and eventually qualified as a school teacher at the age of 18, obtaining an appointment at Gualtieri (province of Reggio Emilia). As a youth he

developed a love of literature and read widely, and soon became interested in the Italian Socialist movement. But he tired of teaching, and determined to go to Switzerland to improve his education. There he earned a precarious livelihood by manual labour of various kinds, but attended the courses at the universities of Lausanne and Geneva, and secured a diploma as teacher of French. He lived mostly among the working classes, and, born organizer as he was, he founded trade unions and even promoted strikes, with the result that he was expelled from one canton after another, and finally from the Confederation. After performing his military service in the Bersaglieri, he returned to teaching, but found time to improve his knowledge of the classics. In 1908 he was involved in the political agrarian conflicts in Romagna, was arrested, tried and condemned to 10 days' imprisonment, and afterwards was under police surveillance as a revolutionary.

At the end of 1908 he went to Trento, where he had been summoned by the local Chamber of Labour as secretary, and he also joined the staff of the local Socialist paper *L'Avvenire*. But when he realised that the Trentino Socialists, in their loathing for the national idea, took their cue from the Vienna Government, Mussolini went over to the *Popolo*, a paper edited and founded by Cesare Battisti, also a Socialist, but above all an Irredentist patriot who was afterwards to serve in the Italian Army during the War, until captured by the Austrians and hanged as a traitor. Here Mussolini took up the study of German literature, and became deeply interested in philosophy, especially in that of Nietzsche. His association with Battisti first inspired him with Irredentist ideas, and after publishing an article stating that "the Italian frontier does not end at Ala" he was arrested and expelled from Austria. On returning to Italy he published an essay of Irredentist tendencies on "The Trentino as seen by a Socialist" in *La Voce*, a periodical printed in Florence which gathered around it some of the most brilliant young *littérateurs* of the day.

The next period of Mussolini's life was wholly devoted to Socialist activity. In 1910 he founded and edited a paper at Forli called *La lotta di classe*, but while he vigorously supported the ideals of Socialism, he deplored the materialism, as he considered it, of the bourgeois spirit into which the Italian Socialist party had degenerated. He drew further and further away from Marx and Lassalle, feeling more sympathy with the ideas of Baboeuf, Blanqui, Proudhon, and above all with the syndicalism of Sorel. An opponent of parliamentarianism, he reproved the Italian socialists for compounding with the bourgeois parties in order to secure seats in the Chamber and lucrative contracts for bogus co-operative societies; he not only advocated direct action, but also put it into practice whenever he saw a chance of securing real advantages for the proletariat thereby, and, unlike other Socialist leaders, he was ever ready to lead his followers and run risks.

The Tripoli Campaign.—When Giolitti's Government decided to send a military expedition to Tripoli, although not rejecting the idea of war in general, Mussolini opposed this policy because, as he said, unlike the Nationalists, who wanted a vast Italy, he preferred an Italy that should be well cultivated, rich and free. On Sept. 25–27, 1911 he therefore organized a popular movement at Forli against the Tripoli expedition, inciting the mob to resist the authorities. He was in consequence arrested and condemned to five months' imprisonment. At the congress of Reggio Emilia in 1912, when Bissolati and Bonomi were expelled from the party for supporting the Government's African policy, Mussolini remained one of the die-hard revolutionaries, and in December of that year was made editor of the *Avanti*, the official organ of the party. Under his able editorship the circulation rose from 40,000 to 100,000, and his vigorous leaders gave the paper an entirely new character. He insisted particularly on the necessity for improving the economic and social conditions of the southern provinces, which other Socialist leaders neglected because their inhabitants gave few votes to the party. During the so-called "Red Week" in the Marche and Romagna (June 7–14, 1914), Mussolini was one of the most active leaders of the outbreak. It was on this occasion that he lost many illusions concerning his fellow Socialist leaders. He also realized that the masses were anything but ripe for revolution.

The World War.—The crisis of Mussolini's life came with the outbreak of the World War. From the first he strongly opposed Italy's intervention on behalf of the Central Powers. After Italy's declaration of neutrality he still hesitated, for the conflict was raging within him between the Socialist and the Italian; as a Socialist he favoured war in the belief that it would end war and re-establish the principles of right and justice, while as an Italian he doubted if his people were ready to enter the fray. In the autumn the tendency in favour of intervention had gained ground, and he wrote that Italian unity must be completed; later he approved the Government's military measures, as he realised the danger of keeping Italy alone unarmed amid the general conflagration. But he was ever less in harmony with the official creed of his party, and he expressed the hope that if Italy did intervene her international status would be raised and an economic and social revolution promoted. He resigned the editorship of the *Avanti*, and on Oct. 25 appeared before the Socialist assembly at Milan to justify his conduct. The audience howled at him, with imprecations of "traitor, hireling, assassin!"; but instead of defending himself he violently attacked the other Socialists for their *petit-bourgeois* spirit and insincerity. He ended by saying, "You hate me because you still love me."

He now founded a new paper of his own, *Il Popolo d'Italia*, and his enemies spread the rumour that Mussolini had received money from the French Embassy to support the Allied cause, whereas the sole capital of his new venture was 4,000 lire advanced by advertisers. The *Popolo d'Italia* first appeared on Nov. 15, 1914, and in the leading article Mussolini asked: "Do we wish to drag out a miserable existence under present conditions, content with the *status quo* of the monarchy and the bourgeoisie, or do we wish instead to break up this wretched combination of intrigue and cowardice?" He concluded with a stirring appeal in favour of war. The paper led a precarious existence in wretched premises, and was hardly able to pay the staff. But it gathered around it a number of brilliant young writers fired with enthusiasm for the national cause, although many were Republicans and Socialists.

Audacity was its keynote, and while the *Idea Nazionale* and D'Annunzio appealed to the older and more intellectual middle classes, Mussolini influenced the younger generation and the workers, and he reached the less educated masses through his friend the Syndicalist, Filippo Corridoni (afterwards killed in action), editor of the weekly *Battaglie sindacali*. But he still believed in revolution, and in April 1915 he was arrested for advocating his views at a public meeting; ten days later he was slightly wounded in a duel with the orthodox Socialist Claudio Treves. When on May 24 war was declared he wrote in the *Popolo d'Italia:* "From to-day onwards the nation is called to arms. From to-day onwards we are all of us Italians and only Italians. Now that steel has to meet steel, one single cry issues from our breasts, *Viva l'Italia!*"

In the Trenches.—In Sept. 1915, Mussolini, who had volunteered for active service (as editor of a paper he had a right to exemption), was called up, and served as a private in the Bersaglieri in the trenches along the Isonzo and on the Carso. He did his duty gallantly until he was seriously wounded by the explosion of a trench mortar on Feb. 23, 1917. He spent many months in hospital, and on recovery returned to his work on the *Popolo d'Italia*. He wrote a graphic account of his war experiences in his *Diario di Guerra*. As early as the beginning of 1917 he realised the gravity of the propaganda which the Socialists and neutralists were able to conduct owing to the feebleness of the Government, especially of the Minister of the Interior, Signor Orlando, and after resuming his editorial chair he uttered warnings which were disregarded, as were those of Gen. Cadorna. After Caporetto he was one of the few who never lost heart and in the columns of his paper he issued daily messages of encouragement.

After the armistice, Mussolini opened a campaign in favour of a dignified foreign policy at the Peace Conference, and of adequate recognition for the services of the ex-service men. In reply to the first manifestation of Bolshevism Mussolini founded the first *Fascio di Combattimento* on March 23, 1919, at Milan (*see* FASCISM); and although the first programme of the new group

contained many demagogic demands, the patriotic note was predominant, and Mussolini continued to combat Bolshevik doctrines. With regard to Fiume, he insisted that its Italian character must be secured. When D'Annunzio occupied Fiume the *Popolo d'Italia* lent him its full support.

Mussolini was now bitterly hated by the Socialists, and when at the elections of 1919 he stood as a candidate for Milan, he secured only a few votes and was described by the *Avanti* as "a corpse to be buried in a ditch." A few days later Nitti had him arrested on a charge of "armed plotting against the security of the State" (in connection with his support of D'Annunzio), but did not dare to maintain the arrest, and he was soon liberated. Mussolini now worked harder than ever at his paper, whose circulation increased rapidly; his relaxations were writing plays and playing the violin, and he also took to motoring and aviation, in which sports he showed his usual disregard of danger.

Fascist Discipline.—The seizure of the factories by the workmen in the autumn of 1920 did not meet with Mussolini's disapproval, as one would have expected; he regarded their action as a form of practical syndicalism breaking away from the pusillanimous policy of the official Socialist party. But when the Communists proceeded to organize political murders at Bologna, Modena and Ferrara, Mussolini and his Fascists became the nuclei of the national anti-Bolshevik reaction; it is due to him that the whole Communist-Socialist domination eventually collapsed, first in the Po valley and then throughout Italy. But Mussolini was now coming to the conclusion that it was not enough to defeat and disperse the Reds. The Italian people, he argued, must be made free to recover, to work and produce undisturbed, to fulfil their higher destinies; the incompetent governing caste, ready to compromise on everything, must be swept away and its place taken by the virile youth of the country who had won the War. Fascism was spreading rapidly, and in Nov. 1921 it was organized into a political party, but its discipline still left much to be desired. Mussolini now proceeded to reorganize it and establish it on a strictly hierarchical basis, until its discipline surpassed that of any other organisation in Italy. All ranks of society he regarded as necessary, for he did not wish to repudiate the past. He was, moreover, becoming ever more keenly interested in foreign politics. "I hold that, having broken the pride of Bolshevism, Fascism should become the watchful guardian of our foreign policy." But the movement was extending to every sphere of national life—internal affairs, finance, labour, industry, agriculture. At the elections of May 1921 Mussolini and 35 other Fascist candidates were returned, and together with their allies the 10 Nationalists played an active part in the debates.

During the next 12 months Fascist influence consolidated itself throughout Italy, and the obvious breakdown of the old political parties convinced Mussolini that the time for bold action was fast approaching. At first he thought only of the possibility of a coalition Government comprising Fascist elements, but by the summer of 1922 he felt that a predominantly Fascist Government was conceivable and indeed necessary. The strike of Aug. 1, 1922, promoted by the revolutionary Alleanza del Lavoro, was broken by the Fascists, and this fact showed the increasing weakness of Signor Facta's Government, which was no longer able to resist any really energetic action from the right or from the left. In the meanwhile, Mussolini had been shedding the last traces of demagogic ideas, and at a Fascist gathering at Udine on Sept. 29 he openly pronounced himself an upholder of the Monarchy, thereby securing the sympathy of many non-Fascists and of the army. He now made no secret of his intention of seizing power, and said so openly at the Fascist meeting in Naples in October. The march on Rome (*see* ITALY: *History*) was organized and directed by Mussolini, and indeed it shows the Mussolini touch in every phase. When the Facta Cabinet resigned the king first sent for Signor Salandra, who tried to form a coalition Government, but Mussolini refused to lend the scheme his support, and Salandra threw up his mandate, whereupon the task was entrusted to Mussolini himself. He formed his Ministry within seven hours, a record for Italy, where, especially during the post-war years, every cabinet crisis had lasted for many days and even weeks. He chose several non-Fascists as Ministers, but refused to contract an alliance with the parties to which they belonged.

His Reforms.—From the moment he assumed office he set to work with his accustomed energy to overhaul and reform the whole administration, to eliminate inveterate abuses, and infuse a new spirit into the State. He himself assumed the portfolios of Foreign Affairs and the Interior, although the work of the latter he left largely to the under-secretary Aldo Finzi. In June 1924, after the Matteotti affair, he appointed Signor Federzoni Minister of the Interior, but in the following spring, on the resignations of Gen. Di Giorgio and Adml. Thaon di Revel (April 3 and May 5, 1925), he assumed the portfolios of War and Marine, and also that of the new Air Ministry; while leaving great latitude to the under-secretaries, he gradually welded the three ministries into a single department of National Defence.

As a Socialist Mussolini was an anti-Parliamentarian, and even later did not regard the Parliament as the sole organ of national life. His object was to make Italy powerful, prosperous and efficient, in as short a time as possible. But in order to make these reforms lasting he determined that the whole body politic shall be imbued with the Fascist spirit—*fascistizzare la nazione*, as he described it—and he therefore inserted Fascism into every activity of the country (for the details of Mussolini's policy as head of the Government *see* ITALY: *History*).

As a Minister, Mussolini's activity was prodigious. Even when he was seriously ill in the spring of 1925, he surprised his friends and disconcerted his adversaries by continuing very largely to conduct his business of government from his bed, and by his quick recovery. While he was immensely popular with the great majority of the people who appreciated the far-reaching benefits of his rule, he had many enemies among the members of the old governing caste, the Socialists, Communists and Republicans and the anti-national freemasons, whose influence he destroyed. His opponents tried to exploit the Matteotti murder (June, 1924) to compromise and overthrow Fascism, but Mussolini's great political ability and his obvious honesty of purpose warded off the attempt.

Settlement of the Roman Question.—His unique contribution to the settlement of the 59 year old Roman Question added great lustre to his name as a statesman. On February 11th, 1929, at the palace of the Lateran in Rome, he was co-signatory with Cardinal Gasparri, Papal Secretary of State, of a treaty by which the Supreme Pontiff became sovereign of a newly created State, "The City of the Vatican." In an address two or three days later, the Pope paid a tribute to Mussolini's "exceptional statecraft," shown in the settlement.

Attempts on Mussolini's Life.—At the end of Oct. 1925, a plot to murder him was discovered by the police, and the would-be murderer, the Socialist ex-deputy Tito Zaniboni, was arrested in the very act; other persons were arrested in connection with the affair, notably Gen. Capello, a leading freemason. The news of the plot aroused general indignation, and Mussolini received a plebiscite of enthusiastic congratulations. On April 7, 1926, as he was leaving the Capitol, where he had inaugurated a surgical congress, an Irishwoman, the Hon. Violet Gibson, fired at him with a revolver, slightly wounding him in the nose. His assailant appeared to be demented. The wound did not prevent him from sailing for Tripoli the following day according to programme. On Sept. 11, 1926, the anarchist Lucetti threw a bomb at the premier's motorcar, but although it exploded and wounded several passers-by, Mussolini escaped unhurt. The would-be assassin was arrested and condemned to 30 years imprisonment. On Oct. 31, while he was returning from the inauguration of the scientific congress at Bologna a youth named Zamboni fired a revolver shot at him and narrowly missed him. Zamboni was instantly lynched by the crowd. This unsuccessful attempt was followed by demonstrations of enthusiasm all over Italy, and new measures were enacted for dealing severely with political crime.

Mussolini is not a finished orator in the classical sense. But every speech bristles with facts, and each phrase contributes to build up the idea which he wishes to assert. On innumerable occasions an apparently difficult, even insoluble, situation has been solved by one of his vigorous speeches. Besides innumerable arti-

cles in *Il Popolo d'Italia, Avanti, Gerarchia,* etc., he has published *Il mio Diario di Guerra* 1915–17 (Milan, 1923), and his speeches have been collected in several volumes. A selection of them has been published in English edited by Baron Quaranta, *Mussolini as revealed in his political speeches, Nov. 1914 to Aug. 1923* (1923). His biography was published in English by Margherita Sarfatti (Butterworth, 1925). *See* F. Gueterbock, *Mussolini und die Fascismus* (1923); A. Dressler, *Mussolini* (Leipzig, 1924); L. Roger, *Historie de Mussolini* (1926); Spencer Jones, *Benito Mussolini* (1927); Antonio Beltramelli, *L'uomo nuova* (new edition, 1928), and Vittorio De Fiori, *Mussolini the Man of Destiny* (1928). *See* also his own account of his life (Eng. trans. *My Autobiography*, 1928). (L. V.)

MUSSOORIE or **MASURI,** a town and sanitarium of British India, in the Dehra Dun district of the United Provinces, about 6,600 ft. above the sea. Pop. (1921), 8,297, rising to 15,000 in the hot season. It stands on a ridge of one of the lower Himalayan ranges, amid beautiful mountain scenery, and is one of the chief summer resorts for European residents in the plains of the United Provinces. The view from Mussoorie over the valley of the Dun and across the Siwalik hills to the plains is very beautiful, as also is the view towards the north, which is bounded by the peaks of the snowy range. Mussoorie practically forms one station with Landaur, the convalescent depot for European troops, 7,362 ft. above the sea. Some distance off, on the road to Simla, is the cantonment of Chakrata, 7,300 ft. There are numerous schools for Europeans, including St. George's college, the Philander-Smith institute, the Oak Grove school of the East Indian railway, and several Church of England and Roman Catholic institutions, together with a cathedral of the latter faith. The first brewery in India was established here in 1850. The town has botanical gardens, and is the summer headquarters of the Trigonometrical Survey.

MUSSORGSKY, MODEST PETROVICH (1835–1881), Russian composer, was born at Karevo, Pskov, on March 28, 1835, and entered the army at an early age. He was a talented amateur, when his acquaintance with Balakirev and Dargomijsky led him to the serious study of music. In 1857 he left the army and devoted himself to music, though this step entailed earning his living as a government clerk and a prolonged period of poverty. He found an intimate friend in Rimsky-Korsakov. His greatest opera, *Boris Godunov,* based on Pushkin's drama, was produced in St. Petersburg in 1874. *Khovantschina,* also based on the period of Peter the Great, was finished by Rimsky-Korsakov. Other unfinished works were based on Gogol's *Marriage Broker* and on Flaubert's *Salammbo.* He also wrote exquisite songs and orchestral works, of a realistic national type. Mussorgsky died in the military hospital at St. Petersburg on March 28, 1881. He had taken to drugs and was a mere shadow of his former self.

See M. D. Calvocoressi, *Mussorgsky* (1908, Eng. trans. 1913); M. Montagu-Nathan, *Moussorgsky* (1916); and the article by Rosa Newmarch in *Grove's Dictionary of Music and Musicians.*

MUSTAFA KEMAL (1880–), Turkish soldier and statesman, was born in comparatively modest circumstances in Salonika. His father was a customs officer who afterwards entered the timber trade and died when Mustafa was yet a small child. The boy was brought up and educated by his mother, a woman of character and ability. He completed his primary education in Salonika and entered a secondary school in the same place; but, having been maltreated by his Arabic teacher, he left school, against his family's wish, and secretly entered the military preparatory school. There he proved to be an exceptional student, especially in mathematics. His teacher in mathematics, who was also named "Mustafa," gave him the distinctive surname of "Kemal" (an Arabic word meaning "perfection"), as a tribute to his unusual ability. Such was his popularity at the military academy that, although he already took an active interest in politics and bitterly criticised the despotism of Abdu'l-Hamid, he was never denounced.

In 1904 he was gazetted lieutenant, but on the same day arrested, and after examination, banished to Damascus. Here, after observing the deplorable condition into which the civil and military organization of the empire had fallen, he founded in 1905 the secret political society "Vatan" ("Fatherland"). From Damascus he was transferred to Jaffa, whence he made his way secretly to Salonika to organize a similar political movement in the European provinces. The association which he founded at Salonika was afterwards affiliated to the Union and Progress Society. The Constantinople Government now again ordered his arrest; but he escaped, and the Government presently forgot him. In 1907 he was promoted and sent to Salonika, where he resumed his revolutionary activities.

When the revolution of 1908 re-established the constitution of 1876, Mustafa Kemal found himself in serious disagreement with the leaders of the victorious Union and Progress party. His political views were more radical than theirs and he protested, though in vain, against the participation of the army in politics. In consequence he abandoned politics for the time and turned his whole energy into his military career, in which he advanced rapidly. He was loved and respected by the younger officers, but some of his superiors mistrusted his uncompromising attitude. In 1911 he went to Tripoli *incognito* to take part in the war against the Italians. There he was promoted major. The first Balkan war was over before he could return; but in July 1913, during the second Balkan war, he was appointed chief of the staff to the newly-organized army corps on the Gallipoli peninsula, where he made a detailed first-hand study of the problem of defending the Dardanelles. After the restoration of peace, he was appointed military attaché at Sofia, with the rank of colonel, and held this post until after the intervention of Turkey in the World War in the autumn of 1914.

Mustafa Kemal believed that Turkey had entered the war prematurely and that Germany was doomed to eventual defeat. Possibly, for this reason, his desire to return to active service was not encouraged; but, on his insistence, he was appointed commander of the forces at Rodosto, and afterwards (in 1915) at the Dardanelles. He inspired the defence of the straits against the British attack—this, when the Turkish high command had lost hope. During the final British assault a splinter of shell right over the heart was intercepted by his watch and he thus escaped with his life.

Mustafa Kemal was then sent to the Caucasus, where he was promoted to the rank of pasha and recovered Bitlis and Mush from the Russians. In 1917 he was posted to the Hejāz. His proposal to recall all the forces in the Hejāz to reinforce the Syrian front was not adopted, but later in the same year he was appointed to the command of the VII. Army Corps in the force which the German general Von Falkenhayn was organizing with a view to the recovery of Baghdad. At this time Germany's intervention in the internal affairs of Turkey had reached its height, and Mustafa Kemal Pasha put himself at the head of the opposition to it. He sent in a succession of reports adverse to the Baghdad expedition, which he thought would end in another disaster, and when his advice was ignored he resigned. He was then transferred to the II. Army Corps, but abstained from taking up his command owing to disagreement on questions of principle with General Headquarters. Sent on a mission to the German G.H.Q. with the heir apparent Vahydu'd-Din Efendi, in the presence of Generals Hindenburg and Ludendorff, he expressed outspokenly his pessimistic views regarding the outcome of the war. In 1918 he yielded to the insistence of Vahydu'd-Din Efendi, who had now meanwhile succeeded to the throne as Sultan Mehmed VI., and accepted command of the VII. Army Corps in Palestine, but all chance of taking the offensive, or even averting disaster, had now disappeared. Mustafa Kemal again distinguished himself, however, in keeping together the remnants of his corps on the retreat which followed General Allenby's great victory, and before the end of September was appointed commander-in-chief of all the corps constituting the so-called Yildirim group.

When the Turkish Government negotiated the armistice of Mudros (Oct. 30, 1918), Mustafa Kemal was opposed to the policy of complete surrender, and after the signature of the armistice retired to Constantinople. The Greek landing at Smyrna on May 16, 1919, which reawakened the Turkish nation, and his appointment by the Ottoman Government in Constantinople as

inspector of the IX. Army Corps in north-eastern Anatolia gave him his chance. His mission, as conceived by the sultan and the grand vizier, was to execute the armistice terms by superintending the disarmament and demobilization of the Turkish army in this remote district. Mustafa Kemal meant to create a nucleus of national resistance against the partition of the country, and therefore accepted with alacrity the position offered him by the unsuspecting Government. As soon as he landed at Samsun he began to organize his new movement locally at Amasia, Tokat and Sivas, and to correspond secretly with other parts of the country. The sultan's government, awaking too late, recalled him to Constantinople, but he went on instead to Erzerum and sent in his resignation to Constantinople. He next convened two congresses, one at Erzerum in July, and the other at Sivas in Sept. 1919. Both congresses endorsed his programme of fighting for national existence to the bitter end, and appointed a standing executive committee under his chairmanship. Thereupon he was outlawed by the Constantinople Government, and relations between the capital and the interior of Anatolia were broken, but all the efforts of the Constantinople Government and the Allied Powers to frustrate Mustafa Kemal's activities simply strengthened his conviction that he had taken the right path.

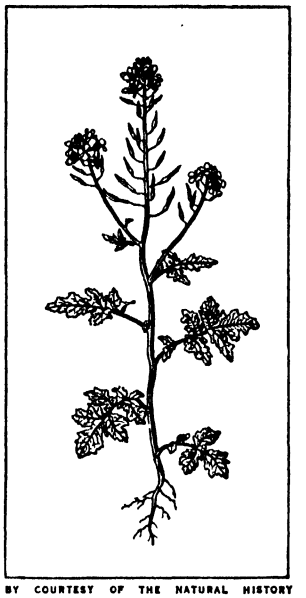
The political and military history of the new Turkish Nationalist movement, commonly called the "Kemalist" movement, after its founder, is given elsewhere. (*See* GRAECO-TURKISH WAR; LAUSANNE, CONFERENCE OF; TURKEY.) Mustafa Kemal was in favour of the Nationalists participating in the general election at the close of 1920, but decidedly opposed to the meeting of the Assembly at Constantinople, and his judgment was borne out by the event. On April 23, 1920, Mustafa Kemal gathered together at Angora the Nationalist members of the late Parliament who had escaped from Constantinople, and was elected unanimously president of this new National Assembly.

During the two and one-half years which followed, Mustafa Kemal was the heart and soul of the Turkish national resistance. His exceptional military ability, his keen intellect and his persuasive oratory carried his countrymen through their ordeal. During the summer campaign of 1921, which was the supreme crisis of the Graeco-Turkish War, the Angora assembly appointed Mustafa Kemal generalissimo of the Turkish forces, with unlimited power, and he took personal charge at the front during the 22 days' and nights' fighting of the battle of the Sakaria. During the battle his horse was wounded and the general broke a rib in falling, but he never left the front. After this battle the assembly gave him the rank of field-marshal and the traditional title of "Ghazi" (the victorious).

The destruction of the Greek army, the peace settlement at Lausanne, the abolition of the sultanate, the declaration of the republic and the abolition of the caliphate—were the direct work of Mustafa Kemal. On Oct. 29, 1923, the date on which the Republic was proclaimed, the great national assembly unanimously elected Mustafa Kemal the first president of the republic. In fact, if not in theory, he became dictator. After the external menace had been removed, the internal unity of the nation began to relax. Kemal's repressive policy deprived Turkey of certain talents which she could ill afford to spare. Embitterment reached a climax in June 1926, with the conspiracy of the former Committee of Union and Progress against Kemal's life. He was left in authority, however, and on Nov. 1, 1927 was unanimously reelected. For the revolution in social organisation and the general policy of Westernization carried out by Mustafa Kemal *see* TURKEY, HISTORY. (A. J. T.)

MUSTANG, the wild or semi-wild horse of the prairies of North America, the descendant of the horses imported by the Spaniards after the conquest in the 16th century (*see* HORSE).

MUSTARD. The varieties of mustard-seed of commerce are produced from several species of the genus *Brassica* (family Cruciferae). Of these the principal are the black mustard, *Brassica nigra* (*Sinapis nigra*), the white mustard, *Brassica alba*, and the Sarepta mustard, *B. juncea*. Both the white and black mustards are cultivated to some extent in various parts of England. The white is grown as a salad plant and has come into increasing favour as a forage crop for sheep and as a green manure, for which purpose it is ploughed down when about to come into flower. The black mustard is grown solely for its seeds, which yield the condiment. When white mustard is cultivated for its herbage it is sown usually in July or August, after some early crop has been removed. In about six weeks it is ready either for feeding off by sheep or for ploughing down as a preparative for wheat or barley.



BY COURTESY OF THE NATURAL HISTORY MUSEUM

WHITE MUSTARD (SINAPIS ALBA), SHOWING FLOWERS AND FRUITS (SILIQUAS)

Brassica nigra occurs as a weed in waste and cultivated ground throughout England and the south of Scotland, and widely in the United States and Canada. It is a large branching annual 2 to 3 ft. high with stiff, rather rough, stem and branches, dark green leaves ranging from lyrate below to lanceolate above, short racemes of small bright yellow flowers one-third of an inch in diameter and narrow smooth pods. *B. alba* is more restricted to cultivated ground in Great Britain and has only sparingly escaped from cultivation in the United States; it is distinguished from black mustard by its smaller size, larger flowers and seeds, and spreading rough hairy pods with a long curved beak.

The pungency and odour to which mustard owes much of its value are due to an essential oil developed by the action of water on two chemical substances contained in the black seed. These bodies are a glucoside (*see* GLUCOSIDES) termed by its discoverers myronate of potassium, but since called sinigrin, $C_{10}H_{18}KNS_2O_{10}$, and an enzyme, myrosin. The latter substance in presence of water acts on sinigrin, splitting it up into the essential oil of mustard, a potassium salt, and sugar. It is worthy of remark that this reaction does not take place in presence of boiling water, and therefore it is not proper to use very hot water (above 120° F) in the preparation of mustard. Essential oil of mustard is in chemical constitution an isothiocyanate of allyl C_3H_5NCS. The seed of white mustard contains in place of sinigrin a peculiar glucoside called sinalbin, $C_{30}H_{44}N_2S_2O_{16}$, in several aspects analogous to sinigrin. In presence of water it is acted upon by myrosin, present also in white mustard, splitting it up into acrinyl isothiocyanate, sulphate of sinapin and glucose. The first of these is a powerful rubefacient, whence white mustard, although yielding no volatile oil, forms a valuable material for plasters.

Both as a table condiment and as a medicinal substance, mustard has been known from a very remote period. Under the name of *νâπυ* it was used by Hippocrates in medicine. The form in which table mustard is now sold in the United Kingdom dates from 1720, about which time Mrs. Clements of Durham hit on the idea of grinding the seed in a mill and sifting the flour.

The volatile oil distilled from black mustard seeds after maceration with water is official in the British Pharmacopeia under the title *Oleum sinapis volatile*. It is a yellowish or colourless pungent liquid, soluble only in about fifty parts of water, but readily so in ether and in alcohol. From it is prepared, with camphor, castor-oil and alcohol, the *linimentum sinapis*. Used internally as a condiment, mustard stimulates the salivary but not the gastric secretions. It increases the peristaltic movements of the stomach very markedly. One drachm to half an ounce of mustard in a tumblerful of warm water is an efficient emetic, acting directly upon the gastric sensory nerves, long before any of the drug could be absorbed so as to reach the emetic centre in the brain. The heart and respiration are reflexly stimulated, mustard being thus *the only stimulant emetic*.

MUSTARD GAS. The name given to dichlordiethyl sulphide, by far the most devastating gas used in the World War. The fact that it was indestructible and gave off small quantities of vapour for a considerable period added to its potency. The inflammation of the respiratory passages which resulted either proved fatal or rendered the lungs subject to subsequent bacterial infection. (*See* RESPIRATION.)

MUSTARD OILS, a general term applied to compounds related to allyl mustard oil, the principal constituent of mustard oil obtained by distilling black mustard seeds (*Sinapis niger*). These seeds contain a glucoside (*q.v.*) termed potassium myronate which undergoes a fermentative change due to an enzyme (*q.v.*), myrosin, also present in the seeds. *Allyl mustard oil* (allyl isothiocyanate), $C_3H_5{\cdot}N{:}C{:}S$, is a colourless liquid sparingly soluble in water and boiling at 151° C; it has a sharp pungent odour and produces blisters on the skin, whence the efficacy of the mustard poultice as a counter-irritant. It can be prepared synthetically by heating allyl sulphide $(C_3H_5)_2S$, with potassium thiocyanate. The odour and taste of mustard (*q.v.*) are due to this substance.

The analogues of allyl isothiocyanate are readily prepared by the action of carbon bisulphide on primary amines, when alkyl dithiocarbamates are formed which on distillation with mercuric chloride yield the corresponding mustard oils. These compounds are colourless liquids with pungent irritating odours. This general reaction proceeds so smoothly that it is employed as a distinctive test for primary amines. (*See* AMINES.) Methyl and ethyl mustard oils are thus obtained from methylamine and ethylamine respectively; the former, a solid, melts at 35° C and boils at 119° C; the latter is liquid and boils at 134° C. Phenyl mustard oil from aniline is a colourless liquid boiling at 222° C.

MUSURUS, MARCUS (*c.* 1470–1517), Greek scholar, was born at Rhithymna (*Retimo*) in Crete, and was a pupil of John Lascaris at Venice. He was professor of Greek at Padua and Venice, and died in 1517. Since 1493 Musurus had been associated with Aldus Manutius, and belonged to the "Neacademia," a society founded by Manutius and other learned men for the promotion of Greek studies. Many of the Aldine classics were brought out under Musurus's supervision, and he is credited with the first editions of the scholia of Aristophanes (1498), Athenaeus (1514), Hesychius (1514), Pausanias (1516).

See R. Menge, *De M. Musuri vita studiis ingenio,* in vol. 5 of M. Schmidt's edition of Hesychius (1868).

MUTATION: *see* VARIATION: *Experimental;* HEREDITY; EVOLUTION.

MUTIAN, KONRAD (1471–1526), German humanist, was born in Homberg on Oct. 15, 1471 of well-to-do parents named Mut, and was subsequently known as Konrad Mutianus Rufus, from his red hair. At Deventer under Alexander Hegius he had Erasmus as schoolfellow; he took the master's degree at Erfurt in 1492. From 1495 he travelled in Italy, taking the doctor's degree in canon law at Bologna. Returning in 1502, the landgraf of Hesse promoted him to high office. The post was not congenial; he resigned it (1503) for a small salary as canonicus in Gotha. The circle which gathered round Mutian at Erfurt, known as the *Mutianischer Bund,* included Eoban Hess, Crotus Rubeanus, Justus Jonas and other leaders of independent thought. He wrote little himself, but inspired others. He desired the reform of the Church, but not schism. Like Erasmus, he was with Luther in his early stage, but deserted him in his later development. Though he had personally no hand in it, the *Epistolae obscurorum virorum* (due especially to Crotus Rubeanus) was the work of the Reuchlinists in his *Bund.* He died at Gotha on March 30, 1526.

See F. W. Kampschulte, *Die Universität Erfurt* (1858–1860); C. Krause, *Eobanus Hessus* (1879), and *Der Briefwechsel des Mutianus Rufus* (1885).

MUTILATIONS AND DEFORMATIONS. In every part of the world to-day, both in civilised as well as uncivilised communities some form of mutilation of the human body is found; but the widest variety of mutilations as well as the most severe occur among the more primitive peoples.

Early historians and writers, long before the Christian era, show that in those days such mutilations as tattooing and circumcision, as well as skull deformation, were well known. Some form of mutilation was probably practised from earliest prehistoric times. On the cave walls of France and Spain, where Aurignacian and Magdalenian man painted the mammoth, elephant and woolly rhinoceros during the closing phases of the last Ice Age (*see* STONE AGE), are painted hands which indicate the removal of one or more finger joints, a practice common to-day in South Africa, India and elsewhere. The reason for this mutilation on the part of prehistoric man can only be conjectured by analogy with these modern primitive peoples. In the Wellcome Historical Medical Museum in London, there is exhibited a skeleton of an early man from a prehistoric grave at Gebel Moya in the Sudan. Found close to the jaw is a stone stud exactly similar to the lip studs worn by Nilotic peoples today. Other evidence may be found in folk tales; early paintings and carvings, and by a careful interpretation of objects found in the graves. The motives behind mutilation may be classified as: Tribal Convention; Adornment; Initiation Ceremonial; Religion; Punishment and Health.

Skin.—Tattooing consists of puncturing the skin in the pattern desired and rubbing in colouring material so that the pattern is indelibly fixed. In New Zealand the Maoris brought tattooing to a very high art, and the intricate patterns with which they adorned their faces were executed with exquisite workmanship and taste. In China, Borneo, India and other parts of the Far East tattooing is prevalent, and thence has been introduced into Europe, chiefly by sailors. Arms, legs, body and face are all considered suitable surfaces for decoration. To-day tattooing saloons exist in London and in many of the bigger sea-ports. True tattooing, but of a less lasting nature, is occasionally found in parts of Africa, and must not be confused with scarification.

Scarification.—This consists of cutting deep marks into the skin and rubbing in charcoal and other irritant material to keep open the wound which eventually is allowed to heal but which leaves a deep scar. Sometimes the wound is so treated that a shiny "keloid" instead of a flat scar results. Scarification occurs all over Africa for reasons as numerous as they are different. Very frequently small scars are made on the face which serve as tribal and clan marks. Often elaborate patterns are worked out on the chest for purely personal adornment; these are especially good on the West Coast. Sometimes the object of the operation is semi-magical, women of many African tribes being scarified on the abdomen during pregnancy. At other times, scarification is merely the result of surgical treatment and is the consequence of rather crude cupping methods followed by the application of an irritant powder. In Australia the aborigines scarify their arms and chests, which often show great black keloids representing many years of patient work, the wound being opened up from time to time and fresh irritants applied.

Hair.—Depilation by some means or other, has been practised by primitive peoples for hundreds of years, while all modern civilised peoples still continue to remove unwanted hair by various methods. One of the commonest primitive methods of hair removal is by plucking out each individual hair by its root, every time it grows. By starting at an early age the time comes when the hair on the parts so treated could only be grown sparsely even if desired. This plucking is usually done with the aid of special tweezers some of which—as those in use among the Akamba in Kenya Colony—are beautifully made. Depilation by plucking is common all over Africa and in many parts of the East and Oceania, and the areas so treated are more especially the face and pubic regions, and chest and under the arms. Some individuals even go to the length of removing all body hair.

Shaving of the face, as well as of the scalp, is a common practice among primitive people, and may be carried out with such instruments as a piece of broken glass, or a special iron blade. It is usually done dry, without the use of water or lather. Depilation by singeing, as well as by the use of ointments occasionally occurs. Removal of the hair is usually due to tribal custom, as hairy people are despised and often unable to find a mate.

Head.—There are few if any parts of the world where some portions of the head and face entirely escape mutilation, but the

most commonly maltreated are the ears, nose, lips and teeth. Skull deformation may be the result of deliberate intention, or of chance. In some tribes, especially in America every individual was intentionally treated as a child with the direct view of reducing the skull to a certain shape. In other cases, as in parts of Africa, deformation is the unintentional result of the local methods of carrying water pots or loads on the head. Young children, especially girls, start such work long before the skull is properly developed and the result is a definite and fairly uniform deformation. Skull deformation occurs in nearly every part of the world, though commonest in the Americas and least common, if at all existent, in Australia. Intentional deformation is carried out from various motives, sometimes a long pointed head, sometimes a flat depressed head being the shape required. Various methods are employed, commonest of which are by bandaging, and by tying the child's head to a flat board fixed to the occipital region.

Ears.—These are pierced to carry earrings all the world over, indeed very few, primitive or civilised peoples, leave the ears totally unmutilated, though the Andamanese, Bushmen and true Baganda are reported as doing so. Both the ear lobes, as well as the cartilage round the top of the ear, are commonly pierced. This is usually done during childhood and a small piece of wood is inserted into the wound which is then left to heal. Later this plug is removed and a larger one inserted, the process being continued until the required size of hole is obtained by reason of this continual stretching. In many countries both sexes treat their ears in this way, while in others it is confined to one or other sex. The greatest distensions are to be found in Borneo and East Africa. In both these places lobes are often seen so stretched that they hang down to the shoulder, with holes so large that it would be possible to pass a closed fist through them. In all these ear mutilations adornment is the end in view. Large carved wooden plugs, carved stone ornaments, metal rings and fibre and paper rolls, all are used as earrings, while to-day even earthenware jam pots and circular cigarette tins are popular in some parts of Africa.

In some tribes such as the Kikuyu, a husband if displeased with his wife breaks the lobe of her ear with his hands.

Nose.—The nose is often mutilated for purposes of personal adornment especially in India, and the East, as well as in New Guinea and Polynesia, S. America, Australia and in parts of Africa. Nose ornaments also signify social rank. Sometimes it is the alae, and sometimes the septum which is perforated. Often only a small hole is made through the septum from which a gold ring or other jewel is suspended; at other times the hole in the septum is big enough for a finger to be passed through. Elsewhere one, and occasionally both, nostrils are pierced and distended to carry coloured studs, sometimes of unbelievable size, as among the Makonde of Portuguese East Africa. Nose ornaments are more common with women than men, but in New Guinea and especially among the Tugeri and the Solomon Islanders, the men wear great pointed sticks, or sometimes the tusks of wild pig through holes in the nose.

Lips.—In several parts of Africa, especially in the Congo, the south east Tanganyika Territory, and the upper reaches of the Nile, and among the Botocudo of S. America enormous plates and plugs are inserted in hugely distended holes, cut in the upper and lower lips. The lip studs and pins of the Nilotic peoples of Uganda, Kenya Colony and the Sudan are usually small and made of ivory, rock crystal or stone, and are inserted through the upper and lower lips or both. Other lip mutilations include pricking and rubbing with irritant to cause them to swell. This is done in parts of West Africa.

Teeth.—Over the greater part of Africa, as well as in Australia, New Guinea and elsewhere, it is a common practice to remove one or more front teeth in the upper or lower or both jaws. Sometimes the ceremonial knocking out of the teeth accompanies initiation and is a test of ability to bear excruciating pain unflinching; sometimes it is simply a matter of custom; sometimes it serves as a tribal mark, while yet another reason given is the fear of lock-jaw. The removal of the teeth is in this case a precaution which would enable the patient to be fed if the disease were contracted.

Another common practice in Africa, found also in Southern India, is the filing or chipping of teeth to serve either as a tribal mark or as an initiation step, or for both purposes. The Akamba and certain Congo peoples file their incisors to sharp points, and for some unknown reason this was considered by early travellers as a sign of cannibalism—a most erroneous view. The Eskimo file the teeth to make them shorter and less like those of dogs and in south and central Africa the incisors are filed to all sorts of shapes and patterns as described by Dr. G. Turner in the *Transvaal Medical Journal* for 1911.

The Dyaks of Borneo and other people in the East, occasionally drilled holes in the teeth, into which plugs of gold were driven to serve as ornament. This method of adornment was also used in ancient Mexico, precious stones being inlaid in the teeth.

Tongue, Cheeks and Neck.—Among the Bateso of East Africa a hole is sometimes bored through the tongue and a brass ring bearing one or two beads is inserted. The cutting out of the tongue was once a legal penalty in Europe, and has only recently been forbidden in some parts of Africa.

The Aleutian Islanders bored a hole through each cheek through which seal's whiskers were stuck. Feathers are put through holes in the cheek in parts of S. America.

The *Padang* of the South Shan States deform the necks of their womenfolk by making them wear—from early childhood onwards—high metal collars whose length is gradually increased; this eventually produces such elongation and dislocation of the neck that if the collars were removed the wearers would not be able to hold up their heads.

Eyes and Body.—Putting out eyes as a punishment for various crimes has existed at different times all over the world—Europe included. Priests and worshippers of certain eastern cults still gash and cut themselves with knives as did the priests of Baal in olden times. In parts of Africa it was once a practice to cut off the breasts of an unfaithful wife.

Limbs.—In former times both in England, and Europe generally, amputation of one or more limbs was a common punishment for crime (*see* Pike's *History of Crime in England*, 1893), and this method has only been suppressed in parts of Africa, as in the Congo and Uganda, by the European governments.

For purposes other than punishment and medical necessity, amputation consists chiefly of cutting off the finger joints, especially the little finger. In South Africa this is either done as mourning, or as a magical preventative measure in the case of a child born to a mother whose last baby was still-born. In Southern India grandmothers used (in some castes) to have to cut off one joint for each grandson born to them. In the Tonga Islands the practice is also considered as of magical importance against disease. There is too the bandaging of girl children's feet to prevent their development. This Chinese practice is now prohibited.

MUTINY: *see* MILITARY LAW and COURT MARTIAL.

MUTIS, JOSÉ CELESTINO (1732–1808), Spanish naturalist, was born at Cadiz on April 6, 1732. He received his bachelor's degree at the University of Seville and afterwards studied medicine at Madrid where in the general hospital he became for a time a lecturer in anatomy. His preference, however, was for the study of mathematics and natural science, especially botany. He became one of the first disciples of the Swedish botanist, Linnaeus (*q.v.*), in Spain. Attracted by the wide and fruitful fields of study which South America then afforded he sailed in 1760 for New Granada (Colombia), accompanying the Spanish viceroy as physician. In New Granada he occupied himself collecting and describing plants both from the lowlands and from the higher Andean regions, but he did not neglect medicine as is shown by his appointment as king's physician in the viceroyship. He spent much time on sanitary problems such as the establishment of proper cemeteries, the prevention of small-pox and the reduction of malaria. He put into general use many American herbs, the properties of which he had studied, among them ipecacuanda, guaco and Peruvian balsam. Some of these, such as the cinnamon laurel of the Andes, he made known in Europe. His

favorite study, however, was quinine, which he studied from every angle from the distribution of the different species of cinchona down to experiments in the curative properties of the drug. His *El Arcano de la Quina* was published in 1793. Later studies were published in the *Papel Periodico* and after his death by his nephew, Sinforoso Mutis, who completed and arranged his notes on the subject. His work probably had much to do with making possible the colonization of malaria-infested regions. His work attracted the attention of the king who created the Royal Botanical Expedition of New Granada and placed Mutis at its head. With 18 of his best students, Mutis carried out a systematic survey in which material was collected for the monumental *Flora de Bogotá ó de Nueva Granada* which he planned in 13 folio volumes. Because of his immense activity in other lines only the first volumes of this intended work were arranged at his death. For the remaining volumes he left manuscripts, notes, illustrations and sketches in such profusion that only some one knowing his schemes of arrangement could have finished the work. Among these botanical riches were 6,480 illustrations, admirable in precision and colour, which were intended for an atlas volume. This material, amounting to over 4,000 folios of loose manuscripts, and his collection of over 20,000 plants were sent after his death to the Botanical Garden at Madrid, where they are preserved. Mutis was instrumental in bringing Alexander von Humboldt to New Granada at the beginning of the 19th century and aided him in his work. Humboldt formed a high opinion of Mutis, whose work had completely surprised him. His work *Plantas Equinocciales* and later his *Geografía de las Plantas* were both dedicated to Mutis. For 18 years Mutis carried on a correspondence with Linnaeus, much of which was published in *A Selection of the Correspondence of Linnaeus* (1821). He furnished many specimens of plants which the Swedish naturalist described. Linnaeus named in his honour the beautiful genus *Mutisia*, of the family Compositae, comprising some 50 species of plants found in South America. He died at Bogotá on Sept. 11, 1808.

See A. F. Gredilla, *Biografía de José Celestino Mutis* (1911); F. González Suárez, *Memoria historica sobre Mutis y la expedición botánica de Bogotá* (2nd ed., 1905); Diego Mendoza, *Expedición botánica de José Celestino Mutis* (1909).

MUTRACHA: *see* CASTE.

MUTSU, MUNEMITSU, COUNT (1842–1896), Japanese statesman, was born in 1842 in Wakayama. A vehement opponent of "clan government"—that is, usurpation of administrative posts by men of two or three fiefs, an abuse which threatened to follow the overthrow of the Tokugawa *shogunate*—he conspired to assist Saigo's rebellion and was imprisoned from 1878 until 1883. While in prison he translated Bentham's *Utilitarianism*. In 1886, after a visit to Europe, he received a diplomatic appointment, and held the portfolio of foreign affairs during the China-Japan War (1894–95), being associated with Prince (then Count) Ito as peace plenipotentiary. He negotiated the first of the revised treaties (that with Great Britain), and for these various services he received the title of count. He died in Tōkyō in 1896.

MUTSUHITO: *see* MEIJI TENNO.

MUTTON. Next to beef and pork, mutton is the most popular form of meat among carnivorous peoples, but its consumption is relatively small except in Great Britain. The total number of sheep in the world, according to the statistics published by the International Agricultural Institute, is rather larger than that of cattle (601 as compared with 547 millions), but every head of cattle means 12 times as much meat as a sheep.

There was a serious depletion of the world's stock of sheep, as of cattle (*see* MEAT), during the war, but the loss was replaced.

NUMBER OF SHEEP (in thousands)

	1913	1926
Europe	191,671	194,916
N. and Central America	55,083	48,052
S. America	100,392	81,144
Asia	57,987	66,340
Africa	74,260	82,288
Oceania	109,331	128,507
Total (in thousands)	588,724	601,247

Of the number credited to Oceania about four-fifths are in Australia and the remainder in New Zealand. In other words, the sheep of Australia are about 100 millions and of New Zealand about 25 millions. But New Zealand now (1928) exports over five times as much mutton and lamb as Australia. The chief reason for this is that from the earliest days sheep were bred and kept in Australia for wool production and the carcass was regarded as having practically no commercial value. The Merino breed was kept almost exclusively and as recently as 1891 over 97% of the sheep kept in New South Wales were of that type.

In New Zealand sheep-breeding was in the first instance adopted, as in Australia, for the production of wool.

International Mutton Trade.—Attempts were made, especially in Australia, to export some of the surplus mutton by tinning or canning it. The same course was adopted in the case of beef and an overseas trade was established. Australian tinned meat was exhibited at the Great Exhibition in London in 1851. In the course of the next few years it became well-known and widely used. The introduction of refrigeration provided a better means of dealing with meat for export, although tinned meat still finds an extensive market for special purposes. The supply is likely to be maintained by meat-exporting countries because canning, or tinning, provides an outlet for the "trimmings" of carcasses.

The total quantity of mutton and lamb shipped from all exporting countries in 1927 was 300,000 tons. All of this was frozen, *i.e.*, it was subject, before shipment, to a temperature of from 10° to 15° F and kept at, or about, that temperature until it was deposited in cold storage at the port of destination.

The quantity in tons exported from each of the main sources of supply in 1927 was:—

Argentina	71,468
Australia	25,586
Chile (Patagonia)	27,760
New Zealand	139,000
Uruguay	27,146

The total quantity which reached the United Kingdom in that year was 276,163 tons.

British Consumption.—The improvement of sheep for mutton began in England in the latter part of the 18th century, and since then mutton and lamb have gradually come to be recognised as a regular part of the dietary of English households. It appears, however, from the calculations made by the Ministry of Agriculture and Fisheries that there was a substantial reduction in the consumption of mutton and lamb during the war and that this has not been since recovered. It is estimated that the average annual pre-war production in England and Wales was 194,000 tons, and that in the quinquennium ending in 1927 it was not more than 130,000 tons although in the latter year it had risen to 156,000 tons. This reduction was attributable to the serious depletion of the flocks of the country at the end of the war. Imports were also greatly reduced under war conditions and in 1918 amounted to no more than 112,000 tons. By 1923 the imports had reached 339,000 tons, which was much in excess of the pre-war quantity, but the total supply was reduced.

United States.—The relative proportion of mutton consumption in the United States is less than one-fifth that of England, and in comparison with that of beef and pork it is of minor significance. There is no recordable surplus for export and imports are negligible. The production which reached a peak of 389,500 tons in 1912 declined rapidly to 237,500 tons in 1918, but after 1922 a steady gain increased the total for 1927 to 327,000 tons. The curve for consumption followed closely that of production, except that since 1922 it has shown but a slight rise and the gap between the two has widened. Consumption in 1927 was but 270,000 tons. (R. H. R.)

Braxy Mutton.—The flesh of sheep that have died of "braxy," a Scotch name including several disorders of sheep, of which the chief are (1) an intestinal disorder accompanied by diarrhoea and (2) a general infection associated with acute gastro-enteritis. Formerly, braxy mutton was eaten to a considerable extent but modern views as to the necessity of complete healthiness in animals used for food have restricted its consumption.

MUTTON-BIRD: *see* SHEARWATER.

MUTTRA or **MATHURA,** a city and district of British India in the Agra division of the United Provinces. The city is on the right bank of the Jumna, 30 m. above Agra; pop. (1921), 52,840. It is an ancient town, mentioned by Fa Hien as a centre of Buddhism about A.D. 400; his successor Hsüan Tsang, about 650, states that it then contained twenty Buddhist monasteries and five Brahmanical temples. It was sacked by Mahmud of Ghazni in 1017–18; about 1500 Sultan Sikandar Lodi utterly destroyed all the Hindu shrines, temples and images; and in 1636 Shah Jahan appointed a governor expressly to "stamp out idolatry." In 1669–70 Aurangzeb visited the city and continued the work of destruction. Muttra was again captured and plundered by Ahmad Shah with 25,000 Afghan cavalry in 1756. The town still forms a great centre of Hindu devotion, and large numbers of Vaishnavite pilgrims flock annually to the festivals. Temples and bathing-stairs line the river bank. The majority are modern, but the mosque of Aurangzeb, on a lofty site, dates from 1669. Most of the public buildings are of white stone, handsomely carved. There are an American mission, a Roman Catholic church, a museum of antiquities and a cantonment for a British cavalry regiment. Cotton, paper and pilgrims' charms are the chief articles of manufacture.

The DISTRICT OF MUTTRA has an area of 1,450 sq.m. It consists of an irregular strip of territory lying on both sides of the Jumna. The general level is only broken at the south-western angle by low ranges of limestone hills. The eastern half consists for the most part of a rich upland plain, abundantly irrigated by wells, rivers and canals, while the western portion, though rich in mythological association and antiquarian remains, is comparatively unfavoured by nature. The population in 1921 was 619,138. The principal crops are millets, pulse, cotton, wheat, barley and sugar cane. The eastern half of the district is watered by the Agra canal, which is navigable, and the western half by branches of the Ganges canal. The district is served by the Rajputana and other railways.

The central portion of Muttra district forms one of the most sacred spots in Hindu mythology. A circuit of 84 kos around Gokul and Brindaban bears the name of the Braj-Mandal, and carries with it many associations of earliest Aryan times. Here Krishna and his brother Balarama fed their cattle upon the plain; and numerous relics of antiquity in the towns of Muttra, Gobardhan, Gokul, Mahaban and Brindaban still attest the sanctity with which this holy tract was invested. During the Buddhist period Muttra became a centre of the new faith. After the invasion of Mahmud of Ghazni the city fell into insignificance till the reign of Akbar; and thenceforward its history merges in that of the Jats of Bharatpur, until it again acquired separate individuality under Suraj Mal in the middle of the 18th century. The whole of Muttra passed under British rule in 1804.

MUTULE, in architecture, a rectangular block, beneath the soffit, or under side of the projecting portion of the cornice of the Doric order. (*See* ORDER.) It is usually decorated on the under side with guttae (*q.v.*), or little cylindrical projecting blocks. In Greek work its lower side is inclined, following approximately the roof slope; in Roman and Renaissance work it is generally level and is crowned with a cap moulding. In origin it is probably a stone representation of an original projecting wooden rafter end.

MUZAFFAR-ED-DÍN, shah of Persia (1853–1907), the second son of Shah Nasr-ed-Dín, was born on March 25, 1853. He was in due course declared *valí ahd,* or heir-apparent, and invested with the governorship of Azerbaijan, but on the assassination of his father in 1896 it was feared that his elder brother, Zill-es-Sultan, the governor of Isfahan, might prove a dangerous rival, especially when it was remembered that Muzaffar-ed-Dín had been recalled to Teheran by his father upon his failure to suppress a Kurd rising in his province. Muzaffar-ed-Dín was duly enthroned, with the support of the British and Russian governments, on June 8, 1896, the Russian general Kosakowsky, commander of the Persian Cossacks, presiding with drawn sword.

Towards the end of 1896 the Amin-es-Sultan, who had been grand vizier during the last years of Nasr-ed-Dín's reign, was disgraced, and Muzaffar-ed-Dín announced his intention of being in future his own grand vizier. The Amin-ad-Dowla, a less masterful servant, took office with the lower title of prime minister. The financial difficulties of the Government, enhanced by the shah's colossal extravagance, gave a great opportunity to the Russians, who provided a Persian loan, and extended their influence in Persia. At the beginning of 1900 a fresh gold loan was negotiated with Russia, and a few months later Muzaffar-ed-Dín started on a tour in Europe by way of St. Petersburg (Leningrad), where he was received with great state. He visited the Exhibition of 1900, and while there an attempt on his life was made by a madman named François Salson. By the end of 1901 his treasury was again empty; but a fresh Russian loan replenished it and in 1902 he again came to Europe, paying on this occasion a State visit to England. On his way back he stopped at St. Petersburg, and at a banquet given in his honour by the tsar toasts were exchanged of unmistakable significance. None the less, during his visit to King Edward VII. the shah had been profuse in his expressions of friendship for Great Britain, and in 1903 a mission went to Teheran to invest him with the Garter.

The shah's misguided policy had created widespread disaffection in the country, and the brunt of popular disfavour fell on the atabeg (the title by which the Amin-es-Sultan was now known), who was once more disgraced in Sept. 1903. The war with Japan now relaxed the Russian pressure on Teheran, and at the same time dried up the source of supplies; and the clergy, giving voice to the general misery and discontent, grew more and more outspoken in their denunciations of the shah's misrule. Muzaffar-ed-Dín made another journey to Europe in 1905; but he failed to obtain further supplies at St. Petersburg. In the summer of 1906 popular discontent culminated in extraordinary demonstrations at Teheran, which practically amounted to a general strike. The shah proclaimed a liberal constitution, the first parliament being opened by him on Oct. 12, 1906. Muzaffar-ed-Dín died on Jan. 8, 1907, being succeeded by his son Mohammed Ali Mirza.

MUZAFFARGARH, a town and district of British India, in the Punjab. The town is near the right bank of the river Chenal, with a railway station. (Pop.) (1921), 5,386. Its fort and a mosque were built by Nawab Muzaffar Khan in 1794–1796.

The District of Muzaffargarh occupies the lower end of the Sind-Sagar Doab. Area, 6,052 sq.m. In the northern half of the district is the wild *thal* or central desert, an arid elevated tract with a width of 40 m. in the extreme north, which gradually contracts until it disappears about 10 m. south of Muzaffargarh town. In cold weather large herds of camels, owned by the povindah merchants of Afghanistan, graze upon the sandy waste. The district forms part of Multan (*q.v.*). The population in 1921 was 568,478. The principal crops are wheat, pulse, rice and indigo. The boundary rivers are navigable, besides furnishing irrigation channels, originally constructed under native rule.

MUZAFFARPUR, a town and district of British India, in the Tirhut division of Behar and Orissa. The town is on the right bank of the Little Gandak river, and has a railway station. Pop. (1921), 32,755. The town is well laid out along two lakes, which originally formed part of the river bed, and is an important centre of trade, being on the direct route from Patna to Nepal. It is the headquarters of the commissioner of the Tirhut division, also of the Behar Light Horse, first raised as a volunteer corps in 1862.

The DISTRICT OF MUZAFFARPUR has an area of 3,036 sq.m. and a population (1921) of 2,754,945. It is a fertile, alluvial plain watered by the Great Gandak, Baghmati and Little Gandak, and by their tributaries. The level plain is dotted with groves of mangoes and clusters of bamboo. It is closely cultivated and densely populated, the average density being 907 per sq.m. Rice is the chief grain crop. The indigo industry, almost extinguished by the synthetic dye, has been largely replaced by sugar. The village of Basarh north-west of Hajipur is identified with the ancient Vaisali, the scene of the second great Buddhist Council. Excavations have laid bare the remains of buildings dating back to about A.D. 300; hundreds of seals of the 4th or 5th century A.D. were also unearthed. At Kolhua, 3 miles to the N.W., is a stone pillar crowned by a lion, set up by the emperor Asoka to mark a stage of his journey to Nepal in 249 B.C.

MUZIANO, GIROLAMO (1528–1592), Italian painter, was born at Acquafredda, near Brescia, in 1528. He died in Rome, and was buried in the church of Santa Maria Maggiore. He came to Rome about 1550, where his pictures gained him the name of *Il Giovane de' paesi* (the young man of the landscapes). His great picture of the "Resurrection of Lazarus" established his fame. As superintendent at the Vatican, he developed mosaic as a perfect imitation of painting. He helped to found the Academy of St. Luke in Rome.

Many of Muziano's works are in the churches and palaces of Rome; he also worked in Orvieto and Loreto. In Santa Maria degli Angeli, Rome, is one of his chief works, "St. Jerome preaching to Monks in the Desert"; his "Circumcision" is in the church of the Gesu, his "Ascension" in the Araceli, and his "St. Francis receiving the Stigmata" in the church of the Conception. A picture by him representing Christ washing the feet of His disciples, is in the cathedral of Reims.

MWERU (or MOERU), a large lake of eastern central Africa. It lies 3,000 ft. above the sea, in a western branch of the great Tanganyika rift-valley. The lake is about 68 m. long by some 25 in breadth, and is roughly rectangular. It is cut a little south of its centre by 9° S. Mweru, first visited in 1798 by Dr. Lacerda, was reached by Livingstone in 1867, but its western shore was first explored in 1890 by Sir Alfred Sharpe, who two years later circumnavigated the lake. The eastern shores belong to Northern Rhodesia, the western to the Belgian Congo. The district is a game preserve and shooting is prohibited.

MYCENAE, one of the most ancient cities of Greece. The citadel on the summit is triangular with sides facing north, south-east and south-west. Part of the south-eastern wall and the palace within have been undermined by the torrent which bounds the lower town on the east. For the artistic significance of the various graves and building remains scattered among the groups of houses forming the lower town, *see* AEGEAN CIVILIZATION. Mycenae is a natural rock citadel standing in the north corner of the Argive plain flanked to north and south by deep ravines. It watched the hills, controlled the plain, and was the key to the road from the Gulf of Argos to the Gulf of Corinth which afforded the shortest route from Crete to central Greece.

The hill is roughly triangular with the apex pointing south and is defended by massive cyclopean walls. At the northwest angle is the Lion Gate surmounted by the famous limestone relief of two confronted lions ten feet high. The gate itself is about ten feet square and with its approaches is built of ashlar masonry in hard conglomerate. In the north wall is a smaller but similar gate and near it lies a secret underground cistern fed by the Perseian spring and approached by a subterranean passage from inside the walls. The extreme northeast angle is a later addition to strengthen this important point and to provide a sally port. Within the Lion Gate lies the Grave Circle enclosing the Royal Graves found by Schliemann and by it are ruined houses and storehouses. From the gate an inclined roadway leads to the summit crowned by the palace. This was built at different periods, but the ruins now visible belong in the main to the last great age of Mycenae. At the northwest angle was a columned entrance porch, and a throne room, a shrine, a bathroom, and a room with store jars have been found. On the south a wide staircase with two flights ascends to a spacious court. To the east a porch and vestibule open into the great hall (*megaron*) in the centre of which is a large circular hearth covered with painted stucco and surrounded by four column bases. The walls and floors of the *megaron,* court and vestibule were covered with painted stucco and there are plentiful remains of frescoes which adorned other rooms at different periods. West of the court a staircase led to the upper stories and to its north ran two parallel corridors giving access to other rooms at higher levels.

From the citadel a narrow ridge runs westwards so that its backbone forms the natural approach to the Lion Gate. Here are three of the beehive tombs (the Tomb of Aegisthus, the Lion Tomb, and the Tomb of Clytaemestra) and also the north wall of the Hellenistic lower town and the ruins of its gymnasium and theatre. At its west end a wider and longer ridge runs due south. Its northern end was included in the Hellenistic lower town and somewhere along it must have run the prehistoric road. On its east side stands the Treasury of Atreus, the largest beehive tomb, and on its west another, and all about are rock cut chamber tombs. Below its southern extremity the ravine which runs from the south side of the citadel was spanned by a prehistoric bridge on the road leading southeast towards the Argive Heraeum and Tiryns. Subsidiary ridges running westwards to the plain are also honeycombed with tombs among which are four more beehive tombs. On one ridge, Kalkani, traces of early Bronze Age occupation have come to light, and in the hollows are two ancient wells. On the peak of Hagios Elias which overlooks Mycenae to the north stands a small fort of the later part of the Third Bronze Age which clearly served as a signal station, for thence the whole plain can be surveyed from Asine to Argos with the passes towards Arcadia, Nemea and Cleonae and the Acrocorinthus itself can be seen. A system of built roads radiates through the hills from Mycenae and they and the signal station emphasize its strategic and political importance.

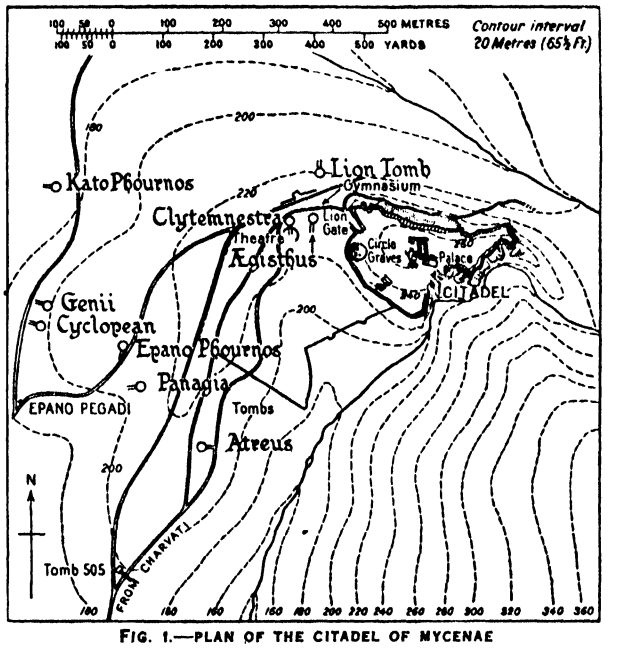


FIG. 1.—PLAN OF THE CITADEL OF MYCENAE

Argolis was inhabited in the Neolithic age by a branch of the race that occupied central and northern Greece. No settlement of this period has yet been found at Mycenae, whose history begins with the Bronze Age. Then the citadel was occupied by the bronze using folk of the Early Aegean period who seem to have come into Greece from the islands and southwest Asia Minor. There is no clue to the language of the neolithic race, but the Bronze Age people probably spoke a non-Hellenic tongue and brought into Greece the place names which end in -nthos, -assos, or -ene. Among these is Mykene, a heroine mentioned by Homer whose name is to Mykenai as Athene is to Athenai. It is hard to estimate either the date of the Bronze Age settlement, which probably existed before the third millennium B.C., or its size, for ceramic remains, though frequent, are much disturbed by later buildings. With the beginning of the Middle Aegean period soon after 2200 B.C. a new racial element of unknown origin entered Greece. Its presence is marked by a class of pottery called Minyan Ware which has several varieties. The plentifulness of this and of a matt painted fabric, developed from the Early Bronze Age pottery at Mycenae, shows that the city prospered under this new impulse. As Minyan ware is practically unknown in Crete, though common in the islands, relations between Crete and Mycenae cannot have been intimate, and so the latter's expansion would have been mainly independent of Crete. Through-

out the Middle Bronze Age, on the hillside where the Grave Circle and Lion Gate were afterwards built, a cemetery had been in use, as this was the nearest spot where the rock was soft enough for simple cist graves of the type usual at the period. Among them in one special area larger and deeper graves were hewn out to contain the remains of the princes, the famous Shaft Graves, the treasures of which, excavated by Schliemann, first revealed the great prehistoric civilisation of Greece. The earliest, the Sixth, contains some objects from Crete, but the bulk of its pottery is unmistakably indigenous.

This Shaft Grave Dynasty rose to power about 1600 B.C. almost coinciding with the establishment of the 18th Dynasty in Egypt and the renaissance of Knossos after its destruction towards the end of the Middle Bronze Age. Slight signs of Cretan influence appear shortly before, but now at the beginning of the Late Bronze Age Cretan fashions and art were largely adopted at Mycenae. Three explanations are possible: (1) that Cretans now conquered the mainland and displacing the native population colonized a large portion; (2) that Mycenaean kings, strong on land and sea, successfully raided Crete, bringing home rich treasures and craftsmen as slaves; (3) that the kings of Mycenae grew powerful and rich, entered into relations with Crete and absorbed its culture. The first view seems least probable because for one reason Cretan pottery of the date of the alleged conquest is extremely rare at Mycenae where local fabrics still continued. Which of the other two is more correct time alone can show. The "Crétoiserie" of the Shaft Grave kings can be compared to the European *Chinoiserie* of the early 18th century, which was not the result of a Chinese conquest of Europe. These kings undoubtedly resided on the summit of the citadel where there are traces of a "palace" underlying the later palace. No signs of a circuit wall have yet been found and in any case it would not have had the area of the later enceinte. Still the richness of the royal graves and of private tombs of the period shows that a high standard of civilisation had been reached. This was not due entirely to the adoption of the Cretan culture, but to the fact that the newcomers of the Middle Bronze Age, who may well have spoken Greek, were themselves keen, energetic, and well advanced in things material, and needed only the contact with Crete to develop artistically as well.

Towards the close of the 16th century B.C. a change in royal burials indicates a new dynasty, which laid its princes in stone built beehive tombs from 25 to 50 feet in height and diameter. Nine such tombs exist at Mycenae. Their architecture displays gradual advance in technical matters, the use and cutting of materials and the handling of the problems of stresses and weights, so that they fall by progressive development into three groups of three tombs each. The first group belongs to the later 16th and to the early 15th century B.C. and the second group to the later 15th century. The earlier tombs were smaller, the construction primitive, the material inferior, the stone unshaped, and stresses not understood. The second group is larger and better built, the stone was hewn but not sawn, and a relieving triangle over the lintel was employed. In the two first groups the finest are the Tomb of Aegisthus and the Lion Tomb which last was closed with a door and threshold instead of rude stone walling. The first Beehive Tomb kings must have lived in the citadel but, apart from signs of their activity in the palace area, no other building can be definitely assigned to this date. The standard of culture was the same and there was intercourse with the islands, Crete and Egypt. The private tombs show that comfort was extending and the rather simple rock cut tombs of the 16th century now developed into spacious chambers with wide entrances.

After 1400 B.C. when Knossos fell and Egypt decayed under the last Amenhoteps, Mycenae, which had been rapidly developing since the end of the Middle Bronze Age, now took first place. Greek traditions, Homer's picture of Agamemnon as suzerain of the princes who sailed against Troy, and its mighty ruins, all bear witness to its greatness. Under the aegis of Mycenae ruled by the later kings of the Beehive Tomb Dynasty the Minoan-Mycenaean culture spread throughout the Eastern Mediterranean, and echoes of this are found in Homer. To this great age the majority of the amazing buildings at Mycenae belong. The palace was reconstructed on a large and sumptuous scale, the cyclopean walls of the citadel were built with the Lion Gate. Within the walls rose storehouses and residences for the civil and military officers of the court, and for their guards and servants. The royal Shaft Graves with part of the old cemetery were enclosed within the enceinte and the space round them was levelled, ringed with standing slabs, and made into a sacred area for the worship of the dead princes.

These later kings of the Beehive Tomb Dynasty to whose energy and ability the greatness of Mycenae seems so largely due, were buried in the last group of Beehive Tombs, the Treasury of Atreus, the Tomb of Clytaemestra, and the Tomb of Genii. These are naturally the best in construction, plan and size, and are built throughout of hard stone, mainly sawn. Each had a door, and a threshold constructed on a wedge principle. The understanding of stresses and of the means to counteract them shows that their architects profiting by earlier experiments perfected their methods and materials, so that two of these tombs still stand almost intact. The Treasury of Atreus is structurally so like the Lion Gate and the palace that it is possible that the royal builder of the two latter prepared the former as his tomb. The same style occurs in the walls and palace at Tiryns which are contemporary. The civilian population of Mycenae must have lived in undefended settlements on the neighbouring hills and the many cemeteries of this date divide into local groups suggesting separate communities. The tombs are carefully hewn in the rock with long narrow entrance passages and were furnished with objects in pottery, bronze, glass, ivory and gold, which show that the culture of Mycenae at its zenith even if less artistic displays wonderful technical ability. During the 14th and 13th centuries B.C. at Mycenae not only were crafts such as the potter's intensively and skilfully practised, but also professions such as those of engineers and architects, for the cyclopean walls and great domes like the Treasury of Atreus imply structural genius.

Troy according to tradition was taken early in the 12th century. Then, as the use of iron spread, the Iron Age began and as the contemporary Egyptian records say "the Isles were restless." This was the age of the Dorian Migration. Then Mycenae fell and the palace and houses were burnt. The walls, however, were not destroyed and as such a stronghold could not be left untenanted Mycenae was inhabited during the early Iron Age, but was of small importance as Dorian Argos usurped her place. As a small city state it preserved its independence and a Doric temple of Athena who ousted the local heroine Mykene arose early in the sixth century upon the ruins of the palace of the Bronze Age kings. Some sculptures from this temple survive. The débris among the ruins proves Mycenae's continuous existence, through the geometric, orientalising and archaic periods of Greek art down to the Persian Wars. Then Mycenae sent her small contingent to join in resisting Xerxes' invasion. Her men fought at Plataea in 479 B.C. and the name Μυκανῆς can still be read on the serpent column from Delphi now in the Hippodrome at Constantinople. Argive jealousy, however, could not forgive and in 470 B.C. when Sparta was in difficulties an Argive army besieged Mycenae. The citadel was starved out, its walls and buildings were overthrown and the site laid waste.

In 235 B.C. the Argive tyrant Aristippos was murdered at Mycenae which like other small towns dependent on Argos was probably reoccupied by the Argive tyrants of the third century B.C. during their struggles with the Achaean League. The walls of the citadel were repaired and part of the hillside on the south was walled in to make a lower town. In this lay a small theatre directly above the Tomb of Clytaemestra and by it was a gymnasium. The Doric temple, which the Argives had perhaps spared in 470 B.C., still stood on the summit of the citadel. Inscriptions dating probably from 194 B.C. and referring to Mycenae's relations with Argos and Nabis of Sparta give some details of its government. After Argos was freed from Nabis Mycenae vanishes from history and Pausanias in the second century A.D. makes no mention of inhabitation. A few remains of the Roman period have been

found so it cannot have been entirely deserted, but the depopulation of Greece must have affected Mycenae and a few inhabitants among ruins so famous would give every impression of desolation. Soon after it must have been completely deserted, for there are no traces of Byzantine or later occupation.

The site of Mycenae was never forgotten as Pausanias who saw the Lion Gate shows and when Greece began to be revisited by travellers from western Europe it became a place of pilgrimage. Excavations were begun by Schliemann who made soundings in 1873, but conducted his epoch-making campaign in 1876 when he found the royal Shaft Graves. Stamatakes followed from 1877 to 1879 when he found the sixth Shaft Grave and cleared the Treasury of Atreus. From 1886 to 1902 Tsountas in a fruitful series of excavations cleared several houses, and found the palace, three beehive tombs, and a large number of private tombs. Rodenwaldt did valuable work on the frescoes in the palace between 1912 and 1914. From 1920 to 1923 Wace excavated here for the British School at Athens, when many tombs were found and new and important results were obtained from the Grave Circle, the Beehive Tombs and the palace.

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MYCETOZOA (slime-fungi), low organisms (often classed with fungi, but undoubtedly more nearly related to the protozoa), of which the individuals (plasmodia) are essentially nothing but giant amoebae. In unfavourable conditions of life, such as hunger or drought, the plasmodia become changed into fructifications (usually stalked capsules, filled with numerous unicellular spores), which bear a close resemblance to the fructifications of some fungi. For further particulars *see* PROTOZOA.

MYCOLOGY is the science of fungi (Greek μύκης, a mushroom, γολός, discourse), and is dealt with in the article FUNGI.

MYCONIUS, FRIEDRICH (1490–1546), Lutheran divine, was born on Dec. 26, 1490, at Lichtenfels on the Main, of worthy and pious parents, whose family name was Mecum. While a student at Annaberg, he had a memorable encounter with the Dominican, Tetzel, his point being that indulgences should be given *pauperibus gratis*. His teacher, Staffelstein, persuaded him to enter (1510) the Franciscan cloister. From Annaberg he passed to Franciscan communities at Leipzig and Weimar, where he was ordained priest (1516), and next year his "eyes and ears were opened" by the theses of Luther. For six years he preached his new gospel, under difficulties, in various seats of his order, lastly at Zwickau, whence he was called to Gotha (1524) by Duke John at the general desire. Here he married Margaret Jäcken. He had Luther's confidence, and was twice entrusted (1528 and 1533) with the ordering of the churches and schools in Thuringia. At the Convention of Schmalkalden he signed the articles on his own behalf and that of his friend Justus Menius. In 1538 he was in England, as theologian to the embassy which hoped to induce Henry VIII. to make common cause with the Lutheran reformation on the basis of the Augsburg Confession, a project which Myconius caustically observed might prosper if Henry were allowed to be pope. He died on April 7, 1546.

His *Historia reformationis*, referring especially to Gotha, was not printed till 1715. See Melchior Adam, *Vitae theologorum* (1706); J. G. Bosseck, *F. Myconii Memoriam . . .* (1739); C. K. G. Lommatzsch, *Narratio de F. Myconio* (1825); K. F. Ledderhose, *F. Myconius* (1854).

MYCORRHIZA. The roots of land plants live in soil, competing therein for water and nutrients with a crowded population of micro-organisms. They are surrounded by a rich and varied fungus flora many members of which are potential parasites, but the majority of roots are relatively immune to such parasitic attack and continue to flourish side by side with their fungus competitors. To the interaction of these three phenomena—the competitive struggle for food, the capacity of many fungi to penetrate living tissues and the properties of resistance to such invasion possessed by roots in common with organisms in general—is probably due the evolution of *mycorrhiza*, that curious and interesting partnership between the roots of vascular plants and fungus mycelium now known to affect a vast number of the higher plants and to be of great importance in their lives.

Mycorrhizae or fungus-roots (μύκης, a mushroom) (ῥίζα, a root) are formed alike by wild and cultivated plants, by species from the high mountains and by those from salt marshes at sea level, in the vegetation of tropical forests as in that within the arctic circle. The phenomenon was comparatively well-known, especially to foresters when, in 1885, the German botanist, Frank, coined the new name, 'mycorrhiza,' to register his own view that the root with its associated mycelium constituted an independent organ of great importance in plant nutrition. He reported an invariable and intimate association of fungus mycelium with the roots of forest trees, especially oak, beech, hornbeam and other members of Cupuliferae, and certain conifers, such infection being, in his opinion, not parasitic but of definite service to the trees in relation to the absorption of water and nutrient salts. On a contemporary view associated especially with the name of Robert Hartig, the root fungi of trees were mischievous parasites hindering root action and conferring no benefit upon the hosts.

By the end of the nineteenth century it was realized by botanists that the mycorrhizal habit was widespread, affecting not only trees but an immense number of herbaceous species belonging to different families.

Distribution and Structure.—Mycorrhiza is formed by ferns, club mosses, conifers and an ever growing list of flowering plants belonging to many different families. It is constant and conspicuous in certain groups, *e.g.*, Orchidaceae, Ericales, Empetraceae and forest trees generally, and is invariably well developed in species lacking chlorophyll, *e.g.*, *Neottia Nidus-avis, Corallorhiza* spp. and a number of tropical orchids belonging to this class, members of the Monotropoideae, and certain species belonging to the families Gentianaceae and Burmanniaceae. Structures closely resembling the mycorrhizal tissues of living species have been described in fossils of Coal Measure age. It is specially characteristic of the vegetation of humus soils, viz., those of moorlands, woodlands and heaths, but may be well developed in garden soil and in the most diverse situations elsewhere. It may be regarded as an annual phenomenon affecting all or a proportion only of the young absorbing roots of the current year.

It is assumed that the fungi concerned are widely distributed in soil, and with few exceptions invasion of the roots takes place from this source. The effect of infection is strikingly different from that in ordinary parasitism, there being no indication that the tissues suffer any permanent injury from the more or less extensive infestation by mycelium to which they are subjected. The external appearance of the root may be altered, as in trees, where arrest of growth accompanied by profuse branching results in the production of dense clusters of rootlets, brown or variously coloured according to the kind of mycelium present. Sometimes the appearance of the roots is not altered in any way. There is great variation in different plants and at different seasons in respect to the relative abundance of mycelium, its distribution upon and within roots and the details of structure of individual mycorrhizas.

It is still convenient to recognize two main types of structure and use the descriptive names given to them by Frank in 1885; the *ectotrophic* type, specially characteristic of trees, in which mycelium completely invests the tip and younger portion of the root as with a sheath of varying thickness, branches from which penetrate between the cortical cells to form a continuous network, while individual cells remain relatively immune from infection; and the *endotrophic* type, showing a variable amount of mycelium externally without formation of a sheath, combined with a more or less profuse distribution of hyphae within the

cells, sometimes irregularly distributed in the cortical tissues, sometimes localized in definite zones. The individual cells that suffer invasion become filled with coiled or branched hyphae continuous with those which form an irregular mesh upon the external surface of the root and permeate the soil around it. In a majority of fungus-roots these intracellular hyphal complexes disintegrate, dwindle and disappear, the soluble by-products presumably passing to the host cells.

These two types of mycorrhiza are not sharply distinguished from one another as Frank believed. It is known now that those of the ectotrophic type often exhibit relatively heavy infection of individual cells, and it seems probable that the structural differences are related to the character of the mycelium and to soil conditions rather than to any fundamental distinction in the association as a whole.

The Mycorrhiza of Orchids.—The mycorrhiza of orchids is of the endotrophic type and mycelium may be widely distributed throughout the root cortex or confined to certain regions. Two contrasting types of cell are observable: *Pilzwirthzellen* or "host cells," containing active hyphae, and *Verdauungzellen* or "digestion-cells," enclosing only their disintegrated remains subsequent to digestion. In the former the mycelium fills the cells with skeins or "pelotons" of characteristic appearance and probably abstracts nutrient materials from the host; in the latter these substances and possibly others brought in from the soil are placed at the disposal of the root.

The researches of a French botanist, Bernard, initiated a new method of experimental inquiry and demonstrated the far-reaching character of the relationship in orchids. The difficulties experienced by growers in germinating seeds of orchids had long been known. Bernard isolated the root fungi from a number of species and showed, by "pure culture" methods, that germination of seed and development of the seedling are bound up with infection by the appropriate root fungus at a critical stage of development. In nature, this *symbiotic* type of germination is ensured by the presence of mycelium of the root fungus in the soil about the roots of the parent plant; in horticultural practice, artificial cultures have been successfully utilized by L. Knudson for the same purpose. It has been discovered that the stimulus normally provided by the appropriate fungus can be replaced artificially by carefully adjusting the chemical constitution and reaction of the seedbed, and such *asymbiotic* methods of securing germination have been successfully applied by horticulturalists in the case of certain orchid species.

There remains much that is obscure in the relation of fungus and host in this group of plants. The nature of the problems awaiting solution is sufficiently indicated by the invariable association of particular fungus strains with individual orchid species, and by the fact that orchid growing is concerned not only with the cultivation of natural species but with the raising of new hybrids.

Mycorrhiza in Ericaceae.—In northern Europe certain members of the family Ericaceae, *e.g.*, various kinds of heath (*Erica* spp.), and heather or ling (*Calluna vulgaris*) are a constant feature of the vegetation of humus soils—moorland and woodland—on which they often monopolize large areas to the almost complete exclusion of other plants.

Described by Frank as *obligate mycorrhiza plants*, it was early recognized that members of this group might exhibit specialized relations with their root fungi. The mycorrhiza is of the endotrophic type with certain characteristic features, in some respects showing points of resemblance with that of trees. The young roots are excessively fine, the outermost layer of cells in each forming a definite mycorrhizal zone. In favourable soil conditions practically every cell in this layer is filled with a densely branched complex of fungal hyphae from which strands of mycelium extend outwards into the soil. The growth of mycellum on the outside of the roots is rather more profuse than in orchids, and, in certain species, may resemble the sheath-like condition found in ectotrophic mycorrhizas. As in orchids, the complexes of mycelium within the root cells are subject to rapid and complete digestion followed by disappearance of the resulting products.

In ling (*Calluna vulgaris*) and certain allied species an obligate relation unique of its kind has been revealed by experimental research. In these plants the mycelium which infests the root spreads throughout the tissues of the vegetative shoots, flowers and fruits reaching eventually the seed-coats of the developing seeds. These are shed bearing with them the mycelium of the fungus partner and at germination the emerging seedling is immediately subject to invasion.

The distribution of mycelium throughout the plant thus compares sharply with that found in orchids where it is limited to the roots of the adult and the embryonic tissues of the seedling. In *Calluna* and kindred ericaceous species it is practically co-extensive with the plant tissues. Only the embryo and endosperm of the resting seed are free from contamination; at all other stages of development and throughout its vegetative existence every plant of ling yet examined is a dual organism. In the genus *Vaccinium* the intimacy of the relation has been carried a stage farther and mycelium is present, not only externally upon the seed-coats, but internally throughout the tissues of the seed. The mode of infection observed in Ericaceae is unique, for, in all other known cases, the mycelium responsible for forming mycorrhiza enters the root from the soil.

In ling and probably in allied species the formation of functional mycorrhiza is closely related to soil conditions. It is at a maximum in peaty soils and in cultivated soils with abundant humus, much less conspicuous in sandy soils deficient in organic matter, and may appear to be absent under certain conditions, although roots are never free from fungus infection.

Since seedling development follows and depends upon invasion by fungus mycelium at germination, it is impossible to provide experimental evidence bearing on the behaviour of individuals with and without fungus infection.

The Mycorrhiza of Trees.—The mycorrhiza of trees is characteristic and easily recognized. Structurally, it belongs to the ectotrophic type; each rootlet is enveloped in a sheath of mycelium formed by the close interweaving of hyphae continuous internally with a branch system penetrating between the cells of the roots, externally with the network of mycelium in the soil.

Woodland soils possess an unusually rich and varied fungus flora among which members of the great group known as Hymenomycetes are conspicuous, as evidenced by the profusion of their spore-bodies—toadstools—produced during suitable seasons. So constant is the association of some of these with certain trees that it has been said that they follow the latter "as the dolphin follows the ship."

In order to prove a direct relation between these common woodland fungi and the mycorrhiza of the trees beneath which they grow, it was necessary to isolate the endophytes, learn something of their behaviour and compare the growth of young trees with and without mycorrhiza. By such means a number of Hymenomycetes have been identified as the specific root fungi of pine, spruce, larch, birch and other trees.

There is no evidence that seedling development is bound up with fungus infection or that anything in the nature of an obligate relation exists. As regards the effect of tree mycorrhiza on nutrition, it must be noted that woodland soils possess certain definite characteristics. There is severe competition for water and salts and they show a notable deficiency of certain plant nutrients, in particular nitrates. On the other hand, they possess large reserves of nitrogen in the form of organic compounds. It has been proved experimentally that the possession of mycorrhiza is beneficial to trees, especially in relation to the supply of nitrogenous nutrients. Hence, the supply of nitrates being deficient it may be concluded that it possesses a vital significance for trees and other plants growing in woodland soils. The application of these conclusions to natural conditions raises problems of great importance to practical foresters.

Identity of Mycorrhizal Fungi.—It may be assumed that the fungi responsible for forming mycorrhiza are widely distributed in soil. Their systematic position is known only in those forms which have been isolated and grown in "pure culture" out-

side the root.

The root fungi of orchids are generally recognized as belonging to a common group, sometimes included in the well-known genus *Rhizoctonia*, sometimes placed in a new genus *Orcheomyces*. The mycelium must be locally present about the roots of wild orchids but nothing is known as to its wider distribution.

The mycorrhizal fungi of *Calluna* and other ericaceous species have been isolated and included in a single species of the genus *Phoma*, *P. radicis*. The specialized strains associated with different ericaceous species are distinct and must be locally distributed in heath and moorland soils but there is no certain knowledge of their wider occurrence.

The fungi definitely identified with the mycorrhiza of trees belong to the genera *Boletus*, *Amanita*, *Cortinarius*, *Lactarius*, *Russula* and *Tricholoma*. It is probable that many others will prove to belong to the same category.

Outside these specialized groups, the fungi responsible for mycorrhiza-formation still await identification. The mycelium present in a large number of herbaceous flowering plants, certain ferns and club mosses is uniform in type and produces characteristic structures: round or pear-shaped swellings or *vesicles*, variously regarded as organs relating to spore-formation or to the storage of reserves, and intracellular branch systems first described by Gallaud in 1905 under the name of *arbuscules*. Following upon digestive activity in the host cells the latter disintegrate to structureless masses named *sporangioles* before their true nature is recognized. The fungus responsible for this widespread type of mycorrhiza has hitherto resisted all attempts at isolation and nothing is known with certainty as to its systematic position.

It has been reported that the mycorrhiza of many herbaceous plants is of dual character, involving primary infection by a fungus with the characters just described followed by secondary infection by one of the type associated with orchid roots. Whether this reported "double infection" is of biological significance is at present unknown.

Rôle of Mycorrhiza in Plant Growth.—There can be little doubt that the mycorrhizal habit had its origin in parasitic attack on the part of certain soil fungi, or that existing mycorrhiza plants are the survivors of a long and perilous evolutionary history. Many must be regarded as cases of compromise fluctuating between an almost complete resistance to fungus invasion and a remarkable toleration of the same. That there is an exchange of nutrient material in practically all cases can hardly be doubted but, in the absence of information based on the behaviour of individuals with and without mycorrhiza, attempts to express the shifting relationships in terms of mutual advantage or the reverse are premature and often misleading.

In certain groups of plants mycorrhiza has become a regular feature in the life history, a condition of delicately balanced equilibrium between fungus and host has been established and critical experimental study has placed certain facts beyond doubt. In both orchids and heaths the normal development of the seedling is bound up with the presence and activities of mycorrhizal fungi showing marked adaptation to individual species, accompanied in members of Ericaceae by a distribution of mycelium throughout the tissues so extensive that it is difficult to conceive of the individual plant as other than a single entity of double constitution. In orchids, the traditional view attributes a beneficial rôle to the root fungi based on their utilization of organic soil constituents and the wholesale digestion of mycelium that takes place subsequently in the root-cells. A claim has been advanced for fixation of atmospheric nitrogen by the root fungi of several orchid species.

It may be safely concluded that mycorrhiza possesses a vital significance for trees and other plants growing in woodland soils, and there is reason to believe that the reaction and constitution of the soil are important factors in promoting its healthy development and functioning. In the Ericaceae, *Calluna* and many of its allies are characteristic and abundant members of the vegetation of humus soils thus pointing to similar conclusions, while in this group there is likewise evidence that the capacity to draw indirectly upon the organic compounds in the soil humus is supplemented by the ability of the root fungi to utilize atmospheric nitrogen. In both orchids and heaths the obligate character of the association is probably confined to the seedling phase and does not extend to the adult, although in heaths infection of the roots follows directly upon that of the seedling tissues.

The older theories of beneficial symbioses in mycorrhiza were deduced from distribution and structure untested by experiment. Modern research has been marked by the application of new and more precise methods and has revealed unsuspected relationships. On the whole, it supports the view that the possession of mycorrhiza is frequently of service to vascular plants, the nature and degree of benefit depending upon the physical conditions of the environment and the character of the association in individual cases. (M. C. R.)

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MYDDELTON or **MIDDLETON, SIR HUGH,** 1ST BART., cr. 1622 (*c.* 1560–1631), was born a younger son of Sir Richard Myddelton, governor of Denbigh castle. Hugh was a successful London goldsmith, occupying a shop in Bassihaw, or Basinghall street; he made money by commercial ventures on the Spanish main, being associated in these with Sir Walter Raleigh; and he was also interested in cloth-making. He was an alderman, and then recorder of Denbigh, and was member of parliament for this borough from 1603 to 1628. In 1609 Myddelton took over from the corporation of London the projected scheme for supplying the city with water obtained from springs near Ware, in Hertfordshire. For this purpose he made a canal about 10 ft. wide and 4 ft. deep and over 38 m. in length, which discharged its waters into a reservoir at Islington called the New River Head. The work was completed in 1613. Myddelton also worked lead and silver mines in Cardiganshire and reclaimed a piece of the Isle of Wight from the sea. He died on Dec. 10, 1631, and was buried at St. Matthew's, Friday street, London.

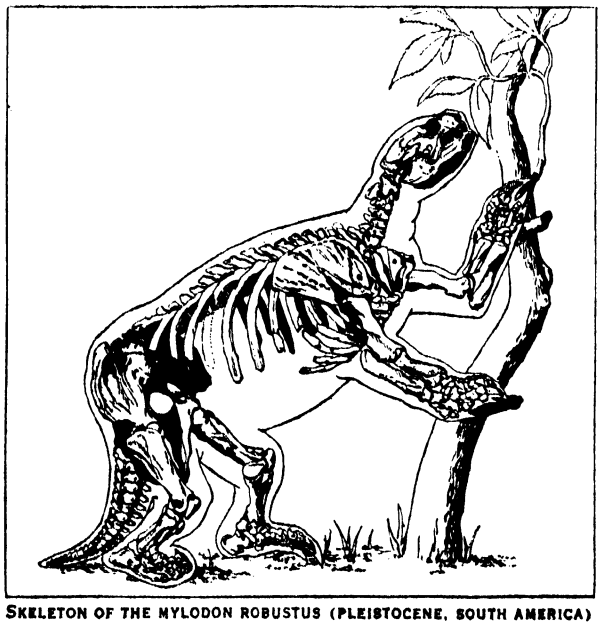
MYELITIS. A medical term for destructive changes involving the spinal cord. As the termination "itis" indicates, these changes formerly were regarded as inflammatory, but it is now known that although the spinal meninges are affected by inflammation, nervous substance is rarely, if ever, "inflamed" because of its paucity of blood-vessels. On the other hand, its nutrition is readily impaired by morbid processes in its neighbourhood, and it degenerates or dies and undergoes softening. Myelitis is such softening of the spinal cord, local or widespread, affecting a portion of the cord or its whole thickness, and the symptoms to which it gives rise depend upon the site and extent of the lesion. It may run a rapid or a chronic course, and in the latter instance the degenerated nerve substance may be, in whole or in part, replaced by proliferated neuroglial tissue which is of the nature of a scar. Any part of the cord may be affected, but it is commoner in the lower half. It leads to paralysis of lower limbs and other muscular parts by interference with conductivity in the white matter of the cord, and to nutritive changes by destruction of the cells in the grey matter. It causes loss of sensation below the level of damage, and often a zone of hyperaesthesia just above that level. If acute it is often followed with great rapidity by bed sores of great size and depth, and incontinence of urine and fæces, particularly when the lumbar cord is affected. The chief causes are injuries and diseases of the vertebræ or meninges leading to pressure on the cord, particularly syphilis. The disease principally affects adults. As might be anticipated, treatment is unsatisfactory and is directed towards relief of symptoms. (W. S. L.-B.)

MYERS, FREDERIC WILLIAM HENRY (1843–1901), English poet and essayist, son of Frederic Myers, was born at Keswick, Cumberland, on Feb. 6, 1843, and educated at Cheltenham and Trinity college, Cambridge, where he was

appointed classical lecturer in 1865. He had no love for teaching, which he soon discontinued, but he took up his permanent abode at Cambridge in 1872, when he became a school inspector under the education department. He published poems, for instance *St. Paul,* but is more likely to be remembered by his *Essays, Classical and Modern* (2 vols., 1883). The essay on Virgil, by far the best thing he ever wrote, represents the matured enthusiasm of a student and a disciple to whom the exquisite artificiality and refined culture of Virgil's method were profoundly congenial. In 1882 Myers led a small band of explorers (including Henry Sidgwick and Richard Hodgson, Edmund Gurney and F. Podmore), who founded the Society for Psychical Research. He was the mouthpiece of the society, and steered a middle course between extremes. He helped to revise the cumbrous mass of *Proceedings,* the chief concrete results being the two volumes of *Phantasms of the Living* (1886). His *Human Personality and its Survival of Bodily Death* (2 vols. 1903) was described by William James as "the first attempt to consider the phenomena of hallucination, hypnotism, automatism, double personality and mediumship, as connected parts of one whole subject." Also there was *Science and a Future Life* (1893). He died at Rome on Jan. 17, 1901, but was buried in his native soil at Keswick.

MYLIUS-ERICHSEN, LUDWIG (1872–1907), Danish explorer, was born at Viborg, Jutland, on Jan. 15, 1872. He made two notable expeditions to Greenland in 1902–04 and in 1906. The first of these yielded much valuable ethnographical information; the second provided increased geographical knowledge of the eastern coast. The explorer died as a result of the hardships he had suffered, on Nov. 25, 1907.

MYLODON, an extinct genus of large ground-sloths characteristic of the Pleistocene of the New World. The animal was of the size of a rhinoceros, with short stout limbs, very large digging claws, five digits on each foot, but the outer ones have no claws, a broad body and massive tail. It walked on the outer edge of the sole, both fore- and hind-foot (compare fore-foot of modern ant-eater). The head was rather long, with wide blunt muzzle, no front teeth, and moderately large prismatic cheek teeth, five above and four below on each side. In cross-section the more anterior teeth are rounded oval, while the posterior ones are progressively larger and more elaborate, the last molar always two- or three-lobed. The skin was probably like that of the allied genus *Grypotherium* in which, as shown by specimens from a cave off the Straits of Magellan, the skin was studded with bony ossicles and covered with heavy coarse brown hair.



SKELETON OF THE MYLODON ROBUSTUS (PLEISTOCENE, SOUTH AMERICA)

The genus *Mylodon* (in the wider sense) ranged from Canada to Patagonia, and many complete skeletons have been found in Argentina, California and the central United States. A number of related genera are also found in the Pleistocene of South America. *Lestodon* has the front pair of teeth enlarged as tusks and a flaring, bell-shaped muzzle. *Scelidotherium* has a much more elongate skull, narrower body and more reduction and specialization in the toes. These with some other less known genera form the family Mylodontidae, whose ancestry can be traced back to the Miocene in Patagonia although not so well known as the related Megatheriidae. These small Miocene ground-sloths come near to being ancestors of the modern tree-sloths as well; they likewise approach the ant-eaters in various particulars and suggest a more remote affinity to the armadillos.

(W. D. M.)

MYLONITE, in petrology, a rock which has been crushed and ground down by earth movement and at the same time rendered compact by pressure. Mylonites are fine-grained, sometimes even flinty, in appearance, and often banded in parallel fashion with stripes of varying composition. The great majority are quartzose rocks, such as quartzite and quartz-schist; but in almost any type of rock mylonitic structure may be developed. Gneisses of various kinds, hornblende-schists, chlorite-schists and limestones are not infrequently found in belts of mylonitic rock. The process of crushing by which mylonites are formed is known also as "granulitization" and "cataclasis," and mylonites are often described as granulites, though the two terms are not strictly equivalent in all their applications. Mylonites occur in regions where there have been intense earth-movements. Thrust planes and great reversed faults are often bounded by rocks which have all been crushed to fine slabby mylonites, that split readily along planes parallel to the direction in which movement has taken place. These "crush-belts" may be only a few feet or several hundred yards broad. The movements have probably taken place slowly without great rise of temperature, and hence the rocks have not recrystallized to any extent.

MYMENSINGH, a town and district of British India, in the Dacca division of Bengal. The town (formerly known as Nasirabad) is situated on an old channel of the Brahmaputra, and has a station of the Eastern Bengal State railway. Pop. (1921) 25,287. The District of Mymensingh, with an area of 6,238 sq.m. and a population (1921) of 4,837,730, is the largest district in India, and its administration is an onerous charge. It occupies a portion of the alluvial valley of the Brahmaputra east of the main channel (called the Jamuna) and north of Dacca, for the most part level and open, covered with well-cultivated fields, and intersected by numerous rivers. The Madhupur jungle is a slightly elevated tract, extending from the north of Dacca district into the heart of Mymensingh; its average height is about 60 ft. above the level of the surrounding country, and it nowhere exceeds 100 feet. This tract divides Mymensingh into two distinct parts. On the west is an alluvial plain watered by the Jamuna; the eastern area is fertilized by the Surma or Meghna, the old Brahmaputra and other streams, and contains extensive marshes, which are under water for eight months in the year and are grazing grounds for cattle for the other four months. The only other elevated tract in the district is on the southern border, where the Susang hills rise. The Jamuna forms the western boundary for a course of 94 m.; during the rainy season it expands in many places to 5 or 6 m. in breadth. The Brahmaputra formerly flowed through Mymensingh till it joined the Meghna a little below Bhairab Bazar, but over a century ago the formation of bars of sand in the upper part of its course diverted the main volume of water into the present channel of the Jamuna. The staple crop is rice. A branch line of the Eastern Bengal State railway runs north from Dacca through Mymensingh, which is also connected with Jagannathganj and Bhairab Bazar.

MYNAH, the name given to several birds of the starling family (*sturnidae*). The Indian house mynah (*Acridotheres tristis*) is a well-known bird in the East and has been introduced into Australia and New Zealand. Somewhat larger than a thrush, with brown plumage, except for a black head and white on the wings and tail, the house mynah is easily domesticated and will

learn to talk. The true talking mynah (*Gracula religiosa*) is, however, a very different bird (*See* GRACKLE).

MYNN, ALFRED (1807–1861), perhaps the greatest of the older cricketers, was born at Goudhurst, in Kent, on Jan. 19, 1807, and died in London on Nov. 1, 1861. A huge man, standing 6 ft. 1 in. and weighing 18 to 20 stone, he was an all-round cricketer, but it is on his bowling that contemporary records lay most stress. "His delivery was noble, walking majestically up to the crease," and his bowling came so sharply in from leg that there is reason to suppose he may have been one of the first to practise the swerve. Two outstanding incidents in his career may be noted. Before the return North v. South match at Leicester, in 1836, he was hurt in practice. Going in to bat, he made 146, when he had to retire in great pain. He was hurried to London, and nearly had to have his leg amputated. In 1838 he won two great matches for the championship of England at single wicket, at which he was never beaten, against Dearman of Sheffield. There are many portraits of Mynn; the best known is in the picture of the All England XI. of 1847. No other cricketer, except "W.G." himself, ever captured so completely by his prowess and personality the hearts of his generation; his epitaph, which appeared in *Bell's Life*, is one of the most famous pieces of cricket literature. It begins with the echo of an old controversy:

> Jackson's pace is very fearful, Willsher's hand is very high and ends
>
> as the changing seasons pass,
> As our champion lies a-sleeping underneath the Kentish grass,
> Proudly, sadly we will name him, to forget him were a sin;
> Lightly lie the turf upon thee—kind and manly Alfred Mynn

See *Scores and Biographies*, vol ii. (1861); R. Daft, *Kings of Cricket* (1893); H. S. Altham, *History of Cricket* (1926).

MYRA (mod. *Dembre*), an ancient town of Lycia situated a short distance inland between the rivers Myrus and Andracus. Its early history is obscure. St. Paul touched Myra on his last journey westward, and changed into "a ship of Alexandria sailing into Italy." In the 3rd century St. Nicholas, of Patara, was its bishop. Theodosius II. made Myra the Byzantine capital of Lycia, and as such it was besieged and taken by Harun al-Rashid in 808. The town seems shortly afterwards to have decayed. A small Turkish village occupied the plain at the foot of the acropolis, and a little Greek monastery lay about a mile westward by the church of St. Nicholas. The latter has formed the nucleus of modern Dembre. The western scarp of the acropolis has been sculptured into a number of sepulchres imitating wooden houses with pillared façades, some of which have pediment reliefs and inscriptions in Lycian. The theatre lies at the foot of this cliff and is partly excavated out of it, partly built. The church of St. Nicholas lies out in the plain, at the western end of Dembre. Its floor is far below the present level of the plain, and until recently the church was half filled with earth. The ancient church is of the domed basilica form with throne and seats still existent in the tribunal. There are also extensive ruins of Andriaca, the port of Myra, about 3 m. west, containing churches, baths, and a great grain store, inscribed with Hadrian's name. They lie along the course of the Andraki river, whose navigable estuary is still fringed with ruined quays.

MYRIAPODA, a convenient name for four classes of arthropods often studied together:—Diplopoda (Millipedes, *q.v.*). Symphyla (*q.v.*), Pauropoda (*q.v.*), and Chilopoda (Centipedes, *q.v.*). There is a superficial resemblance about all four classes because all possess a distinct head provided with one pair of antennae and an undivided trunk bearing a large number of jointed limbs, but the resemblance is deceptive and the grouping unscientific because the centipedes are more nearly related to insects than they are to the other three classes.

MYRICA, in botany, the only genus of the family Myricaceae, perhaps most nearly allied to the willows and birches. There are about 45 species widely distributed throughout the world. Well known representatives are the sweet gale and wax-myrtle (*qq.v.*).

MYRISTICACEAE, in botany, the nutmeg family, comprising 18 genera and 275 species, all tropical and especially numerous in Asia. They are trees or shrubs with evergreen leaves. (*See* NUTMEG.)

MYRMIDONES, in Homer, the inhabitants of Phthiotis in Thessaly. According to posthomeric legends their original home was Aegina, whence they crossed over to Thessaly with Peleus, but the converse view is now more generally accepted. Their name is derived from a supposed ancestor, son of Zeus and Eurymedusa, who was wooed by the god in the form of an ant (Gr. μύρμηξ); or from the repeopling of Aegina (when all its inhabitants had died of the plague) with ants changed into men by Zeus at the prayer of Aeacus, king of the island. As the fierce and devoted followers of Achilles, their name has come to be used in modern times to mean subordinates who carry out orders implacably. (*See* Roscher's *Lexikon*, art. Myrmidon.)

MYROBALANS, the name given to the astringent fruits of several species of *Terminalia*, largely used in India for dyeing and tanning and exported for the same purpose. They are large deciduous trees of the family Combretaceae. The chief kinds are the chebulic or black myrobalan, from *Terminalia Chebula*, which are smooth, and the beleric, from *T. belerica*, which are five-angled and covered with greyish down.

MYRRH, a gum-resin (*see* RESINS), highly esteemed by the ancients as an unguent and perfume, used for incense in temples and also in embalming; it was one of the gifts offered by the Magi. True myrrh is the product of *Commiphora Myrrha*, a small tree of the family Burseraceae that grows in eastern Africa and Arabia, but the name is also applied to gum-resins obtained from other species of *Commiphora*.

Baisa Bol, *Bhesa Bol* or *Bissa Bol*, from *Commiphora Kataf*, resembles true myrrh in appearance, but has a disagreeable taste and is scarcely bitter. It is used in China, mixed with food, to give to cows to improve the quality and increase the quantity of milk, and when mixed with lime as a size to impart a gloss to walls. Opaque bdellium produced by *C. Playfairii*, when shaken with water forms a slight but permanent lather. It is known as *meena hărma* in Bombay, and was formerly used there for the expulsion of the guinea-worm. African bdellium is from *C. africanum*, and like opaque bdellium lacks the white streaks which are characteristic of myrrh and bissa bol; both are acrid, but have scarcely any bitterness or aroma. Indian bdellium, probably identical with the Indian drug googul obtained in Sind and Baluchistan from *C. Mukul* and *C. pubescens*, Hook, is of a dark reddish colour, has an acrid taste and an odour resembling cedarwood, and softens in the hand.

As met in commerce true myrrh occurs in pieces of irregular size and shape, from ½ in. to 2 or 3 in. in diameter, and of a reddish-brown colour. The transverse fracture has a resinous appearance with white streaks; the flavour is bitter and aromatic, and the odour characteristic. It consists of a mixture of resin, gum and essential oil, the resin being present to the extent of 25 to 40%, with 2½ to 8% of the oil, myrrhol, to which the odour is due.

MYRTACEAE, in botany, the myrtle or eucalyptus family, dicotyledonous trees and shrubs found in all the warmer parts of the world, especially in Australia and tropical America. There are about 90 genera and some 2,800 species, all with oil-glands in the evergreen leaves. Several species yield useful timber, and *Eucalyptus* also gives oil; *Eugenia*, cloves, etc. Some have edible fruits, as *Pisidium* (guava), *Rhodomyrtus* (hill-gooseberry) and *Feijoa* (pineapple guava). *Pimenta officinalis* yields allspice (*q.v.*) and *P. acris*, bay oil. (*See* EUCALYPTUS; FEIJOA; GUAVA.)

MYRTLE, the *Myrtus communis*, of botanists, as now found growing wild in many parts of the Mediterranean region. It is a low-growing, evergreen shrub, with opposite leaves, varying in size, but always small, simple, dark-green, thick in texture, and studded with numerous receptacles for oil. When the leaf is held up to the light it appears as if perforated with pin-holes owing to the translucency of these oil-cysts. The fragrance of the plant depends upon the presence of this oil. Another peculiarity of the myrtle is the existence of a prominent vein running round the leaf within the margin. The flowers are borne on short stalks in the axils of the leaves. The fruit is a purplish berry, enclosing very numerous minute seeds. Many varieties are in cultivation. The typical species is quite hardy in the south of England. The Chilean species, *M. Ugni*, a shrub with ovate, dark green leaves

and white flowers succeeded by globular red or black glossy fruit with a pleasant smell and taste, is a greenhouse shrub, hardy in south-west Britain. The common myrtle is the sole representative in Europe of a large genus (70 species) which has its headquarters in extra-tropical South America, whilst other members are found in Australia and New Zealand. The genus *Myrtus* also gives its name to a very large family, Myrtaceae (*q.v.*). The leaves of *M. Chekan* have been used in chronic bronchitis.



MYRTLE (MYRTUS COMMUNIS), SHOWING FLOWERING BRANCH AND VERTICAL SECTION OF FLOWER

MYSIA, a district of north-west Asia Minor, bounded by Lydia and Phrygia on the south, by Bithynia on the north-east, and by the Propontis and Aegean Sea on the north and west. Its precise limits are difficult to assign, the Phrygian frontier being vague and fluctuating, while in the north-west the Troad was sometimes included in Mysia, sometimes not.

The most important cities were Pergamum (*q.v.*) in the valley of the Caicus and Cyzicus (*q.v.*) on the Propontis. But the whole sea-coast was studded with Greek towns, several of which were places of considerable importance; thus the northern portion included Parium, Lampsacus and Abydos, and the southern Assus, Adramyttium, and farther south, on the Elaitic Gulf, Elaea, Myrina and Cyme.

Ancient writers agree in describing the Mysians as a distinct people, like the Lydians and Phrygians, though they never appear in history as an independent nation. That they were kindred with the Lydians and Carians, is attested by their common participation in the sacred rites at the great temple of Zeus at Labranda, as well as by the statement of the historian Xanthus of Lydia that their language was a mixture of Lydian and Phrygian. Strabo was of opinion that they came originally from Thrace (*see* BITHYNIA), and were a branch of the same people as the Mysians or Moesians (*see* MOESIA) who dwelt on the Danube. The Mysians appear in the list of the Trojan allies in Homer; the first historical fact we learn is their subjugation, together with all the surrounding nations, by Croesus of Lydia. After the fall of the Lydian monarchy they remained under the Persian empire until its overthrow by Alexander; they continued to form a part of the Syrian monarchy until the defeat of Antiochus the Great (190 B.C.), after which they were transferred by the Romans to the dominion of Eumenes of Pergamum. After the extinction of the Pergamenian dynasty (130 B.C.) Mysia became a part of the Roman province of Asia.

See J. A. R. Munro in *Geogr. Journal* (1897, Hellespontica); W. von Diest, *Petermanns Mitth.* (Erganzungsheft 94, Gotha, 1889; Pergamene). *Cambridge Ancient History,* vol. iii. (with useful bibliography).

MYSLOWICE (Ger. *Myslowitz*), a town of Poland on the river Przemsa. It is 120 m. S.E. of Breslau by rail and an important railway junction. Pop. (1919) 18,115. It became a town in 1857 and is in an industrial area with coal mines, flax spinning and brick making.

MYSORE, the capital of the state of Mysore, India, 10 m. S.W. of Seringapatam on the Mysore State railway. Pop. (1921), 83,951. The city, which is spread over a large area, has its nucleus at the foot of the Chamundi hill, in a valley formed by two parallel ridges running north and south. The fort stands in the south of the town, forming a quarter by itself; the ground-plan is quadrangular, each of the sides being about 450 yd. long. The palace of the maharaja within the fort contains the throne said to have been presented to Chikka Deva Raj by the emperor Aurangzeb. The houses of the European residents are for the most part east of the town. The residency or government house was built in 1805. The building afterwards used for the district offices was originally built by Colonel Wellesley (duke of Wellington) for his own occupation. The domed building for the public offices in Gordon park, the Maharajah and Maharani's training colleges, the Mary Holdsworth hospital, the fine new Palace offices and the law courts are conspicuous. A teaching and residential university was established in 1916, and the Mysore Bank in 1913. There is also a chamber of commerce. Mysore, though the dynastic capital of the state, was superseded by Seringapatam as the seat of the court from 1610 to 1799, and in 1831, on the British occupation, the seat of administration was removed to Bangalore.

MYSORE, a native state of southern India, almost surrounded by the Madras presidency, but in political relations with the governor-general. It is naturally divided into two regions of distinct character—the hill country called the Malnad, on the west, and the more open country known as the Maidan, comprising the greater part of the state, where the wide-spreading valleys and plains are covered with villages and populous towns. The drainage of the country, with a slight exception, finds its way into the Bay of Bengal, and is divisible into three great river systems—that of the Kistna on the north, the Cauvery on the south, and the Northern and Southern Penner and Palar on the east. Owing to either rocky or shallow beds none of the Mysore rivers is navigable. The main streams, especially the Cauvery and its tributaries, support an extensive system of irrigation by means of channels drawn from immense dams (*anicuts*), which retain the water at a high level and permit only the overflow to pass down stream. The streams are embanked to form reservoirs or tanks.

Mysore is a very prosperous state. Situated on a healthy plateau, it receives the benefit of both the south-west and north-east monsoons, which, in conjunction with its irrigation system, has brought it a large degree of immunity from famine. The silk industry and gold mining are very profitable, and two sandalwood-oil factories have recently been opened. Manganese, mica and steatite are worked. The famous Kolar gold-fields are worked by electric power, which is conveyed for a distance of 92 m. from the Cauvery falls. A long period of administration by British officers led to the introduction of a system based on British models, and the state has developed rapidly in recent years. Departments of industry and commerce and of agriculture have been organized, welfare work for the agricultural population undertaken, a Public Health institution started, and a university opened at Mysore. There is an agricultural college, and several experimental farms.

The total area of the state, including the civil and military station of Bangalore, is 29,469 sq.m., subdivided into 8 districts, namely: Bangalore, Kolar, Tumkur, Mysore, Hassan, Kadur, Shimoga and Chitaldrug. Pop. (1921), 862,628. The influenza epidemic of 1918 was very serious in the state. Kanada is spoken by the majority of the people, ¼ of whom are engaged in agriculture. The proportion of Hindus, who are 16 times as numerous as the Mohammedans, shows how ineffectual was the persecution of Hyder and Tippoo. Of the 71,000 Christians, 57,500 are Roman Catholics. The finances of the state have been successfully managed under native rule, assisted by large profits from railways and gold-mines. The revenue amounts to about £2,278,000, largely derived from land, and a subsidy and peshkash of £233,333 is paid to the British government. The state maintains a military force, which numbered 2,780 in 1925. A representative assembly has been in existence since 1881. In 1923 it was placed on a statutory basis, its powers extended, and the franchise widened. There is also a legislative council of 50 members, 30 non-official and 20 official.

History.—In the earliest historical times the north of Mysore was held by the Kadamba dynasty, whose capital, Banawasi, is mentioned by Ptolemy; they reigned during fourteen centuries, though later they became feudatories of the Chalukyas (*q.v.*). The Cheras were contemporary with the Kadambas, and governed the southern part of Mysore till they were subverted by the Cholas in the 8th century. Another ancient race, the Pallavas, held a small portion of the eastern side of Mysore, but

were overcome by the Chalukyas in the 7th century. These were overthrown in the 12th century by the Ballalas (Hoysalas), an enterprising and warlike race professing the Jain faith. They ruled over the greater part of Mysore, and portions of the modern districts of Coimbatore, Salem and Dharwar, with their capital at Dwarasamudra (the modern Halebid); but in 1310 the Ballala king was captured by Malik Kafur, the general of Ala-ud-din; and seventeen years later the town was entirely destroyed by another force sent by Mohammed Tughlak. After the subversion of the Ballala dynasty, a new and powerful Hindu sovereignty arose at Vijayanagar. In 1565 a confederation of the Mohammedan kingdoms defeated the Vijayanagar sovereign at the battle of Talikota. The most important of the petty local chiefs was the *wodeyar* of Mysore, who in 1610 seized the fort of Seringapatam, and so laid the foundation of the present state. His fourth successor, Chikka Deva Raja, during a reign of 34 years, made his kingdom one of the most powerful in southern India. In the middle of the 18th century the famous Mohammedan adventurer Hyder Ali (*q.v.*), usurped the throne. His dynasty, however, was as brief as it was brilliant, and ended with the defeat and death of his son Tippoo at Seringapatam in 1799. Krishnarajah Wodeyar, only five years old, was placed on the throne, and until he came of age in 1811 the state was under the administration of Purnaiya, the Brahman minister of Hyder and Tippoo. When Krishnarajah took over the management of his state he received an orderly and contented principality with a surplus of two crores of rupees. Within twenty years he had driven his subjects into rebellion and involved himself and his state in heavy debt. The British government therefore assumed the administration in 1831, and placed it in the hands of commissioners. In 1867 it was determined to secure the continuance of native rule in Mysore and on March 25, 1881, Chamarajendra, Krishnarajah's successor, having attained the age of 18 years, was publicly entrusted with the administration of the state.

He made over to the British a small tract at Bangalore, forming the "civil and military station," and received in return the island of Seringapatam. By the signing of the "instrument of transfer," the young maharajah, for himself and his successors, undertook to perform the conditions imposed upon him. The maharajah died at Calcutta on Dec. 28, 1894. His eldest son, the present ruler, Krishnarajah Wadiyar, born in 1884, succeeded him, and his widow, Maharani Vanivilas, was appointed regent, until in 1902 the maharajah was formally invested with full powers by the viceroy in person. In 1913 the "instrument of transfer" was replaced by a treaty, and in 1927 the government of India remitted in perpetuity 10½ lakhs of the annual subsidy.

See B. L. Rice, *Mysore* (2nd ed., Bangalore, 1897); *Mysore and Coorg Gazetteer* (Calcutta, 1908); the annual *Administration Report* (Bangalore).

MYSTERY. It is necessary to differentiate *mystery*, Gr. μυστήριον, from its homophone, properly written *mistery*, late Lat. *ministerium*, a trade or craft; hence *mystery plays* (*see* DRAMA), those performed by trade-gilds. We must also set aside the Hellenistic meaning, common in modern languages, of "secret," "puzzling occurrence."

Properly, then, a mystery is a Greek rite which is kept secret (μύειν, to shut the mouth or eyes) from all save the initiated (οἱ μύσται, οἱ μεμυημένοι). These are specially prepared to have the secret revealed to them, under the guidance of a hierophant (ἱεροφάντης, "revealer of holy things"). According to Theon Smyrnaeus (*de util. math.*, p. 15, Hercher) there were four stages: (1) preliminary purification (καθαρμός); (2) communication of mystic knowledge, τελετῆς παράδοσις, presumably including a sort of sermon of instruction or exhortation; (3) ἐποπτεία, or revelation of the holy things, the central point of the rite; (4) the crowning or garlanding of the mystic, who was thus, as it were, badged as a privileged person. We know that the central revelation was something done (δρώμενον), not spoken, or not merely spoken; Lucian says (*de saltat.*, 15) that all mysteries included dancing. Hence it is usually, and reasonably, concluded that some sort of pageant or rudimentary sacred drama was shown.

We may now ask why the rites should be secret at all. A plausible but mistaken explanation has recently been revived by O. Kern (*Die Religion der Griechen*, i. 1926): the invading Hellenes oppressed, perhaps actually used religious persecution against, the earlier inhabitants of Greece, hence driving their cults into secrecy.

It might be urged in favour of this view that in Crete, according to Diodorus Siculus (v. 77, 3), rites similar to the Greek mysteries lay open to all and had nothing "mysterious" about them, and also that the *telesterion* or hall of initiation at Eleusis originates in Minoan-Mycenaean constructions, and Eleusis itself has a name probably pre-Greek (*cp.* A. W. Persson in *Archiv f. Religionswissenschaft*, xxi., p. 291 ff.; M. P. Nilsson, *Minoan-Mycenaean Religion*, 1927, p. 402, ff.); furthermore, that several survivals of things pre-Hellenic have been more or less certainly traced in the ritual of the mysteries, Eleusinian and other. But these considerations can hardly avail against the facts that the mystic deities include many undoubtedly Greek, as *Demeter, Kore, Ge, Aglauros*, the *Charites, Hecate*, and others; that the ritual is in the hands of noble and distinguished families, not of slaves or other remnants of a conquered population; and that a good magico-religious reason for secrecy can be given. The deities of these cults are one and all chthonian; these, however benevolent, are in their nature dangerous to approach; therefore, to avoid all possibility of disturbance at a critical time, it is but prudent to shroud the whole performance in secrecy, and keep the impure and unprepared at a safe distance.

For the student of Hellenism, the Eleusinian and Orphic ceremonies are of paramount importance; the Samothracian, which vied with these in attractiveness for the later Hellenic world, were not Hellenic in origin; nor wholly hellenized in character, and cannot be considered in an article of this compass.

As regards the Eleusinia, we are in a better position for the investigation of them than our predecessors were; for the modern methods of comparative religion and anthropology have at least taught us to ask the right questions and to apply relevant hypotheses; archaeology, the study of vases, excavations on the site, yielding an ever-increasing hoard of inscriptions, have taught us much concerning the external organization of the mysteries, and have shown us the beautiful figures of the deities as they appeared to the eye or to the mental vision of the initiated.

In seeking to guess what the secret of the mysteries was, we must first rid ourselves of the notion that it was any esoteric philosophy, or elaborate theology kept hidden from the world at large. Negatively, we have no jot of evidence that the initiates were more intelligent than the rest of Greece, or that their belief or practice differed from those of their fellow-countrymen to any marked degree, although there need be no doubt that a certain amount of verbal instruction was given by the hierophant (*see* below). Positively, we have the repeated insistence, from the Homeric hymn down (*hymn. Homer*, ii., 480) that the initiates saw something which greatly comforted their souls, not that they learned anything of great importance. What they saw was doubtless the sacred *dromenon*. We can realize what effect this might have on excited and believing minds, if we consider the importance, for a pious Catholic, of such impressive ceremonies as the elevation of the Host at mass.[1]

Our evidence is of two kinds. Firstly, a number of works of art show us scenes probably or certainly taken from the ritual of the Eleusinian or other mysteries. But here we may be certain that the artists, even if they themselves had no scruples, would not risk violating the deepest religious sentiments of thousands of their fellow-countrymen. Secondly, we have literary evidence. But this, if pagan, is restrained by the same reasons as the artists' from saying too much; if Christian, the writers seldom, if ever, can be shown to have been initiates themselves; some indeed cannot have been, for they were never pagans. Their

[1] This is well and sympathetically discussed by O. Kern, *Die griechischen Mysterien der klassischen Zeit* [1927], especially p. 23 ff. Aristotle [frag. 45, Rose] declares that the *mystae* learned nothing, but underwent "an experience and an influence" [παθεῖν καὶ διατεθῆναι;] an important testimony.

statements are generally uncritical and do not clearly differentiate between the Eleusinian mysteries and others, such as the Orphic, Sabazian, and those of Cybele and Attis.

The questions that the critical analysis of all the evidence may hope to solve are mainly these: (*a*) What do we know or what can we infer concerning the personality of the deities to whom the Eleusinian mysteries were originally consecrated, and were new figures admitted at a later period? (*b*) When was the mystery taken over by Athens and opened to all Hellas, and what was the state-organization provided? (*c*) What was the inner significance, essential content or purport of the Eleusinia, and what was the source of their great influence on Hellas? (*d*) Can we attribute any ethical value to them, and did they strongly impress the popular belief in immortality? Limits of space allow us only to adumbrate the results that research on the lines of these questions has hitherto yielded.

The paramount divine personalities of the mystery were, in the earliest period of which we have literary record, the mother and the daughter, Demeter and Kore, the latter being never styled Persephone in the official language of Eleusis; while the third figure, the god of the lower world known by the euphemistic names of Pluto (Plouton) and at one time Eubouleus, the ravisher and the husband, is an accessory personage, comparatively in the background. This is the conclusion naturally drawn from the Homeric hymn to Demeter, a composition of great ritualistic value, probably of the 7th century B.C., which describes the abduction of the daughter, the sorrow and search of the mother, her sitting by the sacred well, the drinking of the κυκεών or sacred cup, and the legend of the pomegranate. An ancient hymn of Pamphos, from which Pausanias freely quotes and which he regards as genuine[1], appears to have told much the same story in much the same way. As far as we can say, then, the mother and daughter were there in possession at the very beginning. The other pair of divinities known as ὁ θεός, ἡ θεά that appear in a 5th century inscription and on two dedicatory reliefs found at Eleusis, have been supposed to descend from an aboriginal period of Eleusinian religion when deities were nameless[2]. But for various reasons the contrary view is more probable, that ὁ θεός and ἡ θεά are later cult-titles of the married pair Pluto-Cora (Plouton-Kore), the personal names being omitted from that feeling of reverential shyness which was specially timid in regard to the sacred names of the deities of the underworld. And it is a fairly familiar phenomenon in Greek religion that two separate titles of the same divinity engender two distinct cults.

The question as to the part played by Dionysus in the Eleusinia is important. Some scholars, like M. Foucart, have supposed that he belonged from the beginning to the inner circle of the mystery; others that he forced his way in at a somewhat later period owing to the great influence of the Orphic sects who captured the stronghold of Attic religion and engrafted the Orphic-Sabazian ἱερὸς λόγος, the story of the incestuous union of Dionysus-Sabazius with Demeter-Kore, and of the death and rending of Zagreus, upon the primitive Eleusinian faith. A saner and more careful criticism rejects this view. There is no genuine trace discovered as yet in the inner circle of the mysteries of any characteristically Orphic doctrine; the names of Zagreus and Phanes are nowhere heard, the legend of Zagreus and the death of Dionysus are not known to have been mentioned there. Nor is there any print within or in the precincts of the τελεστήριον, the hall of the Μύσται, of the footsteps of the Phrygian deities, Cybele, Attis, Sabazius.

The exact relation of Dionysus to the mysteries involves the question as to the divine personage called Iacchus; who and what was Iacchus? Strabo (p. 468), who is a poor authority on such matters, describes him as "the daemon of Demeter, the founder of the leader of the mysteries." More important is it to note that "Iacchus" is unknown to the author of the Homeric hymn, and that the first literary notice of him occurs in the well-known passage of Herodotus (viii. 65), who describes the procession of the mystae as moving along the sacred way from Athens to Eleusis and as raising the cry Ἴακχε. We find Iacchus the theme of a glowing invocation in an Aristophanic Ode (*Frogs*, 324–398), and described as a beautiful "young god"; but he is first explicitly identified with Dionysus in the beautiful ode of Sophocles' *Antigone* (1119); and that this was in accord with the popular ritualistic lore is proved by the statement of the scholiast on Aristophanes (*Frogs*, 482) that the people at the Lenaea, the winter-festival of Dionysus, responded to the command of "Invoke the god!" with the invocation "Hail, Iacchus, son of Semele, thou giver of wealth!" We are sure, then, that in the high tide of the Attic religious history Iacchus was the youthful Dionysus, a name of the great god peculiar to Attic cult, and this is all that here concerns us to know.

We thus see that Iacchus was an Athenian, not an Eleusinian, god; his abiding-place was Athens, and he merely visited Eleusis for the mysteries. We may indeed conjecture that his votaries read Dionysiac interpretations into Eleusinian *dromena*. But all this is conjecture. The interpretation of what was shown would naturally change somewhat with the changing sentiment of the ages; but Demeter and Kore, τὼ θεώ, and no one else, are the paramount figures at Eleusis from the "Homeric" hymn to Alaric's invasion. Triptolemus the apostle of corn-culture, Eubouleus—originally a euphemistic name of the god of the under-world, "the giver of good counsel," conveying a hint of his oracular functions—these are accessory figures of Eleusinian cult and mythology that may have played some part in the great mystic drama that was enacted in the hall.

As to the history of the Eleusinian mysteries[1], the legends concerning the initiation of Heracles and the Dioscuri imply that originally they were closed to strangers, which, as they probably were in origin local rites in honour of local deities, is exactly what we should expect. But the "Homeric" hymn implies that they are open to all; with this we may connect the sagas of the conquest of Eleusis by Athens (*see* EUMOLPUS) and the early unification of Attica under Theseus (*see* CONSTITUTION OF ATHENS). By what steps the mysteries grew in importance and fame we do not know, but certainly Peisistratus paid attention to them, while Pericles found them highly important and made them more so. Decrees of his time[2] proclaim a holy truce for pilgrims to the festival and invite the subject-allies of Athens to send first-fruits of corn, a part of his imperial policy. The μυστικὸς σηκός at Eleusis is of his date.

At least from the 5th century onwards, Athens was in charge of the organization and external control of the mysteries, the management being in the hands of the archon basileus and a committee of four *epimeletai* (overseers) and a *paredros* (assessor). The State, as elsewhere in Greece, controlled the Church. But the priesthood was Eleusinian. Two ancient clans, the *Eumolpidai* (*see* EUMOLPUS) and the *Kerukes* (*see* HERALD) performed the whole ceremony between them; it appears that in the 4th century the *Kerukes* died out and the *Lukomidai* of Phlye took their place, perhaps bringing with them a tendency to Orphism. From the Eumolpidae was chosen the hierophant, who was so holy that his personal name was no longer used when once he was appointed, and he alone might enter the innermost shrine,—or perhaps, for the details are obscure, he and a priestess. Demeter and Kore had also each a *hierophantis* or female hierophant; considering that the Thesmophoria (*q.v.*) was entirely in the hands of women, it is not surprising that they took part in the mysteries also. The *Kerukes*, afterwards the *Lukomidai*, chose the δᾳδοῦχος or torch-bearer, who ranked next after the hierophant, from their number.

Turning now to the celebration itself, we can only sketch the more salient features here. On the 13th of Boedromion, the Attic month corresponding roughly to our September, the Ephebi (*q.v.*) marched out to Eleusis, and returned to Athens the next

[1] i. 38, 3; i. 39, 1.

[2] *See* Dittenberger, *Syll.* 83, 39; 200, 21; *C.I.G.* ii. Add. 1620c; *Ephem. archaiol.* (1886), πιν. 3; Heberdey in *Festschrift für Benndorf*, p. 3, Taf. 4; Von Prott in *Athen. Mittheil.* (1899), p. 262.

[1] To be distinguished from the Eleusinia, an important festival, but not connected with the mysteries, see *Revue des études grecques*, xxxii., p. 462.

[2] Dittenberger, *Sylloge*, 3rd. ed. 21 (=*I.G.* i. 1); 83, 30 ff.

day, bringing with them the "holy things" (*ἱερά*) to the "Eleusinion" in the city; these *ἱερά* probably included small images of the goddesses. The 16th was the day of the *ἀγυρμός*, the gathering of the catechumens, when they met to hear the address of the hierophant, called the *πρόρρησις*. This was no sermon, but a proclamation bidding those who were disqualified or for some reason unworthy of initiation to depart. The legally qualified were all Hellenes and subsequently all Romans above a certain—very youthful—limit of age, women, and as it appears even slaves; barbarians, and those uncleansed of some notorious guilt, such as homicide, were disqualified. We are sure that there was no dogmatic test, nor would time allow of any searching moral scrutiny, and only the Samothracian rites, in this respect unique in the world of classical religion, possessed a system of confessional. The hierophant appealed to the conscience of the multitude; but we are not altogether sure of the terms of his proclamation, which can only be approximately restored from late pagan and early Christian writers. We know that he demanded of each candidate that he should be "of intelligible speech (*i.e.*, Hellene) and pure of hand"; and he catechized him as to his condition of ritualistic purity— the food he had eaten or abstained from. It appears also from Libanius that in the later period at least he solemnly proclaimed that the catechumen should be "pure of soul" (*Or. Corinth*, iv. 356), and this spiritual conception of holiness had arisen already in the earlier periods of Greek religious thought. On the other hand we must bear in mind the criticism that Diogenes is said to have passed upon the Eleusinia, that many bad characters were admitted to communion, thereby securing a promise of higher happiness than an uninitiated Epameinondas could aspire to.

An essential preliminary was purification and lustration, and after the assembly the "mystae" went to the sea-shore (*ἅλαδε μύσται*) and purified themselves with sea-water, and probably with sprinkling of pigs' blood, a common cathartic medium. After their return from the sea, a sacrifice of some kind was offered as an essential condition of *μύησις*, but whether as a sacrament or gift-offering to the goddesses it is impossible to determine. On the 19th of Boedromion the great procession started along the sacred way bearing the "fair young god" Iacchus; and as they visited many shrines by the way the march must have continued long after sunset, so that the 20th is sometimes spoken of as the day of the exodus of Iacchus. On the way each wore a saffron band as an amulet; and the ceremonious reviling to which the *μύσται* were subjected as they crossed the bridge of the Cephissus answered the same purpose of averting the evil eye. Upon the arrival at Eleusis, on the same night or on the following, they celebrated a midnight revel under the stars with Iacchus, which Aristophanes glowingly describes.

The question of supreme interest now arises: What was the mystic ceremony in the hall; what was said and what was done? We can distinguish two grades in the celebration; the greater was the *τέλεα* and *ἐποπτικά*, the full and satisfying celebration, to which only those were admitted who had passed the lesser stage at least a year before. As regards the actual ritual in the hall of the mystae, much is still uncertain. That there was some kind of holy pageant or play, the accusations against Aeschylus and Alcibiades would suffice to prove, and Porphyry speaks of the hierophant and the *δᾳδοῦχος* acting divine parts. What the subject of this drama was may be gathered partly from the words of Clement—"Deo (Demeter) and Kore became the personages of a mystic drama, and Eleusis with its *δᾳδοῦχος* celebrates the wandering, the abduction and the sorrow" (*Protrept.*, p. 12, Potter), supported by Apuleius (*Met.* vi., 2). We may believe then that the great myth of the mother's sorrow, the loss and the partial recovery of her beloved was part of the Eleusinian passion-play. Did it also include a *ἱερὸς γάμος*? We should naturally expect that the sacred story acted in the mystic pageant would close with the scene of reconciliation, such as a holy marriage of the god and the goddess. But the evidence that this was so is mainly indirect, apart from a doubtful passage in Asterius, a writer of questionable authority in the 4th century A.D. (*Econom. martyr.* p. 194, Combe). At any rate, if a holy marriage formed part of the passion-play, it may well have been acted with solemnity and delicacy. We have no reason to believe that even to a modern taste any part of the ritual would appear coarse or obscene; even Clement, who brings a vague charge of obscenity against all mysteries in general, does not try to substantiate it in regard to the Eleusinia, and we hear from another Christian writer of the scrupulous purity of the hierophant.

It would be interesting to know if the birth of a holy child, a babe Iacchus, for example, was a motive of the mystic drama. The question seems at first sight to be decided by a definite statement of Hippolytus (*Philosoph.* 5. 8), that at a certain moment in the mysteries the hierophant cried aloud: "The lady-goddess Brimo has borne Brimos the holy child." But a careful consideration of the context almost destroys the value of his authority. For he does not pretend to be a first-hand witness, but admits that he is drawing from Gnostic sources, and he goes on at once to speak of Attis and his self-mutilation. The formula may then refer to the Sabazian-Phrygian mystery, which the Gnostics with their usual spirit of religious syncretism would have no scruple in identifying with the Eleusinian. And the archaeological evidence that has been supposed to support the statement of Hippolytus is deceptive.

The simple structure of the building and the absence of any reference, in the many inscriptions, to expenses for scenery or the like forbid us to suppose that there was any elaborate staging. The pageant-play produced its effect by means of gorgeous raiment, torches and stately figures.

But the mystic action included more than the pageant-play. The hierophant revealed certain holy objects to the eyes of the assembly. There is reason to suppose that these included certain primitive idols of the goddesses of immemorial sanctity; and, if we accept a statement of Hippolytus (*loc. cit.*) we must believe that the *epoptai* were also shown "that great and marvellous mystery of perfect revelation, a cut corn-stalk." The value of this definite assertion, which appears to be an explicit revelation of the secret, would be very great, if we could trust it; but unfortunately it occurs in the same suspicious context as the Brimo-Brimos formula, and we again suspect the same uncritical confusion of Eleusinian with Phrygian ritual, for we know that Attis himself was identified in his mysteries with the "reaped corn," the *στάχυς ἄμητος*, almost the very phrase used by Hippolytus. Only, it is in the highest degree probable, whether Hippolytus knew anything or not, that a corn-token was shown among the sacred things of a mystery which possessed an original agrarian significance and was intended partly to consecrate and to foster the agricultural life. But to say this is by no means the same as to admit the view of Lenormant[1] and Dr. Jevons[2] that the Eleusinians worshipped the actual corn, or revered it as a clan-totem. For of direct corn-worship or of totemism there is no trace either at Eleusis or elsewhere in Greece.

Among the *δρώμενα* or "things done" may we also include a solemn sacrament, the celebration of a holy communion, in which the votary was united to the divinity by partaking of some holy food or drink? We owe to Clement of Alexandria (*Protrept.* p. 18, Potter) an exact transcription of the pass-word of the Eleusinian mystae; it ran as follows (if we accept Lobeck's emendation of *ἐγγευσάμενος* for *ἐργασάμενος*) "I have fasted, I have drunk the barley-drink, I have taken (the things) from the sacred chest, having tasted therof I have placed them into the basket and again from the basket into the chest." We gather from this that some kind of sacrament was at least a preliminary condition of initiation; the mystae drank of the same cup as the goddess drank in her sorrow, partly—as we say—"in memory of her," partly to unite themselves more closely with her. We know also from an inscription that the priest of the Samothracian mysteries broke sacred bread and poured out drink for the mystae (*Arch. epigr. Mitth.*, 1882, p. 8, No. 14). But neither in these nor in the Eleusinian is there any trace of the more mystic sacramental conception, any indication that the votaries believed themselves to be partaking of the actual body of their

[1] Daremberg et Saglio, *Dictionnaire*, i., p. 1066.
[2] *Introduction to the Study of Religion.*

divinity[1], for there is no evidence that Demeter was identified with the corn, still less with the barley-meal of which the κυκεών was compounded. Nor is it likely that the sacrament was the pivot of the whole mystery or was part of the essential act of the μύησις itself. In the first place we have an almost certain representation of the Eleusinian sacrament on an archaic vase in Naples[2], probably of Attic *provenance*, and the artistic reproduction of a holy act would have been impious and dangerous, if this had belonged to the inner circle of the mystery. Again, there is no mention of sacrament or sacrifice among the five essential parts of μύησις given by Theo Smyrnaeus, nor in the imaginary narrative of the late rhetorician Sopatros (*Rhet. Graec.* viii., 121) who supposes the strange case of a man being initiated by the goddesses in a dream: they admit him to their full communion merely by telling him something and showing him something.

Besides the δρώμενα, then, there were also certain things said in the hall, or in the earlier stages of initiation, which we would gladly discover. Part of these were mystic formulae, one of which has been discussed already, the pass-word of the votaries. We gather also from Proclus and Hippolytus (*in Tim.* 293c; *Ref. Omn. Haer.* 5, 7, p. 146) that in the Eleusinian rites they gazed up to heaven and cried aloud "rain"—ὗε—and gazed down upon the earth and cried "conceive"—κύε. This ritual charm—we cannot call it prayer—descends from the old agrarian magic which underlay the primitive mystery. What else the votaries may have uttered, whether by way of thanksgiving or solemn litany, we do not know[3]. But there was also a certain ἱερὸς λόγος some exposition accompanying the unfolding of the mysteries; for it was part of the prestige of the hierophant that he was chief spokesman, "who poured forth winning utterance and whose voice the catechumen ardently desired to hear" (*Anth. Pal.*, app. 246); and Galen speaks of the rapt attention paid by the initiated "to the things done and said in the Eleusinian and Samothracian mysteries" (*De usu part.* 7. 14). But we have no trustworthy evidence as to the real content of the λόγος of the hierophant. We need not believe that the whole of his discourse was taken up with corn-symbolism, as Varro seems to imply (Aug. *de civit. Dei.* 20), or that he taught natural philosophy rather than theology, or again, the special doctrine of Euhemerus, as two passages in Cicero (*De natur. deor.* i. 42; *Tusc.* i. 13) might prompt us to suppose. His chief theme was probably an exposition of the meaning and value of the ἱερά as in an Australian initiation rite it is the privilege of the elders to explain the nature of the "churinga" to the youths. And his discourse on these may have been coloured to some extent by the theories current in the philosophic speculation of the day. But though in the time of Julian he appears to have been a philosopher of Neo-platonic tendencies, we ought not to suppose that the hierophant as a rule would be able or inclined to rise above the anthropomorphic religion of the times. Whatever symbolism attached to the ἱερά, the sacred objects shown, was probably simple and natural; for instance, in the Eleusinian, as in Egyptian eschatology, the token of the growing corn may have served as an emblem—though not a proof—of man's resurrection. The doctrine of the continuance of the soul after death was already accepted by the popular belief, and the hierophant had no need to preach it as a dogma; the votaries came to Eleusis to ensure themselves a happy immortality. And in our earliest record, the Homeric hymn, we find that the mysteries already hold out this higher promise. How, we may ask, were the votaries assured? The Egyptianizing theory of Foucart, that they were given directions and spells to take them past the terrors of the underworld, after the manner of the *Book of the Dead*, is wholly improbable. The terror of hell is not normal Greek, although something of the kind existed in Orphism; nor have we any evidence that spells of any kind were taught or that the λόγος was regarded as particularly important. If we could be sure that the Minoans had a developed eschatology (*see* Evans in *Journ. Hell. Stud.*, xlv. p. 43 ff., but *cf.* Nilsson, *Minoan-Myc. Rel.*, p. 549 ff.), we might suppose some of it to survive; but the matter is very doubtful.

The assurance of the hope of the Eleusinian votary was obtained by the feeling of friendship and mystic sympathy, established by mystic contact, with the mother and the daughter, the powers of life after death. Those who won their friendship by initiation in this life would by the simple logic of faith regard themselves as certain to win blessing at their hands in the next.

That the mysteries preached a higher morality than that of the current standard is not proved. That they exercised a direct and elevating influence on the individual character is nowhere explicitly maintained, as Diodorus (v. 49) maintains concerning the Samothracian. But on general grounds it is reasonable to believe that such powerful religious experience as they afforded would produce moral fruit in many minds. The genial Aristophanes (*Frogs*, 455) intimates as much, and Andocides (*De myster.* p. 36, § 31; p. 44, § 125) assumes that those who had been initiated would take a juster and sterner view of moral innocence and guilt.

Besides the greater mysteries at Eleusis, we hear of the lesser mysteries of Agrae on the banks of the Ilissus. Established, perhaps, originally by Athens herself at a time when Eleusis was independent and closed her rites to strangers, they became wholly subordinated to the greater, and were put under the same management and served merely as a necessary preliminary to the higher initiation into them. Sacrifice was offered to the same great goddesses at both; but we have the authority of Duris (*Athenae*, 253*d*), the Samian historian, and the evidence of an Attic painting, called the *pinax* of Nannion[1], that the predominant goddess in the mysteries at Agrae was Kore. And this agrees with the time of their celebration, in the middle of Anthesterion, when Kore was supposed to return in the young corn. Stephanus (*s.v.* Ἄγρα), drawing from an unknown source, declares that the Dionysiac story was the theme of their mystic drama; an isolated statement with nothing to confirm or interpret it.

The influence of Eleusis in early times must have been great, for we find offshoots of its cult, whether mystic or not, in other parts of Greece. In Boeotia, Laconia, Arcadia, Crete and Thera, Demeter was called Eleusinia, meaning in all probability "goddess of Eleusis." The initiation rites of Demeter at Celene near Phlius, at Lerna in Argolis, and at Naples, were organized after the pattern of the Eleusinian. But of these and the other Demeter mysteries in the Greek world, there is little to record that is certain and at the same time of primary importance for the history of religion. The Arcadian city of Pheneus possessed a mystery that boasted an Eleusinian character and origin, yet in the record of it there is no mention of Kore, and we may suspect that, like other Demeter-worships in the Peloponnese, it belonged to a period when the goddess was revered as a single personality and Kore had not yet emanated from her. We know much more of the details of the great Andanian mysteries in Messenia, owing to the discovery of the important and much-discussed Andanian inscription of 91 B.C.[2]. But what we know are facts of secondary importance only. We gather from Pausanias (4. 33. 4; *cf.* 4. I. 5. and 4. 26. 8; 4. 27. 6) that the rites, which he regards as second in solemnity and prestige to the Eleusinian alone, were consecrated to the Μεγάλαι θεαί (the great goddesses) and that Kore enjoyed the mystic title of Hagnē, "the holy one." The inscription has been supposed to correct and to refute Pausanias, but it does not really controvert his statements, which are attested by other evidence; it proves only that other divinities came at

[1]This is Dr. Jevons's supposition—*op. cit.*—on which he bases an important theory of the whole Eleusinian mysteries and their intrinsic attraction.

[2](Farnell, *Cults*, vol. iii. pl. xv.b).

[3]The other formula which the scholiast on Plato (*Gorg.* 407 *c.*) assigns to the Eleusinian rite: "I have eaten from the timbrel, I have drunk from the cymbal, I have carried the sacred vessel, I have crept under the bridal-chamber," belongs, not to Eleusis, but, as Clement and Firmicus Maternus themselves attest, to Phrygia and to Attis.

[1]Farnell, *Cults of the Greek States*, vol. iii. p. 242, Pl. xvi.

[2]*See* Sauppe, *Mysterieninschrift von Andania; cf.* Foucart's commentary in Le Bas, *Voyage archéol.* 2, No. 326a; H. Collitz, *Dialectinschriften*, 4689.

a later time to have a share in the mysteries, such as the Μεγάλοι θεοί who were probably the Cabeiri (*q.v.*). It is clear that the Andanian mysteries included a sacred drama, in which women personated the goddesses. The priestesses were married women, and were required to take an oath that they had lived "in relation to their husbands a just and holy life." We hear also of grades of initiation, purification-ceremonies, but of no sacrament or eschatologic promise; yet it is probable that these mysteries, like the Eleusinian, maintained and secured the hope of future happiness.

The Eleusinian faith is not wholly unattested by the grave-inscriptions of Hellas, though it speaks but rarely on these. The most interesting example is the epitaph of a hierophant who proclaims that he has found that "death was not an evil, but a blessing[1]."

Of equal importance for the private religion of Greece were the Orphic mystic societies, bearing a Thraco-Phrygian tradition into Greece, and associated originally with the name of Dionysus, and afterwards with Sabazius also and the later cult-ideas of Phrygia[2]. The full account of the Dionysiac mysteries would demand a critical study of the Dionysiac religion as a whole, as well as of the private sects that sprang up under its shadow. It is only possible here to indicate the salient characteristics of those which are of primary value for the history of religion.

Originally a great nature-god of the Thraco-Phrygian stock, powerful over all vegetation and especially revealing his power in the vine, Dionysus was forcing his way into Greece at least as early as the Homeric period, and by the 6th century was received into the public cults of most of the Greek communities. We can gather with some certainty or probability his aboriginal characteristics and the form of his worship. Being a god of the life of the earth, he was also a nether divinity, the lord of the world of souls, with whom the dead votary entered into privileged communion; his rites were mystic, and nightly celebrations were frequent, marked by wild ecstasy and orgiastic self-abandonment, in which the votary became at one with the divinity and temporarily possessed his powers; women played a prominent part in the ritual; a savage form of sacramental communion was in vogue, and the animal victim of whose flesh and blood the votaries partook was at times regarded as the incarnation of the divinity, so that the god himself might be supposed to die and to rise again; finally we may regard certain cathartic ideas as part of the primeval tradition of this religion. Admitted among the soberer cults of the Greek communities, it lost most of its wildness and savagery, while still retaining a more emotional ecstatic character than the rest. But this cooling process was arrested by a new wave of Dionysiac fervour that spread over Greece from the 7th century onwards, bringing with it the name of Orpheus, and engendering at some later date the Orphic brotherhoods (*thiasoi*). This religious movement may have started like the earlier one from the lands north of Greece; but Crete and even Egypt are supposed to have contributed much to the Orphic doctrine and ritual. Plato's contemptuous mention (*Rep.* 364A) of wandering Orphic initiators brings to our notice a phenomenon unknown elsewhere in Greek religion; the missionary spirit, the impulse to preach to all who would hear, which foreshadows the breaking down of the gentile religious barriers of the ancient world. And it is probable that some kind of "Orphic" propagandism, whether through books or itinerant mystery-priests, or both, had been in vogue some time before Plato. Orphism was known to Pindar (*Olym.* ii. and frags. 129-133 v. Christ) and Euripides, see *Hipp.* 952–4 and, yet more important, frag. 472 (*Nauck*) which attests the antiquity of these mystic Dionysiac associations in Crete. The initiated votary proclaims himself as sanctified to Zeus of Ida, to Zagreus and to the mountain-goddess Rhea-Cybele; he has fulfilled "the solemn rite of the banquet of raw flesh," and henceforth he "robes himself in pure white and avoids the taint of childbirth and funerals and abstains from meat." And—what is most significant—he calls himself by the very name of his god—he is himself Βάκχος. In spirit and in most of its details the passage accords well with the *Bacchae* of Euripides, which reflects not so much the public worship of Greece, but rather the mystic Dionysiac brotherhoods. Throughout this inspired drama the votary rejoices to be one with his divinity and to call himself by his name, and this mystic union is brought about partly, though Euripides may not have known it, through "the meal of raw flesh" or the drinking of the blood of the goat or the kid or the bull. The sacramental intention of this is confirmed by abundant proof; even in the state-cult of Tenedos they dressed up a bull-calf as Dionysus and reverentially sacrificed it (Ael. *Nat. an.* 12. 34); those who partook of the flesh were partaking of what was temporarily the body of their god. The Christian fathers at once express their abhorrence of this savage ὠμοφαγία and reveal its true significance (Arnob. *Adv. nat.* 5. 119); and Firmicus Maternus (*De error.*, p. 84) attests that the Cretans of his own day celebrated a funeral festival in honour of Dionysus in which they enacted the life and the death of the god in a passion-play and "rent a living bull with their teeth."

But the most speaking record of the aspirations and ideas of the Orphic mystic is preserved in the famous gold tablets found in tombs near Sybaris, one near Rome, and one in Crete. These have been frequently published and discussed; and here it is only possible to allude to the salient features that concern the general history of religion. They contain fragments of a sacred hymn that must have been in vogue at least as early as the 3rd century B.C., and which was inscribed in order to be buried with the defunct, as an amulet that might protect him from the dangers of his journey through the under-world and open to him the gates of Paradise. The verses have the power of an incantation. The initiated soul proclaims its divine descent: "I am the son of Earth and Heaven." "I am perishing with thirst, give me to drink of the waters of memory." "I come from the pure": "I have paid the penalty of unrighteousness": "I have flown out of the weary, sorrowful circle of life." His reward is assured him: "O blessed and happy one, thou hast put off thy mortality and shalt become divine." The strange formula ἔριφος ἐς γάλ' ἔπεσον "I a kid fell into the milk," has been interpreted by Dieterich (*Eine Mithras-Liturgie*, p. 174) with great probability as alluding to a conception of Dionysus himself as ἔριφος, the divine kid, and to a ritual of milk-baptism in which the initiated was born again[1].

We discern, then, in these mystic brotherhoods, the germs of a high religion and the prevalence of conceptions that have played a great part in the religious history of Europe. And as late as the days of Plutarch they retained their power of consoling the afflicted (*Consol. ad. uxor., c.* 10).

The Oriental mysteries, associated with Attis, Cybele, Isis and Sabazius, which invaded later Greece and early imperial Rome, were originally akin to these and contained many concepts in common with them. But their orgiastic ecstasy was more violent, and the psychical aberrations to which the votaries were prone through their passionate desire for divine communion were more dangerous. Emasculation was practised by the devotees of Attis, whatever the reason may have been[2], and the high priest himself bore the god's name. Or communion with the deity might be attained by the priest through the bath of blood in the taurobolium (*q.v.*), or by the gashing of the arm over the altar. A more questionable method which lent itself to obvious abuses, or at least to the imputation of indecency, was the simulation of a sacred marriage, in which the catechumen was corporeally united with the great goddess in her bridal chamber (Dieterich, *op. cit.* pp. 121–134). Prominent also in these Phrygian mysteries were the conception of rebirth and the belief, vividly impressed by solemn pageant and religious drama, in the death and resurrec-

[1] *Eph. arch.* (1883) p. 81.

[2] The best account of the origin and development of the Dionysiac religion is in Rohde's *Psyche*, vol. i.; for Orphic ritual and doctrine see Roscher's *Lexikon*, art. *Orpheus;* J. E. Harrison, *Prolegomena to the Study of Greek Religion*, pp. 455–659, with critical appendix by G. Murray on the Orphic tablets; and *cf.* ORPHEUS.

[1] *See* also C. W. Vollgraff, ἔριφος ἐς γάλ' ἔπεσον (over den oorsprong der dionysische mysteriën), Amsterdam, 1924.

[2] *See* H. J. Rose in *Class. Quart.*, xviii. p. 11, ff.; A. D. Nock, in *Archiv f. Relig.*, xxiii., p. 25, ff.

tion of the beloved Attis. The Hilaria in which these were represented fell about the time of our Easter; and Firmicus Maternus reluctantly confesses its resemblance to the Christian celebration (Farnell, *Cults*, iii., 299).

The Eleusinian mysteries are far more characteristic of the older Hellenic mind. These later rites breathe an Oriental spirit, and though their forms appear strange and distorted they have more in common with the subsequent religious phenomena of Christendom. And the Orphic doctrine may have even contributed something to the later European ideals of private and personal morality[1].

BIBLIOGRAPHY.—C. A. Lobeck, *Aglaophamus* (1829) is still very useful for material. General discussion of the subject in M. P. Foucart, *Les grands mystères d'Eleusis* (1900); Goblet d'Alviella, *Eleusinia* (1903); L. R. Farnell, *Cults of the Greek States*, vol. iii. (1906), with collection of relevant passages. Anthropological parallels, etc., A. Lang, *Myth, Ritual and Religion* (1887); Sir J. G. Frazer, *Golden Bough*, 3rd ed., especially vols. ii. (1911) and vii. (1912) (bibl.). *See* also DIONYSUS; DEMETER; GREAT MOTHER OF THE GODS; MITHRAS; ORPHEUS, and literature cited in text. (L. R. F.; H. J. R.)

MYSTERY STORIES resolve themselves into many types or classes, of which the principal are riddle stories, ghost stories and detective stories. The third of these classes deserves to be classed as a separate branch of fiction from the very nature of its construction. By his terms of reference, the author is obliged to get the main action of the book already over in the first few chapters. This action is (apparently at least) a crime; and the interest of the book lies in determining the circumstances, the methods and the motives of it. The reader is invited to watch the investigation, and to match his wits against the author by attempting to unravel the mystery *pari passu* with the detective hero. Numerous modern novels of adventure wear the air of detective stories, and are often erroneously classed as such: *e.g.*, those of John Buchan and of "Sapper." But the formula of the detective story demands more than mystification; it demands an initial *fait accompli*, the unravelling of which is the principal interest of the book.

It is difficult to suppose that the mystery story has any literary antecedents earlier than the 19th century. The *Oedipus Tyrannus* of Sophocles would be a detective story if the reader did not know the plot beforehand, but this condition was not realized when the play was produced. The art seems to have developed almost simultaneously in France and in the United States of America, suggested perhaps by that modern organization of the police system which the Industrial Revolution brought with it and by the publication of the *Mémoires* of the celebrated criminal-detective Vidocq. Émile Gaboriau was certainly the first writer who introduced the European public to the whole notion of "clues," "deduction," and the detective method generally. In the United States the happy genius of Edgar Allan Poe (1809–49) gave birth to the detective story as it did to the short story itself. Poe achieved what is probably a unique distinction, that of having solved a real police mystery under the guise of fiction and having been proved right by subsequent confessions. "The Mystery of Marie Roget" gives a true account of what happened in the case of Mary Cecilia Rogers (1842), though the scene has been transferred from New York to Paris. Yet the development of the art belongs to England. Few detective stories since produced in the United States have had any considerable public in Europe; and although in our own day Gaston Leroux has revived the tradition of Gaboriau in *The Mystery of the Yellow Room*, he suffers, like Gaboriau himself, from grave limitations of constructive power.

One great detective achievement stands out in the Middle Victorian period, *The Moonstone*, by Wilkie Collins (1824–89). His prolixity is intolerable to the modern reader, but the ingenuity of his work is beyond cavil. Probably, however, more impetus was given to this movement in fiction by a story which is not really a detective story at all—Dickens' *Mystery of Edwin Drood*. Since the author died without completing the book, or even committing the true solution to writing, the ingenuity of critics was naturally challenged; four attempted solutions appeared between 1870 and 1880, and there has been, since then, a whole literature on the subject, to which Andrew Lang contributed (*see* "Edwin Charles," *Keys to the Drood Mystery*, 1908). It was almost before the scent of that trail had grown cold that Sir Arthur Conan Doyle standardized the art and left his permanent impress upon it by the appearance of the Sherlock Holmes stories.

These belong to the world of 1890–1900; *The Hound of the Baskervilles* is the only truly successful revival that Sir Arthur has achieved during the present century, although he has been obliged repeatedly to bring his hero back to his triumphs in order to satisfy the popular demand. The principal importance of his contribution to detective fiction lies in his concentration of interest upon the personality of the detective. Lecoq, Dupin and Sergeant Cuff never won the heart of the public; but Sherlock Holmes became, almost at once, a figure of international notoriety; he has been parodied unceasingly, and taken a permanent place in the language; and the detectives who have followed him—Trent, Father Brown, Hanaud, Poirot, etc.—are attempts to vary him which do not quite succeed in replacing him.

During the present century, and especially since the World War, the vogue of the detective story has been enormous. Its popularity (like that of the "Cross Word Puzzle") may be due to the demand for some "compensation" for tired brains which find the occupations of daily life an insufficient stimulus, and have despaired of tackling the riddle of the universe. The morbidity of the modern sex novel also tends to drive back the reading public to ingenious story-telling. On the whole, detective fiction seems to be a recreation to the author as to the reader, and some of the most successful examples of it belong to the bibliography of writers who would prefer to be remembered by more enduring work. A. E. W. Mason has condescended to the art, with the happiest results, in *At the Villa Rose* and *The House of the Arrow*. G. K. Chesterton's Father Brown, distantly modelled on Fr. John O'Connor of Bradford, as Sherlock Holmes was distantly modelled on Dr. Bell of Edinburgh, has pressed the *roman policier* into the service of metaphysics and even of theology. A. A. Milne's *Red House Mystery* is a parergon worthy of a great humourist. E. C. Bentley may yet go down to posterity as a *homo unius libri* if he does not attempt to repeat the success of *Trent's Last Case*, the despair and the model of all detective writers.

Of the authors who have made their name since the war, Mrs. Agatha Christie probably deserves the palm for ingenuity (in *The Mysterious Affair at Styles*, for example, and *The Murder of Roger Ackroyd*); but some of her work is disfigured by sensationalism. On the other side, there is a tendency to undue laboriousness of detail in the writing of F. W. Croft and R. Austin Freeman. G. D. H. Cole's work may be taken as a good example of detective writing which is conscientious without being pedantic. In general it seems fair to observe that authors who only write one or two detective stores (Philip Macdonald, for example, author of *The Rasp*) are more readable than those professional craftsmen who turn out a new book with every season.

(R. A. K.)

Other Mystery Stories.—Riddle stories are mystery tales based on a question and answer which in no way call for or depend upon the work of a detective, either professional or amateur. Among the finest riddle stories are Poe's "The Oblong Box," and "The Gold Bug." In more modern times Kipling proved himself a master in this line, with "The Sending of Dana Da," and "His Wedded Wife." Collins' "The Woman in White" is a riddle story, and a perfect example is Frank Stockton's "The Lady or the Tiger." De Quincey's "The Avenger" and Bulwer's "A Strange Story" are classic riddle stories. The distinguishing feature of the riddle story is that the reader shall be confronted with a number of mysterious facts of which the explanation is reserved till the end. Aroused curiosity, sustained suspense and an unexpected but satisfactory final revelation are the chief requisites for the plot.

The ghost story, strictly speaking, is a tale of the supernatural. From the days of the Witch of Endor, the superhuman personage has held an exalted place in literature. Shakespeare, Dickens and Washington Irving number among their characters ghosts who became famous. Kipling and Marion Crawford have added to the

[1] See *Archiv für Religionswiss.* (1906), article by Salomon Reinach.

list. The ghost story must fall into one of two classes. Either the ghost is a spectre or it is a machination of a living person. But in either case, fear is the dominant note, and ghost stories include apparitions or other hair-raising horrors that fill readers with shivers of delight. "The Horla" by Maupassant and "What Was It?" by FitzJames O'Brien are typical and famous ghost stories. Kipling's "They" is in the front rank, as is Henry James's "The Turn of the Screw." "The Shadow on the Wall" by Mary E. Wilkins is a perfect example.

From the ages of antiquity the puzzle has held its own among mental activities; and puzzle, in its broader sense, includes all branches of mystery stories. The dictionaries define puzzle as "a riddle, toy or contrivance which is designed to try one's ingenuity." This is the crux of the mystery story. It is designed to try the reader's ingenuity at re-solution, and as an athlete rejoices in his muscular prowess, so the mental acrobat revels in concentrating all his brain power on an analytical problem.

(C. Ws.)

MYSTICISM, a phase of thought, or rather perhaps of feeling, which from its very nature is hardly susceptible of exact definition. It appears in connection with the endeavour of the human mind to grasp the divine essence or the ultimate reality of things, and to enjoy the blessedness of actual communion with the Highest. The first is the philosophic side of mysticism; the second, its religious side. The first effort is theoretical or speculative; the second, practical. The thought that is most intensely present with the mystic is that of a supreme, all-pervading, and indwelling power, in whom all things are one. Hence the speculative utterances of mysticism are always more or less pantheistic in character. On the practical side, mysticism maintains the possibility of direct intercourse with this Being of beings—intercourse, not through any external media such as an historical revelation, oracles, answers to prayer, and the like, but by a species of transfusion or identification, in which the individual becomes in very truth "partaker of the divine nature." God ceases to be an object to him, and becomes an experience.

Universality.—In the writings of the mystics, ingenuity exhausts itself in the invention of phrases to express the closeness of this union. Mysticism differs, therefore, from ordinary pantheism in that its inmost motive is religious; but, whereas religion is ordinarily occupied by a practical problem and develops its theory in an ethical reference, mysticism displays a predominatingly speculative bent, starting from the divine nature rather than from man and his surroundings, taking the symbolism of religious feeling as literally or metaphysically true, and straining after the present realization of an ineffable union. The union which sound religious teaching represents as realized in the submission of the will and the ethical harmony of the whole life is then reduced to a passive experience, to something which comes and goes in time, and which may be of only momentary duration. Mysticism, it will be seen, is not a name applicable to any particular system. It may be the outgrowth of many differing modes of thought and feeling. Most frequently it appears historically, in relation to some definite system of belief, as a reaction of the spirit against the letter. When a religion begins to ossify into a system of formulas and observances, those who protest in the name of heart-religion are not unfrequently known by the name of mystics. At times they merely bring into prominence again the ever-fresh fact of personal religious experience; at other times mysticism develops itself as a powerful solvent of definite dogmas. Mysticism appears in various phases in all the higher religions known to history. Its distinctive characteristics emerge in the religions of India and Persia as well as in the faith of Islam. These subjects are dealt with elsewhere; but its relation to Judaism and the religions of Greece requires special mention here. For opposite reasons, neither the Greek nor the Jewish mind lent itself readily to mysticism: the Greek, because of its clear and sunny naturalism; the Jewish, because of its rigid monotheism and its turn towards worldly realism and statutory observance. It is only with the exhaustion of Greek and Jewish civilization that mysticism becomes a prominent factor in Western thought. It appears, therefore, contemporaneously with Christianity, and is a sign of the world-weariness and deep religious need that mark the decay of the old world. Whereas Plato's main problem had been the organization of the perfect state, and Aristotle's intellect had ranged with fresh interest over all departments of the knowable, political speculation had become a mockery with the extinction of free political life, and knowledge as such had lost its freshness for the Greeks of the Roman Empire. Knowledge is nothing to these men if it does not show them the infinite reality which is able to fill the aching void within. Accordingly, the last age of Greek philosophy is theosophical in character, and its ultimate end is a practical satisfaction. Neoplatonism seeks this in the ecstatic intuition of the ineffable One. The systematic theosophy of Plotinus and his successors does not belong to the present article, except so far as it is the presupposition of their mysticism; but, inasmuch as the mysticism of the mediaeval Church is directly derived from Neoplatonism through the speculations of the pseudo-Dionysius, Neoplatonic mysticism fills an important section in any historical review of the subject.

Neoplatonism.—Neoplatonism appears in the first half of the 3rd century, and has its greatest representative in Plotinus. He develops the Platonic philosophy into an elaborate system by means of the doctrine of emanation. The One, the Good, and the Idea of the Good were identical in Plato's mind, and the Good was therefore not deprived of intelligible essence. It was not separated from the world of ideas, of which it was represented as either the crown or the sum. By Plotinus, on the contrary, the One is explicitly exalted above the νοῦς and the "ideas"; it transcends existence altogether (ἐπέκεινα τῆς οὐσίας), and is not cognizable by reason. Remaining itself in repose, it rays out, as it were, from its own fullness an image of itself, which is called νοῦς, and which constitutes the system of ideas of the intelligible world. The soul is in turn the image or product of the νοῦς, and the soul by its motion begets corporeal matter. The soul thus faces two ways—towards the νοῦς, from which it springs, and towards the material life, which is its own product. Ethical endeavour consists in the repudiation of the sensible; material existence is itself estrangement from God. (Porphyry tells us that Plotinus was unwilling to name his parents or his birthplace, and seemed ashamed of being in the body.) Beyond the καθάρσεις, or virtues which purify from sin, lies the further stage of complete identification with God (οὐκ ἔξω ἁμαρτίας εἶναι, ἀλλὰ θεὸν εἶναι). To reach the ultimate goal, thought itself must be left behind; for thought is a form of motion, and the desire of the soul is for the motionless rest which belongs to the One. The union with transcendent deity is not so much knowledge or vision as ecstasy, coalescence, *contact* (ἔκστασις, ἅπλωσις, ἀφή, *Ennead.*, vi. 9. 8–9). But in our present state of existence the moments of this ecstatic union must be few and short.

It will be seen from the above that Neoplatonism is not mystical as regards the faculty by which it claims to apprehend philosophic truth. It is first of all a system of complete rationalism; it is assumed, in other words, that reason is capable of mapping out the whole system of things. But, inasmuch as a God is affirmed beyond reason, the mysticism becomes in a sense the necessary complement of the would-be all-embracing rationalism. The system culminates in a mystical act, and in the sequel, especially with Iamblichus and the Syrian Neoplatonists, mystical practice tended more and more to overshadow the theoretical groundwork.

Dionysius the Areopagite.—It was probably about the end of the 5th century, just as ancient philosophy was dying out in the schools of Athens, that the speculative mysticism of Neoplatonism made a definite lodgment in Christian thought through the literary forgeries of the pseudo-Dionysius (*see* DIONYSIUS THE AREOPAGITE). The doctrines of Christianity were by that time so firmly established that the Church could look upon a symbolical or mystical interpretation of them without anxiety. The author of the *Theologia mystica* and the other works ascribed to the Areopagite proceeds, therefore, to develop the doctrines of Proclus with very little modification into a system of esoteric Christianity. God is the nameless and supra-essential One, elevated above goodness itself. Hence "negative theology," which ascends from the creature to God by dropping one after another

every determinate predicate, leads us nearest to the truth. The return to God (ἕνωσις, θέωσις) is the consummation of all things and the goal indicated by Christian teaching. The same doctrines were preached with more of churchly fervour by Maximus the Confessor (580–622).

The West.—St. Maximus represents almost the last speculative activity of the Greek Church, but the influence of the pseudo-Dionysian writings were transmitted to the West in the 9th century by Erigena, in whose speculative spirit both the scholasticism and the mysticism of the middle ages have their rise. Erigena translated Dionysius into Latin along with the commentaries of Maximus, and his system is essentially based upon theirs. In Erigena mysticism has not yet separated itself in any way from the dogma of the Church. There is no revulsion, as later, from dogma as such, nor is more stress laid upon one dogma than upon another; all are treated upon the same footing, and the whole dogmatic system is held, as it were, in solution by the philosophic medium in which it is presented. No distinction is drawn, indeed, between what is reached by reason and what is given by authority; the two are immediately identical for Erigena. In this he agrees with the speculative mystics everywhere, and differentiates himself from the scholastics who followed him. The chief representatives of scholasticism aim at demonstrating that the content of revelation and the teaching of reason are identical, but this is only an equation of two things which have been dealt with on the supposition that they are separate. Mysticism, on the other hand, is marked on its speculative side by even an overweening confidence in human reason; and this is pre-eminently visible in the work of Erigena. Nor need this be wondered at if we consider that the unity of the human mind with the divine is its underlying presupposition. Hence where reason is discarded by the mystic it is merely reason overleaping itself; it occurs at the end and not at the beginning of his speculations. Even then there is no appeal to authority; nothing is accepted from without. The appeal is still to the individual, who, if not by reason then by some higher faculty, claims to realize absolute truth and to taste absolute blessedness.

Anti-dialectical.—Mysticism first appears in the mediaeval Church as the protest of practical religion against the predominance of the dialectical spirit. It is so with Bernard of Clairvaux (1090–1153), who condemns Abelard's distinctions and reasonings as externalizing and degrading the faith. St. Bernard's mysticism is of a practical cast, dealing mainly with the means by which man may attain to the knowledge and enjoyment of God. Reason has three stages, in the highest of which the mind is able, by abstraction from earthly things, to rise to *contemplatio* or the vision of the divine. More exalted still, however, is the sudden *ecstatic* vision, such as was granted, for example, to Paul. This is the reward of those who are dead to the body and the world. Asceticism is thus the counterpart of medieval mysticism; and, by his example as well as by his teaching in such passages, St. Bernard unhappily encouraged practices which necessarily resulted in self-delusion. Love grows with the knowledge of its object, he proceeds, and at the highest stage self-love is so merged in love to God that we love ourselves only for God's sake or because God has loved us. "As the little water-drop poured into a large measure of wine seems to lose its own nature entirely and to take on both the taste and the colour of the wine; or as iron heated red-hot loses its own appearance and glows like fire; or as air filled with sunlight is transformed into the same brightness so that it does not so much appear to be illuminated as to be itself light—so must all human feeling towards the Holy One be self-dissolved in unspeakable wise, and wholly transfused into the will of God. For how shall God be all in all if anything of man remains in man? The substance will indeed remain, but in another form, another glory, another power" (*De diligendo Deo*, c. 10).

Mysticism was more systematically developed by Bernard's contemporary Hugh of St. Victor (1096–1141). The Augustinian monastery of St. Victor near Paris became the headquarters of mysticism during the 12th century. It had a wide influence in awakening popular piety, and the works that issued from it formed the textbooks of mystical and pietistic minds in the centuries that followed. Hugh's pupil, Richard of St. Victor, declares, in opposition to dialectic scholasticism, that the objects of mystic contemplation are partly above reason, and partly, as in the intuition of the Trinity, contrary to reason. He enters at length into the conditions of ecstasy and the yearnings that precede it. Bonaventura (1221–1274) was a diligent student of the Victorines, and in his *Itinerarium mentis ad Deum* maps out the human faculties in a similar fashion. He introduces the terms "apex mentis" and "scintilla" (also "synderesis" or συντήρησις) to describe the faculty of mystic intuition. Bonaventura runs riot in phrases to describe the union with God, and his devotional works were much drawn upon by mystical preachers.

Theology of the Heart.—From the 12th and 13th centuries onward there is observable in the different countries of Europe a widespread reaction against the growing formalism and worldliness of the Church and the scandalous lives of many of the clergy. Men began to feel a desire for a theology of the heart and an unworldly simplicity of life. In the beginning of the 13th century the foundation of the Dominican and Franciscan orders furnished an ecclesiastical and regular means of supplying the same wants, and numerous convents sprang up at once throughout Germany. The German mind was a peculiarly fruitful soil for mysticism, and a number of women appear about this time, combining a spirit of mystical piety and asceticism with sturdy reformatory zeal directed against the abuses of the time. Even before this we hear of the prophetic visions of Hildegard of Bingen (a contemporary of St. Bernard) and Elizabeth of Schönau. In the 13th century Elizabeth of Hungary, the pious landgravine of Thuringia, assisted in the foundation of many convents in the north of Germany. (For an account of the chief of these female saints *see* the first volume of W. Preger's *Geschichte der deutschen Mystik*.) Mechthild of Magdeburg appears to have been the most influential, and her book *Das fliessende Licht der Gottheit* is important as the oldest work of its kind in German. It proves that much of the terminology of German mysticism was current before Eckhart's time. Mechthild's clerico-political utterances show that she was acquainted with the "eternal gospel" of Joachim of Floris. Joachim had proclaimed the doctrine of three world-ages—the kingdom of the Father, of the Son, and of the Spirit. The reign of the Spirit was to begin with the year 1260, when the abuses of the world and the Church were to be effectually cured by the general adoption of the monastic life of contemplation.

Very similar to this in appearance is the teaching of Amalric of Bena (d. 1207); but, while the movements just mentioned were reformatory without being heretical, this is very far from being the case with the mystical pantheism derived by Amalric from the writings of Erigena. His followers held a progressive revelation of God in the ages of the Father, Son and Holy Spirit. Just as the Mosaic dispensation came to an end with the appearance of Christ, so the sacraments of the new dispensation have lost their meaning and efficacy since the incarnation of God as Holy Spirit in the Amalricans. With this opposition to the Church they combine a complete antinomianism, through the identification of all their desires with the impulses of the divine Spirit. Amalric's teaching was condemned by the Church, and his heresies led to the public burning of Erigena's *De divisione naturae* in 1225.

Eckhart.—In Meister Eckhart (? 1260–1327) the German mind definitively asserts its pre-eminence in the sphere of speculative mysticism. Eckhart was a distinguished son of the Church; but in reading his works we feel at once that we have passed into quite a different sphere of thought from that of the churchly mystics; we seem to leave the cloister behind and to breathe a freer atmosphere. The scholastic mysticism was, for the most part, practical and psychological in character. It was largely a devotional aid to the realization of present union with God; and, so far as it was theoretical, it was a theory of the faculties by which such a union is attainable. But in Eckhart the attitude of the churchman and traditionalist is entirely abandoned. His system enables him to give a profound significance to the doctrines

of the Church; but, instead of the system being accommodated to the doctrines, the doctrines—and especially the historical facts—acquire a new sense in the system, and often become only a mythical representation of speculative truth.

The political circumstances of Germany in the first half of the 14th century were in the last degree disastrous. The war between the rival emperors, Frederick of Austria and Louis of Bavaria, and the interdict under which the latter was placed in 1324 inflicted extreme misery upon the unhappy people. From some places the interdict was not removed for twenty-six years. Men's minds were pained and disquieted by the conflict of duties and the absence of spiritual consolation. The country was also visited by a succession of famines and floods, and in 1348 the Black Death swept over Europe like a terrible scourge. In the midst of these unhappy surroundings religion became more inward in men of real piety and the desire grew among them to draw closer the bonds that united them to one another. Thus arose the society of the Friends of God (*Gottesfreunde*) in the south and west of Germany, spreading as far as Switzerland on the one side and the Netherlands on the other. They formed no exclusive sect. They often took opposite sides in politics and they also differed in the type of their religious life; but they uniformly desired to strengthen one another in living intercourse with God. Among them chiefly the followers of Eckhart were to be found. Such were Heinrich Suso of Constance (1295–1366) and Johann Tauler of Strasbourg (1300–1361), the two most celebrated of his immediate disciples. It was doubtless one of the Friends who sent forth anonymously from the house of the Teutonic Order in Frankfort the famous handbook of mystical devotion called *Eine deutsche Theologie*, first published in 1516 by Luther.

Jan van Ruysbroeck (1294–1381), the father of mysticism in the Netherlands, stood in connexion with the Friends of God, and Tauler is said to have visited him in his seclusion at Groenendal near Brussels. He was decisively influenced by Eckhart, though there is noticeable occasionally a shrinking back from some of Eckhart's phraseology. Ruysbroeck's mysticism is more of a practical than a speculative cast. He is chiefly occupied with the means whereby the *unio mystica* is to be attained, whereas Eckhart dwells on the union as an ever-present fact, and dilates on its metaphysical implications. Towards the end of Ruysbroeck's life, in 1378, he was visited by the fervid lay-preacher Gerhard Groot (1340–1384), who was so impressed by the life of the community at Groenendal that he conceived the idea of founding a Christian brotherhood, bound by no monastic vows, but living together in simplicity and piety with all things in common, after the apostolic pattern. This was the origin of the Brethren of the Common Lot (or Common Life). The first house of the Brethren was founded at Deventer by Gerhard Groot and his youthful friend Florentius Radewyn; and here Thomas à Kempis (*q.v.*) received his training. Similar brother-houses soon sprang up in different places throughout the Low Countries and Westphalia, and even Saxony.

Mysticism and the Reformation.—It has been customary for Protestant writers to represent the mystics of Germany and Holland as precursors of the Reformation. In a sense this is true. But it would be false to say that these men protested against the doctrines of the Church in the way the Reformers felt themselves called upon to do. There is no sign that Tauler, for example, or Ruysbroeck, or Thomas à Kempis had felt the dogmatic teaching of the Church jar in any single point upon their religious consciousness. Nevertheless, mysticism did prepare men in a very real way for a break with the traditional system. Mysticism instinctively recedes from formulas that have become stereotyped and mechanical. On the other hand its claim for spiritual freedom was soon to be found in opposition also to the Reformers.

The wild doctrines of Thomas Münzer and the Zwickau prophets, merging eventually into the excesses of the Peasants' War and the doings of the Anabaptists in Münster, first roused Luther to the dangerous possibilities of mysticism as a disintegrating force. He was also called upon to do battle for his principle against men like Caspar Schwenkfeld (1490–1561) and Sebastian Franck (1500–1545), the latter of whom developed a system of pantheistic mysticism, and went so far in his opposition to the letter as to declare the whole of the historical element in Scripture to be but a mythical representation of eternal truth. Valentin Weigel (1533–1588), who stands under manifold obligations to Franck, represents also the influence of the semi-mystical speculation that marked the transition from scholasticism to modern times. The final breakdown of scholasticism as a rationalized system of dogma may be seen in Nicolas (or Nicolaus) of Cusa (1401–1464), who insists that all real apprehension of God is by way of a "knowledge above knowledge." The influence of later mediaeval mysticism is seen in Jacob Boehme (1575–1624).

Other Forms of Mysticism.—Mysticism did not cease within the Catholic Church at the Reformation. In St. Theresa (1515–1582) and John of the Cross the counter-reformation can boast of saints second to none in the calendar for the austerity of their mortifications and the rapture of the visions to which they were admitted. But, as was to be expected, their mysticism moves in that comparatively narrow round, and consists simply in the heaping up of these sensuous experiences. The speculative character has entirely faded out of it, or rather has been crushed out by the tightness with which the directors of the Roman Church now held the reins of discipline. The gloom and harshness of these Spanish mystics are absent from the tender, contemplative spirit of François de Sales (1567–1622); and in the quietism of Mme. Guyon (1648–1717) and Miguel de Molinos (1627–1696) there is again a sufficient implication of mystical doctrine to rouse the suspicion of the ecclesiastical authorities.

In the 17th century mysticism is represented in the philosophical field by the so-called Cambridge Platonists, and especially by Henry More (1614–1687), in whom the influence of the Kabbalah is combined with a species of Christianized Neoplatonism. Pierre Poiret (1646–1719), an ardent student of Tauler and Thomas à Kempis, exhibits a violent reaction against the mechanical philosophy of Descartes, and especially against its consequences in Spinoza. The first influence of Boehme was in the direction of an obscure religious mysticism. J. G. Gichtel (1638–1710), the first editor of his complete works, became the founder of a sect called the Angel-Brethren. All Boehme's works were translated into English in the time of the Commonwealth, and regular societies of Boehmenists were formed in England and Holland. Later in the century he was much studied by the members of the Philadelphian Society, John Pordage, Thomas Bromley, Jane Lead, and others. The mysticism of William Law (1686–1761) and of Louis Claude de Saint Martin in France (1743–1803), who were also students of Boehme, is of a much more elevated and spiritual type. The "Cherubic Wanderer," and other poems, of Johann Scheffler (1624–1677), known as Angelus Silesius, are more closely related in style and thought to Eckhart than to Boehme.

The religiosity of the Quakers, with their doctrines of the "inner light" and the influence of the Spirit, has decided affinities with mysticism; and the autobiography of George Fox (1624–1691), the founder of the sect, proceeds throughout on the assumption of supernatural guidance. Stripped of its definitely miraculous character, the doctrine of the inner light may be regarded as the familiar mystical protest against formalism, liberalism, and scripture-worship. Swedenborg, though selected by Emerson in his *Representative Men* as the typical mystic, belongs rather to the history of spiritualism than to that of mysticism as understood in this article. He possesses the cool temperament of the man of science rather than the fervid Godward aspiration of the mystic proper; and the speculative impulse which lies at the root of this form of thought is almost entirely absent from his writings. Accordingly, his supernatural revelations resemble a course of lessons in celestial geography more than a description of the beatific vision.

Analysis.—The term mysticism is often extended by popular usage and philosophical partisanship to the whole activity of the German idealistic thinkers who followed Kant; but this looseness of phraseology only serves to blur important distinctions. However absolute a philosopher's idealism may be, he is erroneously styled a mystic if he moves towards his conclusions only by the

patient labour of the reason. Hegel therefore, to take an instance, can no more fitly be classed as a mystic than Spinoza can. It would be much nearer the truth to take both as types of a thoroughgoing rationalism. In either case it is of course open to anyone to maintain that the apparent completeness of synthesis really rests on the subtle intrusion of elements of feeling into the rational process. But in that case it might be difficult to find a systematic philosopher who would escape the charge of mysticism; and it is better to remain by long-established and serviceable distinctions.

So, again, when Récéjac defines mysticism as "the tendency to draw near to the Absolute in moral union by symbolic means," the definition, as developed by him, is one which would apply to the philosophy of Kant. Récéjac's interesting work, *Les Fondements de la connaissance mystique* (Eng. trans. 1899), though it touches mysticism at various points, and quotes from mystic writers, is in fact a protest against the limitations of experience to the data of the senses and the pure reason to the exclusion of the moral consciousness and the deliverances of "the heart." But such a position is not describable as mysticism in any recognized sense. On the other hand, the term is in place where the movement of revulsion from a mechanical philosophy takes the form rather of immediate assertion than of reasoned demonstration, and where the writers, after insisting generally on the spiritual basis of phenomena, either leave the position without further definition or expressly declare that the ultimate problems of philosophy cannot be reduced to articulate formulas. Examples of this are men like Novalis, Carlyle and Emerson, in whom philosophy may be said to be impatient of its own task.

Modern Studies.—Study of the subject may be said to begin with Dean Inge's Bampton Lectures on Christian Mysticism (1899). It has since been pursued along the parallel routes of psychology, history and philosophy of religion, with the result that the claim of mysticism to be regarded as a genuine form of human experience is justified. These aspects of mysticism cannot rigidly be separated, or indeed understood in isolation, each being of vital importance to the rest.

William James, in his epoch-making Gifford Lectures on *The Varieties of Religious Experience* (1902), originated the serious study of mysticism, especially from the psychological point of view, and attempted to discover its relation to other forms of consciousness. Although based on material chosen from too restricted a field, the publication of this book revolutionised the attitude of students towards religious psychology. The conception of the subconscious was now first used to provide an explanation and sanction for the ecstatic and other abnormal phenomena found in connection with mysticism, and an attempt was made to distinguish the accompaniments of genuine religious apprehension from their pathological imitations.

These researches have continued vigorously, especially in America and France. Pratt's *Religious Consciousness* (1921) represents the matured result of the movement started by James. Considerable advance has been made towards the correlation and better understanding of such types as the prophet, visionary and religious revivalist, in all of whom a strong mystical impulse is commonly at work. The hostile study of mysticism from the psychological standpoint has its chief exponent in J. H. Leuba, and to some extent in the work of experimental psychologists such as P. Janet, whilst an approach midway between the philosophical and psychological is provided by Bucke's *Cosmic Consciousness*, a curious work which has exercised considerable influence. Delacroix's sympathetic but penetrating analyses of the evolution of the great mystics have shed much light on the psychological characteristics of religious genius. Valuable studies of the nature of mystical contemplation, and restatement in modern terms of its processes, have been produced by Roman Catholic scholars, the best being those of Père Poulain, S.J.

Influence of Psychology.—The psychological study of mystical phenomena has illuminated many historical problems, especially those connected with prophecy and the origins of religious movements. The treatment of the subject in such works as Heiler's *Das Gebet* and *Der Katholizismus* or Brémond's monumental *Histoire du Sentiment religieux en France,* is symptomatic of the changed outlook. Material available for students of historical mysticism has been much enriched. Good texts and translations of many masterpieces of European mysticism have appeared, with valuable studies such as those of Abbot Butler and Rufus Jones, based on the historical method.

The changed outlook of physical science, the new understanding of its limitations and the marked revolt from 19th-century materialism, have brought about a *rapprochement* between mysticism and philosophy. Inge's *Philosophy of Plotinus* (1918) and Otto's widely discussed essay *Das Heilige* (The Idea of the Holy, 1924) show different aspects of the reaction of philosophy to mysticism. But this is also felt in the pure metaphysics of Wittgenstein, and in the inimical attitude of Croce and his school. The greatest and ultimately most influential expositions of the place of mysticism in theistic philosophy, and its limitations and rightful relation with other aspects of knowledge, are Von Hügel's *Mystical Element of Religion* and *Eternal Life*. These books have affected all modern religious thinkers, and may provide the starting-point of a critical realism harmonising the mystical, moral and intellectual approaches to reality. In America, Hocking's *Meaning of God in Human Experience* is probably the most important philosophic contribution to this subject.

Modern Practical Mysticism.—The first quarter of the 20th century saw, especially in France, a revival of genuine Christian mysticism; possibly the beginning of what later historians may recognise as a "mystical epoch." Its most impressive document is the *Spiritual Journal* of the lady known as Lucie-Christine (1844–1908), a record which bears comparison with the historical classics of mysticism. Its most striking product is the career of the hermit saint of the Sahara, Charles de Foucauld (1858–1916). These stand out among a number of more obscure personalities, such as Elizabeth de la Trinité (1880–1906) and Madeleine Sémer (1874–1921), all of whom claim and describe with a conviction and sobriety compelling respect the characteristic mystical experience and certitude. From India, the autobiography of the saintly Hindu theist Maharshi Devendranath Tagore (1817–1905), and the experiences of the Christian convert Sadhu Sundar Singh (born 1889), whose career and personality have made a widespread impression, provide unspoilt examples of first-hand mysticism, and deepen the sense of unity in the spiritual intuitions.

The revived interest in mysticism has had popular results in several directions. It has seemed to endorse the shallow eclecticism in which many escape the difficulties of belief. Its superficial peculiarities have been exploited by theosophists and other apostles of eccentric religiosity. It has produced numerous bastard cults, mostly hailing from America though often wearing Oriental disguise; cults mainly compounded of pantheism, quietism and crude autosuggestion, and offering a "mystical religion" to those seeking a spiritual home full of modern conveniences and devoid of discipline. On the other hand, its spirit has affected for good the literature and activity of the organised Churches; shifting the emphasis from tradition to experience, and bringing back into focus those mysterious realities which religious symbols and institutions seek to express.

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schichte der Deutschen Mystik (1874–93). *See* also articles on the greater mystical writers named. (A. S. P.-P.; E. Un.; X.)

MYTH AND RITUAL. The fundamental association of myth with ritual emerges clearly in the view of Robertson Smith, that in all antique religions mythology takes the place of dogma. He thought that mythology was no essential part of ancient religion for it had no sacred sanction and no binding force on the worshippers. Belief in myths was not obligatory as a part of true religion. He argued that, from the outset, ritual and practical usage were strictly speaking, the sum total of ancient religions. Political institutions are older than political theories and in like manner religious institutions are older than religious theories. Dr. Cook (*Religion of the Semites*, 3rd Edn. 1927) points out that myth and ritual often act upon each other. Some, he thinks, are based upon misunderstandings, are explanations of explanations, are the product of the more intelligent and sophisticated individuals, or have been purified of earlier crudities, while fancy and imagination have transformed them. While myths are specifically of personal interest, in general they appeal to the different types of mind in mixed communities. The views of Robertson Smith have assumed a more precise shape in the argument of Professor Radcliffe Brown that "it is necessary to take into account the explanations given by the natives themselves. Although these explanations are not of the same kind as the scientific explanations that are the objects of research, yet they are of great importance as data. Like the civilized man of Western Europe, the savage of the Andamans seeks to rationalise his behaviour; being impelled to certain actions by mental dispositions of whose origin and real nature he is unaware, he seeks to formulate reasons for his conduct, or even if he does not when left to himself, he is compelled to when the enquiring ethnologist attacks him with questions. Such a reason as is produced by this process of rationalisation is rarely, if ever, identical with the psychological cause of the action that it justifies, yet it will nearly always help us in our search for the cause. At any rate, the reason given as explaining the action is so intimately connected with the action itself that we cannot regard any hypothesis as to the meaning of a custom as being satisfactory unless it explains, not only the custom, but also the reasons that the natives give for following it. . . . Tales that might seem merely the products of a somewhat childish fancy are very far indeed from being merely fanciful and are the means by which the Andamanese express and systematise their fundamental notions of life and nature and the sentiments attaching to these notions." (A. R. Brown, *Andaman Islanders*, pp. 234 and 330, 1922.)

The process of symbolic thought is of important reference to and criticism of the interpretation of "the beliefs of savages as being the result of attempts to *understand* natural facts such as dreams, death, birth, etc. Such writers assume that the savage is impelled by the same motive that so strongly dominates themselves, the desire to understand—scientific curiosity, and that such beliefs as animism or totemism are in the nature of scientific hypothesis, invented to explain the facts of dreaming and of death on the one hand, and of conception and birth on the other. If this view of the nature of primitive thought were correct it would be impossible to conceive how such inconsistencies as those that were met with among the Andamanese could be permitted. On the view that the myths of primitive society are merely the result of an endeavour to express certain ways of thinking and feeling about the facts of life which are brought into existence by the manner in which life is regulated in society, the presence of such inconsistencies need not in the least surprise us, for the myths satisfactorily fulfil their function, not by any appeal to the reasoning powers but by appealing, through the imagination, to the mind's affective dispositions." (A. R. Brown, *The Andaman Islanders*, 1922, p. 397.)

Malinowski insists that "the function of myth, briefly, is to strengthen tradition and endow it with a greater value and prestige by tracing it back to a nigher, better, more supernatural reality of ancient events." From myth spring the epic romance and tragedy. Myth, therefore, touches the deepest desires of man—his fears, his hopes, his passions, his sentiments as it validates the social order, justifies the existing social scheme and ranges from expressions of sheer artistry to legalism. (*Myth in Primitive Psychology*, 1927.)

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MYTHOLOGY, the science which examines μῦθοι, myths or legends of cosmogony and of gods and heroes. Mythology is also used as a term for these legends themselves. Thus when we speak of "the mythology of Greece" we mean the whole body of Greek divine and heroic and cosmogonic legends. When we speak of the "science of mythology" we refer to the various attempts which have been made to explain these ancient narratives. Very early indeed in the history of human thought men awoke to the consciousness that their religious stories were much in want of explanation. The myths of civilized peoples, as of the Aryans of India and the Greeks, contain two elements, the rational and what to modern minds seems the irrational. The rational myths are those which represent the gods as beautiful and wise. The real difficulties of mythology spring from the irrational element, which to modern minds appears senseless or repellent.

Classical mythology is discussed under Greek Religion; Roman Religion and such articles as Odysseus; Theseus; Orpheus. For other mythology consult Animism; Totemism; Lycanthropy; Metempsychosis and similar articles; *see* Religion, Articles on.

MYXINE, a genus of hag-fishes, containing a single species, *M. glutinosa* of the north Atlantic. (*See* Hagfish; Cyclostomata.)

MYXOEDEMA, the medical term for a constitutional disease (*see* Metabolic Diseases) due to the degeneration of the thyroid gland, and occurring in adults; cretinism is essentially the same condition appearing in early childhood. There are two forms, myxoedema proper and operative myxoedema (*cachexia strumipriva*). (1) Myxoedema has been termed "Gull's Disease" from Sir William Gull's observations in 1873. Women are more often the victims than men, in a ratio of six to one. It frequently affects members of the same family and may be transmitted through the mother; it has been observed sometimes to follow exophthalmic goitre. The symptoms are a marked increase in bulk and weight of the body, puffy appearance of skin which does not pit on pressure, the line of the features becoming obliterated and getting coarse and broad, the lips thick and nostrils enlarged, with loss of hair, subnormal temperature and marked mental changes. There is striking slowness of thought and action, the memory becomes defective, and the patient becomes irritable and suspicious. In some instances the condition progresses to that of dementia. The thyroid gland itself is diminished in size, and may become completely atrophied and converted into a fibrous mass. The untreated disease is progressive, but the course is slow and the symptoms may extend over 12 to 15 years, death from asthenia or tuberculosis being the most frequent ending. (2) Symptoms similar to the above may follow complete removal of the thyroid gland. Kocher of Berne found that, in the total removal of the gland by operation, out of 408 cases operative myxoedema occurred in 69, but it is thought that if a small portion of the gland is left, or if accessory glands are present, these symptoms will not develop. The treatment of myxoedema, like that of cretinism, is by administration of thyroid extract. (*See* Animal Extracts.)

N In all known alphabets the letter N has stood in close connection with M, the particular form of one being generally reflected in the other. Semitic 𐤍 (*nun*) and Greek Ν (*nu*) are its predecessors. In the inscriptions from Thera the form was consistently Ν. Other forms were ⋀ from Corinth and N in the Ionic alphabet of Abu-Simbel. In the Lydian alphabet the form was 𐤍. Etruscan has sometimes the curious form ⋔ corresponding to its five-stroked Μ (M). In the Italic alphabets the form of the letter followed that of M, being found in Umbrian as ⋀, in Oscan as ⋂ and in Faliscan as ⋀. The Latin forms were N and ⋂.

The minuscule cursive form of the 6th century was 𝔑, probably accounted for by the writing of the letter without taking the pen from the paper commencing at the top of the left-hand

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	B.C. 1,200	𐤍
CRETAN	1,100-900	𐤍
THERAEAN	700-600	𐤍
ARCHAIC LATIN	700-500	Ν
ATTIC	600	𐤍
CORINTHIAN	600	𐤍
CHALCIDIAN	600	Ν
IONIC	403	𐤍
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	Ν
URBAN ROMAN		N
FALISCAN		⋀
OSCAN		⋂ N
UMBRIAN		⋂ ⋀
CLASSICAL LATIN AND ONWARDS		N

DEVELOPMENT OF THE LETTER "N" FROM THE EARLIEST TIMES TO THE PRESENT DAY

vertical stroke. This would cause the oblique stroke to rise from left to right instead of being downward in direction. The Carolingian hand developed the rounded minuscule form 𝔫. From this derives the modern minuscule.

The sound that the letter has represented throughout its history is the dental nasal, the nasals being of all sounds the least liable to change. (B. F. C. A.)

NABATAEANS, a people of ancient Arabia, whose settlements gave the name of Nabatene to the border-land between Syria and Arabia from the Euphrates to the Red sea. The history of the Nabataeans cannot be carried back beyond 312 B.C., at which date they were attacked without success by Antigonus I. (*Cyclops*) in their mountain fortress of Petra.

The Nabataeans were Arabs—as their proper names show—who came under Aramaic influence. They wrote a letter to Antigonus "in Syriac letters," and Aramaic continued to be the language of their coins and inscriptions when the tribe grew into a kingdom, and profited by the decay of the Seleucids to extend its borders northward over the more fertile country east of the Jordan. They occupied Haurān, and about 85 B.C. their king Aretas (Ḥārīthath) became lord of Damascus and Coele-Syria. Allies of the first Hasmonaeans in their struggles against the Greeks (i. Macc. v. 25, ix. 35; 2 Macc. v. 8), they became the rivals of the Judaean dynasty in the period of its splendour, and a chief element in the disorders which invited Pompey's intervention in Palestine. The Roman arms were not very successful, and King Aretas retained his whole possessions, including Damascus, as a Roman vassal. (*cf.* 2 Cor. xi. 32). As "allies" of the Romans the Nabataeans continued to flourish throughout the first Christian century. Their power extended far into Arabia, particularly along the Red sea; and Petra was a meeting-place of many nations, though its commerce was diminished by the rise of the Eastern trade-route from Myoshormus to Coptos on the Nile. A sober, acquisitive, orderly people, wholly intent on trade and agriculture (Strabo, xvi. 4), they might have long been a bulwark between Rome and the wild hordes of the desert but for the short-sighted cupidity of Trajan, who reduced Petra and broke up the Nabataean nationality (A.D. 105). (*See* SEMITIC LANGUAGES.) (W. R. S.; S. A. C.)

NABBES, THOMAS (b. 1605), English dramatist, was born in humble circumstances in Worcestershire. He entered Exeter College, Oxford, in 1621, but left the university without taking a degree, and about 1630 began a career in London as a dramatist.

Nabbes's plays were collected in 1639; and *Microcosmus* was printed in Dodsley's *Old Plays* (1744). All his works, with the exception of his continuation of Knolles's history, were reprinted by A. H. Bullen in his *Old English Plays* (second series, 1887). *See* also F. G. Fleay, *Biog. Chron. of the English Drama* (1891).

NABHA, an Indian State, within the Punjab. Area 928 sq.m. Pop. (1921) 263,334. Its territories are scattered; one section with twelve separate tracts, lies among the territories of Patiala and Jind, in the East and South of the Punjab; the other section is in the extreme South-East. Nabha is one of the Sikh states, founded by a member of the Phulkian family, which established its independence about 1763. In 1807–1808, the raja obtained British protection against threatened encroachments of Ranjit Singh. During the Mutiny in 1857 the raja showed distinguished loyalty, and was rewarded by grants of territory to the value of over £10,000. The State also did good service during the World War. It was in 1929 under the administration of a Council of Regency, the chief being a minor. The estimated gross revenue is £190,000.

The town of Nabha, founded in 1755, has a station on the North-Western railway. Pop. (1921) 14,750.

NÁBIGHA DHUBYÁNÍ [Ziyād ibn Mu'awīyya] (6th and 7th centuries), Arabian poet, was one of the last pre-Islamic poets.

He lived at the courts of Hira and Ghassān. In Hira he remained under Mondhir (Mundhir) III., and his successor. After a sojourn at the court of Ghassān, he returned to Hira under Nu'mān. He was compelled to flee to Ghassān, but returned again about 600. About 605 he withdrew to his own tribe. The date of his death is uncertain. He wrote mainly eulogies and satires concerned with the strife of Hira and Ghassān, and of the Bani Abs and the Bani Dhubyān. He is one of the six pre-Islamic poets whose poems were collected before the middle of the 2nd century of Islam.

His poems have been edited by W. Ahlwardt in the *Diwans of the six ancient Arabic Poets* (London, 1870), and separately by H. Derenbourg (Paris, 1869, a reprint from the *Journal asiatique* for 1868). (G. W. T.)

NABIS, tyrant of Sparta, seized the throne after Sparta's heavy defeat by the Achaean League in 207 B.C. He seems to have put into practice the "four points" of the revolutionary programme of the day, abolition of debt, division of land, confiscation of personal property and liberation of slaves, though he does not appear to have tackled the Helot problem very completely. Whether he was the monster of cruelty represented by Polybius it is difficult to say. No revolutionary leader gets fair play from contemporary historians as a rule, and few revolutionary leaders can afford very gentle measures. In any case, he carried out more thoroughly the aims of Agis and Cleomenes, and extended his system to Argos, which was put into his hands by Philip V. in 198. The Achaeans under Philopoemen first attacked him in 201, and defeated him at Scotitas. Later in 195 B.C. after the conclusion of the war with Philip the Romans under Flamininus turned their attention to the affairs of Greece. The League was unanimous for war against Nabis, and Flamininus duly undertook it. Nabis organized a vigorous defence, and raised an army of 10,000 from Sparta with the help of the enfranchised Helots. After some desultory fighting and a good deal of negotiation, Nabis obtained peace at the price of losing Argos and some harbours, and the internal affairs of Sparta were left undisturbed. As soon as the Romans had gone Nabis was embroiled with the Achaeans again. He was eventually murdered by some Aetolian auxiliaries, and Philopoemen ruthlessly suppressed one of the few whole-hearted attempts at social revolution in Greek history.

See Plutarch, *Philopoemen;* Polyb. xiii.–xx.; Paus. iv. viii.; Liv. 31–35; W. W. Tarn, in *The Hellenistic Age* (Cambridge, 1923), and *Hellenistic Civilization* (1927).

NABOB, a corruption of word *nawab,* a native Indian ruler. In the 18th century, it was sarcastically applied to Anglo-Indians who returned with fortunes from the East.

NABUA, a municipality (with administration centre and 20 *barrios* or districts) in the extreme south of the province of Camarines Sur, Luzon, Philippine Islands, on the Bikol river, a short distance north of Lake Bato. Pop. (1918) 19,314. It is connected with the provincial capital, Naga, by road to Iriga and thence by railroad. Nabua is the centre of an agricultural district which produces rice, corn, sugar and pepper. In 1918, it had 538 household industry establishments with output valued at 127,400 pesos. The language spoken is Bikol.

NACHTIGAL, GUSTAV (1834–1885), German explorer in Central Africa, son of a Lutheran pastor, was born at Eichstedt in the Mark of Brandenburg, on Feb. 23, 1834. After studying medicine at the universities of Halle, Würzburg and Greifswald he practised for some years as a military surgeon. He went to Algiers and Tunis in search of health, and took part, as a surgeon, in several expeditions into the interior. The king of Prussia sent him on a mission to the sultan of Bornu in 1869. He visited Tibesti and Borku, regions of the central Sahara then unknown to Europeans. From Bornu he went to Bagirmi, and, proceeding by way of Wadai and Kordofan, arrived at Khartum in the winter of 1874. His journey, graphically described in his *Sahara und Sudan* (3 vols., 1879–89), placed the intrepid explorer in the front rank of discoverers. Nachtigal was consul-general for the German empire at Tunis until 1884, when he was sent by Bismarck to West Africa as special commissioner, ostensibly to enquire into the condition of German commerce, but really to annex territories to the German flag. As the result of his mission Togoland and Cameroon were added to the German empire. On his return voyage he died at sea off Cape Palmas on April 20, 1885.

Nachtigal's travels are summarized in *Gustav Nachtigal's Reisen in der Sahara und im Sudan,* by Dr. Albert Frankel (Leipzig, 1887).

NADEN, CONSTANCE CAROLINE WOODHILL (1858–1889), English author, was born at Edgbaston, Birmingham, on Jan. 24, 1858, her father being an architect. In 1881 she published *Songs and Sonnets of Springtime;* in 1887, *A Modern Apostle, and other Poems.* W. E. Gladstone included her, in an article in the *Speaker,* among the foremost English poetesses of the day. She died on Dec. 23, 1889. After 1876 she had paid increasing attention to philosophy, with her friend Dr. Robert Lewins, and the two had formulated a system of their own, which they called "Hylo-Idealism." Her main ideas on the subject are contained in a posthumous volume of her essays (*Induction and Deduction,* 1890), edited by Dr. Lewins.

NADIA, a district of British India, in the Presidency division of Bengal. Area, 2,778 sq.m.; pop. (1921), 1,487,572. Standing at the head of the Gangetic delta, Nadia is an alluvial plain, the level of which has been raised by deposits of silt, so that it is subject to inundation only in years of high flood. Along the north-eastern boundary flows the main stream of the Ganges or Padma, of which the remaining rivers of the district are offshoots. The Bhagirathi on the eastern border, and the Jalangi and the Matabhanga meandering through the centre of the district, are the chief of those offshoots, called distinctively the "Nadia rivers." In former times the Nadia rivers afforded a regular means of communication between the Ganges and the seaboard; but the levels of the river beds have risen and, except in the rains, the rivers have diminished into shallow streams. The land no longer receiving a fertilizing deposit of silt, the productiveness of the soil has been reduced; this, with obstructed drainage and consequent epidemics of fever, has caused a gradual loss of population. Rice is the staple crop; but the district is not as a whole fertile, the soil being sandy. The manufacture of molasses from the juice of date palms is the principal industry.

The headquarters of the district are at Krishnagar (pop. 22,309), which contains the residence of the Maharajah of Nadia and a Government college; a local industry is the moulding of clay figures, which display considerable art. The battlefield of Plassey is situated in this district.

NADIA or NABADWIP was formerly situated on the east bank of the Bhagirathi, which has since changed its course. Pop. (1921), 15,584. It is celebrated for its capture by the Mohammedans at the end of the 12th century, for the sanctity and learning of its pundits, and as the birthplace of Chaitanya, the Vaishnava reformer of the 16th century. Its Sanskrit schools, called *tols,* are well known and of ancient foundation.

NADIR, a term used in astronomy for the point in the heavens exactly opposite to the zenith, the zenith and nadir being the two poles of the horizon. (Arabic *naḍir,* "opposite to," used elliptically for *naḍir-es-semt,* "opposite to the zenith.") It is thus used figuratively of the lowest point in a career.

NAEGELI, KARL WILHELM VON (1817–1891), Swiss botanist, was born on March 26, 1817, near Zürich. He studied botany under A. P. de Candolle at Geneva, graduated at Zürich in 1840, then devoted himself to the microscopical study of plants. Soon after graduation he became *Privatdozent* and subsequently professor extraordinary, in the University of Zürich. He was later called to fill the chair of botany in the universities of Freiburg (1852), and Munich (1858), where he died on May 10, 1891.

Naegeli made many important and varied discoveries. He extended Robert Brown's discovery of the nucleus to the principal families of Cryptogams and asserted that it is present in all plants. He investigated the "mucous layer" (*Schleimschicht*) in cells and showed this to be the living matter of the cell. This discovery was made independently and at the same time by Hugo von Nohl (1805–1872), who called the living substance "protoplasm." Naegeli also investigated the mode of growth in a large number of plants belonging to the algae, mosses, liverworts and angiosperms. He discovered the spermatozoids and antheridia of ferns. He also wrote papers on the anatomy of vascular plants

and on the structure, development and various forms of starch grains. In his last book he introduced the idea of a substance which he called "idioplasm" as the definite material basis of heredity.

Among his more important contributions to science were a series of papers in the *Zeitschrift für wissenschaftliche Botanik* (1844–46); *Die neuern Algensysteme* (1847); *Gattungen einzelliger Algen* (1849); *Pflanzenphysiologische Untersuchungen* (1855–58), with C. E. Cramer; *Beiträge zur wissenschaftlichen Botanik* (1858–68); a number of papers contributed to the Royal Bavarian academy of sciences, forming three volumes of *Botanische Mitteilungen* (1861–81); and, finally, his volume, *Mechanisch-physiologische Theorie der Abstammungslehre*, published in 1884.

More detailed accounts of Naegeli's life and work are to be found in *Nature*, Oct. 16, 1891, and in *Proc. Roy. Soc.*, vol. li.

NAEVIUS, GNAEUS (*c.* 264–? 194 B.C.), Latin epic poet and dramatist. From a phrase in Gellius (i. 24. 1.) it has been inferred that he was born in a colony in Campania, but it seems just as probable that he was a Roman citizen. He served in the First Punic War. His career as a dramatic author began with the exhibition of a drama in or about the year 235, and continued for 30 years. Towards the close he incurred the hostility of some of the nobility, especially, it is said, of the Metelli, by the attacks which he made upon them on the stage, and at their instance he was imprisoned (Plautus, *Mil. Glor.* 211). After writing two plays during his imprisonment, in which he is said to have apologized for his former rudeness (Gellius iii. 3. 15), he was liberated through the interference of the tribunes of the commons; but he had shortly afterwards to retire from Rome (in or about 204) to Utica. His epic may have been written during his exile. Probably his latest composition was the epitaph already referred to, written like the epic in Saturnian verse:—

"Immortales mortales si foret fas flere,
Flerent divae Camenae Naevium poetam;
Itaque postquam est Orci traditus thesauro
Obliti sunt Romai loquier lingua Latina"[1]

Like Livius, Naevius professed to adapt Greek tragedies and comedies to the Roman stage. Among the titles of his tragedies are *Aegisthus, Lycurgus, Andromache* or *Hector Proficiscens, Equus Trojanus*, the last named being performed at the opening of Pompey's theatre (55). But he also produced at least two specimens of the *fabula praetexta* (national drama) one founded on the childhood of Romulus and Remus (*Lupus* or *Alimonium Romuli et Remi*), the other called *Clastidium*, which celebrated the victory of M. Claudius Marcellus over the Celts (222). But it was as a writer of comedy that he was most famous. He is placed in the canon of the grammarian Volcacius Sedigitus third (immediately after Caecilius and Plautus) in the rank of Roman comic authors. He is there characterized as ardent and impetuous in character and style. He is also appealed to as a master of his art in one of the prologues of Terence. His comedy, like that of Plautus, seems to have been rather a free adaptation of his originals than a rude copy of them, as those of Livius probably were, while the titles of most of them, like those of Plautus, are Latin. He used the stage, as it had been used at Athens, as a political arena, and his sympathies are strongly popular and anti-Senatorial. Among the few lines still remaining from his lost comedies, we seem to recognize the idiomatic force and rapidity of movement characteristic of the style of Plautus. There is also found that love of alliteration which is a marked feature in all the older Latin poets. In one considerable comic fragment attributed to him—the description of a coquette—there is great truth and shrewdness of observation. But we find no trace of the exuberant comic power and geniality of his great contemporary.

He was not only the oldest native dramatist, but the first author of an epic poem (*Bellum Punicum*)—which, by combining the representation of actual contemporary history with a mythical background, may be said to have created the Roman type of epic poetry. The earlier part of it treated of the mythical adventures of Aeneas, and the later part of the events of the First Punic War in the style of a metrical chronicle. This poem is the first appearance in Roman literature of the belief in the foundation of Rome by Aeneas. The few remaining fragments produce the impression of vivid and rapid narrative, to which the flow of the native Saturnian verse, in contradistinction to the weighty and complex structure of the hexameter, was naturally adapted.

[1] "If it were permitted that immortals should weep for mortals, the divine Camenae would weep for Naevius the poet; for since he hath passed into the treasure-house of death men have forgotten at Rome how to speak in the Latin tongue."

Fragments (dramas) in L. Müller, *Livi Andronici et Cn. Naevi Fabularum Reliquiae* (1885), and (*Bellum Punicum*) in his edition of Ennius (1884); monographs by E. Klussmann (1843); M. J. Berchem (1861); D. de Moor (1877); F. Marx, *Naevius* (Leipzig, 1911); Mommsen, *History of Rome*, bk. iii., ch. 14. On Virgil's indebtedness to Naevius and Ennius, *see* V. Crivellari, *Quae praecipue hausit Vergilius ex Naevio et Ennio* (1889).

NAEVUS, in medicine, a non-malignant tumour composed of newly-formed blood channels. Three varieties, capillary, venous, and arterial, are described, but the walls of the blood channels differ widely in their microscopic appearances from the corresponding normal vessels. The capillary naevus consists of tortuous small channels, often with relatively thick walls; it may be slightly raised above the surface of the skin (and then bleeds readily on slight injury) or flat and purple in colour, when it constitutes the "port-wine stain" or "mother's mark." The venous naevus consists of large irregular channels with very thin walls and is usually found in the subcutaneous tissue or the liver. Capillary and venous naevi are common on the face and may extend in size rapidly. The arterial naevus is rare; it pulsates and the channels may be emptied by pressure. Most naevi are so small as to call for no special treatment; if they take on growth or are initially so large as to cause disfigurement they may be treated by electro-puncture or by application of radium or carbonic-acid snow. The object desired is coagulation of the contained blood and replacement of the tumour by scar tissue. In the case of a large naevus, especially if venous, treatment may take weeks but great cosmetic improvement is usually possible.

NAGA, a municipality (with administration centre and 15 *barrios* or districts), capital of the province of Camarines Sur, Luzon, Philippine Islands, a short distance south of San Miguel bay, on the Bikol river and on the railway leading from Manila into Albay province. It lies in a fertile agricultural region and can be reached by small steamers from Manila via the Bikol river. Pop. (1918), 9,396. In 1918 it had 19 manufacturing establishments with output valued at 192,400 pesos; and 22 household industry establishments with output valued at 10,300 pesos. Of the eight schools, six were public. The language spoken is Bikol. Juan de Salcedo had reached this vicinity as early as 1573, and shortly afterwards, by order of Gov. Francisco de Sande, a Spanish town called Nueva Cáceres was founded on the site of the native town of Naga, and became the capital of the old province of Camarines. In 1919, the united province was divided into Camarines Norte and Camarines Sur, Naga becoming the capital of the latter.

NAGA HILLS, a district of British India in the Surma Valley and Hill Districts division of Assam. It forms part of the mountainous borderland lying between the Brahmaputra valley and Upper Burma. Area, 3,115 sq.m.; pop. (1921) 160,960. The whole country forms a wild expanse of forest, mountain and stream: Japvo (9,890 ft.), south of Kohima, is the highest mountain in Assam. Coal is known to exist in many localities, as well as iron ore and petroleum; a coal mine is worked by the Nazira Coal Company. The administrative headquarters of the district are at Kohima, at which is stationed a battalion of the Assam Rifles. When the British first came into contact with them, the Nagas were blood thirsty savages with a passion for head-hunting. The necessity of protecting British subjects from their ferocious raids led to punitive expeditions and the gradual occupation of the hills. A frontier district was first formed in 1866; the twelfth and last expedition came to a successful issue in 1880, after which it was decided that the Naga Hills should be administered as British territory. In 1904 some territory of the eastern Angamis, the most warlike tribe, was annexed, and during the operations of 1917–19 against the Kukis of Manipur a further tract was occupied, bringing the boundary up to Burma, north of Manipur. Since 1880 the Nagas have given no serious trouble and have been pacified and to some extent civilized. (X.)

The Nagas.—This name is used for a group of tribes inhabiting the northern part of the hills dividing Assam from Burma. Within the group are tribes of mixed origin, varying cultures, and very different physique and appearance, but having enough in common to make it generally possible to say, within the area indicated, whether a given tribe is Naga (as distinct from Kachin, Kuki, Kachari, etc.) or not.

Every sort of political organization is found from the autocracy of tabued chiefs (Konyak tribes) though gerontocracy (Ao tribe) to purest democracy (Angami tribe). Socially patrilineal exogamy is everywhere the rule, but there are indications of the pre-existence of matrilineal and perhaps totemistic systems and of leviritical polyandry. Dual organization (*q.v.*) is found and communal houses for the unmarried. Some tribes (*e.g.*, Sema, Chang) practice polygyny; monogamy is more common, divorce being easy and frequent. Inheritance of land always passes in the male line.

Agriculture is practised by all tribes, some growing rice on elaborately built up and irrigated terraces (Angami, Tangkhul), others growing it dry, and others using millet, *Coix lachryma* or taro as the staple crop, with maize, sorghum, yams and sago as subsidiary. Millet is often grown on dry terraces among pollarded alders; cotton is grown, cattle are kept and numbers of mithun (*bos frontalis*), which has generally but not everywhere displaced the buffalo. Dogs are reared for food (*see* CYNOTHERAPY) as well as hunting. Fishing is practised, particularly with the use of intoxicants which kill or incapacitate the fish. Manufactures and the arts include weaving (on simple tension looms), dyeing, pot-making, blacksmith's work and rough wood-carving. Material culture shows many links with Indonesia and Melanesia, and the northern tribes make huge wooden xylophones, membraneless "drums" often suggestive of dug-out canoes with carved figure-heads, which are beaten to raise an alarm or celebrate important events. The prevailing weapon is the throwing-spear, but cross-bows are used by some tribes, also guns. Music and dancing are most highly developed in the southern tribes, but are everywhere popular. The languages, which belong to the Tibeto-Burmese family, are diverse and excessively numerous, nearly every village having its own dialect. All dialects are tonal and agglutinative.

See Mills, *The Ao Nagas* (1926, bibl.). (J. H. H.)

NAGASAKI, a town on the south-west of the island of Kyushu, Japan, in 32° 44′ N., 129° 51′ E., with 189,071 (1925) inhabitants. The first port of entry for ships coming from the south or the west to Japan, it lies at the head of a beautiful inlet some 3 m. long, which forms a splendid anchorage, and is largely used by ships coming to coal and by warships. Marine products, coal and cotton goods are the chief exports, and raw cotton, iron, as well as other metals and materials used for shipbuilding, constitute the principal imports. The most important industries of the town are represented by the engine works of Aka-no-ura, three large docks and a patent slip, the property of the Mitsubishi Company. Nagasaki is a noted shipbuilding port and coaling station. The coal is obtained chiefly from Takashima, an islet 8 m. S.E. of the entrance to the harbour, and in lesser quantities from two other islets, Naka-no-shima and Ha-shima, which lie about 1 m. farther out.

Nagasaki owed its earliest importance to foreign intercourse. Originally called Fukae-no-ura (Fukae Bay), it was included in the fief of Nagasaki Kotaro in the 12th century, and from him it took its name. But it remained an insignificant village until the 16th century, when, becoming the headquarters of Japanese Christianity, and subsequently the sole emporium of foreign trade in the hands of the Dutch and the Chinese, it developed considerable prosperity. The opening of the port of Moji (*q.v.*) for export trade deprived Nagasaki of its monopoly as a coaling station.

NAGAUR, a town in India, in Jodhpur state of Rajputana. Pop. (1921) 10,227. Nagaur is surrounded by a wall more than 4 m. in circuit. It has given its name to a famous breed of cattle.

NAGINA, a town of British India, in Bijnor district of the United Provinces, 48 m. N.W. of Moradabad. Pop. (1921) 18,736. There is considerable trade in sugar, besides manufactures of guns, glassware (especially bottles for the use of pilgrims carrying the sacred water of the Ganges from Hardwar) and ebony wares.

NAGOYA, the capital of the province of Owari, Japan, on the great trunk railway of Japan, 235 m. from Tokyo and 94 m. from Kioto. Pop. (1925), 768,558. It is the third of the chief cities in Japan. It lies near the head of the shallow Isenumi bay, about 30 m. from the port of Yokkaichi, with which it communicates by light-draught steamers and by rail. The castle of Nagoya, erected in 1610, never suffered in war, but in modern times became a military depôt; the interior contains much splendid decoration. The religious buildings of Nagoya include a very fine Buddhist temple, Higashi Hongwanji. Nagoya is one of the great seats of the pottery trade; 13½ m. distant are the potteries of Seto, where the first glazed pottery made in Japan was produced by Kato Shirozaemon, after a visit to China in 1229. Cotton mills have been established, and an extensive business is carried on in the embroidery of handkerchiefs. Another of its celebrated manufactures is *arimatsushibori*, or textile fabrics (silk or cotton), dyed so as to show spots in relief from which the colour radiates. It was the birthplace of *cloisonné* enamelling in Japan.

NAGPUR, a city, district and division of British India in the Central Provinces, of which it is the capital. The old capital of the Bhonsla dynasty has expanded out of all recognition between 1852, when it came under British rule, and the present day. Its population, 84,000 in 1872, had expanded to 145,193 at the census of 1921. From being the terminus of a branch line it has become an important railway centre, nearly half way between Bombay and Calcutta and on the new north and south railway route between Madras and Delhi. It is also connected by a 2 ft. 6 in. gauge railway with Chindwara and Chanda. It is the commercial, as well as the administrative capital of the Province and the centre of education, being the seat of the university and the headquarters of both the Anglican and Roman Catholic dioceses and of important Protestant missions.

The whole area is dominated by the hill and fort of Sitabaldi, overlooking the civil station on the west, the city proper on the east and north, and the suburbs of Sitabaldi and Craddock Town to the south. This hill is the scene of the famous battle of Nov. 1817 where a small British force of less than 1,500 strong repulsed the Mahratta army of 20,000. The only regular troops in Nagpur now are those stationed in this fort, but it is the headquarters of the auxiliary force. Besides the mills, there is an important hand-weaving industry carried on by Koshtis, producing fine fabrics and silk-bordered cloths. There is also a large community of Momins or Mohammedan weavers.

The DISTRICT OF NAGPUR has an area of 3,834 square miles and a population of 792,521 (1921) as compared with 630,346 in 1872. It contains in all 12 towns and is situated on an extension of the Berar plain eastwards of the Wardha river. In the western portion Deccan trap overlies sandstone formation. In the eastern portion the sandstone is broken up by granite and the juxtaposition of these formations, which meet at Sitabaldi, makes the geology of the district interesting. In the north and north-east there are valuable deposits of manganese ore which are worked by three large companies and several individual concessionaires. The sacred hill of Ramtek in the north-east, with its gleaming white temples, is a landmark for miles around. The drainage of the east is to the Wainganga in Bhandara, and of the west to the Wunna and Wardha rivers. The plain is broken up in the west by ranges of flat-topped hills, but there are many plains, fertile valleys and pockets of rich land.

Agriculture is varied, Kunbis being the great cultivating Mahratta caste, but Raghvis and Kirars, immigrants from Upper India, are also excellent cultivators. To the west the cropping is mainly cotton and *juar*, in the centre and south wheat, linseed, and pulses are the chief staples. On the north-east and south-east there is a considerable area of rice. There are fine betel leaf plantations and the district is famous for its orange gardens. Government forests cover 500 square miles, mostly concentrated in the reserves along the Pench river on the north, but isolated blocks of not much value are scattered over the rest of the district.

NAGYKANIZSA (nŏd'ĭ-kăn-ĭts'ah), a town of west Hungary, county Zala, a railway junction and agricultural market town. It has large flour-mills, distilleries, breweries and vegetable-preserving works, manufactures bricks and trades in cereals and cattle. It was once a powerful fortress, important during the attacks of the Turks who held it 1600–90. Pop. (1920) 30,037.

NAGYSZOMBAT: *see* TRNAVA.

NAHUATL. The Nahua or Nahuatl language was that spoken in and about Anahuac—the high valley of Mexico. It forms, with Shoshonean and Piman, the Uto-Aztecan speech family. The centre of the Nahuan peoples was on the south-east end of the great central mesa of Mexico, where the Toltecs were the most important prehistoric and the Aztecs the best known historic representatives. Nahuan groups also extended southward into Morelos and Guerrero, eastward along the coast to Colima, and northward again into Jalisco, where they abutted on Piman-Sonoran peoples. Except at this point, the related Piman and Nahuan groups were not in contact, but were separated by the alien Tarasca and Otomi. South-east of Mexico and Puebla, the Atlantic lowlands from Vera Cruz to Tabasco were Nahuan; here were the Olmecs and others, north of the Zapotec and Mixe-Zoque, and bordering in the east on Mayan peoples. The Nahua territory is continuous thus far. Beyond, there were detached areas in Chiapas, Guatemala, San Salvador, Nicaragua, and even Panama. These represented dispersal migrations, some early, some later. Nahuan speech seems to have been fairly uniform, but was further standardized to the dominant Aztec by Spanish influence. It is still the mother tongue of over half a million Mexican Indians, while probably as many more, and many whites, are partially acquainted with it. Through the Toltecs and Aztecs, the Nahuan peoples share with the Maya the distinction of having been the bearers of highest culture in aboriginal America.

NAHUM (Hebrew for "rich in comfort [is God]"), an Old Testament Prophet. Of the Prophet himself, all that is known is the statement of the title that he was an Alkoshite. But the locality denoted by the designation is quite uncertain. The original heading of Nahum's prophecy is contained in the second part of the superscription: "(the book of) the vision of Nahum the Alkoshite." The first part ("Oracle concerning Nineveh") is a late editorial insertion, but correctly describes the main contents of the little book.

Contents.—Chapters i. and ii. The prophecy against Nineveh in its present form really begins with chapter ii. 1, followed immediately by v. 3, and readily falls into three parts, viz. (*a*) ii. 1, 3–10; (*b*) ii. 11–13; and (*c*) iii. Here (*a*) describes the assault on Nineveh. The city is mentioned by name in ii. 8 (9 Heb. text), its capture and sack; (*b*) contains an oracle of Yahweh directed against the king of Assyria; (*c*) again gives a vivid picture of war and desolation which are to overtake and humiliate Nineveh, as they have already overtaken No-Amon (*i.e.*, Egyptian Thebes, vv. 8–10). The absence of distinctly religious motive is remarkable.

Chapter i. forms the exordium of the prophecy of doom against Nineveh. Its tone is exalted, and a fine picture is given of Yahweh appearing in judgment: The effects of the divine anger on the physical universe are forcibly described (vv. 3–6); on the other hand, God cares for those "that put their trust in Him" (v. 7), but overwhelms His enemies (vv. 8–12*a*). In the following verses (12*b*–15) the joyful news is conveyed to Judah of the fall of the oppressor.

Regarding Chapter i. and ii. 2 (=i. and ii. 1, 3, Heb. Text) there has been much discussion in recent years. It was long ago noticed that traces of an alphabetic acrostic survive in this section of the book. In vv. 12*b*, 13 and (certainly) v. 15 (=ii. 1 Heb.) Judah appears to be addressed. The text of i. 1–15, ii. 1–2 has been reconstructed by H. Gunkel and G. Bickell so as to form a complete alphabetic psalm with contents of an eschatological character, and is regarded by them as a later addition to the book. It is generally held by scholars that i. 1–8, 13, 15, and ii. 3 certainly do not proceed from Nahum (i. 9–12 may, however, belong to the prophet). No satisfactory solution has been reached.

Date.—The date of the composition of Nahum's prophecy must lie between 612, when Nineveh was captured and destroyed by the Babylonians and Medes, and the capture of Thebes (No-Amon), which is alluded to in iii. 8–10, in 663 B.C. On the whole a date somewhat near 612 is more probable. The poetry of the book is of a high order.

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(G. H. B.)

NAIADS, in Greek mythology the nymphs of wells, mountains and the sea, taking their name from the sphere of nature they represented. *See* NYMPH.

NAIDU, SAROJINI (1879–), Indian poet and feminist leader, eldest child of Dr. Aghorenath Chattopadhyay, a noted Bengali Brahman educationist and principal of the Nizam's college, Hyderabad, was born there on Feb. 13, 1879. Passing the matriculation examination of the Madras university at 12 she began writing English verse in her early teens. Sent to England in 1895 she studied at King's college, London, and Girton college, Cambridge. Her first volume of verse, "The Golden Threshold," was sponsored by Arthur Symons, and the second, "The Bird of Time," by Edmund Gosse. "The Broken Wing" followed. These volumes have been translated into most of the Indian vernaculars and some into Continental languages, while portions of her verse have been set to music. Her marriage in 1898 to Dr. M. G. Naidu, a Rajput in the Nizam's service, caused some sensation and resentment in orthodox Hindu circles. Her address at the all-India Social Conference at Calcutta in 1905 marked the beginning of an active career as a most eloquent speaker on social and political questions, and as a leader in the women's movement in India. She gained the enthusiastic admiration of Indian students by her sympathy with their outlook and her power of thrilling presentation. She had some share in the militant women's suffrage movement in England before the World War, and this experience tended in later years to draw her to Gandhi's non-cooperation movement. A tour in South Africa in 1924, on behalf of the Indian settlers there, deepened her strong criticism of British rule in her own land. In 1925 she was the first Indian woman to preside over the annual Indian National Congress at Cawnpore. Her acute mental equipment was linked with a certain attractive mischievousness, but her eloquence was inspired and deepened by a strong burning patriotism. In 1928 she visited England and America, to lecture upon Indian affairs. (F. H. BR.)

NAIK or **NAYAK,** from a Sanskrit word meaning a leader, a title used in India in various senses. In the army it denotes a rank corresponding to that of corporal, and Hyder Ali of Mysore was proud of being called Haidar Naik, analogous to "le petit caporal" for Napoleon. It was also the title of the petty dynasties that arose in S. India on the downfall of the Hindu empire of Vijayanagar in the 16th century.

NAIL MANUFACTURE. Iron nails were commonly in use during the Roman occupation of Britain, large numbers having been found in places where they were wrought by the Romans. There is a striking similarity between the forged Roman nail (fig.1) and the type of nail which is manufactured at the present time. The forging of nails was an industry of some importance in Great Britain up to the end of the 17th century, and only gave way before the advent of machinery and the cut and machine-headed nail. During the year 1927, 20,000 tons of wire nails were manufactured in Great Britain, whilst another 60,000 tons were imported.

Wire Nails.—The use of wire for nail making has completely revolutionized the method of manufacture; nails of this description are made so cheaply that they can be bought at almost the same price as the wire from which they are made.

Cut nails (fig.1) are formed by being sheared out of plates or strips of iron, no other work being required to form the head. Wedge-shaped nails, sheared out of strip, with no definite head, are also sometimes used for fastening down flooring boards, etc., as in this form they do not damage the timber where the thick end enters. Cut nails with a central head (fig.1) are also sheared

out of plate and at the same time passed continuously through machinery which forms the head.

Of nails manufactured in the cold state out of wire, in one large works alone no fewer than 300 different kinds, varying in section of wire, length, diameter, size and shape of head, point, etc., may be manufactured. Some of these shapes are shown in the accompanying figure (fig. 1): (*a*) and (*f*) show two different sizes of bright oval nails; (*b*) is the ordinary round wire nail; (*c*) is a round nail with a diamond head; (*d*) a round-headed nail made from square wire; (*e*) a rose-headed nail; (*g*) a tram nail; (*h*) a roofing nail; (*i*) is a special form of brad-head nail containing a centre punch mark which enables it to be driven by a centre punch beneath the surface of wood without damage to the wood; (*j*) and (*l*) are clout-headed nails; (*k*) is a short stiff nail with a strong head.

A screw nail (fig. 1) has also been invented which rotates as it is driven or forced into wood whether by hand or machine power. It is claimed that this nail drives more easily, has increased holding power, and in consequence of the screw cutting action does not split the wood whilst being driven in. This type of nail is extensively used as a heel pin for boots on account of its holding power. It is made from wire which is specially manufactured for the purpose, a screwed helix being formed on the surface of the wire as it passes along from the swift to the block, the nail being formed from this wire in the same way as for the ordinary nail.

One of the heaviest nails made both by heading and pointing in the cold state is the dog spike (fig. 1), used to hold down light tram rails. In the manufacture of heavy wire nails the pressure engendered to form the heads and points in the cold state is very great, and the machine must be of a corresponding strength. In the action of forming the point and head of the nail, the hammer or heading tool moves back with the nail as it is pushed forward to its required length, the side cutters then closing up on the wire to cut if off and to form a diamond point. Whilst this cutting is taking place the wire is very firmly gripped as will be seen by the "cording" marks or ribs at the neck of the nail.

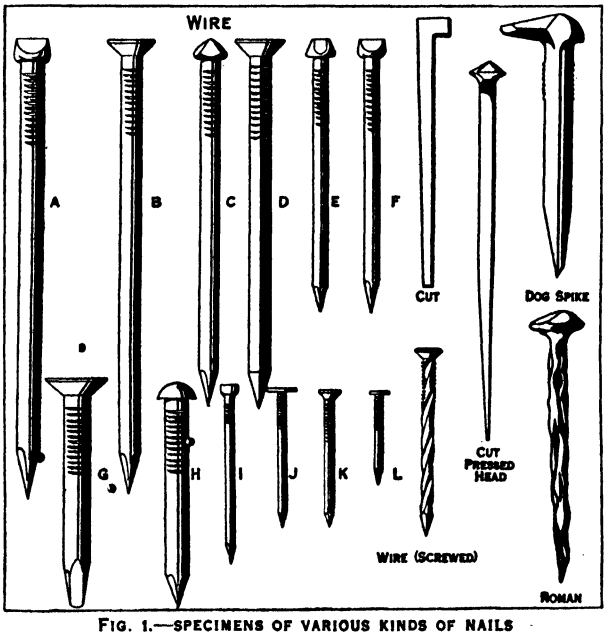

FIG. 1.—SPECIMENS OF VARIOUS KINDS OF NAILS
(A) Large oval, (B) common round, (C) round diamond, (D) square wire, (E) rose-headed, (F) small oval, (G) tramway, (H) roofing, (I) brad head, (J) clout head, (K) stiff strong head, (L) small clout head

Nails are made so rapidly that the movements can hardly be observed by the human eye, small nails being made at the rate of about 400 per minute. After they are formed they are collected and automatically conveyed to barrelling or tumbling machines in which they are shaken together for a period of 20 minutes to an hour. This process not only polishes the nails but trims off any rough points. After the polishing the machines are emptied, the nails being automatically fed into bags or drums for despatch.

Staples.—As staples are a form of nail, their manufacture is usually carried on with that of nails. They are made both from bright and galvanized wire, and in all kinds of sizes. The three different forms of points on staples are illustrated (fig. 2), the names themselves indicating the difference in the style of point. The term "presser point" simply means that the point is so sharp and fine that the staple can be stuck into the wood by simple pressure previous to being hammered down.

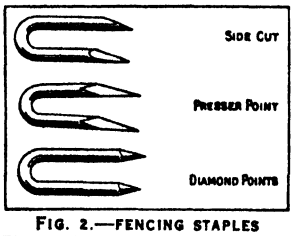

FIG. 2.—FENCING STAPLES
The points are selected according to the kinds of wood used

The several types of machines used in the making of staples follow the same principle as in the making of the straight nail, the wire being automatically fed forward from the swift, and the operation of cutting and pointing being immediately followed by the bending of the wire into its required shape to form the staple.

(E. A. A.)

NAIL VIOLIN, a musical curiosity invented by Johann Wilde, a musician in the imperial orchestra at St. Petersburg. It consisted of a wooden soundboard about 1½ft. long and 1ft. wide, bent into a semicircle. In this soundboard were fixed a number of iron or brass nails of different lengths, tuned to give a chromatic scale, and the sound was produced by friction with a strong bow, strung with black horsehair.

NAINI TAL, a town and district of British India, in the Kumaon division of the United Provinces. The town is 6,400 ft. above sea-level. Pop. (1921) 10,392. Naini Tal is a popular sanatorium for the residents in the plains, and the summer headquarters of the government of the province. It is situated on a lake, surrounded by high mountains, and is subject to landslides; a serious catastrophe of this kind occurred in September 1880. There are several European schools, besides barracks and convalescent depôt for European soldiers.

The DISTRICT OF NAINI TAL comprises the lower hills of Kumaon and the adjoining Tarai or submontane strip. Area, 2,721 sq.m. Pop. (1921) 276,875. The district includes the Gagar and other foothills of the Himalayas, which reach an extreme height of nearly 9,000 ft. The Bhabar tract at their base consists of boulders from the mountains, among which the hill streams are swallowed up. Forests cover vast tracts of the hill-country and the Bhabar. Beyond this is the Tarai, moist and extremely unhealthy. Here the principal crops are rice and wheat. In the hills a small amount of tea is grown, and a considerable quantity of fruit.

NAINSOOK, a light and fine cotton fabric of the plain calico weave, and of texture similar to that of lawn and cambric. It is usually bleached and sometimes striped and checked and finished with a very soft feel for use as lingerie and underwear.

NAIRN, county town of Nairnshire, Scotland, on the Moray Firth, at the mouth of the Nairn, 15¼ m. N.E. of Inverness by L.M.S.R. Pop. (1921) 4,474. The town, though of great age, shows no signs of this. It attracts many summer visitors by its good sea-bathing and golf-course. Salmon and deep-sea fishing are carried on. There is a good harbour with breakwater and pier. Nairn, originally called Invernarne (the mouth of the Nairn), was made a royal burgh by Alexander I. (d. 1124); but his charter having been lost, was confirmed by James VI. in 1589.

NAIRNE, CAROLINA, BARONESS (1766–1845), Scottish song writer, was born in the "auld hoose" of Gask, Perthshire, on Aug. 16, 1766. She was descended from an old family settled in Perthshire in the 13th century, and could boast of kinship with the royal race of Scotland. Her father, Laurence Oliphant, was one of the foremost supporters of the Jacobite cause, and she was named Carolina in memory of Prince Charles Edward. In 1806 she married W. M. Nairne, who became Baron Nairne in the year 1824. She brought out a collection of national airs set to appropriate words. To this collection, *The Scottish Minstrel* (1821–24), she contributed a large number of original

songs, adopting the signature "B. B."—"Mrs. Bogan of Bogan." The music was edited by R. A. Smith. She died at Gask on Oct. 26, 1845.

Among her most famous songs are: "The Laird o' Cockpen," "The Fife Laird," "John Tod," "Charlie is my darling," "Caller Herrin' " and the "Land o' the Leal." For vivacity, genuine pathos and bright wit her songs are surpassed only by those of Burns.

For Lady Nairne's songs, see *Lays from Strathearn, arranged with Symphonies and Accompaniments for the Pianoforte by Finlay Dun* (1846); vol. i. of the *Modern Scottish Minstrel* (1857); *Life and Songs of the Baroness Nairne, with a Memoir and Poems of Caroline Oliphant the Younger*, edited by Charles Rogers (1869, new ed. 1886). *See* also T. L. Kington-Oliphant, *Jacobite Lairds of Gask* (1870).

NAIRNSHIRE, a north-eastern county of Scotland, bounded west and south by Inverness-shire, east by Elginshire and north by the Moray Firth. It has an area of 104,252 ac. and a coast line of 9 m., and is the fourth smallest county in Scotland. The seaboard, which is skirted by sandbanks dangerous to navigation, is lined by low dunes extending into Elginshire. Traces of old marine terraces are seen at elevations of 100, 50 and 25 ft. above present sea-level. Parallel with the coast there is a deposit of blown sand and gravel about 90 ft. high stretching inland for 4 or 5 m. This and the undulating plain behind are a continuation westward of the fertile Laigh of Moray. The lowland rocks are Old Red Sandstone, widely covered with glacial deposits consisting of lower and upper boulder clays, with later gravels forming ridges on the moorland between the rivers Findhorn and Nairn. From this region southward the land rises rapidly to the confines of Inverness-shire, where the chief heights occur. This higher land consists of the eastern, Dalriadan, or younger Highland schists, with associated granite masses. Several of the border hills exceed 2,000 ft. in elevation. The only rivers of importance are the Findhorn and the Nairn, both rising in Inverness-shire. The Findhorn after it leaves that county takes a mainly north-easterly direction down Strathdearn for 17 m. and enters the sea to the north of Forres in Elginshire after a total course of 70 m. The Nairn, shortly after issuing from Strathnairn, flows towards the north-east for 12 m. out of its complete course of 38 m. and falls into the Moray Firth at the county town. There are eight lochs, all small: that of Clans contains crannogs, or ancient lake-dwellings. Nairnshire contains many beautiful woods and much picturesque scenery.

Industries.—The soil of the alluvial plain, or Laigh, is light and porous and careful cultivation has rendered it very fertile; and there is some rich land on the Findhorn. Although advanced methods of agriculture are in use, but a small proportion of the surface is capable of tillage, less than one quarter of the whole area being under crops. The hills are mostly covered with heath and pasture, suitable for sheep, and cattle are kept on the lower lying ground. A little sandstone quarrying and the sea and salmon fisheries of the Nairn are the only industries of the shire. The L.M.S. railway from Forres to Inverness crosses the north of the shire.

Population and Government.—The population numbered 8,790 in 1921. Nairn (pop. 4,474) is the county town and only royal burgh. Nairn and Moray shires combine to return one member to parliament. The shire forms a sheriffdom with Moray and a sheriff-substitute from Elgin sits also at Nairn.

History.—The country was originally peopled by the Gaelic or northern Picts. Stone circles believed to have been raised by them are found at several places, particularly in the valley of the Nairn. To the north of Dulsie Bridge is a monolith called the Princess Stone. Mote hills and stones with cup-markings are also common. Beyond the occasional finding of Roman coins, there is little evidence of effective Roman occupation. Columba and his successors made valiant efforts to Christianize the Picts, but it was long before their labours began to tell, although the saint's name was preserved late in the 19th century in the annual fair at Auldearn called "St. Colm's Market," while to his biographer Adamnan—corrupted into Evan or Wean—was dedicated the church at Cawdor, where an old Celtic bell also bears this name. By the dawn of the 10th century the Picts had been subdued with the help of the Norsemen, and Nairn, which was one of the districts colonized by the Scandinavians, as part of the ancient province of Moray, soon afterwards became an integral portion of the kingdom of Scotland. Hardmuir, between Brodie and Nairn, is the heath where Macbeth is reputed to have met the witches. Territorially Moray was greatly contracted in the reign of David I., and thenceforward the history of Nairn merges in the main in that of the bishopric and earldom of Moray. (*See* ELGIN.) The thane of Cawdor was constable of the king's castle at Nairn, and when the heritable sheriffdom was established towards the close of the 14th century this office was also filled by the thane of the time.

NAIROBI, the capital of Kenya Colony, British East Africa, 330 m. by railway from Mombasa. It is built on the Athi plains, at the foot of the Kikuyu hills and is 5,452 ft. above sea level. It commands magnificent views of Kilimanjaro and Mt. Kenya. Pop. (1927) 13,145, of whom 3,565 were Europeans and 8,052 Indians. Nairobi is the seat of the Kenya Legislature and the headquarters of most of the European organizations in the colony. Nearly all the whites are British, and the town has most of the amenities of a European city. Both the standard and the cost of living are high. Laid out on a large scale, Nairobi has many fine private and public buildings, though still in a transitional stage (1929). The main thoroughfares are Government road, where numbers of shops and offices are owned by Indians, and Sixth avenue. The churches include an Anglican cathedral. In Sixth avenue are a cenotaph to the European soldiers who fell in the World War and opposite it a striking memorial, three figures on a single base, to the African troops and carriers who fell in the war. The African memorial was erected in 1928. Parklands is a residential suburb for Europeans. A natural history museum, in Kirk road, was opened in 1922. The Indian bazaar covers nine acres. The natives occupy a separate location with some 20,000 inhabitants. A branch railway runs to the foot of Mt. Kenya, and from Nairobi there is a motor-road to the navigable Nile at Nimule or Rejaf. This is part of a motor road from Rhodesia to the Sudan (practicable in dry weather). Nairobi is governed by an elected municipality, with separate franchise rolls for Europeans and Indians.

The site of Nairobi was selected as the headquarters of the Uganda railway, and the first buildings were erected in 1899. For some time nearly all its inhabitants were railway officials and Indian coolies engaged in the construction of the line. In 1902 the surrounding highlands were found to be suitable for European settlement and Nairobi speedily grew in importance; in 1907 the headquarters of the administration were transferred to it from Mombasa. Nairobi had then 350 white inhabitants; in 20 years their number increased ten-fold. An ambitious town-planning scheme was adopted in 1927.

NAIVASHA, a lake, town and province, in Kenya colony. The lake, which is roughly circular with a diameter of some 13 m., lies 6,135 ft. high on the crest of the highest ridge in the eastern rift-valley between the Kikuyu escarpment (east) and the Mau escarpment (west). It is fed by the rivers Gilgal and Morendat which run in deep gullies, but has no known outlet. The water of the lake is fresh; the shore in many places is lined with papyrus. North and north-west the lake is closed in by the volcanic Buru hills; to the south towers the extinct volcano of Longonot. Hippopotami and otters frequent the lake, and on an island about 1 m. from the shore are large numbers of antelopes and other game. Naivasha was discovered in 1883 by Gustav Adolf Fischer (1848–86), and visited in the same year by Joseph Thomson, the Scottish explorer. The railway from Mombasa to Victoria Nyanza skirts the eastern side of the lake, and on the railway close to the lake is built the town of Naivasha, 6,230 ft. above the sea, 395 m. N. by rail from Mombasa. Naivasha province contains much land suitable for colonization by white men, and large areas have been leased to Europeans. The land is specially suitable for cattle and sheep rearing which is now in a very prosperous state.

NAIYADIS. The Naiyadis, or hunters, of Malabar are the dog-eaters and the lowest of the Hindu castes. Miserable specimens of humanity, they used to be excellent shots but the Arms

Act deprived them of their weapons and they now manufacture ropes, slings, mats and so on, with occasional cultivation. They have succession in the male line and adultery is abhorrent to them. Some have been converted to Christianity and others to Islam, the latter maintain themselves by begging from Mohammedans. Their chief priest, Muppon, is hereditary. He enquires into all matters affecting the community and can excommunicate a guilty person.

NAJARA, ISRAEL BEN MOSES, Hebrew poet, was born in Damascus and wrote in the latter part of the 16th century (1587–1599). He was inspired by the mystical school, and his poems are marked by their bold, sensuous images, as well as by a depth of feeling unequalled among the Jewish writers of his age. He often adapted his verses to Arabic and Turkish melodies. To tunes which had been associated with light and even ribald themes, Najara wedded words which reveal an intensity of religious emotion which often takes a form indistinguishable from love poetry. Some pietist contemporaries condemned his work for this reason; but this did not prevent many of his poems from attaining wide popularity and from winning their way into the prayer-book.

He published during his lifetime a collection of his poems, *Songs of Israel* (*Zemiroth Israel*), in Safed in 1587; an enlarged edition appeared in Venice (1599–1600). Others of his poems were published at various times, and W. Bacher has described some previously unknown poems of Najara (*Revue des études juives,* Nos. 116 *seq.*).

NAJIBABAD, a town of British India, in the Bijnor district of the United Provinces. Pop. (1921) 18,504. It was founded in the middle of the 18th century by a Rohilla chief, and still contains several architectural monuments of Rohilla magnificence. There is considerable trade in timber, sugar and grain, and manufactures of metal-ware, shoes, blankets and cotton cloth.

NAKHICHEVAN, an autonomous republic of Russian Transcaucasia created in 1921, and linked administratively with the Azerbaijan S.S.R., from which it is, however, separated by a strip of Armenian territory. It is bordered on the south and south-west by Persia and on the north and east by the Armenian S.S.R. Area 6,524 sq.km. Pop. (1926) 103,600. Though the republic is small, its relief is varied. In the south-west it consists of the valley on the left bank of the Araxes river, which here forms the boundary between Russia and Persia, and along the left bank of which goes the railway loop from Tiflis on the Black sea–Caspian line, which links Armenia and the south of Azerbaijan with Baku, and from which a branch line goes to Tabriz from Dzhulpha in the Nakhichevan republic. The republic thus forms a centre for trade between Russia and Persia. From the valley of the Araxes the Armenian or Transcaucasian plateau rises to a height of about 10,000 feet.

The industries of the region are mainly silk weaving, cotton cleaning and wine production. In 1926 of the 16 former silk factories in Ordubat only 6 were working. The numerous small cotton-cleaning enterprises were re-organised after the revolution into two large government factories which produce 16,000 tons of cotton per annum. The former brandy distilling industry has not revived. A jam factory is under construction at Ordubat which provides for an output of 800 tons per annum. Of the mineral wealth in the republic, salt, lead, sulphur, arsenic, copper, sulphur pyrites and coal, only salt is exploited. In 1926 about 37,000 tons of salt were produced as against 43,000 in 1913. Curative arsenical and sulphur springs have been known to the native shepherds for centuries.

The population consists chiefly of Armenians and Azerbaijan Turks, with some Russians in the towns of Nakhichevan (pop. 8,946) and Ordubat (pop. 3,665). The number of schools and teachers has markedly increased, and there are Turkish, Armenian and Russian schools, but many children still receive no education. Grants from the Central Government of the U.S.S.R. provided for the building of a school, hospital and electric station in the town of Nakhichevan, and a grant was also made for the repair and rebuilding of the small factories, and the irrigation canals, and the development of cotton, silk and salt production. The region was important at an early date because it lay on the route from Teheran and Tabriz to Caucasia. It was laid waste by the Persians in the 4th century, by the Seljuk Turks in the 11th century and by the Mongols in the 13th century. From that time until 1828, when by the peace of Turkman-chai it passed under Russian rule, it was frequently devastated during the wars between Persia, Armenia, Turkey and Russia. Its importance for trade and its great fertility helped it to recover after each of these disasters and after the more recent 1917–20 period of disorder and struggle.

NAKHICHEVAN, a Russian town, the administrative centre of the Nakhichevan S.S.R. in 39° 14′ N., 45° 24′ E., on the Kishchai river and at the terminus of a short line linking it with the railway that runs north of the Araxes river and which is being prolonged to Baku (1928). The town is on a spur of the Karabagh mountains at an altitude of 2,940 ft. Pop. (1926) 8,946, mainly Tatars and Armenians. It has an electric plant, motor-driven flour mills and a leather factory. A little to the south-east of it, a branch railway goes to Tabriz. An ancient site on the Tiflis to Tabriz and Teheran road, the town had much transit trade, especially in salt, between Persia and the north in pre-railway days. Armenian tradition claims Noah as its founder, and a mound of earth as his grave. Ptolemy mentions it as Naxuana. The Persians sacked the town in the 4th century and it did not revive until the 10th century. Alp Arslan, Sultan of the Seljuk Turks, captured it in 1064 and the Mongols raided it in the 13th century. From this period onwards it was a bone of contention between Persians, Armenians and Turks. By the peace of Turkman-chai in 1828 it became Russian. The present houses have for the most part been quarried from ancient ruins. A gateway with a Persian inscription and the 12th century Tower of the Khans remain.

NAKHICHEVAN-ON-THE-DON, a town of Russia in the North Caucasian Area on the right bank of the Don, in 47° 18′ N., 39° 45′ E., 6 m. N.E. of Rostov-on-Don. Pop. (1926) 71,321. It shares in the trading prosperity of the latter town, and has smelting, rope and cloth works. It was founded in 1780 by Armenian immigrants, and their descendants still form a large percentage of the population along the banks of the Don.

NAKSKOV, a seaport of Denmark, in the *amt* (county) of Maribo, on a wide bay of the Laalands belt at the west end of the island of Laaland, 31 m. by rail W. of Nykjøbing. Pop. (1925), 13,817. A great dike, extending south-east to Rødby (20 m.), protects the coast against inundation. Nakskov possesses a fine harbour and shipyards, and one of the largest sugar factories in Europe.

NAMAQUALAND, a region of south-western Africa, extending along the west coast over 600 m. from Damaraland (22° 43′ S.) on the north to 31° S., and stretching inland 80 to 350 miles. It is divided by the lower course of the Orange river into two portions—Little Namaqualand to the south and Great Namaqualand to the north. Little Namaqualand forms part of Cape Colony (*q.v.*), and Great Namaqualand is the southern portion of German South-West Africa (*q.v.*). The people of Namaqualand are the purest surviving type of Hottentots, and number some twenty to thirty thousand.

NAMASUDRA, "low Shudra," the largest caste in Eastern Bengal, India; the older Chandal now divided into several sub-castes. *En masse* it ranks low, but its agricultural sub-castes stand higher. Numbering 2,172,823 in 1921, it shows no tendency to decline.

NAME. The distinguishing appellation by which a person, place, thing or class of persons or things is known. (O.Eng. *nama;* the word is common to all Indo-European languages.)

(*a*). **Savage and Barbarian.**—To the savage, and in a lessening but still considerable degree, to the barbarian and the civilized man in his earlier stages, the name shares the essence of the personality. Therefore a savage has a personal name which is seldom or never pronounced, he being referred to in common parlance by some nick-name or by a term of relationship. Not infrequently, to avoid calling the attention of evil spirits to him a savage child is not named at all, being referred to simply as "the child," or he may be given some derogatory name, as "grub," "filth," to deceive hostile powers. Apart from this, we may often distinguish, firstly a birth-name. This is given by the

parents or by some relation, as a rule, and its choice is governed by various considerations. Thus, he may be named from some trifling incident at the time of birth, or from the state of affairs in the country at the time ("Famine" and "War" are known Basuto names); or he may be given a name signifying "child of such a one" (patronymic or matronymic); or frequently among peoples who believe in reincarnation, he may be named after some dead relative supposed to be reborn in him. Very often, at puberty, or on undergoing some ceremony of initiation, he is given a new name, which may be kept secret. Various ceremonies often attend the giving even of the childhood-name.

(*b*). **Civilized.**—Modern surnames include: those derived from a place-name, as Johnston (the *ton* or steading of John); these often occur among noble families, as Dumaresque (*de Mariscis*, "of the marshes"; a plebeian equivalent is Marsh); from an occupation, as Smith, Miller; nicknames, as Longfellow, Campbell ("crooked-lip"); and patronymics, as Dickenson (son of Dicken). The familiar Celtic names of the types Ap Rhys, Bowen (Ap Owain), O'Brian, MacFarlane, are of this kind, the surname proper being of later development among Celts than among Teutonic peoples.

Roman Names.—The earliest Italian and Roman names, consisted of a personal name (*praenomen*), as Marcus, followed by an adjective signifying the clan to which the person belonged (*nomen*), as Caecilius, "of the *gens Caecilia*." All the *praenomina* had originally a meaning, as Gaius, "joyful." It is stated by the author of the little work *de praenominibus* that boys were never given a *praenomen* till they came of age, girls until they married. The latter statement is certainly wrong, since a woman never officially had a *praenomen* at all; the former is contradicted by most of the available evidence. It is possible, however, that a boy's name was not officially given him until he took the *toga virilis* or garb of manhood. Later, a third name was added, originally a personal name or nick-name, as *Pulcher*, "handsome." This was called a *cognomen*, and often became a family name, *i.e.*, one common to all the direct descendants of its original bearer, who formed a section of the clan or *gens*. A man might have any number of these *cognomina*, as Publius Cornelius Scipio Aemilianus Africanus, where Scipio is the *cognomen* of the family into which the bearer had been adopted, Aemilianus an adjective formed from the name of his original clan, the *gens Aemilia*—this was a common, although not invariable, method of indicating adoption—and Africanus an officially bestowed title. (*See* also PLACE-NAMES.)

Law.—The Christian name, *i.e.*, the name given to a person on admission to baptism into the Christian Church, dates back to the early history of the Church. In England individuals were for long distinguished by Christian names only, and the surname (*see* below) or family name is still totally ignored by the Church. In process of time the use of surnames became universal, the only exceptions in England being the members of the royal family, who sign by their baptismal names only.

A clergyman of the Church of England is compelled to perform the ceremony of baptism when required by a parishioner, and to give whatever name or names the godparents select, but although the rubrics do not expressly say so he can object to any name on religious or moral grounds.

The freedom enjoyed in England and the United States as to the kind of Christian name which may be given to a child is somewhat limited in France and Germany. In France, by a decree of the 11 Germinal, an XI., the only names permitted to be recorded in the civil register as Christian names (*prénoms*) of children were those of saints in the calendar and the names of personages known in ancient history. Even at the present day an official list is issued (revised from time to time) containing a selection of forenames, and no name of a child will be registered unless it occurs in this list. A limitation more or less similar prevails in Germany and other European countries.

As regards the surname, custom has universally decreed that a man shall be known by the name of his father. But in England and in some of the United States this custom is not legally binding; there is no law preventing a man from taking whatever name he has a fancy for, nor are there any particular formalities required to be observed on the occasion of the adoption of a fresh surname. If a person adopts a new name and wishes to have it publicly notified and recognized in official circles, the method of procedure usually adopted is that by royal licence, which is subject to duty. If granted, the royal licence is given under the sign manual and privy seal of the sovereign, countersigned by the home secretary. Where there is a more formal adoption of a surname it is usual, for purposes of publicity and evidence, to advertise the change of name in the newspapers and to execute a deed poll setting out the change, and enrol the same in the central office of the supreme court. In America statutes in many States prescribe an application to a court of record as the method by which a person may change his name. A record of the change is thus certain to be made, but these statutes do not commonly deny an individual his common law right to change his name without resort to the courts.

Both in France and Germany official authorization must be obtained for any change of name. By the German Code 1900 (s. 12) if the right to a new name is disputed by another or his interest is injured thereby, the person entitled can compel the abandonment of the new name.

In England and the United States, a wife on marriage adopts the surname of her husband, disregarding entirely her maiden surname; in Scotland the practice usually is for the wife to retain her maiden surname for all legal purposes, adding the name of her husband as an alias. On remarriage the rule is for the wife to adopt the name of the new husband, but an exception to this is made in the case of a title acquired by marriage when the holder remarries a commoner. See in *Cowley* v. *Cowley*, 1901, A.C. 450.

In Spain and in her colonies a man takes the surname of his father, followed by the maiden surname of his mother, joined by "and" (*y*), but this conjunction is often omitted in some colonies.

Peers of Great Britain when signing their names use only their surnames or peerage designations. It is merely a privileged custom, which does not go back further than the Stuart period. Peeresses sign by their Christian names or initials followed by their peerage designation. Bishops sign by their initials followed by the name of the see. In Scotland it is very usual for landowners to affix to their names the designation of their lands, and this was expressly sanctioned by an act of 1672.

See *Ency. Eng. Law*, tits. "Christian Name," "Surname"; W. P. W. Phillimore, *Law and Practice of Change of Name* (1905); A. C. Fox-Davies and P. W. P. Carlyon Britton, *Law concerning Names and Changes of Name* (1906).

NAMPA, a city of Canyon county, Idaho, U.S.A., in the south-western part of the State, at an altitude of 2,492 ft., near the Snake river and 18 m. W. of Boise. It is on the Old Oregon Trail and the Oregon Short Line of the Union Pacific railway system. Pop. (1920) was 7,621—93% native white; 1928 local estimate over 11,000. Nampa is in the heart of an extensive and highly productive irrigated region, surrounded by grazing and timber lands, which in 1926 shipped 45,000 carloads (valued at $75,000,000) of apples, vegetables (including 1,088 cars of the enormous Idaho potatoes), certified seeds, honey, wool, hides, sheep, cattle, lumber and other produce of the fields, forests and hills. It is a division point on the Union Pacific and an icing station for fruit cars. The icing plant has a manufacturing capacity of 150 tons a day, and a "dock" from which 110 cars can be re-iced in 20 minutes. Among the other industrial establishments are meat, poultry, and fruit packing plants, creameries and condenseries, a chick hatchery, grain elevators, a pickle factory, flour mills, wood-working plants and factories making boxes, brooms and apiary supplies. Electric-power is available from plants on the Snake river. The State sanatorium for the feeble-minded is located here.

NAMUR, one of the nine provinces of Belgium, between Hainaut on one side and Liége and Luxembourg on the other, extends from Brabant up the Meuse to the French frontier. Area, 1,414 sq.m.; pop. (1925) 353,363 or 250 per sq.m. It is fertile north of the Meuse and forested in the south. There are a few iron and coal-mines between the Sambre and Meuse, and the quarries are

important. Arboriculture, especially fruit-tree plantation, is increasing. There are three arrondissements, Namur, Dinant and Philippeville, fifteen cantons and 366 communes.

NAMUR (Flemish, *Namen*), a town of Belgium, capital of the province of Namur. Pop. (1925) 31,164. The town lies on the left bank at the junction of the rivers Sambre and Meuse, while the rocky promontory forming the fork between them is crowned with the old citadel, which occupies the site of the old castle of the counts of Namur. This citadel is no longer used for military purposes, and its hill is converted into a park, while the crest is occupied by a hotel reached by a cogwheel railway. Namur is connected with the citadel by two bridges across the Sambre, and from the east side of the promontory there is a fine stone bridge to the suburb of Jambes. This bridge was constructed in the 11th century and rebuilt in the reign of Charles V. It is the only old bridge in existence over the Belgian Meuse. The cathedral of St. Aubain or Albin was built in the middle of the 18th century. The church of St. Loup is a century older, and is noticeable for its columns of red marble from the quarry at St. Rémy near Rochefort. There is a considerable local industry in cutlery, and there are tanneries and glassmaking factories.

In the feudal period Namur formed a marquisate in the Courtenay family. Jousts on stilts were a mediaeval custom that lasted into recent times here. Don John of Austria made Namur his headquarters in the Netherlands, and died here in 1578. Louis XIV. took it in 1692 and Vauban renewed the defences but William III. retook it in 1695, though the French held it again from 1702-12. In 1893, under the new scheme of Belgian defence, the citadel and its detached works were abandoned, and in their place nine outlying forts were constructed at a distance of from 3 to 5 m. Namur suffered considerably in the World war. (*See* BELGIUM, INVASION OF.)

NANAIMO, a city of British Columbia, on the east coast of Vancouver island. Pop. (with suburbs) (1921), 9,088. It is connected with Victoria by the Esquimalt and Nanaimo railway, and has a daily steamer service to Vancouver. It is in a fruit-farming, dairying and poultry raising district, and has a good harbour, carrying on a large trade in coal from the neighbouring mines, and in cured herrings, which are sent to the east. The industries include sawmills and wood-working shops, breweries, canneries, foundries, brickworks, etc.

NANA SAHIB, the common designation of Dandu Panth, an adopted son of the ex-peshwa of the Mahrattas, Baji Rao, who took a leading part in the great Indian Mutiny (*q.v.*) and was proclaimed peshwa by the mutineers. Nana Sahib had a grievance against the British Government because they refused to continue to him the pension of eight lakhs of rupees (£80,000) which was promised to Baji Rao by Sir John Malcolm on his surrender in 1818. This pension, however, was only intended to be a life grant to Baji Rao himself. For this refusal the Nana bore the British a lifelong grudge, which he washed out in the blood of women and children in the massacres at Cawnpore (*q.v.*). In 1859, when the remnants of the rebels disappeared into Nepal, the Nana was among the fugitives. His death was reported some time afterwards, but his real fate remains obscure.

NAN-CHANG, the capital of the province of Kiangsi, China, situated on the Kankiang, up which boats may come from Poyang lake. The population has been variously estimated at 300,000–500,000, and there is considerable commerce, chiefly in the agricultural products of the province, which include tea, rice, cotton, tobacco, hemp, etc. Some of the more northerly cereals are also grown and dealt in. Some manufactures are carried on.

NANCY, a town of north-eastern France, the capital formerly of the province of Lorraine, and now of the department of Meurthe-et-Moselle, 219 m. E. of Paris on the railway to Strasbourg. Pop. (1926) 108,439.

At the close of the 11th century Odelric of Nancy, brother of Gerard of Alsace, possessed at Nancy a castle which enabled him to defy the united assaults of the bishops of Metz and Treves and the count of Bar. In the 12th century the town was surrounded with walls, and became the capital of the dukes of Lorraine; and in 1477 Charles the Bold was defeated here by René II. (*See* SWISS WARS.) Refortified by Charles III., it was taken by the French in 1633. After the peace of Ryswick in 1697 it was restored to Duke Leopold. He founded academies, established manufactures and set about the construction of the new town. But it was reserved for Stanislas Leczinski, the last of the dukes of Lorraine, to make Nancy one of the palatial cities of Europe. The city, which became French in 1766, was occupied by the allies in 1814 and 1815, and put to ransom by the Prussians in 1870. After the Franco-German war the population was greatly increased by the immigration of Alsatians and of people from Metz and its district.

Although Nancy remained outside the area of actual fighting during the World War it was bombarded by German aeroplanes and long-range guns, but the damage was not very serious.

Nancy stands on the left bank of the Meurthe 6 m. above its junction with the Moselle and on the Marne-Rhine canal. The railway from Paris to Strasbourg skirts the city on the south-west side; other railways—to Metz, to Épinal by Mirecourt, to Château Salins—join the main line near Nancy, and make it an important junction. The town consists of two portions—the *Ville-Vieille* in the north-west, with narrow and winding streets, and the *Ville-Neuve* (16th–18th centuries) in the south-east with wide straight streets. Between the two lies the Place Stanislas, and on all sides rise imposing buildings of the 18th century—the town hall, episcopal palace, etc. A fine triumphal arch erected by Stanislas in honour of Louis XV. leads from the Place Stanislas to the Place Carrière, which forms a beautiful tree-planted promenade, containing at its further end the government palace (1760) now the residence of the general commanding the XX. army corps, and adjoins the so-called Pépinière (nursery) established by Stanislas.

The cathedral in the Ville-Neuve, built in the 18th century, has a wide façade flanked by two dome-surmounted towers. Of particular interest is the church of the Cordeliers, in the old town, built by René II. about 1482 to commemorate his victory over Charles the Bold. Pillaged during the Revolution period, but restored to religious uses in 1825, it contains the tombs of the counts of Vaudémont. Here also is a chapel built at the beginning of the 17th century to receive the tombs of the princes of the house of Lorraine. The church of St. Epvre, rebuilt between 1864 and 1874 on the site of an old church of the 13th, 14th and 15th centuries, has a fine spire and belfry and good stained glass windows. Of the old ducal palace, begun in the 15th century by Duke Raoul and completed by René II., there remains but a single wing, partly rebuilt after a fire in 1871. The entrance to this wing, which contains the archaeological museum of Lorraine, is Gothic of the early 16th century. One of the greatest treasures of the collection is the tapestry found in the tent of Charles the Bold after the battle of Nancy. Of the old gates of Nancy the most ancient and remarkable is the Porte de la Craffe (1463). The town hall contains a museum of painting and sculpture.

Nancy is the seat of a bishop, a prefect, a court of appeal and a court of assizes, headquarters of the XX. army corps, and centre of an *académie* (educational division) with a university comprising faculties of law, medicine, science and letters, and a higher school of pharmacy. There are also tribunals of first instance and of commerce, a board of trade-arbitrators, and a national school of forestry. The industries of Nancy include printing, brewing, cotton- and wool-spinning and the weaving of cotton and woollen goods, and the manufacture of tobacco (by the State), of boots and shoes, straw hats, pottery, casks, embroidery, machinery, motor cars and spare parts, engineering material, farm implements and iron goods.

NANDI, an East African tribe of mixed Nilotic, Bantu and Hamitic origin. With them are more or less closely allied the Lumbwa (correctly Kipsikis), Buret (or Puret) and Sotik (Soot) tribes, as well as the Elgonyi (properly Kony) of Mount Elgon. They have also affinities with the Masai. The Nandi-Lumbwa peoples inhabit the country stretching south from Mount Elgon to about 1° S. and bounded east by the escarpment of the eastern rift-valley and west by the territory of the tribes, such as the

Kavirondo, dwelling round the Victoria Nyanza. They have given their name to the Nandi plateau. They have a double administrative system, the chief medicine man or *Orkoiyot* being supreme chief and regulating war affairs, while representatives of the people, called *Kiruogik,* manage the ordinary affairs of the tribe.

The medicine men are of Masai origin and the office is hereditary. The young men form a separate warrior class to whom is entrusted the care of the country. A period of about 7½ years is spent in this class, and the ceremony of handing over the country from one "age" to the succeeding "age" is of great importance. (*See* AGE GRADES.) The arms of the warriors are a stabbing spear, shield, sword and club. Many also possess rifles. All the Nandi are divided into clans, each having its sacred animal or totem. They have no towns, each family living on the land it cultivates. The huts are of circular pattern. The Nandi believe in a supreme deity—Asis—who takes a benevolent interest in their welfare, and to whom prayers are addressed daily. Their language is Nilotic. The primitive hunting tribe known as the Wandorobo speak a dialect closely resembling Nandi.



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LUMBWA WARRIOR EQUIPPED TO SPEAR LIONS

See A. C. Hollis, *The Nandi: Their Language and Folk-lore,* with introduction by Sir Charles Eliot (1909), and the works there cited.

NANDU, the Brazilian name for the rhea (*q.v.*).

NANKANA, a people resembling the Bura and the Mampursi, living in the Navoro district of the Northern Territories, Gold Coast, and across the Upper Volta border in the Leo district. They speak a Mossi dialect.

See Cardinal, *The Natives of the Gold Coast.*

NANKEEN, a cotton cloth originally made in China, and now imitated in various countries. The name is derived from Nanking, the city in which the cloth is said to have been originally manufactured. The characteristic yellowish colour of nankeen is attributed to the peculiar colour of the cotton from which it was originally made.

NANKING ("the southern capital"), the name by which Kiang-ning, the chief city in the province of Kiangsu, China, has been known for several centuries. Pop. about 390,000. The city is nearly equidistant between Canton and Peking, on the south bank of the Yangtze Kiang 235 m. from the sea. It dates only from the beginning of the Ming dynasty (1368), although it is built on the site of a city which for more than two thousand years figured under various names in the history of the empire. The more ancient city was originally known as Kin-ling; under the Han dynasty (206 B.C. to A.D. 25) its name was converted into Tan-yang; by the T'ang emperors (A.D. 618–907) it was styled Kiang-nan and Shêng Chow; by the first sovereign of the Ming dynasty (A.D. 1368–1644) it was created the "southern capital" (Nan-king), and was given the distinctive name of Ying-t'ien; and with the accession to power of the Manchu rulers it was officially known as Kiang-ning, though still popularly called Nan-king. It was the seat of the imperial court only during the reigns of the first two emperors of the Ming dynasty, and was deserted for Shun-t'ien (Peking) by Yung-lo, the third sovereign of that line, who in 1403 captured the town and usurped the crown of his nephew, the reigning emperor.

The T'aip'ing rebels, who carried the town by assault in 1853, swept away all the national monuments and most of the public buildings it contained, and destroyed the greater part of the magnificent wall which surrounded it. The wall, of which only small portions remain, was about 70 ft. in height, measured 30 ft. in thickness at the base, and was probably 20 miles in circumference and pierced by thirteen gates. Encircling the north, east and south sides of the city proper was a second wall which enclosed about double the space of the inner enclosure. In the north-east corner of the town stood the imperial palace reared by Hung-wu, the imperial founder of the modern city. After suffering mutilation at the overthrow of the Ming dynasty, this building was burnt to the ground on the recapture of the city from the T'aip'ing rebels in 1864. The most conspicuous public building at Nanking was the famous porcelain tower, which was designed by the emperor Yung-lo (1403–1428) on a previously sacred site to commemorate the virtues of his mother. The building was begun in 1413. In shape the pagoda was an octagon, and was about 260 ft. in height. The outer walls were cased with bricks of the finest white porcelain, and each of the nine stories into which the building was divided was marked by overhanging eaves composed of green glazed tiles of the same material. Hung on chains which stretched from this apex to the eaves of the roof were five large pearls of good augury for the city's safety from flood, fire, storm and civil disturbance.

Nanking was formerly one of the chief literary centres of the empire. It was taken by the British in 1842 and made a treaty port by the French treaty of 1858, but was not formally opened. Its proximity to Chinkiang, where trade had established itself while Nanking was still in the hands of the rebels, made its opening of little advantage. In 1899 it was voluntarily thrown open to foreign trade by the Chinese government, and in 1909 it was connected by railway with Shanghai. Satin, crêpe, nankeen, cloth, paper, pottery and artificial flowers were among its chief manufactures. There is a depth of from 17 to 45 ft. at the quays and all vessels can reach Nanking if they are able to pass the flats at the mouth of the Yangtze. The town imports cotton goods and yarn, metals, bean and kerosene oil and sugar. The exports include silk goods, skins, beans and frozen meats and dairy produce.

The Nationalist Government (Kus Min Tang) decided to remove the capital from Peking as a further dissociation from the old régime, and, in view of the special position of Nanking, this city was chosen as the republican capital. In 1928 and 1929, Nanking was the scene of frequent disorder, connected with the alleged malpractices of the Nationalist authorities but its position as the headquarters of the republican authorities offers too many advantages for it lightly to be given up.

NANNING, a treaty port in the province of Kwangsi, south China (22° 48′ N., and 108° 15′ E.), and recently created capital of the province, is situated about 30 miles below the junction of the two branches (Tso-kiang and Yu-kiang) of the south (main) stream of the West River, and about 470 miles above Canton. Nanning was voluntarily opened to foreign trade by China in 1907 to offset French influence at Lungchow, a Treaty port near the Tongking frontier. It is the highest accessible point for steamers on the West River, but the river between Wuchow and Nanning during winter suffers from lack of water so that trade is seriously affected. Numerous small competitive river vessels run between Wuchow and Nanning. Its economic orientation is towards the Canton delta by the natural route of the Si-kiang, rather than towards the nearer Red River delta of Tongking. The construction, however, of the projected railway from Canton, via Nanning, to connect with the Tongking railway system at Langson (the present terminus) may have the effect of diverting some of the trade of Nanning into Tongking; or again, the construction of a railway may draw much of it to Pakhoi on the Gulf of Tongking, the nearest outlet by sea to Nanning.

The value of the whole trade in 1924 was as follows:—net foreign imports 2,758,547, net Chinese imports 1,824,497, exports 2,040,392; total 6,623,437 Hk Taels. The trade of the port in 1926 suffered as a result of the Hongkong boycott. The chief imports of Nanning, to be distributed in W. Kwangsi, and adjacent Yünnan and Tongking, are cotton piece goods, kerosene, clothing, matches, straw mats, while exports comprise chiefly aniseed, beans, hides, groundnut cake, medicines, and antimony (the export of which increased greatly during the World War). Nanning is a collecting and distributing centre for a considerable area further west. Two main channels serve this trade—the Yu-kiang which is navigable for large junks during the summer flood season as far as Pose-ting (whence a road leads up to the

high plateau of Yünnan), and the Tso-kiang which is navigable for large junks and small launches as far as the Treaty port of Lungchow, close to the Tongking border.

The population of the port of Nanning as returned for 1926 by the Chinese Maritime Customs is 65,800.

NANNY-BERRY (*Viburnum Lentago*), a handsome North American shrub or small tree of the honeysuckle family (Caprifoliaceae), called also black haw, sheep-berry, wild raisin and sweet viburnum, sometimes planted for ornament. It is native to rich soil from Quebec to Hudson bay and southward to New Jersey, Georgia and Colorado. The nanny-berry, though usually a shrub, sometimes grows 30 ft. high, with a trunk diameter of 10 inches. It has slender branches, ovate, long-pointed, finely-toothed leaves and bears small white flowers borne in showy clusters, 2 to 5 in. broad. The oval, bluish-black, sweet, edible fruit ripens in late autumn.

NANSEN, FRIDTJOF (1861–), Norwegian scientist, explorer and statesman, was born at Frōen near Christiania, where he spent his childhood, on Oct. 10, 1861. In his fifteenth year his parents removed to Christiania, where he went to school. He entered Christiania university in 1880 and studied zoology; in March 1882 he joined the sealing-ship "Viking" for a voyage to Greenland waters. On his return he became curator of the Bergen Museum, under Daniel Cornelius Danielssen (1815–1894). In 1886 he spent a short time at the zoological station at Naples, during which he wrote papers and memoirs on zoological and histological subjects, for one of which, "The Structure and Combination of the Histological Elements of the Central Nervous System" (Bergen, 1887), the Christiania university conferred upon him the degree of doctor of philosophy. But his voyage in the "Viking" had indicated Greenland as a possible field for exploration, and in 1887 he began preparations for a crossing of the great ice-field of the interior of that country. Nansen took with him Otto Sverdrup (b. 1855), Captain O. C. Dietrichson (b. 1856), K. K. Trana (b. *c.* 1864), and two Lapps. The expedition started in May 1888, proceeded from Leith to Iceland, and there joined a sealing-ship bound for the east coast of Greenland. On Aug. 16 began the ascent of the inland ice amid storms, intense cold, and other hardships, they reached the highest point of the journey (8,920 ft.) on Sept. 5, and on the 28th struck the west coast at Ameralik Fjord. They were obliged to winter at the settlement of Godthaab, and Nansen used the opportunity to study the Eskimos and gather material for his book *Eskimo Life* (English translation, London, 1893). The party returned home in May 1889. A report of the scientific results was published in *Petermanns Mitteilungen* (Gotha, 1892). On his return from Greenland Nansen became curator of the Zootomic Museum of Christiania university. In Sept. 1889 he married Eva, daughter of Professor Michael Sars of Christiania university, and a noted singer (d. 1907).

In 1890 he propounded his scheme for a polar expedition before the Norwegian Geographical Society, and in 1892 he laid it before the Royal Geographical Society in London. (*See* "How can the North Polar Region be crossed?" *Geogr. Journal*, vol. i.) His adversely criticized plan succeeded. The Norwegian parliament granted two-thirds of the expenses, and the rest was obtained by subscription from King Oscar and private individuals. His ship, the "Fram" (*i.e.*, "Forward"), was specially built of immense strength and peculiar form, being pointed at bow and stern and having sloping sides, so that the colliding ice-floes would tend, not to crush, but merely to slip beneath and lift her. She sailed from Christiania on June 24, 1893. Otto Sverdrup was master; Sigurd Hansen, a Norwegian naval lieutenant, was in charge of the astronomical and meteorological observations; Henrik Blessing was doctor and botanist. On Sept. 22 the "Fram" was made fast to a floe in 78° 50′ N., 133° 37′ E.; she was frozen in, and the long drift began. She bore the pressure of the ice perfectly. On March 14, 1895, Nansen, being satisfied that the "Fram" would continue to drift safely, left her in 84° N., 101° 55′ E., and started northward on foot with Johansen. On April 8 they turned back from 86° 14′ N., the highest latitude then reached by man; and they shaped their course for Franz Josef Land. They suffered from shortage of food, and were compelled to winter on Frederick Jackson Island (so named by Nansen) in Franz Josef Land from Aug. 26, 1895, to May 19, 1896. They were uncertain as to the locality, but, after having reached 80° N. on the south coast of the islands, they were travelling westward to reach Spitsbergen, when, on June 17, they fell in with Frederick Jackson and his party of the Jackson-Harmsworth expedition, and returned to Norway in his ship, the "Windward," reaching Vardö on Aug. 13. A week later the "Fram" also reached Norway safely, having drifted north to 85° 57′, and returned by the west coast of Spitsbergen. A great welcome awaited Nansen. In England he gave the narrative of his journey at a great meeting in the Albert Hall, London (Feb. 8, 1897), and elsewhere.

In 1896 a professorship of zoology was established for him at the Christiania university; he worked up the results of his expedition and made scientific research in physical geography and oceanography. In the summer of 1900 he took part in an Arctic oceanographic expedition in the S.S. "Michael Sars," headed by Dr. Johan Hjort, and became director of the International Central Laboratory in Christiania for the Research of the Sea. In 1902 he published *The Oceanography of the North Polar Basin*, and in 1904 *The Bathymetrical Features of the North Polar Seas*. In 1905 Nansen took up politics, issuing a manifesto and many articles in connection with the crisis between Norway and Sweden. His attitude may be summarized by the last words of a short work published later in the year: "Any union in which the one people is restrained in exercising its freedom is and will remain a danger" (*Norway and the Union with Sweden*, London, 1905). On the establishment of the Norwegian monarchy Nansen was appointed minister to England (1906), and in the same year was created G.C.V.O. In 1908 he retired from his post and returned to his scientific work as professor of oceanography at Christiania university. In co-operation with Professor Bjorn Helland-Hansen, of the Bergen Museum, he wrote *The Norwegian Sea, its Physical Oceanography* (*Report* on Norwegian Fishery and Marine Investigations, vol. 2, 1909).

In 1910 Nansen made an oceanographic cruise in the "Frithjof" through the northeastern North Atlantic from Ireland to Iceland and back to Norway, and in 1911 published *In Northern Mists* (2 vol.) on the exploration of the northern regions from early times up to the beginning of the 16th century. In 1912 he made a further oceanographic cruise to Spitsbergen and the waters to the north in his yacht the "Veslemoy," and in 1913 he made an expedition through the Arctic and the Kama Seas to the mouth of the Yenisei river and through Siberia and the Amur region.

In 1914, jointly with Helland-Hansen, Nansen made an oceanographic expedition in the eastern North Atlantic to Portugal, Madeira and the Azores and back to Norway. During the World War oceanographic expeditions were impossible. In 1917 Nansen became head of a Norwegian Govt. commission to the United States, and secured a satisfactory agreement with the American Govt. in regard to the import into Norway of essential supplies. After the Armistice (1918) Nansen, as Commissioner of the League of Nations with the executive assistance of the national Red Crosses, was responsible for the repatriation of about 500,000 prisoners of war from Siberia, China and other parts of the world. This work was financed largely by the governments participating in the International Committee for Relief Credits, Paris, of which Lord Bradbury was chairman.

In 1919 Nansen conferred with Hoover on the possibilities of assisting the Russian people, and suggested an organization on the lines of the Belgian Relief Commission. The Supreme Council supported the proposal on the condition that all hostilities in Russia cease. As this was at the time when Kolchak and Denikin were advancing towards Moscow the project was abandoned. In 1921 Nansen was asked by an international conference in Geneva of delegates of 48 Red Cross societies and 12 governments to direct relief work for famine-stricken Russia, and on Aug. 27 he signed an agreement in Moscow with Chicherin, the Soviet Foreign Minister, regarding the method of furnishing relief on a large scale, and visited the famine areas. In Sept. Nansen failed to induce the League of Nations to assist the starving

millions in Russia by raising, under safeguards, an international governmental relief loan. He next visited the chief capitals of Europe, and as a result the European Red Crosses fed and clothed at the peak of the Russian famine over 1,600,000 inhabitants of the Volga and South Ukraine regions. His publicity campaign had great influence in America, which under Hoover's direction fed at one time 10,000,000 Russian sufferers. Nansen's mission in Russia continued to conduct two agricultural demonstration estates in the former famine areas. In 1923 Nansen published *Russia and the Peace* setting out the economic position of Soviet Russia. As high commissioner for refugees to the League, he was responsible for the protection and settlement of Russian, Armenian and Greek refugees.

In 1923 Nansen was awarded the Nobel Peace Prize, which he gave to the furtherance of the Nansen agricultural demonstration estates and model farms in Saratov and Ekaterinoslav Governments, Russia. In his early manhood Nansen was a great athlete and the popularity of ski-ing in the Alps is largely due to him; and evidence of his enthusiasm for sport is his work on *Sport in the Polar Regions* and *Wild Norway* (1925). Nansen, as delegate for Norway to the League of Nations, made an impassioned intervention protesting against the occupation of Corfu by Italy in 1923, and at the Fifth Assembly in 1924 he conducted the first informal negotiations for the entry of Germany into the League of Nations. Nansen's interest in education has been evidenced by his campaign in favour of Russian professors and universities. In 1925 he was elected lord rector of St. Andrews, and in 1928 published *Armenia and the Near East*. (*See* POLAR REGIONS; REFUGEES.)

Besides works mentioned above, Nansen described his travels in *The First Crossing of Greenland* (Eng. trans., 1893); *Farthest North* (Eng. trans., 1897); *The Waters of the Northeastern North Atlantic (Internationale Revue der gesammten Hydrobiologie und Hydrogeographie*, Leipzig, 1913); *En ferd til Spitzbergen* (1912); *Through Siberia, the Land of the Future* (London, 1914). The scientific results of the various expeditions are given in the following works—the 1888 expedition, in *Petermanns Mitteilungen* (Gotha, 1892); the 1893 expedition, in *The Norwegian North Polar Expedition, 1893–96: Scientific Results* (London, etc., 1900 *sqq.*); the 1912 expedition, in *Spitzbergen Waters* (Society of Science, Oslo, 1915); of the 1914 expedition jointly with Helland-Hansen, in *The Eastern North Atlantic* (Geophysic Publication, Academy of Science, Oslo).

NANTERRE, a suburb 13 kilometres north-west of Notre Dame de Paris, with a port on the Seine, in the department of Seine, at the foot of Mount Valerien, 8 m. N.W. of Paris on the railway to St. Germain. Pop. (1926) 31,038. The principal manufactures are chemicals, tallow and aluminium; stone is quarried in the vicinity; the town is noted also for its cakes. Nanterre (the ancient *Nemptodurum* or *Nemetodurum*) owes its origin to the shrine of Ste. Geneviève (420–512), the patron-saint of Paris. The shrine is the object of a pilgrimage in September.

NANTES, a city of western France, capital of the department of Loire-Inférieure, on the Loire, 35 m. above its mouth, at the junction of the Orléans, Ouest-état and State railways, 55 m. W.S.W. of Angers by rail. In population (1926, 166,507), Nantes is the first city of Brittany. The Loire here divides into several branches forming islands over portions of which the city has spread.

History.—Before the Roman occupation Nantes was the chief town of the Namnetes and consisted of *Condovicnum*, lying on the hills away from the river, and of *Portus Namnetum*, on the river. Under the Romans it became a great commercial and administrative centre, though its two parts did not coalesce till the 3rd or 4th century. In the middle of the 3rd century Christianity was introduced by St. Clair. Clotaire I. got possession of the city in 560, and placed it under the government of St. Félix the bishop, who caused the Loire to flow under the walls of the castle. After being several times subdued by Charlemagne, Brittany revolted under his successors, and Nominoé, proclaimed king in 842, razed the fortifications of Nantes because it had sided with Charles the Bald. The Normans held the town from 843 to 936. About this time began the rivalry between Nantes and Rennes, whose counts disputed the sovereignty of Brittany. Pierre de Dreux, declared duke of Brittany by Philip Augustus, made Nantes his capital, surrounded it with fortifications and defended it against John of England. During the Breton wars of succession Nantes took part first with Jean de Montfort, but afterwards with Charles of Blois, and did not open its gates to Montfort till his success was assured and his English allies had retired. In 1560 Francis II. granted Nantes a communal constitution. Averse to Protestantism, it joined the League along with the duke of Mercoeur, governor of Brittany, who helped to raise the country into an independent duchy; and it was not till 1598 that it opened its gates to Henry IV., who here signed on May 2 of that year the famous Edict of Nantes which until its revocation by Louis XIV. in 1685 was the charter of Huguenot liberties in France. The city was in 1793 the scene of the *noyades* of J. B. Carrier, envoy of the Committee of Public Safety.

The Port.—The maritime port of Nantes is reached by way of the Loire and the ship canal between the island of Carnet and La Martinière (9½ m.). Vessels drawing as much as 20 ft. 8 in., and at spring tides, 22 ft., can reach the port, which extends over a length of about 1½ m. The outer port stretches ½ m. to Chantenay. The principal quays extend along the right bank of the branch which flows past the town, and on the western shore of the island of Gloriette. Their total length used for trading purposes is 5 m., and warehouses cover an area of 17 ac. A slipway facilitates the repairing of ships. The river port occupies the St. Félix and Madeleine branches, and has quays extending for half a mile. Finally, on the Erdre is a third port for inland navigation. The quays are bounded by railway lines along the right bank of the river, which the railway to St. Nazaire follows. The older quarter of Nantes is situated to the east of the Erdre.

Buildings.—The cathedral, built above a 12th century crypt, was unfinished till the 19th century. There are two interesting monuments in the transept; Michel Colomb's tomb of Francis II., duke of Brittany, and his second wife Marguerite de Foix (1507), and that of Gen. Juchault de Lamoricière, a native of Nantes, by Paul Dubois (1879). Between the cathedral and the Loire stands the castle of Nantes, founded in the 9th or 10th century. Rebuilt by Francis II. and the duchess Anne, it is flanked by huge towers and by a bastion erected by Philip Emmanuel duke of Mercoeur in the time of the League. A fine Gothic façade looks into the courtyard. From being the residence of the dukes of Brittany, the castle became a state prison and is now occupied as the artillery headquarters. The chapel in which the marriage of Louis XII. with Anne of Brittany was celebrated was destroyed in 1800. Nantes has an archaeological collection in the Dobrée museum, and in the museum of fine arts a splendid collection of paintings, modern French masters being well represented. It is the seat of a prefect, of a bishopric under the archbishop of Tours and a court of assizes, and headquarters of the XI. army corps; it has tribunals of first instance and of commerce, a board of trade-arbitrators and a chamber of commerce. It has many educational institutions.

Industries.—Among the more important industries of Nantes are sugar-refining, rice-husking, the manufacture of oil, soap, flour pastes and biscuits, chocolate and the preparation of tinned provisions (sardines, vegetables, etc.); the manufacture of tin boxes, tiles, chemical manures, acid, leather, paper, rope, boots and shoes, brushes, porcelain and glass; shipbuilding, metal founding and the construction of engineering material; and wool and cotton-spinning and the manufacture of cotton and other fabrics, rubber goods, hosiery and knitted goods. Coal and petroleum, sugar, coffee, cotton-seed, copra, hemp, grain, phosphates and pyrites, timber and pulp-wood are imported. The principal exports are machinery, pit-props, iron ore, slate, hoops and provisions. The merchandise handled at the port of Nantes has slightly increased since 1913 when the amount of goods handled at the port was 1,964,000 tons (metric). In 1924 it was 2,154,000 and in 1925, 2,086,000 metric tons.

NANTES, EDICT OF, the law promulgated in April 1598 by the French king, Henry IV., which secured a large measure of religious liberty to his Protestant subjects, the Huguenots. Its main provisions may be summarized as follows: (1) It gave liberty of conscience to the Protestants throughout the whole

of France. (2) It gave them the right of holding public worship in those places where they had held it in 1576 and the earlier part of 1577; also in places where this freedom had been granted by the edict of Poitiers (1577) and the treaties of Nérac (1579) and of Fleix (1580). The Protestants could also worship in two towns in each *bailliage* and *sénéchaussée*. The greater nobles could hold Protestant services in their houses; the lesser nobles could do the same, but only for gatherings of not more than 30 people. Regarding Paris, the Protestants could conduct worship within five leagues of the city instead of ten leagues as previously. (3) Full civil rights were granted them. They could trade freely, inherit property and enter the universities, colleges and schools. All official positions were open to them. (4) To deal with disputes arising out of the edict, a chamber was established in the parlement of Paris (*le chambre de l'édit*). This group was to be composed of ten Roman Catholic and six Protestant members. Chambers for the same purpose, but consisting of Protestants and Roman Catholics in equal numbers, were established in connexion with the provincial parlements. (5) The Protestant pastors were to be paid by the State and to be freed from certain burdens, their position being made practically equal to that of the Roman Catholic clergy. (6) A hundred places of safety were given to the Protestants for eight years, the expenses of garrisoning them being undertaken by the king.

The edict was greatly disliked by the Roman Catholic clergy, and a few changes were made to conciliate them. The parlement of Paris shared this dislike, but was forced by the king to register the edict on Feb. 25 1599. After similar trouble it was also registered by the provincial parlements, the last being the parlement of Rouen, which delayed the registration until 1609.

That the strong political position thus secured to the French Protestants was a danger to the State was proved by the troubles which arose during the minority of Louis XIII. After Richelieu had succeeded in crushing the quasi-independent power of the Huguenot lords and cities, however, the French Protestants ceased to be a political danger. With the revocation of the Edict of Nantes, on Oct. 18 1685, the French Protestants were deprived of all civil and religious liberty.

BIBLIOGRAPHY.—*See* FRANCE: *History;* and HUGUENOTS. For further details see the papers and documents published as *Le Troisième centenaire de l'édit de Nantes* (1898); N. A. F. Puaux, *Histoire du Protestantisme français* (Paris, 1894); H. M. Baird, *The Huguenots and the Revocation of the Edict of Nantes* (London, 1895); A. Lods, *L'Édit de Nantes devant le parlement de Paris* (1899); and C. Benoist, *La Condition des Protestants sous le régime de l'édit de Nantes et après sa révocation* (Paris, 1900).

NANTEUIL, ROBERT (1623–1678), French line-engraver, was born about 1623, or, as other authorities state, in 1630, the son of a merchant of Reims. Having received an excellent classical education, he studied engraving under his brother-in-law, Nicholas Regnesson. He became known by his crayon portraits, and was pensioned by Louis XIV. and appointed designer and engraver of the cabinet to that monarch. It was mainly due to his influence that the king granted the edict of 1660, dated from St. Jean de Luz, by which engraving was pronounced free and distinct from the mechanical arts, and its practitioners were declared entitled to the privileges of other artists. He died at Paris in 1678. The plates of Nanteuil, several of them almost life-size, number about three hundred. In his early practice he imitated the technique of his predecessors, working with straight lines, strengthened, but not crossed, in the shadows, in the style of Claude Mellan, and in other prints cross-hatching like Regnesson, or stippling in the manner of Jean Boulanger. He then gradually acquired an individual style, modelling the faces of his portraits with the utmost precision and completeness, and employing various methods of touch for the draperies and other parts of his plates. Among the finest of his mature works are the portraits of Pomponne de Bellièvre, Gilles Ménage, Jean Loret, the duc de la Meilleraye and the duchess de Nemours.

A list of his works will be found in Dumesnil's *Le Peintre-graveur français*, vol. iv.

NANTICOKE, a borough of Luzerne county, Pennsylvania, U.S.A., on the Susquehanna river and Federal highway 11, 8 m. W.S.W. of Wilkes-Barre. It is served by the Pennsylvania railroad and (through West Nanticoke) by the Lackawanna, and for freight also by the Central of New Jersey. Pop. (1920) 22,614 (29% foreign-born white). It is an important anthracite-mining centre, and has a number of factories (making chiefly silk yarn, stockings and cigars) with an output in 1925 valued at $2,630,227. Nanticoke was laid out in 1793 and was incorporated in 1874.

NANTUCKET, an island 28m. S. of Cape Cod off the south-east coast of Massachusetts, was for more than a century a principal seat of the whaling industry. In 1830 the town of Nantucket ranked after Boston and Salem as the third commercial city of the State; in 1842 it was the home port of 86 ships and barks, 2 brigs and 2 schooners, with a total capacity of 36,000 tons. Leadership in the industry had passed to New Bedford about 1820, however, and soon after 1840 the decline of whaling began in earnest. Retaining its old atmosphere and a distinctive physical character inherited from years of Quaker dominance and whaling prosperity, Nantucket has become a famous summer resort. Its population, once about 10,000, was 3,152 in 1925. For the most part the island is sandy and level. It has few trees and few hills, the highest of which is 191ft. above the sea. Although the length of the island proper is only about 15m. and its average width 2½m., there are 88m. of shore. The climate is profoundly modified by this insular position. Slightly separated from Nantucket are the smaller islands of Tuckernuck and Muskeget.

Nantucket was discovered by Bartholomew Gosnold and purchased, with Martha's Vineyard, by Thomas Mayhew of Watertown in 1641. Thomas Macy led the first band of settlers in 1659, founding a village at what is now Madaket. The present site of Nantucket town was occupied in 1672, named Sherburne in 1673 and rechristened Nantucket in 1695. Christopher Hussey took the first sperm whale in 1712, and development of the vessel fishery, succeeding the old shore fishery of whales, was rapid. The American Revolution, the War of 1812 and the American Civil War were the only interruptions to the prosperity based upon whaling until its final decline. Modern Nantucket is described as an "almost perfect record of what our Yankee forefathers considered a seemly town." The island has extensive fisheries.

BIBLIOGRAPHY.—*See* Obed Macy, *History of Nantucket* (1835); N. S. Shaler, "Geology of Nantucket," *Bulletin No. 53, U.S. Geological Survey* (1889); *Bulletins Nantucket Historical Society* (1894, *et seq.*); R. A. D. Lithgow, *Nantucket, A History* (1914); W. F. Macy, *Story of Old Nantucket* (1915); W. F. Macy and R. B. Hussey, *Nantucket Scrap Basket* (1916); A. Starbuck, *History of Nantucket* (1924).

(H. B. H.)

NANTWICH, a market town and urban district in the Crewe parliamentary division, Cheshire, England, 161 m. N.W. of London, on the L.M.S. and G.W. railways. Pop. (1921) 7,296. It lies on the river Weaver, in the upper part of its flat, open valley. The church of St. Mary and St. Nicholas is a cruciform building in red sandstone, of the Decorated and Perpendicular periods, with a central octagonal tower. The fine old carved stalls are said to have belonged to Vale Royal abbey, near Winsford. Nantwich retains a few old timbered houses (16th and 17th centuries), but the town as a whole is modern in appearance. The grammar school was founded in 1611. The salt industry was so important here in the time of Henry VIII. that there were three hundred salt-works. Though this industry has lapsed here, there are now brine baths, and the former mansion of Shrewbridge Hall is converted into a hotel with a spa. Nantwich has tanneries, a manufacture of boots and shoes, and clothing factories; and corn-milling and iron-founding are carried on.

Remains found in the district indicate a Roman settlement here, probably because of the salt. The Domesday Survey contains a long account of the laws, customs and values of the salt-works. The salt-houses were divided between the king, the earl of Chester and certain resident freemen. The name of the town appears variously as Wych Manbank, Wie Malban, Nantwich, Lache Mauban, Wysmanban, Wiens Malbanus, Namptewiche. About the year 1070 William Malbedeng was created baron of Nantwich, but the barony became subdivided later. The only town charter was granted by Queen Elizabeth (1568). There was a gild merchant and also a town bailiff, but the latter office was

soon dropped. There is documentary evidence of a castle at Nantwich in the 13th century.

NANTY-GLO, a coal-mining borough of Cambria county, Pennsylvania, U.S.A., 24 m. W.S.W. of Altoona; served by the Cambria and Indiana and the Pennsylvania railways. Pop. 5,028 in 1920 (27% foreign-born white).

NAOS, in Greek architecture, the most important portion of the enclosed part, or cella, of a temple. When the cella contains but one room, this is the naos; when it contains two, the naos is the larger of these, in which the statue of the deity is placed.

NAPA, a city of California, U.S.A., 11 m. N. of San Pablo bay and 40 m. N. by E. of San Francisco, at the head of navigation on the tidal Napa river; the county seat of Napa county. It is served by the Southern Pacific and electric railways, and by steamboats to points on San Francisco bay. Pop. 6,757 in 1920 (82% native white); estimated locally at 7,600 in 1928. It is the commercial and industrial centre of the fertile Napa valley, which is famous for its grapes, nuts, prunes, early pears, apples, oats, alfalfa, and other ranch products. The city's manufactures include shoes, gloves, shirts, athletic equipment, paper boxes, stone, dried fruits, butter, cheese, mineral water and grape juices. Napa was settled in 1831 and incorporated as a city in 1872.

NAPERVILLE, a city of Du Page county, Illinois, U.S.A., on the Burlington Route railway, 28 m. W. of Chicago. Pop. 3,830 in 1920; estimated locally at over 5,000 in 1928. It has orchid greenhouses, nurseries, poultry farms and several factories, and is the seat of North Central ("North-Western" until 1926) college, founded by the Evangelical Church in 1861 at Plainfield (Illinois) and moved to Naperville in 1870, and of the Evangelical Theological seminary (1910). The city was founded about 1831.

NAPHTALI was, according to Genesis xxx. 8, a son of Jacob by Rachel's handmaid Bilhah, and full brother of Dan. This may be no more than a reflection of the fact that geographically the tribes of Dan and Naphtali are closely associated. Not only did the land of Naphtali in northern Palestine border on that of Dan, but we find in Deut. xxxiii. 23 an indication that Naphtali dwelt near to Dan in the older seat of the latter tribe in the south-west. The story of the conflict against Sisera, Judges iv. *seq.*, associates Zebulon closely with Naphtali, and informs us that from Kadesh, the old Amorite city which was the chief place in Naphtali's territory, came the hero Barak. Naphtali, because of its exposed situation, suffered at the hands of Syria (1 Kings xv. 20); it was depopulated by Tiglath-Pileser (2 Kings xv. 29). The reference to Naphtali in the Blessing of Jacob, Genesis xlix. 21, is obscure and of uncertain interpretation. (W. L. W.)

NAPHTHA, a word originally applied to the more volatile kinds of petroleum, issuing from the ground in the Baku district of Russia and in Persia. It is the *νάφθα* of Dioscorides, and the *naphtha,* or *bitumen liquidum candidum* of Pliny. By the alchemists the word was used principally to distinguish various highly volatile, mobile and inflammable liquids, such as the ethers, sulphuric ether and acetic ether having been known respectively as *naphtha sulphurici* and *naphtha aceti.*

The term is now seldom used, either in commerce or in science, without a distinctive prefix, and we thus have the following:—

1. *Coal-tar Naphtha.*—A volatile commercial product obtained by the distillation of coal-tar. (*See* COAL-TAR.)

2. *Shale Naphtha.*—Obtained by distillation from the oil produced by the destructive distillation of bituminous shale. (*See* PARAFFIN.)

3. *Petroleum Naphtha.*—A name sometimes given (*e.g.,* in the United States) to a portion of the more volatile hydrocarbons distilled from petroleum. (*See* PETROLEUM.)

4. *Wood Naphtha.*—Methyl alcohol (*q.v.*).

NAPHTHALENE, a hydrocarbon, $C_{10}H_8$, formed when many organic compounds, *e.g.,* acetylene, ethylene, acetic acid, ether or camphor, are passed as vapours through a red-hot tube. This accounts for its presence in certain fractions of the coal-tar distillate (*see* COAL-TAR), where it was originally observed in 1819 by Garden and independently by Brande. Its composition was first determined by Faraday, in 1826. The amount of naphthalene produced during the manufacture of coal-gas varies with the type of coal used and increases with rising temperature of carbonization; it rarely exceeds 10% of the tar distillate, and the usual amount is about 5%. Its presence among the products obtained by the modern low-temperature carbonization processes has not yet been established. Even when formed in only small amounts, naphthalene is frequently carried by the coal-gas through the various purifying chambers and escapes into the service pipes, where it gradually accumulates to such an extent as to necessitate its removal by mechanical means. Naphthalene also occurs in some natural mineral oils, but derivatives in nature are rare. Juglone (5-hydroxy-1:4-naphthoquinone), occurring in freshly-gathered walnut shells, and santonin and artemisin, the active principles of wormseed, are the chief.

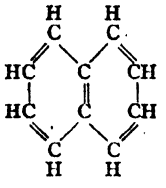
When the "carbolic oil" fraction (boiling point 170°–230° C) of the coal-tar distillate is allowed to cool, the crude naphthalene crystallizes out and is readily purified. The oily impurities are first removed by filtration; the naphthalene crystals are then hot-pressed, washed with hot caustic soda to remove acidic phenols (*see* CARBOLIC ACID) and then heated at 100° C for an hour with 5–10% of strong sulphuric acid to remove basic substances and any residual phenols. After further washings with dilute alkali and hot water, the naphthalene is finally distilled with steam or sublimed.

Properties and Uses.—Pure naphthalene crystallizes in white, shining plates, melting at 80° C, and boiling at 218° C. It possesses a characteristic tarry odour, a pungent taste, and is appreciably volatile even at ordinary temperatures. It is sparingly soluble in hot water and in petroleum spirit, but dissolves readily in benzene, alcohol and ether. With picric acid it forms a stable crystalline picrate, $C_{10}H_8$, $C_6H_2(NO_2)_3OH$; this, in the absence of other picrate-forming compounds, provides a method of estimating naphthalene. When heated in acetic acid solution with formaldehyde and a little sulphuric acid, naphthalene gives a resin, which, unlike phenolic resins, does not become infusible when baked. (*See* RESINS, SYNTHETIC.) The products obtained on oxidizing naphthalene vary considerably with the type of oxidizing agent employed. Potassium permanganate, in alkaline solution, gives phthalonic acid, but in acid solution phthalic acid is the chief product. Potassium dichromate and sulphuric acid, too, give phthalic acid, but with chromic acid in acetic acid solution, 1:4-naphthoquinone is mainly formed. The action of an excess of 100% sulphuric acid and mercuric sulphate at 200° C produces mainly phthalic acid, which was formerly manufactured by this method.

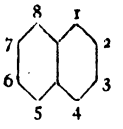
Naphthalene burns with a luminous, smoky flame, and is in consequence used for increasing the illuminating power of coal-gas. It is also utilized as a vermin killer (in the form of the so-called "white carbon" balls), though as its antiseptic properties are slight, it more frequently functions as a solid solvent for other substances, *e.g.,* para-dichlorobenzene, of higher germicidal power. It is also a useful solvent for sulphur, phosphorus, metallic sulphides, and indigo. The value of naphthalene depends most, however, on its extensive employment in the manufacture of dyestuffs, of explosives, and of phthalic acid (*q.v.*), the last-named being manufactured by the oxidation of naphthalene in the vapour phase by air, using vanadium pentoxide or vanadyl chloride as catalyst. The derivatives most important to the dyestuffs manufacturer are the sulphonic acids of the naphthylamines, naphthols, aminonaphthols, and dihydroxynaphthalenes, but not all are of equal value. Indeed, only relatively few form azo-dyes which are completely satisfactory as regards solubility, fastness, tinctorial power and delicacy of shade. The market price of naphthalene varies of course with the degree of purity, but approximates to £14 per ton. Commercial naphthalene has setting point 79° C, and boiling point 217° C; it should volatilize completely, leaving no residue, and be free from phenols and quinoline bases; it should remain white in nitric acid (sp.gr. 1.42) for half an hour.

Constitution.—In the empirical formula, $C_{10}H_8$, for naphthalene, there are two more carbon atoms than hydrogen atoms, and from a consideration of its chemical properties, its products on disruption and from various modes of synthesizing it, naphthalene is best represented by formula I., or conventionally by formula

II.; the carbon atoms, except the two "submerged" atoms, are

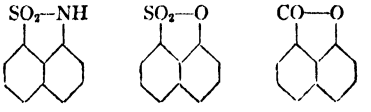


Formula I.



Formula II.

associated with a hydrogen atom each, numbered as shown. Although such a formula would appear to consist merely of two benzene rings, neither ring is in fact benzenoid in character until the unsaturation of the other has been destroyed (*see* below). Positions 1, 4, 5, 8 are termed α-positions; 2, 3, 6, 7 are β-positions. Among di-derivatives, as in the benzene series, the 1:2-position is *ortho*, 1:3-*meta*, and 1:4-*para*; of the heteronucleal di-derivatives, the only important names are those given to the 2:6- and the 1:8-, which are called respectively *amphi*- and *peri*-positions. Peri-substituted compounds react in many respects as though they were true ortho-compounds. For instance, naphthalene-1:8-dicarboxylic acid (naphthalic acid) easily forms an anhydride; the corresponding diketone (acenaphthene-quinone) readily condenses with ortho-diamines; 1:8-naphthylene-diamine combines with suitable organic substances to form another ring; while sultams I. (from peri-amino-sulpho-derivatives), sultones II. (from peri-hydroxy-sulpho-derivatives), and lactones III. (from peri-hydroxy-carboxy-derivatives) may be produced by



I. II. III.

the elimination of water. There are ten possible disubstitution products if the entering groups are the same, but if different, 14. The number of trisubstituted products is much greater.

When naphthalene is nitrated, aminated, chlorinated, brominated or iodinated, the entering group invariably replaces the hydrogen atom in the α-position. On sulphonation, however, both α- and β-positions may be occupied by the entering group, the amount of each monosulphonic acid depending on the temperature and duration of the reaction, and also to a lesser extent on the strength and quantity of the acid used. All other monosubstituted β-derivatives must be prepared by indirect processes. Even with one group already in the nucleus, in either the α- or the β-position, further substitution tends to take place at another α-position, though there are exceptions, again more especially on sulphonation.

NAPHTHALENE DERIVATIVES

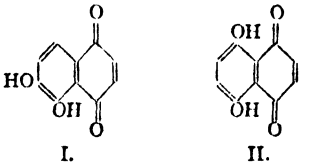
Homologues.—The methyl, ethyl and other alkyl derivatives of naphthalene used to be of little importance, but they are now being investigated as low-temperature lubricating oils. α-Methylnaphthalene is a liquid which boils at 240° C; β-methylnaphthalene is a solid, melting at 32° C. Both are present in coal-tar, which also contains at least four dimethylnaphthalenes.

Chloronaphthalenes.—During the classical researches of Armstrong and Wynne on the constitution of naphthalene derivatives, the mono-, di- and tri-chloronaphthalenes (all of which—and there are 26—were prepared) were of the greatest scientific importance, in that any naphthalene compound of unknown configuration could be converted into the corresponding chloro- derivative, and its constitution thus established. Only α-chloronaphthalene and 1:4-dichloronaphthalene can, however, be produced cheaply; the former is manufactured by passing chlorine into boiling naphthalene in presence of ferric chloride, and is an oil, boiling at 263° C; its chlorine atom is more reactive than that in chlorobenzene. 1:4-Dichloronaphthalene, melting point 68° C, is prepared by heating naphthalene with thionyl chloride at 140–160° C.

Naphthalene Chlorides.—Another type of chlorinated naphthalene is known in which the halogen atoms are associated with the carbon atoms of the nucleus without replacing the hydrogen atoms. These "additive" compounds, as they are called, are of little technical value, but their formation serves to show the unsaturated nature of the naphthalene nucleus. Napthalene dichloride, $C_{10}H_8Cl_2$, is a yellow oil formed when the hydrocarbon is treated with potassium chlorate and hydrochloric acid. When heated to 50° C hydrogen chloride is eliminated, leaving α-chloronaphthalene. Naphthalene tetrachloride, $C_{10}H_8Cl_4$, formed when chlorine is passed into a chloroform solution of the hydrocarbon, melts at 182° C.

Nitronaphthalenes.— α-Nitronaphthalene, $C_{10}H_7{\cdot}NO_2$, prepared by the action of strong nitric acid on naphthalene, is readily soluble in benzene, ether and hot alcohol from which it crystallizes in yellow needles, melting point 61° C. It is not volatile in steam. Its technical importance is mainly due to the fact that on vigorous reduction it gives α-naphthylamine (*see* below). β-Nitronaphthalene is commercially unimportant because of its relative inaccessibility. The most convenient method of preparation is that of Vesely and Dvorak (1922), who obtained it in 28% yield by decomposing diazotized β-naphthylamine sulphate with copper bronze in presence of potassium nitrite. It crystallizes from dilute alcohol in yellow needles, melting point 79° C; unlike the α-compound, it is volatile in steam.

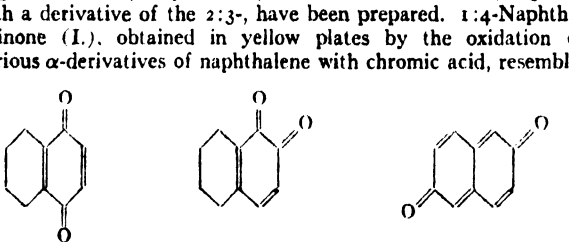
On further nitration with nitric acid in presence of sulphuric acid, α-nitronaphthalene yields a mixture of 1:5- and 1:8-dinitronaphthalenes, the former after purification melting at 216° C, and the latter at 170° C. A mixture of the same two components is obtained on dinitrating naphthalene itself. This crude mixture, when heated with sulphur and fuming sulphuric acid, or when dissolved in sulphuric acid and electrolysed at 130° C, furnishes naphthazarin, the bisulphite compound of which is the important black mordant dyestuff Naphthazarin S. For many years naphthazarin was assumed to be 5:6-dihydroxy-α-naphthoquinone, I., because of its similarity to alizarin (*q.v.*). In 1925, however, it was proved to possess the constitution II. Several tri- and



I. II.

tetra-nitronaphthalenes have been described; some of them find a limited use in the manufacture of explosives.

Naphthoquinones.—Six different naphthoquinones, $C_{10}H_6O_2$, are theoretically possible, three homonucleal, *i.e.*, with the :CO groups in the same ring, and three heteronucleal (in different rings). Of these, only the 1:4-, the 1:2- and the 2:6-, together with a derivative of the 2:3-, have been prepared. 1:4-Naphthoquinone (I.), obtained in yellow plates by the oxidation of various α-derivatives of naphthalene with chromic acid, resembles



(I.) (II.) (III.)

benzoquinone in that it has a characteristic odour and is volatile in steam. A hydroxy-derivative of this quinone, juglone, affords a very delicate test of nickel, since in 1% alcoholic solution it gives a distinct violet colour with 0·001% of Ni. 1:2-Naphthoquinone (II.), obtained by oxidizing 2-amino-α-naphthol with ferric chloride, differs from the 1:4-quinone in being, like phenanthraquinone, odourless and non-volatile in steam. 2:6-Naphthoquinone (III.), too, is non-volatile and odourless, but similar to

benzoquinone in chemical properties; it is formed by the oxidation of the corresponding dihydroxynaphthalene with lead peroxide in benzene solution. The 1:2- and 2:6-quinones are red.

Naphthalenesulphonic Acids.—Naphthalene-α-sulphonic acid, $C_{10}H_7{\cdot}SO_3H$, predominates when the hydrocarbon is sulphonated below 80° C, the β-isomeride when the temperature of sulphonation is 160–180° C. Further sulphonation of the former yields 1:5- and 1:6-, and of the latter 2:7- and 2:6-disulphonic acids. Other disulphonic acids are obtainable by synthetic methods, and numerous tri- and tetra-sulphonic acids are also known. All these acids liberate hydrochloric acid from sodium chloride. They and their alkali salts are soluble in water, but the lead, barium and calcium salts often differ widely in solubility, and can occasionally be utilized in the separation of mixtures. The value of these polysulphonic acids depends largely on the ease with which they lose sulphonic groups or exchange them for hydroxyl groups, both changes taking place more readily from α- than from β-positions.

Naphthylamines (aminonaphthalenes).—Since sulphonation is the only convenient means of obtaining β-derivatives directly from the hydrocarbon, the manufacture of β-naphthylamine and its substitution products (from naphthalene-β-sulphonic acid *via* β-naphthol) differs from that of α-naphthylamine (which is easily accessible through α-nitronaphthalene). The two naphthylamines are the analogues of aniline (*q.v.*), but differ from it in some respects; they may, for instance, be prepared by heating the corresponding naphthol with the ammonia compound of zinc chloride or calcium chloride; aniline cannot easily be so obtained from phenol.

α-Naphthylamine, $C_{10}H_7{\cdot}NH_2$, is made in large quantities by reducing α-nitronaphthalene with soft iron borings ("swarf") and dilute hydrochloric acid at 50–70° C; milk of lime is then added to neutralize the acid, and the liberated amine distilled, either with superheated steam, or preferably in a vacuum. Further distillation and crystallization are necessary to obtain the pure product. If naphthalene is heated at 220° C with sodamide in presence of phenol, α-naphthylamine is formed, hydrogen being evolved. It may also be prepared by heating α-naphthol with ammonium bisulphite under pressure or with ammonia-calcium chloride at 270° C. α-Naphthylamine is soluble in most solvents, and crystallizes when quite pure in colourless flat needles or scales, which melt at 51° C, and boil at 300° C. The technical product gradually acquires a greyish-violet colour when exposed to air, owing probably to the presence of easily oxidized 1:8-diaminonaphthalene. α-Naphthylamine can be readily distinguished from the β-isomeride by its faecal odour, by its slight volatility in steam, and by the azure-blue precipitate, soluble in chloroform, which aqueous solutions of its salts give when oxidized with ferric chloride. Diazo-solutions of amines couple with α-naphthylamine in the 4-position, or if this is occupied in the 2-position, giving aminoazo-compounds. If both positions are blocked, either one of the intruding substituents is removed, or azo-coupling does not take place.

α-Naphthylaminesulphonic acids can be prepared in several ways, of which the most important technically are (*a*) sulphonation of α-naphthylamine, (*b*) amination of α-naphtholsulphonic acids, using ammonia and ammonium sulphite, and (*c*) nitration of naphthalenesulphonic acids, with subsequent reduction. Of the seven possible monosulphonic acids of α-naphthylamine, all except the 3- acid are in common use; the most important is 1-naphthylamine-4-sulphonic acid (naphthionic acid), produced by "baking" α-naphthylamine acid sulphate at 180–200° C in a vacuum, or by heating the amine with sulphuric acid at 170° C in presence of 3% of oxalic acid. When diazotized it constitutes the first component of many azo-dyes of the fast red series. It also couples with diazotized bases forming ortho-azo-dyes, but in these circumstances the still intact amino-group in the 1-position cannot be further diazotized owing to the proximity of the diazo-complex; one of the best known dyes in this class is Congo red, from diazotized benzidine (*q.v.*) and two molecules of naphthionic acid.

β-Naphthylamine is manufactured in almost quantitative yield by heating in an autoclave under the pressure of 6 atmos. β-naphthol, 40% ammonium sulphite solution, and 20% ammonia in suitable proportions at 150° C for several hours. (This reaction, named after Bucherer, has an extensive application throughout the naphthalene series.) The crude naphthylamine is removed by filtration, washed with caustic soda to remove unchanged naphthol, and finally distilled in a vacuum to remove $\beta\beta'$-dinaphthylamine, which is always produced in small quantity. When pure, β-naphthylamine crystallizes from alcohol in colourless, lustrous scales, melts at 112° C, and boils at 294° C. Unlike the α-isomeride, it is odourless, moderately volatile in steam, and appreciably soluble in hot water, and solutions of its salts give no colour with ferric chloride or other mild oxidizing agents.

The most important reactions used for the manufacture of *β-naphthylaminesulphonic acids* are (*a*) sulphonation of naphthylamine, (*b*) amination of naphtholsulphonic acids in presence of ammonium bisulphite, and (*c*) reduction of β-nitronaphthalenesulphonic acids. As sources of azo-dyes these acids are not so important as the α-amino-compounds; many of the dyestuffs derived from them are of little worth and, moreover, once they have coupled (in the α-position) with other diazotized amines, the contiguous β-amino-group cannot be itself diazotized. β-Naphthylamine-6-sulphonic acid (Brönner acid) and β-naphthylamine-3:6-disulphonic acid are among the more important. One valuable property, however, which the β-naphthylamine-di- and tri-sulphonic acids possess is that of exchanging an α-sulphonic group for a hydroxyl group when digested with caustic soda, thus producing the valuable aminonaphtholsulphonic acids; α-naphthylamine-di- (though not tri-) sulphonic acids under the same conditions exchange the amino-group for a hydroxyl group giving merely naphtholdisulphonic acids. The naphthylaminesulphonic acids of both the α- and β- series may be estimated by titration with diazotized *para*-nitraniline.

An important feature of sulphonic groups, not only in the naphthylamine and naphthol series, but also in naphthalenesulphonic acids, is the frequency with which they "migrate" from one position to another during the sulphonation process. This apparent shifting is due largely to hydrolysis of the sulphonic group, followed by resulphonation in another position under the altered conditions. For example, sulphonation of β-naphthol at the ordinary temperature gives the 1-, at 60° C the 8-, and at 100° C the 6-sulpho-derivative.

The ten possible *diaminonaphthalenes* have all been prepared, most of them by heating the corresponding aminonaphthol or dihydroxynaphthalene with ammonia under pressure, but reduction of nitronaphthylamines, of dinitronaphthalenes, or of azo-dyes furnishes others which would otherwise be difficult of access. They have found little application in the colour industry. 1:8-Naphthylenediamine, $C_{10}H_6(NH_2)_2$, melting point 67° C, is of interest because, like the true ortho-diamines (1:2- and 2:3-), it readily forms another ring by condensation with such substances as acetone, acetic anhydride, phosgene, ethyl oxalate and nitrous acid. The diaminonaphthalenesulphonic acids are unimportant.

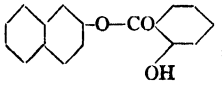
Naphthols (hydroxynaphthalenes).—These industrially important substances are the naphthalene analogues of phenol (*see* CARBOLIC ACID), which they resemble in a general way. Nevertheless, there are certain important differences due to the greater reactivity of the hydroxyl group in the naphthols. For instance, the naphthols when heated under pressure with ammonia furnish the corresponding naphthylamines; they can be etherified when heated with alcohol and hydrochloric acid at 150° C; and they are converted into naphthyl ethers (dinaphthyl oxides) by boiling sulphuric acid. Phenol undergoes none of these reactions to any appreciable extent. The naphthols are said to occur in very small amount in high-boiling coal-tar fractions. Many tests have been devised for detecting and estimating traces of α- and β-naphthols in each other. Moreover, certain colour reactions are available: (1) ferric chloride, with which the α- isomeride gives an opalescence changing to a violet precipitate of $\alpha\alpha$-dinaphthol, whereas the β- gives a pale green colour changing to a white precipitate of $\beta\beta'$-dinaphthol; (2) bleaching powder solution, α- giving a violet colour, and β- a pale yellow; (3) sodium hypoiodite (α- gives a purple colour, and β- nil), and (4) titanyl

sulphate (α- gives an intense green colour changing to reddish-violet on addition of acetic acid, and β- nil). Both α- and β-naphthols develop Prussian blue colorations with chloroform and caustic potash solution.

α-Naphthol, $C_{10}H_7OH$, is usually manufactured by adding sodium naphthalene-α-sulphonate to fused caustic soda in an open vessel at about 300° C, or by heating it with strong caustic soda solution in an autoclave at about 280° C for 10–12 hours, whereby the formation of oxidation products attendant upon open pot fusions is avoided. If required quite free from β-naphthol (which is always present in α-naphthol prepared by fusion processes), it may be obtained by heating α-naphthylamine sulphate or hydrochloride with water at 200° C under pressure for four hours. Another method consists in heating under pressure α-chloronaphthalene, caustic soda and methyl alcohol at 210° C for several hours. α-Naphthol crystallizes in white, lustrous prisms, melting point 94° C, boiling point 278–280° C. It is readily soluble in most organic solvents and in caustic alkali solutions, but only sparingly in hot water. Unlike β-naphthol, it is volatile in steam at 100° C, and possesses a phenolic odour. α-Naphthol is more poisonous than β-naphthol, and finds no medicinal application. Nitrous acid converts it into a mixture of 2- and 4-nitroso-α-naphthol, the former preponderating. One chlorine atom can be introduced by using sulphuryl chloride to give 4-chloro-α-naphthol, but chlorination with chlorine leads to the formation of the 2:4-dichloro-derivative. Nitration gives, in the same way, not a mononitro-compound, but 2:4-dinitro-α-naphthol. The sodium salt of this substance, known variously in commerce as Martius yellow, Manchester yellow, or naphthalene yellow, was formerly used as a golden-yellow dye for silk and wool. It is easily removed from the fibre, however, and has been superseded. A closely related dyestuff of greater importance is naphthol yellow S (2:4-dinitro-α-naphthol-7-sulphonic acid).

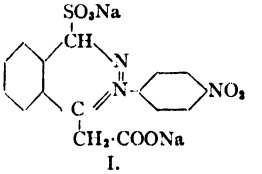
The most important technical methods for the manufacture of *α-naphtholsulphonic acids* are (*a*) sulphonation of α-naphthol, (*b*) replacement of the amino-group of α-naphthylaminesulphonic acids by hydroxyl, through the diazo-reaction, (*c*) conversion of α-naphthylaminesulphonic acids by heating with sodium bisulphite solution (*i.e.*, the reverse of Bucherer's reaction for the introduction for an amino-group), (*d*) exchange of one of the α-sulphonic groups in naphthalenepolysulphonic acids for hydroxyl by fusion with caustic alkali, and (*e*) similar exchange of the chlorine atom in α-chloronaphthalenesulphonic acids. The best known is 1-naphthol-4-sulphonic acid (Neville and Winther's acid) which is used for making a large number of azo-dyes.

β-Naphthol is invariably made technically by fusion of the sodium salt of naphthalene-β-sulphonic acid with caustic alkali, and is therefore liable to contain a small amount of the α-isomeride unless carefully purified. When pure it crystallizes in plates, melting point 122° C, boiling point 285°–286° C. Its solubility in various solvents is similar to that of α-naphthol, but it is odourless, and appreciably volatile only in superheated steam. It has marked antiseptic properties, and its salicylate

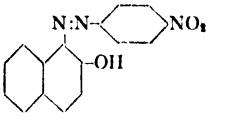


, which is known in pharmacy as betol or naphtholsalol, is useful medicinally. When ortho-aminoazotoluene is diazotized and coupled with β-naphthol, a dark reddish-brown powder, called scarlet red, is formed. This possesses valuable therapeutic properties, and is also used for stains in microscopy. The alkyl ethers of β-naphthol find scope as cheap perfumes. With nitrous acid, β-naphthol yields the 1-nitroso-derivative, which forms insoluble precipitates with certain metallic salts, thus enabling cobalt to be separated from nickel, iron from aluminium, and copper from cadmium, magnesium and zinc. These precipitates are easily converted into metallic oxides by ignition, and so afford a means of estimating cobalt, iron and copper. Chlorination of β-naphthol gives the 1-chloro-derivative, but on nitration 1:6-dinitro-β-naphthol is obtained. If β-naphthol is condensed in alcoholic solution with para-nitrosodimethylaniline hydrochloride, an oxazine, Meldola's blue (dimethylaminonaphthophenoxazonium chloride), is formed (*see* DYES, SYNTHETIC).

The general methods available for the production of *β-naphtholsulphonic acids* are somewhat limited by the difference in reactivity between α- and β-sulphonic groups in the naphthalene nucleus. For instance, only from those disulphonic acids (and there are but two available, the 2:6- and 2:7-) containing *both* sulphonic groups in β-positions can a β-naphthol derivative be obtained by fusion with alkali, for if an α-sulphonic group be present it will be replaced preferentially. Furthermore, replacement of the β-amino-group by hydroxyl is usually impracticable, as the most convenient method of preparing the required β-naphthylaminesulphonic acids is from the β-naphtholsulphonic acids themselves. Fortunately a greater number of β-naphtholsulphonic acids can be obtained by direct sulphonation than in the α-series. Of these, β-naphthol-1-sulphonic acid (oxy-Tobias acid) is of little value for dyestuff purposes, but it is unique among the acids of the naphthalene series in that it undergoes a curious transformation when successively condensed with diazotized para-nitraniline and treated with an excess of sodium hydroxide, a complex phthalazine I. being formed, instead of the usual para red II.β-Naphthol-6-sulphonic acid (Schaeffer acid), -8-sulphonic



I.



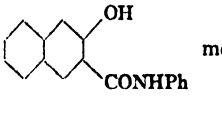
II.

acid (Croceine acid), -3:6-disulphonic acid (R-acid), -6:8-disulphonic acid (G-acid), and -3:6:8-trisulphonic acid, all produced by sulphonation of β-naphthol under varying conditions, are very important. G-Acid furnishes a series of valuable yellow or orange azo-dyes, hence its name (from Ger. *Gelbsäure* = yellow acid), in contradistinction to R-acid (from *Rotsäure* = red acid) which gives the more common red shades.

The *dihydroxynaphthalenes* and their sulphonic acids are of greater technical importance than the diaminonaphthalenes, especially 1:5-dihydroxynaphthalene, 1:8-dihydroxy-4-sulphonic acid, and 1:8-dihydroxy-3:6-disulphonic acid (chromotropic acid). When coupled with diazotized amines they furnish dyes which form insoluble lakes with iron, aluminium or chromium mordants.

Among the more important *aminonaphtholsulphonic acids* are 2-amino-5-naphthol-7-sulphonic acid (J-acid) (which, unlike its isomerides, endows many dyes of which it is a component with the property of dyeing unmordanted cotton), 2-amino-8-naphthol-6-sulphonic acid (γ-acid), and 1-amino-8-naphthol-3:6-disulphonic acid (H-acid), the last being one of the most valuable intermediates that the dyestuff industry possesses. H-Acid, as well as other 3:6-naphthalenedisulphonic acids, has also been employed in the synthesis of trypanocides for use in combating sleeping sickness. Several of the aminonaphtholsulphonic acids, *e.g.*, "Eikonogen" and "Diogen," are used in photography.

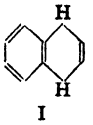
Carboxylic Acids.—Only certain hydroxy-derivatives of α- and β-naphthoic acids are technically valuable. Their chief interest, with one exception, lies in one of the methods of preparation, for Kolbe's synthesis (the action of carbon dioxide under pressure on the dry sodium or potassium salt of the naphthol) furnishes from α-naphthol the 2-carboxy-acid, and from β-naphthol the 1-, 3-, or 6-carboxy-acid, according to the temperature. Of these, 2-hydroxy-3-naphthoic acid, melting point 216° C, is most important, since it gives rise to various anilides, toluidides, naphthylamides, etc., when heated in a solution of a tertiary base, such as dimethylaniline, with the appropriate amine in presence of phosphorus trichloride. These substances, of which the simplest,



melting point 243°–244° C, has the trade

name "Naphthol AS" (Brenthol AS), possess a strong affinity for both natural and artificial fibres. When the material so impregnated is passed through a diazo-solution from *p*-nitroaniline or other aromatic base, coupling takes place inside rather than on the surface of the fibre, and the colours are much faster to light and washing than those from azo-dyes produced by merely "padding" the fibre with (say) β-naphthol. Various dyestuffs of this series are available for cotton, wool and artificial silks.

Hydrogenated Derivatives.—All the hydrogenated products of naphthalene, from dihydronaphthalene, $C_{10}H_{10}$, to decahydronaphthalene, $C_{10}H_{18}$, are known, each member having two hydrogen atoms more than its immediate predecessor. Three general methods are available for their preparation, in all of which, however, the products vary considerably with variations in the conditions. (1) Reduction with hydriodic acid: this method gives mixtures difficult to purify. Two intermediate products in the preparation of decahydronaphthalene by this method have been identified, viz., 1:4-dihydro- and 1:4:5:8-tetrahydro-naphthalene. (2) Reduction with sodium and an alcohol: by this method no more than four hydrogen atoms can be introduced into the naphthalene nucleus, no matter what alcohol is employed. Amyl alcohol and sodium yield 1:2:3:4:-tetrahydronaphthalene, but the product when any other alcohol is used depends to a certain extent on the concentration of the sodium alcoholate, and also on the boiling point of the solvent. 1:4-Dihydronaphthalene I. is the first product and un-



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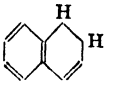
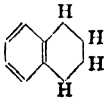
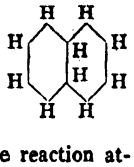
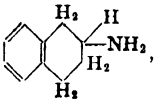
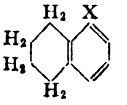


II

less this isomerizes to 1:2-dihydronaphthalene II. hydrogenation can proceed no further. (3) Reduction with hydrogen in presence of a catalyst: the particular hydro-derivative obtained by this method depends upon a variety of conditions. Most important is the nature and oxygen content of the catalyst, but the degree of hydrogenation is dependent also on the temperature, pressure and duration of the reaction, and on whether the naphthalene reacts in the vapour or liquid phase or in solution.

Tetralin.—The method adopted for the manufacture of 1:2:3:4-tetrahydronaphthalene  ("Tetralin") by the Tetralin Co. at their works near Rosslau in Germany, where 120 tons per day can be produced, is briefly as follows: Commercially pure naphthalene, which contains sulphur compounds (*e.g.*, thionaphthenes) equivalent to 0·25% of sulphur, is freed from them by heating with fuller's earth, kieselguhr or other absorbent material. If this were not done, the catalyst would be quickly poisoned and unable to function. The purified naphthalene is distilled into the hydrogenating autoclaves, which contain the catalyst (usually finely-divided nickel and copper oxide deposited on an inert medium), and hydrogen (freed from carbon monoxide and sulphur dioxide) is pumped in until at 200° C a pressure of about 220lb. per sq.in. is attained. The agitated molten naphthalene rapidly takes up hydrogen until the tetrahydro-stage is reached, when the rate of absorption diminishes. The product is then distilled under reduced pressure, a fresh charge of molten naphthalene introduced, and the process repeated. As many as 40 hydrogenations can be effected before the catalyst has to be reactivated. If "Decalin" (decahydronaphthalene)  is required, more hydrogen is introduced when the reaction attains the tetrahydro-stage, and the process continued.

Tetralin is a colourless liquid, boiling point 206°–208° C, flash point 78° C. It is insoluble in water and only sparingly soluble in ethyl alcohol (except after long standing, when oxidation products have affected its physical properties), but it mixes freely with amyl alcohol, butyl alcohol or benzene. It is a useful solvent for certain types of synthetic resins, essential and vegetable oils, waxes, rubber, sulphur and many organic substances and dyestuffs; it also finds application as a diluent in boot polishes. Both it and "tetralin extra" (a mixture of decalin and tetralin) are used in the manufacture of lacquers and varnishes; decalin alone has not such a powerful solvent action. Tetralin was used in Germany during the World War as a motor fuel in place of petrol, but under normal conditions its high flash point is a serious objection for such a purpose. When it is treated with concentrated sulphuric acid and the sulphonated oil neutralized with caustic soda, tetralin-soda sulphite, a white soapy substance, soluble in water and possessing a powerful emulsifying action, is formed: "Tetralol" (*ar.*-tetra-hydro-β-naphthol) is used as a disinfecting soap; it is non-poisonous to man and may therefore also be employed for the preservation of fruit-trees.

When the naphthylamines and naphthols are reduced to their tetrahydro-derivatives with sodium in boiling amyl alcohol, two types of compounds are formed: (*a*) those in which the four hydrogen atoms are attached to the same ring as the original substituent, and (*b*) those in which the original substituent is in one ring and the four added hydrogen atoms are in the other. The members of class (*a*) are termed "alicyclic" (or *ac.*-) derivatives, because they have become aliphatic in character; *e.g.*, β-naphthylamine is hydrogenated to *ac.*-tetrahydro-β-naphthylamine, , in 95% yield; this substance is strongly alkaline, has an ammoniacal odour, absorbs carbon dioxide from the air, and cannot be diazotized. β-Naphthol similarly gives a secondary alcohol. The members of class (*b*) are termed "aromatic" (or *ar.*-) because they still bear a close analogy to the corresponding compounds in the benzene series; *e.g.*, α-naphthylamine and α-naphthol yield on hydrogenation *ar.*-tetrahydro-naphthylamine and -naphthol  (where X is -NH_2 or -OH), the properties of which closely resemble those of ortho-xylidine and ortho-xylenol respectively.

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NAPHTHOLS: *see* NAPHTHALENE.

NAPHTHYLAMINES: *see* NAPHTHALENE.

NAPIER, SIR CHARLES (1786–1860), British admiral, second son of the Hon. Charles Napier, R.N., and grandson of the 5th Lord Napier, was born at Merchiston Hall, near Falkirk, on March 6, 1786. He became a midshipman in 1800 and lieutenant in 1805. He was appointed to the "Courageux" (74), serving with her in the West Indies, and later was appointed commander of the "Pultusk" brig (Nov. 30, 1807). In August 1808 he was moved into the "Recruit," and in April 1809 took part in the capture of the "Hautpoult" and was promoted acting post captain. Coming home with a convoy, he was put on half pay and spent some time at the university of Edinburgh, and later visited Portugal. He served in 1811 in the Mediterranean and in 1813 on the coast of America. He spent his leisure in Italy and Paris, but was ruined by speculation in a steamboat company. In 1827 he was appointed to the "Galatea," was at the Azores when they were held by the count de Villa Flor for the queen of Portugal, and accepted the offer of the constitutional leaders to take command of the fleet (February 1833). With it he destroyed

the Miguelite fleet on July 5, and was struck off the English navy list. He commanded the Portuguese land forces in the defence of Lisbon (1834) and was made Count Cape St. Vincent in the peerage of Portugal.

Napier then returned to England, was restored to his former rank in 1836, and received the command of the "Powerful" in 1838. In 1840 he was made K.C.B. for his services as second in command in Syria. He was M.P. for Marylebone from 1842–46. He was promoted rear-admiral in 1846 and commanded the Channel fleet from 1846–48. In the Russian War he received the command of the Baltic fleet, and hoisted his flag in February 1854. He refused to attack Cronstadt, and a great outcry was raised against him for not obeying the orders of the Admiralty. He was not again offered a command. He was M.P. for Southwark from February 1855 until his death on Nov. 6, 1860.

See Major-General E. Napier's *Life and Correspondence of Admiral Sir. Charles Napier, K.C.B.* (2 vols., 1862); Napier's own *War in Syria* (2 vols., 1842); *The Navy: its past and present state, in a series of letters*, edited by Sir W. F. P. Napier (1851); and *The History of the Baltic Campaign of 1854, from documents and other materials furnished by Vice-Admiral Sir C. Napier, K.C.B.* (1857). *See* also *The Life and Exploits of Commodore Napier* (1841); and *Life of Vice-Admiral Sir C. Napier* (1854).

NAPIER, SIR CHARLES JAMES (1782–1853), British soldier and statesman, was born in London, the eldest son of Colonel George Napier (a son of the 5th Lord Napier) and Lady Sarah Lennox, on Aug. 10, 1782. He was lieutenant in 1800 and captain in the staff corps under Sir John Moore. He became major in 1806 and served in the Danish campaign (1807) and in Portugal, but was badly wounded at Coa and Busaco. He took part in the pursuit of Masséna and became lieutenant-colonel (1811) of the 102nd regiment, which he thoroughly reorganized. At Bermuda in 1813 he served against the United States, but returned in 1815 and was made C.B. From 1822 to 1830 he was military resident of Cephalonia, where he met Lord Byron, and was recommended as commander-in-chief of the Greek forces. Napier declined, and, after trouble with Sir Frederick Adams, the high commissioner, he became commanding officer in the north of England during the Chartist riots (1839), although his sympathies were on the popular side. He accepted an Indian commission in 1841, and in September 1842 was ordered to Sind.

His command in Sind lasted until August 1847. He at once determined to seek the first opportunity of conquering the amirs. He was to be accompanied by James Outram (*q.v.*) who had been British resident in Sind during the Afghan War. On Feb. 15, 1843, Outram was treacherously assailed at Hyderabad, and on the 17th Napier attacked the Baluch army 30,000 strong, with but 2,800 men. With these 2,800 men, including the 22nd regiment, he won the brilliant and decisive victory of Miani, one of the most amazing in the history of the British army, in which generals had to fight like privates. In March he finally destroyed the army of the amirs at the battle of Hyderabad, and for this service received the K.C.B. Sind, when it came under British rule, was in a state of anarchy, for the Baluchis had formed a tyrannical military government. The native population was protected by Sir Charles Napier. The difficulties of administration were increased by the necessity of repressing the hill tribes, encouraged to lawless acts by the licence which followed the Afghan War; the later years were made very stormy by attacks in England on the policy of the conquest. Napier left Sind in August 1847 after quarreling with nearly every authority in India. His short stay in England was occupied with incessant struggles with the directors of the East India Company, but the panic in England which followed the news of the indecisive victory of Chillianwalla obliged the company to summon the greatest general of the day to command its armies.

Napier left for India at once, only to find that the victory of Gujrat had been won and the Sikh War was over. He was on good terms with the governor-general, Lord Dalhousie, until, in Dalhousie's absence at sea, Napier took upon himself, in face of a threat of mutiny, to alter the regulations regarding allowances to native troops. On Dalhousie's return he reprimanded the commander-in-chief, and reversed his decision. Napier immediately resigned, and, when Wellington repeated the reprimand, he returned to England.

He has been credited with foreseeing the Mutiny of 1857, and on the whole with justice. On one occasion he wrote that mutiny was "one of the greatest, if not the greatest, danger threatening India—a danger that may come unexpectedly, and if the first symptoms be not carefully treated, with a power to shake Leadenhall." On the mutiny of the 66th native regiment at Govindgarh he disbanded it, and handed its colours over to a Gurkha regiment, thus showing that he distrusted the high-class Brahman, and recognized the necessity of relying upon a more warlike and more disciplined race. His constitution was undermined by the Indian climate, and he died at Portsmouth on Aug. 29, 1853. The bronze statue of him by G. G. Adams, which stands in Trafalgar Square, London, was erected by public subscription, by far the greater number of the subscribers being, as the inscription records, private soldiers.

The chief authority for Sir Charles Napier's life is his *Life and Opinions* by his brother (1857); consult also MacColl, *Career and Character of C. J. Napier* (1857); M'Dougall, *General Sir C. J. Napier, Conqueror and Governor of Scinde* (1860); W. N. Bruce, *Sir Charles Napier* (1855); and T. R. E. Holmes, *Four Famous Soldiers* (1889). His own works are *Memoir on the Roads of Cephalonia* (1825); *The Colonies, treating of their value generally and of the Ionian Islands in particular; Strictures on the Administration of Sir F. Adam* (1833); *Colonization, particularly in Southern Australia* (1835); *Remarks on Military Law and the Punishment of Flogging* (1837); *A Dialogue on the Poor Laws* (1838?); *A Letter on the Defence of England by Corps of Volunteers and Militia* (1852); *Lights and Shadows of Military Life* (trans. from the French, 1840); and *A Letter to the Right Honourable Sir J. C. Hobhouse on the Baggage of the Indian Army* (1849); *Defects, Civil and Military, of the Indian Government* (1853); *William the Conqueror, a Historical Romance*, edited by Sir W. Napier (1858). On Sind, consult primarily Sir W. Napier, *The Conquest of Scinde* (1845); *The Administration of Scinde* (1851); *Compilation of General Orders issued by Sir C. Napier* (1850); and Outram, *The Conquest of Scinde, a Commentary* (1846). For his command-in-chief, and the controversy about his resignation, consult J. Mawson, *Records of the Indian Command of General Sir C. J. Napier* (Calcutta, 1851); *Minutes on the Resignation of the late General Sir C. Napier, by Field-Marshal the Duke of Wellington*, etc. (1854); *Comments by Sir W. Napier on a Memorandum of the Duke of Wellington* (1854); Sir William Napier, *General Sir C. Napier and the Directors of the East India Company* (1857); Sir W. Lee Warner, *Life of Lord Dalhousie* (1904).

NAPIER, JOHN (1550–1617), Scottish mathematician, the inventor of logarithms, was born in Merchiston near Edinburgh in 1550, and was the eighth Napier of Merchiston. He matriculated at St. Salvator's college, St. Andrews, in 1563. Very little is known of his life at this time, but it is plain from the "Discourse" which he prefixed to his *Plaine Discovery* that he was already a devoted adherent of the Protestant cause. From St. Andrews he went apparently to study in Paris, and travelled in Italy and Germany. But he was back at Merchiston in 1571, and in the next year married Elizabeth, daughter of Sir James Stirling. The son of this marriage was Archibald, Lord Napier. Elizabeth Napier died in 1579, and soon after Napier married Agnes Chisholm.

Napier was one of the Edinburgh commissioners to the General Assembly in 1588, and on Oct. 17, 1593, was a member of a committee nominated by a convention of delegates to make representations to the king at Jedburgh on the safety of the Church and the punishment of the Roman Catholic earls. He was a member of a similar delegation later in the month. On Jan. 29, 1594, Napier addressed to the king the letter which forms the dedication of his *Plaine Discovery of the whole Revelation of Saint John: set down in two treatises . . .* (Edinburgh, 1593). This book has a great place in the history of theology in Scotland, for it is the first important Scottish work on the interpretation of scripture.

After the publication of the *Plaine Discovery*, Napier seems to have occupied himself with the invention of secret instruments of war, for in the Bacon collection at Lambeth Palace there is a document, dated June 7, 1596, and signed by Napier, giving a list of his inventions for the defence of the country against the anticipated invasion by Philip of Spain. In 1614 appeared *Canonis Descriptio* embodying his invention of logarithms. Their nature is explained by reference to the motion of points in a straight line, and the principle upon which they are based is that of the correspondence of a geometrical and an arithmetical series of numbers.

The table gives the logarithms of sines for every minute to seven figures. This work contains the first announcement of logarithms to the world, the first table of logarithms and the first use of the name logarithm, which was invented by Napier.

In 1617 Napier published his *Rabdologia*. The method which Napier terms "Rabdologia" consists in the use of certain numerating rods for the performance of multiplications and divisions. These rods were commonly called "Napier's bones." The second method, which he calls the "Promptuarium Multiplicationis," involves the use of a number of lamellae or little plates of metal disposed in a box. In an appendix he gives his third method, "local arithmetic," which is performed on a chess-board, and depends, in principle, on the expression of numbers in the scale of radix 2. In the *Rabdologia* he gives the chronological order of his inventions.

John Napier died on April 4, 1617, the same year as that in which the *Rabdologia* was published.

The *Canonis Descriptio* on its publication in 1614 at once attracted the attention of Edward Wright, whose name is known in connection with improvements in navigation, and Henry Briggs, then professor of geometry at Gresham college, London. The former translated the work into English, but he died in 1615, and the translation was published by his son Samuel Wright in 1616. The logarithms introduced by Napier in the *Descriptio* are not the same as those now in common use, nor even the same as those now called Napierian or hyperbolic logarithms. The change from the original logarithms to common or decimal logarithms was made by both Napier and Briggs, and the first tables of decimal logarithms were calculated by Briggs, who published a small table, extending to 1,000, in 1617, and a large work, *Arithmetica Logarithmica*, containing logarithms of numbers to 30,000 and from 90,000 to 100,000, in 1624. (*See* LOGARITHM.) Napier's *Descriptio* of 1614 contains no explanation of the manner in which he had calculated his table. This account he kept back, as he himself states, in order to see from the reception met with by the *Descriptio* whether it would be acceptable. Though written before the *Descriptio* it had not been prepared for press at the time of his death, but was published by his son Robert in 1619 under the title *Mirifici Logarithmorum Canonis Constructio*. In this treatise (which was written before Napier had invented the name logarithm) logarithms are called "artificial numbers."

Napier's priority in the publication of the logarithms is unquestioned and only one other contemporary mathematician seems to have conceived the idea on which they depend.

An account of the contents of the manuscripts of John Napier in the possession of the family which survived a disastrous fire at the end of the 18th century was given by Mark Napier in the appendix to his *Memoirs of John Napier*, and the manuscripts themselves were edited in their entirety by him in 1839 under the title *De Arte Logistica Joannis Naperi Merchistonii Baronis Libri qui supersunt. Impressum Edinburgi* M.DCCC.XXX.IX., as one of the publications of the Bannatyne club. The *Arithmetica* consists of three books, entitled: (1) De Computationibus Quantitatum omnibus Logisticae speciebus communium; (2) De Logistica Arithmetica; (3) De Logistica Geometrica. At the end of this book occurs the note—"I could find no more of this geometricall pairt among all his fragments." The *Algebra Joannis Naperi Merchistonii Baronis* consists of two books: (1) "De nominata Algebrae parte; (2) De positiva sive cossica Algebrae parte," and concludes with the words, "There is no more of his algebra orderlie sett doun."

Besides the logarithms and the calculating rods or bones, Napier's name is attached to certain rules and formulae in spherical trigonometry. To him also seems to be due the first use of the decimal point in arithmetic. Decimal fractions were first introduced by Stevinus in his tract *La Disme*, published in 1585, but he used cumbrous exponents (numbers enclosed in circles) to distinguish the different denominations, primes, seconds, thirds, etc. In the *Rabdologia* Napier gives an "Admonitio pro Decimali Arithmetica," in which he commends the fractions of Stevinus and gives an example of their use, the division of 861094 by 432. The quotient is written 1993.273 in the work and 1993,2′7″3′″ in the text. The decimal point is, however, used systematically in the *Constructio* (1619), there being perhaps two hundred decimal points altogether in the book.

Napier was in possession of all the conventions and attributes that enable the decimal point to complete so symmetrically our system of notation, viz. (1) he saw that a point or separatrix was quite enough to separate integers from decimals, and that no signs to indicate primes, seconds, etc., were required; (2) he used ciphers after the decimal point and preceding the first significant figure; and (3) he had no objection to a decimal standing by itself without any integer. Napier thus had complete command over decimal fractions and the use of the decimal point.

The bibliography of Napier's work attached to W. R. Macdonald's translation of the *Canonis Constructio* (1889) is complete and valuable. Napier's three mathematical works are reprinted by N. L. W. A. Gravelaar in *Verhandelingen der Kon. Akad. van Wet te Amsterdam* (1899).

NAPIER, SIR WILLIAM FRANCIS PATRICK (1785–1860), British soldier and military historian, third son of Colonel George Napier (1751–1804), was born at Celbridge, near Dublin, on Dec. 17, 1785. He became an ensign in the Royal Irish Artillery in 1800, but at once exchanged into the 62nd, and was put on half-pay in 1802. He afterwards became a cornet in the Blues, but he soon exchanged into the 52nd, which was about to be trained at Shorncliffe. Through Sir John Moore he soon obtained a company in the 43rd, joined that regiment at Shorncliffe and became a favourite with Moore. He served in Denmark, and was present at the engagement of Kioge, and, shortly afterwards bore himself nobly through the retreat to Corunna. In 1809 he became aide-de-camp to the duke of Richmond, lord lieutenant of Ireland, but joined the 43rd when that regiment was ordered again to Spain. With the light brigade (the 43rd, 52nd, and 95th), under the command of General Craufurd, he marched to Talavera and had an attack of pleurisy on the way. He refused to leave Spain, was wounded on the Coa, and shot near the spine at Cazal Nova. After he left the lines of Torres Vedras he became brigade major, was present at Fuentes d'Onor, but had an attack of ague and was obliged to return to England. He married Caroline Amelia Fox, daughter of General Henry Fox. Three weeks afterwards he again started for Spain, and was present at the storming of Badajoz, where his great friend Colonel M'Leod was killed. He took command of the 43rd regiment (he was now a substantive major) and commanded it at the battle of Salamanca. At the battle of the Nivelle he secured the most strongly fortified part of Soult's position, practically without orders. He served with his regiment at the battles of the Nive, where he was wounded, Orthes, and Toulouse. For his services he was made brevet lieutenant-colonel, and one of the first C.B.'s. He then entered the military college at Farnham. He commanded his regiment in the invasion of France after Waterloo, and remained in France with the army of occupation until 1819, when he retired on half-pay. As this was not enough for him to live on with a wife and family, he studied with George Jones, the academician to become an artist.

His career was to be great in literature, not in art. The tendency appeared in a review of Jomini's works (*Edinburgh Rev.*) in 1821, and in 1823 Bickersteth (afterwards Lord Langdale) suggested to him writing a history of the Peninsular War. The duke of Wellington gave him much assistance, and handed over to him the whole of Joseph Bonaparte's correspondence which had been taken at the battle of Vittoria; this was all in cipher, but Mrs. Napier, with great patience, discovered the keys. Marshal Soult also took an active interest in the work and arranged for the French translation of Mathieu Dumas. In 1828 the first volume of the *History* appeared. The publisher, John Murray, was disappointed in the sale of the first volume and Napier published the remainder himself. But the excitement which followed the appearance of each volume is proved by the innumerable pamphlets issued by those who believed themselves to be attacked, and by personal altercations with many distinguished officers. This success was due to a combination of qualities which have justly secured for Napier the title of being the greatest military historian England has produced. When in 1840 the last volume of the

History was published, his fame was safely established.

His life during these years had been chiefly absorbed in his *History,* but he had warmly sympathized with the movement for political reform which was agitating England. The Radicals of Bath and many other cities and towns pressed him to enter parliament, and Napier was invited to become the military chief of a national guard to obtain reforms by force of arms. He refused the dangerous honour on the ground that he was in bad health and had a family of eight children. In 1830 he had been promoted colonel, and in 1842 he was made a major-general and given the lieutenant-governorship of Guernsey. Here he managed the relations between the soldiers and the inhabitants, and worked out proposals for a complete scheme of reform in the government of the island.

In 1845 he published his *History of the Conquest of Scinde,* and in 1851 the corresponding *History of the Administration of Scinde.* In 1847 he resigned his governorship, and in 1848 was made a K.C.B., and settled at Scinde House, Clapham Park. In 1851 he was promoted lieutenant-general. His time was occupied in defending his brother, and in revising the numerous editions of his *History* which were being called for. His energy is the more astonishing when it is remembered that he never recovered from the effects of the wound he had received at Cazal Nova, and that he often had to lie on his back for months together. His domestic life was shadowed by the incurable affliction of his only son. He devoted himself to writing the life of his brother Charles, which appeared in 1857. He died on Feb. 12, 1860. Four months earlier he had been promoted to the full rank of general.

His brother, SIR GEORGE THOMAS NAPIER (1784–1855), entered the army in 1800, and served with distinction under Moore and Wellington in the Peninsula. He became major-general in 1837, K.C.B. in 1838 and lieutenant-general in 1846. He was governor and commander-in-chief at the Cape from 1839 to 1843. He was offered, but declined, the chief command in India after Chillianwalla, and also that of the Sardinian army in 1849. He became full general in 1854. He died at Geneva on Sept. 16, 1855. His autobiography, *Passages in the Early Military Life of General Sir G. T. Napier,* was published by his son, General W. C. E. Napier in 1885.

The youngest brother, HENRY EDWARD NAPIER (1789–1853), served in the navy during the Napoleonic wars, retired as a captain, and wrote a learned *Florentine History from the earliest authentic Records to the Accession of Ferdinand III. of Tuscany* (1846–1847).

For Sir William Napier's life, *see* his *Life and Letters,* edited by H. A. Bruce (Lord Aberdare) (1862).

NAPIER AND ETTRICK, FRANCIS NAPIER, Baron (1819–1898), British diplomatist, descended from the ancient Scottish family of Napier of Merchistoun, was born on Sept. 15, 1819, the son of William John, ninth Lord Napier. He entered the diplomatic service in 1840, and held successive posts at Vienna, Constantinople, Naples, Washington and The Hague. In 1860 he became ambassador at St. Petersburg, and in 1864 at Berlin. In 1866 he was appointed governor of Madras, and was at once confronted with a serious famine in the northern districts. In dealing with this and other problems he showed great activity and practical sense, and he encouraged public works, particularly irrigation. In 1872 he acted for a few months as Viceroy, after Lord Mayo's assassination; and on Lord Northbrook's appointment to the office he returned to England, being created a baron of the United Kingdom (Baron Ettrick of Ettrick) for his services. He was for a time a member of the London School Board, and was chairman of the Crofters' Commission in 1883, the result of which was the appointment of a permanent body to deal with questions affecting the Scottish crofters and cottars. He died at Florence on Dec. 19, 1898.

NAPIER OF MAGDALA, ROBERT CORNELIS NAPIER, 1ST BARON (1810–1890), British field-marshal, son of Major Charles Frederick Napier, was born at Colombo, Ceylon, on Dec. 6, 1810. He entered the Bengal Engineers from Addiscombe College in 1826, and after the usual course of instruction at Chatham, arrived in India in November 1828. For some years he was employed in the irrigation branch of the public works department, and in 1838 he laid out the new hill station at Darjeeling. Promoted captain in January 1841, he was appointed to Sirhind, where he laid out cantonments on a new principle—known as the Napier system—for the troops returning from Afghanistan. In December 1845 he joined the army of the Sutlej, and commanded the Engineers at the battle of Mudki, where he had a horse shot under him. At the battle of Ferozeshah on Dec. 31 he again had his horse shot under him, and, joining the 31st Regiment on foot, was severely wounded in storming the entrenched Sikh camp. He was present at the battle of Sobraon on Feb. 10, 1846, and in the advance to Lahore. He was chief engineer at the reduction of Kote-Kangra by Brigadier-General Wheeler in May 1846, and received the thanks of government. He was then appointed consulting engineer to the Punjab resident and council of regency, but was again called to the field to direct the siege of Multan. He was wounded in the attack on the entrenched position in September 1848, but was present at the action of Shujabad, the capture of the suburbs, the successful storm of Multan on Jan. 23, 1849, and the surrender of the fort of Chiniot. He then joined Lord Gough, took part, as commanding engineer of the right wing, in the battle of Gujrat in February 1849, accompanied Sir W. R. Gilbert in his pursuit of the Sikhs and Afghans, and was present at the passage of the Jhelum, the surrender of the Sikh army, and the surprise of Attock. At the close of the war Napier was appointed civil engineer to the board of administration of the annexed Punjab province, and carried out many important public works. In December 1852 he commanded a column in the first Hazara expedition, and in the following year against the Boris. He was appointed military secretary and adjutant-general to Sir James Outram's force for the relief of Lucknow in the Indian Mutiny in 1857, and was engaged in the actions which culminated in the first relief of Lucknow. He directed the defence of Lucknow until the second relief, when he was severely wounded in crossing an open space with Outram and Havelock to meet Colin Campbell. He was chief of the staff to Outram in the defence of the Alambagh position, and drew up the plan of operations for the attack of Lucknow, which was approved by Campbell and carried out by Napier, as brigadier-general commanding the Engineers, in March 1858. On the fall of Lucknow Napier received the C.B. He joined Sir Hugh Rose as second-in-command in his march on Gwalior, and commanded the 2nd brigade at the action of Morar on June 16. On the fall of Gwalior he was entrusted with the task of pursuing the enemy. With only 700 men he came up with Tantia Topi and 12,000 men on the plains of Jaora Alipur and completely defeated him, capturing all his guns (25), ammunition and baggage. On Rose's departure he took command of the Gwalior division, captured Paori in August, routed Ferozeshah, a prince of the house of Delhi, at Ranode in December, and in January 1859, succeeded in securing the surrender of Man Singh and Tantia Topi, which ended the war. For his services Napier received the thanks of parliament and of the Indian government, and was made K.C.B.

In January 1860 Napier was appointed to the command of the 2nd division of the expedition to China under Sir Hope Grant, and took part in the action of Sinho, the storm of the Peiho forts, and the entry to Peking. For the next four years Napier was military member of the council of the governor-general of India and, on the sudden death of Lord Elgin, for a short time acted as governor-general, until the arrival of Sir W. T. Denison from Madras. In January 1865 he was given the command of the Bombay army; in March 1867 he was promoted lieutenant-general, and, later in that year, appointed to command the expedition to Abyssinia, selecting his own troops and making all the preparations for the campaign. He arrived at Annesley Bay in the Red Sea in January 1868, reached Magdala, 420 m. from the coast, in April; stormed the stronghold, freed the captives, razed the place to the ground, returned to the coast, and on the 18th June the last man of the expedition had left Africa. He received for his services the thanks of parliament, a pension, a peerage, the G.C.B., the G.C.S.I., and many academic honors. He held the

command-in-chief in India for six years from 1870, during which he did much to benefit the army and to encourage good shooting. He was promoted general in 1874, and appointed a colonel-commandant of the Royal Engineers. In 1876 he was the guest of the German crown prince at the military manoeuvres, and from that year until 1883 held the government and command of Gibraltar. In the critical state of affairs in 1877 he was nominated commander-in-chief of the force which it was proposed to send to Constantinople. On Jan. 1, 1883 he was promoted to be field-marshal, and in December 1886 appointed Constable of the Tower of London. He died in London on Jan. 14, 1890.

See H. D. Napier, *Field Marshal Lord Napier of Magdala* (1927).

NAPIER, a seaport on the east coast of North Island, New Zealand, capital of the provincial district of Hawke's Bay, 200 m. by rail N.E. of Wellington. Pop. (1927) 18,680. The main portion of the town stretches along the flat shoreland of Hawke's Bay, while the suburbs extend over the hills to the north. The site consists of a picturesque peninsula known as Scinde Island. The harbour (Port Ahuriri) is sheltered by a breakwater. The cathedral church of St. John (1888) for the bishopric of Waiapu, is one of the finest ecclesiastical buildings in New Zealand, imitating the Early English style in brick. The district is agricultural, and wool, frozen meats and fruit are exported.

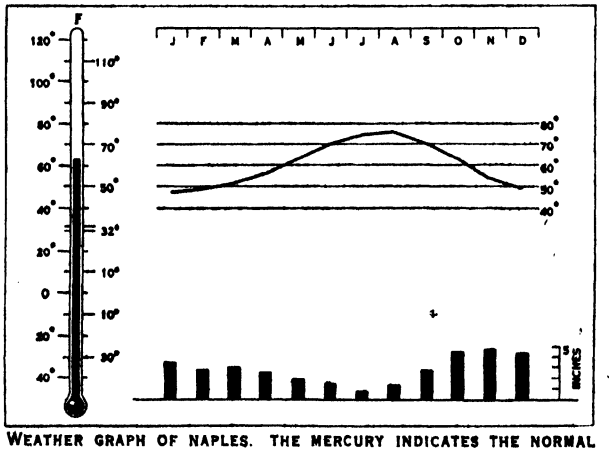
NAPLES (Ital. *Napoli*, and Lat. *Neapolis*), formerly the capital of the kingdom of the Two Sicilies, and since 1860 the chief town of the province which bears its name. It was the largest city in the country in 1901, containing 547,503 inhabitants, but has now been outstripped by Milan. Its population in 1921 was 771,857 (town), 772,405 (commune). It is the see of a cardinal archbishop; the residence of the general commanding the X. Army Corps and of the admiral commanding the second Naval Department of Italy; and it possesses also an ancient and important university. Since 1925 the province has been placed under a high commissioner.

Naples disputes with Constantinople the claim of occupying the most beautiful site in Europe. It is situated on the northern shore of the Bay of Naples (*Sinus Cumanus*), in 40° 52′ N., 14° 15′ 45″ E., as taken from the lighthouse on the mole. By rail it is distant 135 m. from Rome, by the direct line, and 155 by the older line via Cassino. (For map, *see* ITALY.) The circuit of the bay is about 35 m. from the capo di Miseno on the north-west to the Punta della Campanella on the south-east, or more than 52 m. if the islands of Ischia, at the north-west, and of Capri, at the south entrance, be included. At its opening between these two islands it is 14 m. broad; while another 4 m. separates Capri from the mainland at the Punta della Campanella, and from the opening to its head at Portici the distance is 15 miles. It affords good anchorage, with nearly 7 fathoms of water, and is well sheltered, except from winds which blow from points between south-east and south-west.

On the north-east shore east of Naples is an extensive flat, forming part of the ancient *Campania Felix*, and watered by the small stream Sebeto and by the Sarno, which last, in classical times, formed the port of Pompeii. From this flat, between the sea and the range of the Apennines, rises Mt. Vesuvius, at the base of which, on or near the sea-shore, are populous villages as well as the classic sites of Herculaneum and Pompeii. At the south-east extremity of the plain, 3 m. beyond the outlet of the Sarno, a great offshoot of the Apennines, branching from the main range near Cava, and projecting as a peninsula more than 12 m. W., divides the Bay of Naples from the Bay of Salerno (*Sinus Paestanus*), and ends in the bold promontory of the Punta della Campanella (Promontorium Minervae), which is separated by a strait of 4 m. from Capri. On the north slope of this peninsula, where the plain ends and the coast abruptly bends to the west, stands the town of Castellammare di Stabia, at the foot of Mt. Sant' Angelo, which rises to a height of 4,722 feet.

The north-west shore to the west of Naples is more broken and irregular. The promontory of Posilipo, which projects due south, divides this part of the bay into two smaller bays—the eastern, with the city of Naples, and the western, or Bay of Baiae, which is sheltered from all winds. A tunnel through the promontory, 2,244 ft. long, 21 ft. broad, and in some places as much as 70 ft. high, possibly constructed by Marcus Agrippa in 27 B.C., forms the so-called grotto of Posilipo; at the Naples end stands the reputed tomb of Virgil, which has recently been restored. Beyond Posilipo is the small island of Nisida (*Nesis*); and at a short distance inland are the extinct craters of Solfatara and Astroni and the lake of Agnano. Farther west, on the coast, and provided with a convenient harbour, stands Pozzuoli (*Puteoli*), containing many Roman remains, and beyond it, round the Bay of Baiae, are Monte Nuovo, a hill thrown up in a single night in Sept. 1538; the classic site of Baiae; the Lucrine lake; Lake Avernus; the Lake of Fusaro (*Acherusia Palus*); and the port and promontory of Misenum. Still farther to the south-west lie the islands of Procida (*Prochyta*) and Ischia (*Pithecusa, Aenaria* or *Inarime*), which divide the Bay of Naples from the extensive Bay of Gaeta. All this country was comprised in classical times under the title of the *Phlegrean Fields*, and was certainly then more actively volcanic than it now is, although the severe shock of earthquake which occurred in the island of Ischia in 1883, completely destroyed Casamicciola, and did serious damage to Forio, Lacco Ameno and Serrara Fontana, shows that there is great seismic activity in the locality. The whole region abounds with fissures, from which steam highly charged with hydrochloric acid is continually issuing, and in many places boiling water is found at a very few feet below the surface.

The city of Naples is built at the base and on the slopes of a range of volcanic hills, and, rising from the shore like a theatre, is seen to best advantage from the sea. From the summit occupied by the castle of St. Elmo a transverse ridge runs south to form the promontory of Pizzofalcone, and divides the city into two natural crescents. The western crescent, known as the Chiaja ward, though merely a long narrow strip between the sea and Vomero hill, is the fashionable quarter most frequented by foreign residents and visitors. A fine broad street, the Riviera di Chiaja, was begun at the close of the 16th century by Count d'Olivares, and completed by the duke de Medina Celi (1695–1700), running for a mile and a half from east to west, ending



WEATHER GRAPH OF NAPLES. THE MERCURY INDICATES THE NORMAL MEAN TEMPERATURE. THE CURVE SHOWS THE NORMAL MONTHLY MEAN TEMPERATURE. THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION

in the quarter of Mergellina and Piedigrotta, at the foot of the hill of Posilipo. In front lie the public gardens of the Villa Nazionale, the chief promenade of the city, which were first laid out in 1780, and have been successively extended in 1807, in 1834, and again in recent years; and the whole edge of the bay from the Castel dell' Ovo to Mergellina is lined by a massive embankment and carriage-way, the Via Caracciolo, constructed in 1875–81. The eastern crescent includes by far the largest, as well as the oldest, portion of Naples.

The best known thoroughfare is the historic Toledo (officially Via Roma), which runs almost due north from the Piazza del Plebiscito in front of the Palazzo Reale, till, as Via Nuova di Capodimonte, crossing the Ponte della Sanità (constructed by

Murat across the valley between Santa Teresa and Capodimonte), it reaches the gates of the Capodimonte palace, thus dividing the city into two parts. A fine street, the Corso Vittorio Emmanuele, winds along the slopes behind the city from the Mergellina railway station till it reaches the museum by the Via Salvator Rosa. The character of the shore of the eastern crescent has been much altered by the new harbour works, which, with the wharves and warehouses, have absorbed the Villa del Popolo, or People's Park, originally constructed on land reclaimed from the bay. The two crescents have now been united by the construction of a connecting thoroughfare on the seaward side of the Castel Nuovo, the royal palace, and the hill of Pizzofalcone; while a tunnel (the Galleria della Vittoria) has been cut under this hill, thus further uniting the east and west halves of the city. There is also a metropolitan underground railway between the central station at Naples and Pozzuoli.

The streets of Naples are generally well-paved with large blocks of lava or volcanic basalt. In the older districts there is a countless variety of narrow gloomy streets, many of them steep. The houses are mostly five or six storeys high, are covered with stucco made of a kind of pozzolana, which hardens by exposure, and have large balconies and flat roofs. The castle of S. Elmo (S. Erasmus), which dominates the whole city, had its origin in a fort (Belforte) erected by King Robert the Wise in 1329. The present building, with its rock-hewn fosses and massive ramparts, was constructed by Don Pedro de Toledo in 1537–46, and was long considered practically impregnable. It is now a military prison. Off a small island (I. del Salvatore, the *Megaris* of Pliny), now joined to the shore at the foot of the Pizzofalcone by an arch-supported causeway, stands the Castel dell' Ovo, restored in the 16th century. Castel Nuovo, a very picturesque building constructed near the harbour in 1279–82 by Charles I. of Anjou, contains between the round towers of its façade the triumphal arch erected in 1455–58 to Alfonso I. In the interior is a fine Gothic hall. (*See* CELESTINE V.) The whole building has recently been restored. Castel del Carmine was demolished in 1906. The royal palace, begun in 1600 from designs by Domenico Fontana, partly burned in 1837, and repaired and enlarged by Ferdinand II., is an enormous building with a sea frontage of 800 ft. and a main façade 554 ft. long and 95 ft. high, exhibiting the Doric, Ionic and Composite orders in its three storeys. It now contains the important National Library (Biblioteca Nazionale Vittorio Emmanuele III.) with valuable books and mss., including mss. recovered from Austria after the war, which had been removed to Vienna by Charles V. Another royal palace, that of Capodimonte, contains a gallery of modern pictures and a fine collection of 18th century Neapolitan porcelain.

Naples has 237 churches and 57 chapels. Most of the churches are notable rather for rich internal decoration than for architectural beauty. The cathedral of St. Januarius was erected in 1294–1323. The general plan is that of a basilica with a nave and two (Gothic vaulted) aisles separated by pilasters. The western façade was completed in 1906. Beneath the high altar is a subterranean chapel containing the tomb of St. Januarius (San Gennaro), the patron saint of the city; in the right aisle there is a chapel (Cappella del Tesoro) built between 1608 and 1637 in popular recognition of his having saved Naples in 1527 "from famine, war, plague and the fire of Vesuvius"; and in a silver tabernacle behind the high altar of this chapel are preserved the two phials partially filled with his blood, the periodical liquefaction of which forms a prominent feature in the religious life of the city. Accessible by a door in the left aisle of the cathedral is the church of Sta. Restituta, a basilica of the 4th century. Its baptistery contains important mosaics of that period. Santa Chiara (14th century, richly restored in the baroque style in the 18th) is interesting for a fresco ascribed to Giotto (at one time there were many more), and monuments to Robert the Wise, his son's wife, Mary of Valois, and his daughter Mary, empress of Constantinople.

San Domenico Maggiore, founded by Charles II. in 1289, but completely restored later, has an effective interior particularly rich in Renaissance sculpture. In the neighbouring monastery is shown the cell of S. Thomas Aquinas. San Filippo Neri or dei Gerolomini, erected in 1592–1619, has a white marble façade and contains the tombstone of Giambattista Vico. Sta. Maria del Parto, in the Chiaja, contains the tomb of Sannazaro, and is named after his poem, *De Partu Virginis*. San Francesco di Paola, opposite the royal palace, is an imitation of the Pantheon at Rome, by Pietro Bianchi of Lugano (1815–18). The church of the Certosa (Carthusian monastery) of San Martino, has now become a museum. Dating from the 14th century, and restored in the 17th, it is a building of extraordinary richness of decoration, with paintings and sculpture by Guido Reni, Lanfranco, Caravaggio, D'Arpino, Solimena, Luca Giordano and Ribera. The monastery has been transformed into a mediaeval museum. The view from the south-western balcony is incomparable.

Other churches with interesting monuments are Sant' Anna dei Lombardi (the church of Monte Oliveto), built in 1414, which contains some splendid marble Renaissance sculpture; Sant' Angelo a Nilo, which contains the tomb of Cardinal Brancaccio, the joint work of Donatello and Michelozzo (1426–28), San Giovanni a Carbonara, built in 1343 and enlarged by King Ladislaus in 1400, which contains among much other remarkable sculpture the tomb of the king, the masterpiece of Andrea da Firenze (1428), and that of Gianni Caracciolo, the favourite of Joanna II., who was murdered in 1432 (the chapel in which it stands has one of the earliest majolica pavements in Italy); San Lorenzo (13th century), the Royal Church of the House of Anjou, and S. Maria Donna Regina, with its frescoes by Pietro Cavallini. The catacombs of S. Gennaro (2nd century) are in many respects not inferior to those at Rome.

Of the secular institutions in Naples none is more remarkable than the National Museum, formerly known as the Museo Borbonico. The building was put to its present use in 1790, when Ferdinand IV. placed in it the Farnese collection, which he had inherited from his father, and all the specimens from Herculaneum, Pompeii, Stabiae, Puteoli, Paestum, etc., which till then had been housed in the palace at Portici. Vast numbers of objects have since been added to it, both by purchase and from excavations, and it is now unique as a treasure house of Italo-Greek and Roman antiquities, besides containing important pictures.

The building, as now arranged, contains the large bronzes and statues on the ground floor; a gallery of Pompeian frescoes and mosaics in the entresol; the picture gallery, papyri, terra cottas and small bronzes, on the first floor; and the glass, jewellery, arms, gems, and the collection of Italo-Greek vases, on the second floor. The large bronzes are almost the only ones which have survived from classical times, the most famous of them being the seated Mercury and the dancing Faun; the marbles reckon among their vast number the Psyche, the Capuan Venus, as well as the huge group called the Toro Farnese (Amphion and Zethus tying Dirce to the horns of the bull), the Farnese Hercules, the excellent though late statues of the Balbi on horseback, and a very fine collection of ancient portrait busts.

The Galleria Umberto I. and Galleria Principe di Napoli somewhat resemble the Milan arcade. The Borsa (or exchange) is a fine building in the Piazza of the same name, built over the remains of the very ancient church of Sant' Aspreno, which are still preserved in the crypt. In front of it is the fine 16th century Fontana Medina.

Educational and Learned Institutions.—The university of Naples was founded by Frederick II. in 1224, and is well equipped with zoological, mineralogical and geological museums, a physiological institute, a cabinet of anthropology, and botanical gardens. The buildings were originally erected in 1557 for the use of the Jesuits. The new building, completed in 1906, faces the Corso Umberto I. (Rettifilo), the street from the Borsa to the railway station. The famous zoological station at Naples, whose aquarium is the principal building in the Villa Nazionale, was founded by Dr. Dohrn in 1872; the marine flora and fauna of the neighbourhood are more varied than those of any district in Europe. The chief universities of the world pay £100 a year for tables to which they send students. The astronomical observatory is situated on the hill of Capodimonte.

The Royal Society of Naples, dating from 1756, is divided into three academies, namely, moral and political; physical and mathematical; letters, archaeology and fine arts. The famous Accademia Pontaniana, founded by Antonio Becardella and J. J. Pontanus in 1442, was restored in 1808 and still exists. The Royal School for Oriental Languages owes its existence to Matteo Ripa, who in 1732 established a school for Chinese missionaries. The Royal Conservatory of Music in S. Pietro a Majella has existed in one form or other since 1760, and has had many famous pupils.

Elementary education has been greatly improved. Whereas in 1925 the schools were utterly insufficient, the attendances have risen from 42,000 to 51,000 in 1928, out of the 90,000 who should by law attend. The higher grade schools are also numerous, and there are special foreign schools, established by private enterprise.

The State archives in Vico San Severino e Sossio contain all the records of past Governments; the Notarial archives in Via San Paolo contain all the original notarial acts from 1450 onwards, to the number of 800,000. The Società di Storia Patria, established in 1875 to record all details of the history of the locality, has a good library also.

The San Carlo opera house, with its area of 5,157 sq.yd. and its stalls capable of seating 1,000 spectators, is one of the largest in Europe. It was originally built in 1737 under Charles III., but was destroyed by fire in 1816 and completely rebuilt. The Mercadante dates from 1778.

Charitable institutions are numerous in Naples. The Reclusorio or poorhouse was founded in the 18th century, and besides being a refuge for the indigent poor has a series of industrial schools attached, at which foundling boys are educated and taught trades. There are also several hospitals, the largest being the Incurabili, founded in 1519.

Harbour.—At a very early date the original harbour at Naples, now known in its greatly reduced state as Porto Piccolo, and fit only for boats and lighters, became too small. In 1302 Charles II. of Anjou began the construction of the Porto Grande by forming the Molo Grande or San Gennaro, which stretched eastward into the bay, and was terminated by a lighthouse in the 15th century. By the addition of a new pier running north-east from the lighthouse, and protected by a heavily armed battery, Charles III. in 1740 added greatly to the safety of the harbour. In 1826 the open area to the south of the Porto Grande was formed into the Porto Militare by the construction of the Molo San Vincenzo, 1,200 ft. long. The lengthening of the Molo San Vincenzo to a total of more than 5,000 ft., and the construction of curving moles on the east to meet it, has formed a large outer basin, the Avamporto, and an inner harbour (Porto Mercantile). New quays have been made all the way from the old Immacolatella landing-place to the Capitaneria di Porto, close to which is the marine railway station, with piers such that the largest liner can lie alongside the jetty. The depth of this new harbour is from 25 to 30 feet. To the east are dock basins, silos for grain and other warehouses. In 1926 the total tonnage entering the port amounted to 8,540,025 tons in 9,536 vessels, while the clearances were almost identical; 1,711,500 tons of goods were imported, and 422,137 exported (including coastwise trade); while the passenger traffic was 650,503 embarked, and 627,378 disembarked. The difference is accounted for by the excess of Italian emigrants over those returning from abroad; while the figures are enormously swollen by the passengers on the night mail boats to and from Palermo. The specialties of Naples are the manufacture of coral, tortoise-shell, kid gloves and macaroni, but it has been growing also as an industrial centre. The port of Naples is second only to that of Genoa.

Water Supply.—Naples has as fine a water supply as any city in Europe, derived from the hills in the neighbourhood of Avellino. It is received in a covered masonry canal, whence it flows in iron pipes till it reaches five enormous reservoirs constructed just opposite to the entrance gates of the royal palace at Capodimonte. Hence it comes by natural gravitation into the town at a pressure of five atmospheres, so that it supplies the highest parts of the town with abundant water. The supply was brought into the town just after the terrible cholera outbreak of 1884. The effect on the health of the city has been extraordinary. Cholera epidemics, which used to be frequent, have become things of the past, and there is now abundant water.

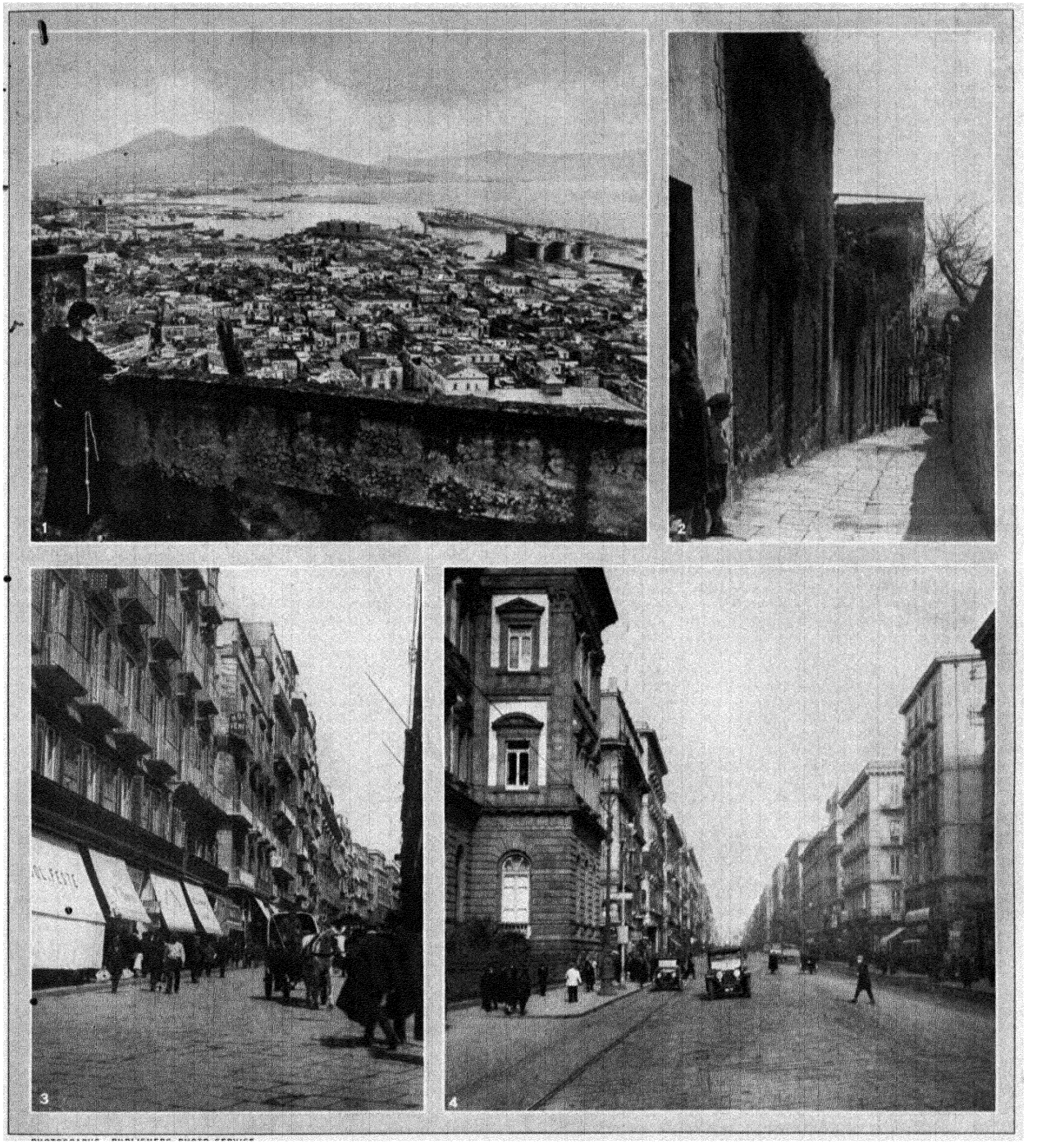
Modern Growth.—Naples has increased in modern times at an enormous rate. On the large areas reclaimed from the sea, hotels and mansions let in flats have been erected. The gardens at the west end of the town are all built over. The Vomero is now an important suburb. The commune has been built over in every direction, one great incentive being the creation of an industrial zone to the eastward of the city, set aside for the purpose of industrial development. It now contains a large number of factories for spinning silk, cotton, jute and wool, and the making of railway plant, automobiles, the building of ships, etc. After the cholera epidemic of 1884, Depretis, then premier, visited Naples, and uttered the famous dictum *"Bisogna sventrare Napoli"*—"Naples must be disembowelled!" The worst slums, which lay between the centre of the town and the railway station, were pulled down and a wide street was constructed from the centre of the town to the eastward. A large working-class quarter was erected to the north and beyond the railway station, known as the Rione Vasto. There are also new middle-class quarters at Santa Lucia, Vomero Nuovo and Sant' Efremo, Poggioreale and Fuorigrotta, and better houses on the Riviera di Chiaja, Via Elena and Via Caracciolo at Mergellina, Via Partenope near the Chiatamone, and an aristocratic quarter in the large extensions made in the Rione Amedeo. The narrow alleys of Porto, Pendino and Mercato have nearly all disappeared, and old Naples has been vanishing day by day. About 50,000,000 lire were assigned to Naples in 1927–28 for public works.

Folk-lore.—The charms against the Evil Eye used by the Neapolitans are derived from classical legends. They are: first, the sprig of rue in silver, with sundry emblems attached to it, all of which refer to the worship of Diana, whose shrine at Capua was of considerable importance; secondly, the serpent charms, which formed part of the worship of Aesculapius, and were no doubt derived largely from the ancient eastern ophiolatry; and lastly, charms derived from the legends of the Sirens.

History.—All ancient writers agree in representing Naples as a Greek settlement. The earliest Greek settlement in the neighbourhood was at Pithecusa (Ischia), but the colonists, being driven out of the island by the frequent earthquakes, settled on the mainland at Cumae, where they found a natural acropolis of great strategic value. From Cumae they founded Dicearchia (Pozzuoli) and subsequently Parthenope or Palaeopolis, where Naples now stands, upon the splendid natural acropolis formed by the hill of Pizzofalcone, defended on the land side by a fosse which is now the Strada di Chiaja, and a massive wall, of which remains may still be traced at the back of the existing houses. To the colonists of Parthenope there came afterwards a considerable addition from Athens and Chalcis, and they built themselves a town which they called *Neapolis*, or the "new city," in contradistinction to the old settlement, which in consequence was styled Palaeopolis or the "old city."

In 328 B.C. the Palaeopolitans having provoked the hostility of Rome by their incursions upon her Campanian allies, the consul Publilius Philo marched against them, and laid regular siege to Palaeopolis; at length the city was betrayed into the hands of the Romans. Neapolis, perhaps, surrendered without resistance, as it was received on favourable terms, had its liberties secured by a treaty, and obtained the chief authority. From that time Palaeopolis totally disappeared from history, and Neapolis became an allied city (*foederata civitas*)—a dependency of Rome, to which it remained faithful. In 280 B.C. Pyrrhus unsuccessfully attacked its walls; and in the Second Punic War Hannibal was deterred by their strength from attempting to make himself master of the town. During the civil wars of Marius and Sulla a body of partisans of the latter, having entered it by treachery (82 B.C.), massacred the inhabitants; but Neapolis soon recovered, as it was again a flourishing city in the time of Cicero.

Neapolis long retained its Greek culture and institutions; and even at the time of Strabo it had gymnasia and quinquennial games, and was divided into *phratriae* after the Greek fashion.



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NAPLES, THE METROPOLIS OF SOUTHERN ITALY

1. View of the city of Naples, the bay, and Mount Vesuvius from the Corso Vittorio Emmanuele, a winding driveway which ascends the slopes above the city. The massive structure in the distance at the right is the Castel Nuovo (13th century), long a royal and vice-regal residence. Extending into the bay to the right of the castle is the Molo San Vincenzo, off which the largest ocean liners are moored. Commercial shipping is chiefly served at the Molo San Gennaro and Molo Orientale further to the left
2. A narrow street in Naples characteristic of the older city
3. Typical Neapolitan street scene in the newer part of the city, showing the five and six storey, densely populated tenements with shops on the street level
4. Via Roma, still popularly called the Via Toledo, after its founder Don Pedro di Toledo (1532–54), viceroy during the Spanish regime. With its continuation, the Via Enrico Pessina, this street runs in a nearly straight line for 1½ miles, from the Palazzo Reale to the Museo Nazionale. It is one of the busiest streets of the modern city

Many of the Romans of the upper classes, from a love of Greek manners and literature, resorted to Neapolis, either for education and the cultivation of gymnastic exercises or for the enjoyment of music and of a soft and luxurious climate. It was the favourite residence of many of the emperors; Nero made his first appearance on the stage in one of its theatres; Titus assumed the office of its archon; and Hadrian became its demarch. It was chiefly at Neapolis that Virgil composed his *Georgics;* and he desired to be buried on the hill of Pausilypon, the modern Posilipo, in its neighbourhood, though his traditional tomb is really a *columbarium* of some family unknown. It was also the favourite residence of the poets Statius (A.D. 61) and Silus Italicus (A.D. 25), the former of whom was a Neapolitan by birth.

After the fall of the Roman empire, Neapolis suffered severely during the Gothic wars. Having espoused the Gothic cause in the year 536, it was taken, after a protracted siege, by Belisarius, who diverted the water of a subterranean aqueduct, marched into the city through it, and put many of the inhabitants to the sword. In 542 Totila besieged it and compelled it to surrender, but after being recovered by Narses, it long remained a dependency of the exarchate of Ravenna, under the immediate government of a duke, appointed by the East Roman emperors. When the Lombards pushed their conquests in the south, the limits of the Neapolitan duchy were considerably narrowed. In the beginning of the 8th century, at the time of the iconoclastic controversy, the Neapolitans, encouraged by Pope Gregory III., threw off their allegiance to the Eastern emperors, and established a republican form of government under a duke of their own appointment. Under this régime Neapolis retained independence for nearly 400 years, though constantly struggling against the powerful Lombard dukes of Benevento. The Normans, in their turn, gradually superseded all powers in the south of Italy, and checked the Saracens in their advances through Apulia.

From that date the history of Naples becomes that of a kingdom, sometimes separate, sometimes merged with the kingdom of Sicily in that of the Two Sicilies. The city of Naples henceforth formed the metropolis of the kingdom to which it gave its name. (*See* NAPLES, KINGDOM OF.)

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NAPLES, BANK OF, is an autonomous, public utility, non-profit earning foundation, incorporated under a charter granted in 1866. Its origins date back to 1539 when two public-spirited Neapolitans, Aurelio Paparo and Leonardo di Palma, founded in their city a first bank with a capital of 4,000 ducats for granting loans on pledge and without or at a very low rate of interest to free the poorer classes from the evils of usury.

The institution rapidly developed, and survived all the vicissitudes of the kingdom of Naples. After the annexation of Naples to the kingdom of Italy the *Banco di Napoli* remained a bank of issue. Regional interests and the still strong traditions of regional independence maintained this situation until May 6, 1926, when the *Banca d'Italia* became the sole bank of issue.

The *Banco di Napoli* is a foundation organized as a trust, administered by a Board whose members are nominated by the Government, by the province and municipality of Naples, and by the organs representing the commercial activities of the province. Its officers have the status of public officials. Its capital and reserves stood in Dec. 1927 at 1,251·7 million lire. It acts as a savings bank, an agricultural credit bank, and a pledge bank for the southern provinces, and discharges the services connected with emigrant remittances from abroad, for which purpose it has agencies in New York and Chicago. Part of its profits are assigned to purposes of public utility and charity, the bulk going to increase its reserves.

By a process of amalgamation it has absorbed the agricultural credit institutes of the Southern provinces and is now the most powerful instrument for the progress of South Italian agriculture and one of the most effective agencies for economic development.

(O. R. A.)

NAPLES, KINGDOM OF, the name conventionally given to the kingdom of Sicily on the Italian mainland (Sicily beyond the Faro), to distinguish it from that of Sicily proper (Sicily on this side of the Faro, *i.e.*, Messina).

The leaders of the Norman house of Hauteville, Robert Guiscard and Richard of Aversa, in 1059 did homage to Pope Nicholas II. (*q.v.*) for all the conquests they made both in the island and upon the mainland. In 1130 Roger de Hauteville (Roger II. as "great count" of Sicily) assumed the style of king as Roger I. In this way the south of Italy, together with the island of Sicily, was converted into one political body.

The Hohenstaufen.—After the death of Tancred, son of William II., the emperor Henry VI., of the house of Hohenstaufen, who by his marriage with Constance or Costanza d'Altavilla, daughter of Roger I. (d. 1154), laid claims to the kingdoms of Naples and Sicily, descended into Italy in 1194. He easily conquered both the mainland and the island, but died in 1197. Costanza then had her son, Frederick (b. 1194) proclaimed king, and obtained the support of the Holy See on condition that the kingdom should be once more recognized as a fief of the Church. The Hohenstaufen kings afterwards refused to admit this claim; thus provoking the persistent hostility of the popes and many foreign invasions. Costanza died in 1198, leaving Pope Innocent III. regent and tutor to her son. In 1209 Frederick married Costanza, daughter of the king of Aragon, with whose help he succeeded in reducing a large part of Sicily to obedience. Two years later he was elected king of the Romans, and in 1220 he was crowned emperor in Rome by Pope Honorius III., but continued to reside in Sicily. In 1227 Gregory IX. excommunicated him because he delayed the crusade which he had promised to undertake. Frederick sailed for Palestine the following year and on his return defeated the army which the pope had sent into Neapolitan territory, peace being made at San Germano in 1230 and the excommunication withdrawn. In 1231 he issued the celebrated Constitutions of the Sicilian kingdom at the parliament of Melfi. He died in 1250.

His son Conrad IV. succeeded to the empire, while to his illegitimate son Manfred he left the principality of Taranto and the regency of the southern kingdom. Conrad died in 1254, leaving an infant son, Conradin (b. 1252), and Manfred was appointed vicar-general during the latter's minority. In 1258, on a rumour of Conradin's death, Manfred was offered and accepted the crown of Naples and Sicily. The rumour was false, but he retained the crown, promising to leave the kingdom to Conradin at his death and to defend his rights.

Angevin and Aragonese.—In 1265 Clement IV., wishing to rid himself of the Hohenstaufen, induced Charles of Anjou, brother of Louis IX. of France, to come to Italy. Agreeing to accept the kingdom of the Two Sicilies as a fief of the Church, Charles, in 1266, marched southward with the privileges of a crusader (*see* CHARLES I., king of Naples and Sicily). Manfred was defeated and killed at Benevento, and Charles was soon master of almost the whole kingdom.

In Sicily, however, Charles's government soon made itself odious by its exactions and the insolence and cruelty of the king's French officials and favourites. The malcontents were led by the Salernitan noble Giovanni da Procida, who had induced Peter III. of Aragon, husband of Manfred's daughter Costanza, to make good his shadowy claims to the crown of Sicily. On Easter day 1282, just as Charles was preparing an expedition to the East, the popular rising known as the Sicilian Vespers broke out at Palermo and resulted in the massacre of nearly all the French in the island. Peter reached Palermo in September. Pope Martin IV. proclaimed a crusade against the Aragonese, and the war continued for many years. The Sicilian fleet under Ruggiero di Lauria defeated that of the Angevins at Malta in 1283, and in 1284 in the Bay of Naples. Charles I. died in 1286; his heir, Charles the Lame, being a prisoner, was not crowned until two years later. (*See* CHARLES II., king of Naples and Sicily, and FREDERICK III., king of Sicily.)

Charles II. died in 1309 and was succeeded by his second son Robert, who became leader of the Guelphs in Italy. War between

Naples and Sicily broke out once more, when Frederick allied himself with the emperor Henry VII. on his descent into Italy and proclaimed his own son Peter heir to the throne. Robert died in 1342; he had been a capable ruler, a scholar, and a friend of Petrarch, but his authority was limited by the rights of a turbulent and rebellious baronage (*see* ROBERT, king of Naples). He was succeeded by his granddaughter Joanna, wife of Andrew of Hungary, who was assassinated in 1345, not without suspicion of Joanna's complicity. Andrew's brother Louis, king of Hungary, attempted to make good his claims on Naples and avenge the murder of Andrew; but as Pope Clement refused to recognize his claims he went back to Hungary in 1348 and Joanna and her second husband Louis of Taranto were crowned at Naples by the pope's legate in 1352, but Niccolò Acciaiuoli, the seneschal, became the real master of the kingdom. Joanna nominated Louis of Anjou her heir, but while the latter was recognized by the anti-pope Clement VII., Pope Urban VI. declared Charles of Durazzo (great-grandson of Charles II.) king of Sicily *al di quà del Faro* (*i.e.* of Naples). Charles conquered the kingdom and took Joanna prisoner in 1381, and had her murdered the following year. Louis failed to drive out Charles, and died in 1384. A period of anarchy followed during the reigns of Charles III. and his son Ladislas, and on the latter's death in 1414 he was succeeded by his sister Joanna II. (*q.v.*), during whose reign the kingdom sank to the lowest depths of degradation. Louis died in 1434 and Joanna in 1435. Alphonso was recognized as king of Naples by Pope Eugene IV. in 1443.

Under Alphonso, surnamed "the Magnanimous," Sicily was once more united to Naples and a new era was inaugurated, for the king was at once a brilliant ruler, a scholar, and a patron of letters. He died in 1458, leaving Naples to his illegitimate son Ferdinand I. (Don Ferrante) (*q.v.*), and Sicily, Sardinia, and Aragon to his brother John. Ferdinand died in 1494 and was succeeded by Alphonso. In the September of the following year Charles VIII. of France entered Italy and conquered the Neapolitan kingdom without much difficulty. Alphonso abdicated, and his son Ferrandino and his brother Frederick withdrew to Ischia. But Ferrandino, with the help of Ferdinand II. of Spain, was able later to reoccupy his dominions. He died much regretted in 1496 and was succeeded by Frederick. The country was torn by civil war and brigandage, and the French continued to press their claims; until, with Gonzalo de Cordoba's victory on the Garigliano in Dec. 1502, the whole kingdom was in Spanish hands.

Spanish Rule.—On Ferdinand's death in 1516, the Habsburg Charles became king of Spain, and three years later was elected emperor as Charles V.; in 1522 he appointed John de Lannoy viceroy of Naples, which became henceforth an integral part of the Spanish dominions. Spanish rule presently provoked several rebellions. On July 7, 1647, tumults occurred at Naples in consequence of a new fruit tax, and the viceroy, Count d'Arcos, was forced to take refuge in the Castelnuovo. The populace, led by an Amalfi fisherman, known as Masaniello (*q.v.*), obtained arms, erected barricades, and, while professing loyalty to the king of Spain, demanded the removal of the oppressive taxes and murdered many of the nobles. D'Arcos came to terms with Masaniello; but in spite of this, and of the subsequent assassination of Masaniello, the disturbances continued.

In 1670 disorders broke out at Messina, which developed into an anti-Spanish movement; and while the inhabitants called in the French, the Spaniards, who could not crush the rising, called in the Dutch. In 1707 an Austrian army conquered the kingdom and Spanish rule came to an end.

The Bourbons.—In Sicily the Spaniards held their own till the peace of Utrecht, in 1713, when the island was given over to Duke Victor Amadeus of Savoy, who assumed the title of king. In 1718 he had to hand back his new possession to Spain, which, in 1720, surrendered it to Austria and gave Sardinia to Victor Amadeus. In 1733 the treaty of the Escurial between France, Spain, and Savoy against Austria was signed. Don Carlos of Bourbon, son of Philip V. of Spain, easily conquered both Naples and Sicily, and in 1738 he was recognized as king of the Two Sicilies, Spain renouncing all her claims. Charles was well received and, with the Tuscan Bernardo Tanucci as his minister, introduced many useful reforms. In 1759 Charles III., having succeeded to the Spanish crown, abdicated that of the Two Sicilies in favour of his 8-year-old son Ferdinand, who became Ferdinand IV. of Naples and III. of Sicily, with a regency under Tanucci. The regency ended in 1767, and the following year Ferdinand married the masterful and ambitious Maria Carolina, daughter of the empress Maria Theresa. With the help of John Acton, an Englishman whom she made minister in the place of Tanucci, she secured a *rapprochement* with England and Austria.

On the outbreak of the French Revolution the king and queen were not at first hostile to the new movement; but in 1793 they joined the first coalition against France, instituting severe persecutions against all who were remotely suspected of French sympathies. Republicanism, however, gained ground, especially among the aristocracy. In 1798, during Napoleon's absence in Egypt and after Nelson's victory at Aboukir, Maria Carolina induced Ferdinand to go to war with France. The French marched on Naples, but not until Jan. 20, 1799, were the invaders masters of the city. On the 23rd the Parthenopaean republic was proclaimed. The Republicans were men of culture and high character, but doctrinaire and unpractical, and they knew very little of the lower classes of their own country. Meanwhile the court at Palermo sent Cardinal Fabrizio Ruffo to Calabria, to organize a counter-revolution. He succeeded beyond expectation, and with his "Christian army of the Holy Faith" (*Esercito Cristiano della Santa Fede*), consisting of brigands, convicts, peasants and some soldiers, advanced on the capital, whence the French, save for a small force under Méjean, withdrew. On June 13 Ruffo and his hordes reached Naples and, after a desperate battle at the Ponte della Maddalena, entered the city. The French in Castel Sant' Elmo and the Republicans in Castelnuovo and Castel dell' Uovo still held out and finally an armistice was concluded and a capitulation agreed upon, whereby the castles were to be evacuated and the garrisons free to remain in Naples unmolested or to sail for Toulon.

Nelson at Naples.—On June 24 Nelson arrived with his fleet, and on hearing of the capitulation refused to recognize it save in so far as it concerned the French. Ruffo indignantly declared that the treaty had been signed, not only by himself but by the Russian and Turkish commandants and by the British captain, Foote. On the 26th Nelson changed his attitude and informed the cardinal that he would do nothing to break the armistice; while Captains Bell and Troubridge wrote that they had Nelson's authority to state that the latter would not oppose the embarcation of the Republicans, who thereupon embarked on the vessels prepared for them. But on the 28th Nelson, acting on despatches from the court (in reply to his own), held up the vessels and many of the Republicans were arrested. Caracciolo, who commanded the Republican Fleet, was tried by court-martial on board Nelson's flagship, condemned to death, and hanged at the yard arm (*see* CARACCIOLO and NELSON).

On July 8 King Ferdinand arrived from Palermo and the State trials resulted in hundreds of persons being executed, including some of the best men in the country, such as the philosopher Mario Pagano, the scientist Cirillo, Massa, the defender of Castel dell' Uovo, and Ettore Caraffa, the defender of Pescara. After the peace of Amiens in 1802 the court returned to Naples, where it was well received. But when the European war broke out again in the following year King Ferdinand played a double game, appearing to accede to Napoleon's demands while negotiating with Britain. After Austerlitz, Napoleon declared that "the Bourbon dynasty had ceased to reign" and sent an army under his brother Joseph to occupy the kingdom.

Joseph Bonaparte and Murat.—Ferdinand and Maria Carolina fled to Palermo in 1805; in Feb. 1806 Joseph Bonaparte entered Naples as king. A cultivated, well-meaning, not very intelligent man, he introduced many useful reforms and abolished feudalism, but the taxes and forced contributions proved very burdensome. Joseph's authority did not exist throughout a large part of the kingdom, where royalist risings, led by brigand chiefs, maintained a state of anarchy, and a British force, under Sir John

Stuart, defeated the French at Maida in Calabria (July 6, 1806).

In 1808 Napoleon conferred the crown of Spain on Joseph and appointed Joachim Murat king of Naples. Murat continued Joseph's reforms and reorganized the army; and although he introduced the French codes and conferred many appointments and estates on Frenchmen, his administration was more or less native and favoured the abler Neapolitans. The king gained many sympathies; he gradually became estranged from Napoleon and secretly opened negotiations with Austria and Great Britain. In Jan. 1814 he signed a treaty with Austria, and the following month proclaimed his separation from Napoleon. But when Napoleon escaped from Elba, Murat suddenly returned to the allegiance of his old chief, marched into northern Italy, and from Rimini issued his famous proclamation in favour of Italian independence (March 30, 1815). He was subsequently defeated by the Austrians several times and on May 18 sailed from Naples for France (*see* MURAT, JOACHIM). On the 23rd the Austrians entered Naples to restore Bourbon rule.

The Restoration.—Ferdinand and Maria Carolina had continued to reign in Sicily, where the court's extravagance and the odious Neapolitan system of police espionage rendered their presence a burden instead of a blessing to the island. A bitter conflict broke out between the court and the parliament, and the British minister, Lord William Bentinck, forced Ferdinand to resign his authority and appoint his son regent and introduced many valuable reforms. In 1812 a constitution on British lines was introduced, and the queen, who was perpetually intriguing against Bentinck, was exiled. Bentinck, whose memory is still cherished in the island, departed in 1814. Ferdinand dissolved parliament in May 1815, after concluding a treaty with Austria for the recovery of his mainland dominions by means of an Austrian army. On June 9 Ferdinand re-entered Naples and bound himself in a second treaty with Austria not to introduce a constitutional government. At first he abstained from persecution and received many of Murat's old officers into his army. In Oct. 1815 Murat, believing that he still had a strong party in the kingdom, landed with a few companions at Pizzo di Calabria, but was immediately captured by the police and the peasantry, court-martialled, and shot.

Ferdinand proclaimed himself king of the Two Sicilies at the congress of Vienna, incorporating Naples and Sicily into one state, and abolished the Sicilian constitution (Dec. 1816). In 1818 he concluded a Concordat with the Church, by which the latter renounced its suzerainty over the kingdom, but was given control over education, the censorship, and many other privileges. But there was much disaffection throughout the country, and the Carbonarist lodges had made much progress, especially in the army (*see* CARBONARI). In July 1820 a military mutiny broke out at Caserta, the mutineers demanding a Spanish constitution although professing loyalty to the king. Ferdinand, feeling himself helpless to resist, acceded to the demand. The new government's first difficulty was Sicily, where the people had risen in rebellion demanding their own charter of 1812, and although the Neapolitan troops quelled the outbreak with much bloodshed the division proved fatal to the prospects of liberty.

This outbreak seriously alarmed the Powers responsible for the preservation of the peace in Europe. At the congress of Troppau (Oct. 1820) the famous protocol was issued affirming the right of collective "Europe" to interfere to crush dangerous internal revolutions. Both France and Great Britain protested against this dangerous principle; but by general consent King Ferdinand was invited to attend the adjourned congress, fixed to meet at Laibach in the spring of the following year. Under the new constitution the permission of parliament was necessary before the king could leave Neapolitan territory. This was weakly granted, after Ferdinand had sworn the most solemn oaths to maintain the constitution. He was scarcely beyond the frontiers, however, before he repudiated his engagements, as exacted by force. The powers authorized Austria to march an army into Naples to restore the autocratic monarchy. General Pepe commander of the Constitutional forces, was sent to the frontier at the head of 8,000 men, but was completely defeated by the Austrians at Rieti on March 7. On the 23rd the Austrians entered Naples, followed soon afterwards by the king. Every vestige of freedom was suppressed, and the inevitable State trials instituted with the usual harvest of executions and imprisonment. Pepe saved himself by flight. (*See* FERDINAND IV., king of Naples.)

Ferdinand died in 1825 and was succeeded by his son Francis I., an unbridled libertine, under whom the corruption of the administration assumed unheard-of proportions. (*See* FRANCIS I., king of the Two Sicilies.) He died in 1830 and was succeeded by his son, Ferdinand II., who at first awoke hopes that the conditions of the country would be improved; but on the death of his first wife, Cristina of Savoy, he married Maria Theresa of Austria, who encouraged him in his reactionary tendencies and brought him closer to Austria. The desire for a constitution was by no means dead, and the survivors of the old Carbonari gathered round Carlo Poerio, while the *Giovane Italia* society (independent of Mazzini) promoted a few sporadic outbreaks easily crushed. The following year the Venetian brothers Bandiera, acting in concert with Mazzini, landed in Calabria, believing the whole country to be in a state of revolt; they met with little local support and were quickly captured and shot, but their deaths aroused much sympathy, and the whole episode was highly significant as being the first attempt made by Italians from other parts of the country to promote revolution in the south.

Revolution of 1848.—On Jan. 12, 1848, a revolution under the leadership of Ruggiero Settimo broke out in Sicily. These events were followed by demonstrations at Naples, and on Jan. 28 the king granted the constitution. The popular demand was now that Naples should assist the Lombards in their revolt against Austria, for a feeling of Italian solidarity was growing up. Ferdinand declared war against Austria (April 7, 1848); and a Neapolitan army under General Pepe marched towards Lombardy in May, while the fleet sailed for Venice. But a dispute between the king and the parliament concerning the form of the royal oath having arisen, a group of demagogues with criminal folly provoked disturbances and erected barricades (May 14). The king refused to open parliament unless the barricades were removed. A few shots were fired on the 15th, the Swiss regiments stormed the barricades and street fighting lasted all day. By the evening the Swiss and the royalists were masters of the situation. A new ministry under Prince Cariati was appointed. Parliament was dissolved, the National Guard disbanded and the army recalled from the Po.

In Sicily the revolutionists were bitterly hostile to the Neapolitans. The Sicilian assembly met in March 1848, and Settimo in his inaugural speech declared that the Bourbon dynasty had ceased to reign and that Sicily united her destinies to those of Italy; Settimo was elected president of the Government. After the Austrian victories Ferdinand sent a Neapolitan army under Carlo Filangieri (*q.v.*) to subjugate the island. The troops landed at Messina, whose citadel had been held by the royalists throughout, and after three days' desperate fighting the city itself was captured and sacked. Filangieri marched forward, committing many atrocities. In April he reached Palermo while the fleet appeared in the bay, and tumults having broken out within the city the Government surrendered on terms which granted amnesty for all except Settimo and 42 others.

For a few months after the dissolution of the Neapolitan parliament the Government abstained from persecution, but with the crushing of the Sicilian revolution its hands were free; and when the commission on the affair of May 15 had completed its labours thousands of respectable citizens were thrown into prison, such as L. Settembrini, Carlo Poerio, and Silvio Spaventa. The abominable conditions of the prisons in which the best men of the kingdom were immured were made known to the world by the famous letters of W. E. Gladstone, which branded the Bourbon regime as "the negation of God erected into a system of government." In 1857 Carlo Pisacane, an ex-Neapolitan officer who had taken part in the defence of Rome, fitted out an expedition, with Mazzini's approval, from Genoa, and landed at Sapri in Calabria; but the local police assisted by the peasantry attacked the band, killing many, including Pisacane himself, and

capturing most of the rest. The following year, at the instance of Great Britain and France, Ferdinand commuted the sentences of some of the political prisoners to exile. (*See* FERDINAND II., king of the Two Sicilies.)

In May 1859 Ferdinand died and was succeeded by his son, Francis II. (*q.v.*). Victor Emmanuel, king of Sardinia, wrote to him proposing an alliance for the division of Italy, but Francis refused. In June part of the Swiss Guard mutinied and were shot down; and this affair resulted in the disbanding of the whole force—the last support of the autocracy. Various proposals were made for an alliance with Sardinia, but Francis rejected them and indeed began to negotiate with Austria.

Garibaldi.—In the meantime events in Sicily were reaching a crisis destined to subvert the Bourbon dynasty. Mazzini's emissaries, F. Crispi (*q.v.*) and R. Pilo, had been trying to organize a rising in favour of Italian unity and, although they merely succeeded in raising a few armed bands, they persuaded Garibaldi (*q.v.*) that the revolution, which he knew to be imminent, had broken out. Garibaldi, whose hesitation had been overcome, embarked on May 5, 1860, at Quarto, near Genoa, with 1,000 picked followers on board two steamers, and sailed for Sicily. On the 11th the expedition reached Marsala and landed without opposition. Garibaldi was somewhat coldly received by the astonished population; but he set forth at once for Salemi, where he issued a proclamation assuming the dictatorship of Sicily in the name of Victor Emmanuel, with Crispi as secretary of state. On the 15th he attacked and defeated 3,000 of the enemy under General Landi at Calatafimi; the news of this brilliant victory revived the revolutionary agitation throughout the island, and Garibaldi was joined by Pilo and his bands. By a cleverly devised ruse he avoided General Colonna's force, which expected him on the Monreale road, and entering Palermo from Misilmeri received an enthusiastic welcome. After three days' street fighting the Bourbonist commander, General Lanza, not knowing that the Garibaldians had scarcely a cartridge left, asked for and obtained a 24 hours' armistice (May 30). Garibaldi went on board the British flagship to confer with the Neapolitan generals Letizia and Chrétien; then he informed the citizens by means of a proclamation of what he had done, and declared that he would renew hostilities on the expiration of the armistice. Although unarmed, the people rallied to him as one man, and Lanza became so alarmed that he asked for an unconditional extension of the armistice, which Garibaldi granted; 15,000 Bourbon troops embarked for Naples on June 7, leaving the revolutionists masters of the situation. The Sardinian Admiral Persano's salute of 19 guns on the occasion of Garibaldi's official call constituted a practical recognition of his dictatorship by the Sardinian (Piedmontese) Government. In July further reinforcements of volunteers under Cosenz and Medici, assisted by Cavour, arrived at Palermo with a good supply of arms furnished by subscription in northern Italy. Garibaldi's forces were now raised to 12,000 men, besides the Sicilian *squadre*. Cavour's attempt to bring about the annexation of Sicily to Sardinia failed, for Garibaldi wished to use the island as a basis for an invasion of the mainland. When the Garibaldians advanced eastward they encountered a force of 4,000 of the enemy under Colonel Bosco at Milazzo; on July 20 a desperate battle took place, resulting in a hard-won Garibaldian victory. The Neapolitan Government then decided on the evacuation of the whole of Sicily except the citadel of Messina, which did not surrender until the next year.

The news of Garibaldi's astonishing successes entirely changed the situation in the capital, and on June 25, 1860, the king granted a constitution, and appointed A. Spinelli prime minister. Disorders having taken place between Liberals and reactionaries, Liborio Romano was made minister of police in the place of Aiossa. The king appealed to Great Britain and France to prevent Garibaldi crossing the Straits of Messina, and only just failed (for this episode *see* under LACAITA, SIR JAMES). On Aug. 19 Garibaldi crossed with 4,500 men and took Reggio by storm. He was soon joined by the rest of his troops, 15,000 in all, the Neapolitan army collapsed before Garibaldi's advance, and the people rose in his favour almost everywhere. On Sept. 6 the king and queen sailed for Gaeta; on the 7th Garibaldi entered Naples alone, although the city was still full of soldiers, and was received with delirious enthusiasm; on the 11th a part of the royalists capitulated and the rest retired on Capua. Cavour now decided that Sardinia must take part in the liberation of southern Italy, for he feared that Garibaldi's followers might induce him to proclaim the republic and attack Rome, which would have provoked French intervention; consequently a Piedmontese army occupied the Marche and Umbria and entered Neapolitan territory with Victor Emmanuel at its head. On Oct. 1 and 2, 1860, a battle was fought on the Volturno and the Garibaldians, although inferior in numbers, were victorious. On the 26th he met Victor Emmanuel at Teano and hailed him king of Italy and subsequently handed over his conquests to him. On Nov. 3 a plebiscite was taken, which resulted in an overwhelming majority in favour of union with Sardinia under Victor Emmanuel. Garibaldi departed for his island home at Caprera, while L. C. Farini was appointed viceroy of Naples and M. Cordero viceroy of Sicily. The last remnant of the Bourbon army was concentrated at Gaeta, the siege of which was begun by Cialdini on Nov. 5; on Jan. 10, 1861, the French fleet, which Napoleon III. had sent to Gaeta to delay the inevitable fall of the dynasty, was withdrawn at the instance of Great Britain; the fortress surrendered on Feb. 13 and the royal family departed by sea. The citadel of Messina capitulated a month later and Civitella del Tronto on March 21. On Feb. 18 the first Italian parliament met at Turin and proclaimed Victor Emmanuel king of Italy. Thus Naples and Sicily ceased to be a separate political entity and were absorbed into the united Italian kingdom..

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(L. V.; X.)

NAPOLEON I. (1769–1821), emperor of the French. Napoleon Bonaparte was born at Ajaccio on Aug. 15, 1769, the year following the reunion of Corsica with France. His father, Charles Buonaparte—it was not until after 1796 that the spelling Bonaparte was adopted—came of a good family which had been established in the island since the 16th century. The family origins may perhaps be traced to Tuscany, an Italian province, the relations of which with Corsica had always been close. Napoleon himself, in later years, scoffed at the exaggerated tales invented by flatterers and courtiers, of the lordly status formerly held by the family at Treviso and Bologna. Yet his father was undoubtedly of noble birth, and was the delegate of the Corsican nobility at Paris. Charles Buonaparte married Laetitia Ramolino, a woman of strong character and great personal beauty. He was a lawyer by profession and brought up a large family in difficult times. After the Corsicans had, several times, revolted against their Genoese masters, the republic of Genoa, despairing of ever bringing the rebels to submission, ceded its rights to France, against which the Corsicans, led by Paoli (*q.v.*) at first attempted resistance. Charles Buonaparte joined Paoli's party. He even joined him in his campaign, taking with him his wife and children,

lest they should be seized as hostages by the French. When Paoli was beaten and had to fly Charles Buonaparte became reconciled to French rule and benefited by the protection of M. de Marbeuf, the governor, to whom he was able to make himself useful. In 1779, sent on a mission to Versailles, he took with him his second son, Napoleon, for whom M. de Marbeuf had obtained a bursary at the military academy at Brienne.

EARLY LIFE

These facts enable us to understand the character of Napoleon. He was born a Frenchman, of a family which, unwilling at first to become French, afterwards unreservedly accepted the *fait accompli*. From the age of ten he was educated with other boys of his own class by French people according to French ideas. Though we must make due allowance for heredity, family influence, and the impressions of early childhood, it is an exaggeration to explain Napoleon, as historians since Stendhal have been too much inclined to do, entirely in the light of his Corsican and Tuscan origin, and to see in him the incarnation of a *condottiere*, or of a 14th century Italian city despot, a modern Castruccio Castracani. It is more important to bear in mind that young Bonaparte, born in an island which had only just become part of France, shared neither the traditions nor the prejudices of his new country.

In 1789, at the age of 20, he came into the Revolution with an open mind, feeling neither like nor dislike for many things which other Frenchmen either regretted or frankly detested. If he remained Corsican in temperament he was, by virtue of the instruction he had received, and the books he had read, preeminently a man of the 18th century. His occasional early philosophical writings leave no doubt as to this side of his character, which is also illustrated by the life-long habit of epigrammatic, well-turned, often paradoxical expression, a trait which he had in common with Chamfort and Rivarol; witness his celebrated definition of love as *"une sottise faite à deux."* Further, having lost his father in 1785, and having been designated by him as the head of the family, although he was the second and Joseph the eldest son, he had known poverty and the responsibility of helping to provide for his mother, brothers and sisters. Success was more necessary to him than to others, and the upheaval of 1789 favoured the ambitious.

We must realize therefore that he entered the Revolution in rather an unusual frame of mind, occasionally ardent, joining the Jacobins without hesitation, but also capable of coolly judging events as when on June 20, at the capture of the Tuileries, he was moved to scorn by the weakness of Louis XVI. We must also remember that, having begun his studies at the cadet school at Brienne, he completed them at the *Ecole Militaire* in Paris, where (1784–5) he received a solid grounding in the work of an artilleryman and an officer. It would be wrong to look on him as a kind of self-taught genius, a god of war, who might be said to have discovered, taught, and even created strategy and tactics.

The Artillery Officer.—He himself acknowledged, modestly and loyally, his debt to his teachers. He had studied the treatises of Bourcet and of Guibert, who had evolved from modern armaments new principles and methods of warfare. As a sub-lieutenant at Auxonne, after leaving the *Ecole Militaire*, he received at first hand instruction from baron du Teil, brother of the author of a remarkably advanced work on the use of modern artillery. He profited by the instruction, and always spoke of it with appreciation. However gifted a man may be, he still needs inspiration and counsel, and learns more from his predecessors than he himself passes on to his contemporaries and to posterity. The genius of Napoleon was not least evident in the way in which he made use of the instruction which he received. Curiously enough, Guibert in his *Système de guerre moderne* had predicted that a great man would arise to put into practice the military theories which were then taking shape. These facts, which place Napoleon in his proper intellectual environment, seem to the writer to throw more light on his mind and his character than would countless anecdotes of his childhood and schooldays, such as that at Brienne he was nicknamed *Paille au nez* by his companions because of the way in which he pronounced *Napolione*.

Between his spells of garrison duty at Valence and at Auxonne as a young artillery officer, a part of his early career of which little is known was passed in the leave which he spent on more than one occasion in Corsica, where the somewhat complicated affairs of his family demanded his presence. At Ajaccio in Sept. 1789, he found his elder brother Joseph deep in the affairs of the democratic party which had inevitably, with the progress of the Revolution, become the party of France. Paoli, who had at first thought that events in France would bring about Corsican independence, had soon been disillusioned, Jacobinism being essentially a unifying and centralising force. He inclined therefore to the counter-revolution and entered the opposite camp.

Napoleon, promoted lieutenant in 1791 on the reorganization of the artillery, was stationed for another three months at Valence, where he continued his studies, and even wrote an essay on a subject set for competition by the academy of Lyons: "What are the principles and institutions most likely to bring about the greatest happiness of mankind?" He treated the subject in the style and according to the principles of Jean Jacques Rousseau. When, years afterwards, Talleyrand showed him the essay, he threw it into the fire.

He was again in Corsica from Sept. 1791 to May 1792. Feeling ran high in the island, as a result of the disestablishment of the Catholic Church. He plunged into political intrigue, outstayed his leave, and became liable to the penalties in force against deserters and émigrés. On April 20, 1792, however, the legislative assembly had declared war on Austria. Officers were needed. Instead of undergoing any penalty, Bonaparte, whose zeal for the Revolution was well known, was made a captain. In this capacity he remained in Paris for several months, and witnessed the great events of the Revolution. After the September massacres, he went to Ajaccio to take home his sister Elisa from the convent of Saint Cyr which had just been closed. This was his last visit to his native country. The break with Paoli was now complete. Bonaparte was on the side of the *"patriotes,"* while the old champion of independence was appealing to the English against the Republic, One and Indivisible. Paoli was victorious. Bonaparte and his family, now entirely ruined, had to fly from the island and take refuge in France. This was the termination of what we may call his "insular" period. As he himself said afterwards, once he had left Ajaccio, more important affairs left him little time to think of Corsica and Paoli.

Early Military Opportunities.—In Sept. 1793, Napoleon Bonaparte was still unknown to the world which was to ring with his name. Amazed himself at his extraordinary career, and the incredible swiftness of his rise to power, he said in Saint Helena to Las Cases, "Centuries will pass before the unique combination of events which led to my career recur in the case of another." Favourable circumstances were also required to bring the young artillery officer to the front, and these were not lacking. The republic, which had challenged half Europe, had to face foreign and civil war, under conditions of anarchy. Bonaparte was a Jacobin, with a great reputation as an artillery officer. At Beaucaire, on his way to Paris, he had written a pamphlet, the *Souper de Beaucaire*, in which he had refuted the arguments of three Southern federalists or counter-revolutionaries. It is probable that it reflects a conversation which actually took place in an inn of the little town beside the Rhone. Its publication attested the patriotism of its author. The good word of Robespierre's brother and of Napoleon's compatriot, the deputy Salicetti, were also of assistance. At this juncture it was necessary to recapture Toulon, the inhabitants of which had rebelled against the Convention and called in the assistance of an English squadron. An able officer of artillery was required to direct the siege operations. Bonaparte was chosen.

There has since grown up the legend of "the great Napoleon at the siege of Toulon," though the part which he really played was essentially that of a technical expert. He found in command General Carteaux, formerly an artist, who was too ignorant even to understand that to take Toulon he must capture the position which commanded the roadstead. Things were no better under

his successor, Doppet, and until the arrival of General Dugommier, a soldier of greater experience, who, together with Gasparin, the people's commissary, recognized the knowledge and good sense of the young artillery officer.

On the fall of Toulon in Dec. 1793, Napoleon was promoted general of brigade, and in Feb. 1794 he was given the command of the artillery of the army of Italy. These were still subordinate positions, offering little opportunity for prominence. He spent the next few months—the period of the Terror—in inspecting fortifications and was even for a time "suspect" for having reconstructed an old fort at Marseilles, a town which had also risen against the Convention. He had rejoined the army of Italy, when fresh disaster seemed imminent. After the 9th Thermidor, his relations with the Jacobins became compromising. Accused of having disclosed certain plans to the younger Robespierre, he was arrested, but, in default of evidence, was released on Carnot's instructions. Nevertheless his position at this juncture was extremely precarious. Under the nerveless leadership of Schérer, he had no opportunity of distinguishing himself in the Italian campaign except at Saorgio and on the Roja. He was marking time, in fact. Like a true soldier he detested the campaign in la Vendée, and he refused the command of an infantry brigade which was to be sent against the Western royalists. Aubry, the minister of war, removed him from the active list in consequence.

Reverses.—He now experienced real poverty, and had to sell his books and his watch. He thought of taking service with the sultan to re-organize the Turkish army. Madame Tallien, wife of the member of the Convention, whom he met at this time, interested herself in him and made his peace with the authorities. When Kellermann lost the lines of the Apennines it was remembered that Bonaparte knew Italy, he was taken into consultation, and joined the topographical service of the army.

At this time, in the autumn of 1795, Hoche, Marceau and Joubert were already famous; Bonaparte was still unknown. It looked almost as if fortune were definitely against him. The only thing which he had brought back from his campaigns was the itch and, probably, the malaria, which made him very ill. He was obliged to shave his head, which was later on to bring him the nickname of *"le petit tondu."* Small in stature, thin, yellow-faced, badly dressed, his person was unimposing and no one would have seen in him the future emperor of the French.

The Insurrection of 1795.—It needed a day of revolution and of civil war to bring him into prominence, by giving him the chance to do the Republican Government a service, the vital service of saving the Republic. In the autumn of 1795 the majority of the people of Paris were chafing against dear food, *assignats* and never-ending war. The Convention, by declaring for a constitution designed to keep its own members in power, provoked an insurrection, which, owing to the weakness of General Menou, very nearly succeeded. The Convention then placed the deputy Barras in command of the home forces. He, having known and learnt to value Bonaparte at the siege of Toulon, asked for, and obtained, his appointment as second in command. The young general at once assumed complete control, issued rapid orders, forestalled the insurgents who were about to capture the artillery parked at Les Sablons, and shot them down in the rue Saint-Honoré, on the steps of the church of Saint-Roch. In less than a day he had subdued a serious royalist rising (*13 Vendémiaire*—Oct. 4, 1795). He had saved the republic and earned the nickname *Général Vendémiaire*.

ITALIAN AND EGYPTIAN CAMPAIGNS

Italy.—His first reward was the hand of Josephine, a beautiful Creole, widow of the viscount de Beauharnais, who had been guillotined during the Terror. Josephine, whose morals were none too strict, was living at this time mainly by her wits. The general was six years younger than she, but he seemed to be on the threshold of a brilliant career, and the marriage freed her from poverty. He had, in fact, as his second reward been appointed commander in chief of the Army of Italy. Like Josephine, the government of the Republic was at the end of its financial resources. At this moment, indeed, there was difficulty enough in feeding the troops; it was hoped they would live on the conquered territory. At the beginning of March 1795 Bonaparte married Josephine. At the end of the month he arrived at his headquarters at Nice.

His army consisted of thirty thousand starving soldiers, in want of everything. He issued to them the famous proclamation:—"You are badly fed and all but naked. . . . I am about to lead you into the most fertile plains in the world. Before you are great cities and rich provinces; there we shall find honour, glory, and riches." He entered Italy on April 10. His plan of campaign—the separation of the Piedmontese from the Austrians—was very simple; he executed it successfully after severe actions at Montenotte, Millesimo and Dego.

While he was conducting the campaign, he did not forget that he was a general of the Revolution, and issued to the Italian people proclamations which, while treating the Catholic religion with respect, spoke the language of liberty. The king of Sardinia took fright, and, on the advice of the Archbishop of Turin, sued for peace to an army "with neither artillery, cavalry, nor shoes to its feet." The pope and the dukes of Parma, Modena and Tuscany were not long in following the example of Victor Amadeus. Great political schemes were taking shape in Bonaparte's mind, but first he had to beat the Austrians. This was, indeed, his first experience of large-scale operations. The crossing of the bridge of Lodi was a bold achievement which made his name known in a day all over France and indeed all over Europe. That day, by an old camp custom, his soldiers dubbed him corporal, and another nick-name, the *"petit caporal,"* stuck to him.

New Republics.—In May, some weeks after the setting out of his ragged army, he entered Milan in triumph. He could write to the directory: "The republic holds all Lombardy." At that same moment he received from Paris orders which upset all his plans. Sure that his resignation would not be accepted, he sent it in, and, while waiting for the answer, harried the Austrians, whose generals "faithful to the old system of warfare, scattered their troops in small detachments before a man who practised mass-movement." The further Bonaparte advanced with so small an army, the greater was the need for skill and boldness. At Arcola he suffered in his own person, by falling into a swamp. These "miracles of genius and courage" were crowned by the victory of Rivoli, followed by the preliminary negotiations of Leoben (April 18, 1797). "No other general could show such fourteen months." He had forced Austria to sue for peace. He had founded the Cispadane, the Cisalpine, and the Ligurian republics, which brought a large part of Italy under the same *régime* as France, and preparations were begun for its annexation. He had been able to provide for his army by requisitioning; to conquer without costing the treasury anything, and had even sent money to Paris. Finally when the Republicans, having lost their majority in the Councils, were in need of help, Bonaparte, though he had cause for complaint against the directory, sent them his subordinate Augereau, for the *coup de force* of Fructidor (Sept. 1797) directed against the royalists and the moderates. True, the royalists and moderates wanted peace, while Bonaparte agreed with the Jacobins, and aspired to secure France's "natural frontiers."

He was able to congratulate himself on fulfilling both desires by the Treaty of Campo-Formio (Oct. 17, 1797). By it the emperor ceded to France both Belgium and the left bank of the Rhine. Glorious as it was, however, and in keeping with Revolutionary foreign policy, the treaty, far from ending the war, perpetuated it. To assure the permanence of these conquests the goodwill of England was necessary, and England was not in a position to give it; compulsion was therefore necessary. The whole story of Napoleon up to Waterloo turns on this. Henceforth he was to struggle against England, and in that struggle he was in the end to be vanquished.

England and Egypt.—The brusqueness of his manner, and still more his popularity with the masses made him an object of suspicion, in spite of the services which he had rendered the Republic. He, on his side, despised the corrupt government of the directory, "a government of lawyers," whether Jacobin or moderate. He soon realised that their plans for an invasion of England

had no chance whatever of success. In any case he thought it prudent to quit France for a time. The East had always fascinated him. "Only in the East can one do great things," he said. Reading and reflection had convinced him that Egypt was one of the keys of the world. This idea had already emerged in the days of Louis XIV., and was taken up again during the 18th century wars between France and England; there too Napoleon had his forerunners. He planned to strike at the power of England through Egypt and the route to India, and to stir the imagination of his own country-men. The directory accepted the scheme.

The Egyptian expedition was thus indirectly to be the means of forcing the British government to recognise the territorial acquisitions of the Revolution. The weakness of this plan, a weakness inherent in the whole struggle with England, was that France had no navy. Though Bonaparte, by a fortunate combination of circumstances, was able to land his army near Alexandria (July 1, 1798), Nelson, a month later (Aug. 1), destroyed the French fleet at Aboukir. From that moment the Egyptian expedition, instead of being *"le commencement d'une grande chose"* was merely an adventure. In vain Bonaparte executed a brilliant campaign, capturing Cairo, and subduing the country in three weeks. Of the great expedition nothing has endured but famous sayings, such as "Soldiers, from these pyramids forty centuries look down on you"; the Institute of Egyptology; the diffusion of the French language in the valley of the Nile; and, in Bonaparte's own case, a romantic touch of orientalism, symbolised by his faithful mameluke Roustan. Nevertheless, to carry through his great scheme, he undertook the conquest of Syria. Acre, under Admiral Sidney Smith, held out. "That man made me miss my destiny," he said later.

18th BRUMAIRE AND THE CONSULATE

The Coup d'État.—The expedition was, in fact, a failure. Bonaparte realized that there was nothing to be done in Egypt. At the same time came news which told him that there was work for him in France. The directory was in difficulties both at home and abroad. Disorder was rampant, finance and currency desperate, discontent everywhere. The Government, not knowing which way to turn, swayed one day to the Jacobins, the next to the moderates. In Germany the war continued, and in Italy the Republican armies suffered a series of reverses, and invasion was only checked with difficulty by Brune at Bergen, and by Masséna at Zürich. The restoration of the monarchy seemed inevitable. The republic could be saved only by a military leader.

"I seek a sword," said Sieyès, one of the five directors, racking his brains for a general to whom he could confide the defence of the Republic. At that crucial moment Bonaparte decided to return. He went boldly on board a frigate, slipped through the English cruisers in the Mediterranean, and landed at Fréjus on Oct. 8, 1799. He was greeted with shouts of "Long live the republic." He was the man of the hour for all those who desired an end of anarchy but were opposed to the return of the Bourbons. Without him the Revolution was a lost cause. This consideration is essential to the understanding of the famous *coup d'état* of the *18 Brumaire* (Nov. 9, 1799).

The *coup d'état* was organized, indeed, from within. Not only had Bonaparte accomplices among those in power, he had not even to offer or to impose himself; he was sought out. Baudin, a deputy from the Ardennes, and a staunch Republican, died of joy when he heard of the return of *"Général Vendémiaire,"* who was once more to save the Republic. Of the five directors, Sieyès, though a regicide, had given up hope of saving the country except by a dictatorship, of which he hoped to be the head, with Bonaparte as his strong right hand. Roger-Ducos was of the same opinion. The third, Barras, was corrupt, and would do anything for money. Only the remaining two, Moulin and Gohier, were immovable in their Jacobinism, and had to be silenced. Resistance could come only from political circles, the assemblies, or perhaps from part of the army, where Jacobinism was still strong. The conspirators were assured in advance of the support of public opinion. It is, therefore, essential to note that the *coup d'état* was conceived and organized by Sieyès, who took charge of the parliamentary side, while Bonaparte was an executive agent charged with assuring the support of the army. We must not forget that from its origin to the days of *Fructidor* and *Prairial*, the Revolution had undergone many forcible changes and had violated its different constitutions over and over again.

The pretext for the transference of the two legislative assemblies from Paris to Saint Cloud on the *18 Brumaire* was a terrorist plot invented for the occasion. The plan, though well laid, all but miscarried. On the first day, that of *18 Brumaire*, all went well, and, as the Convention had done in *Vendémiaire*, the assemblies placed Bonaparte in command of their forces. On the morrow at Saint Cloud, affairs took a dangerous turn. The Upper Chamber or Council of the "Ancients" had been won over, but the lower or Council of the Five Hundred, whose Jacobin members had had time to summon their forces, greeted the general with shouts of "Down with the dictator! Outlaw him!" Bonaparte lost the thread of his speech, lost countenance, and for a moment was surrounded by a threatening crowd of deputies. Soldiers came to his assistance; however, the day would have been lost but for his brother Lucien, who had made his way in politics and was president of the assembly. Declaring that the right of free speech had been outraged, he dramatically threw off his insignia and rushed into the court of the Orangery to harangue the still hesitating soldiers. Bonaparte, having recovered from a fainting condition, appeared, his face bleeding where, in his agitation, he had scratched it. This made the soldiers think that he had been wounded. General Leclerc, his brother-in-law, thus charged at the head of his grenadiers and cleared the hall of the refractory deputies. That very evening Bonaparte, Sieyès and Roger-Ducos were elected "consuls" by the Council of the Ancients.

The Revolution was not over. Bonaparte was to continue it under monarchical forms, and to give it at last a government. Sieyès dreamed of giving a constitution to France, but France had worn out so many constitutions during the last ten years! Bonaparte, who had used the "ideologues" as stepping stones to power, now made it clear to them that they had a master; and of Sieyès' constitution, only such portions as suited him remained. Authority was narrowing its limits. Five directors had given place to three consuls.

First Consul.—Immediately after, Napoleon became the first, the only one, elected for ten years. Public opinion gave him what was practically unlimited power. Disillusion and anxiety made him master of France. Some were tired of violence and disorder. Others, who had profited by the Revolution to possess themselves of national property, feared the return of the Bourbons and its restoration to its former owners. The mass of the people therefore, desired the consolidation of the new *régime*. Had it not been for the *18 Brumaire*, it is probable that the restoration of the legitimate branch would have taken place much sooner, before the Napoleonic empire had consolidated the results of the revolution by permanent institutions. The great mistake of the royalists was to look upon Bonaparte as another General Monk. He replied with disdain to the overtures of the comte de Provence—the future Louis XVIII. The royalists in their turn hastened to resume the struggle against him, thus definitely marking him as the representative of the "revolution in arms."

The Revolution was further indissolubly bound to its idea of "natural frontiers," and could not surrender the conquests which the rest of Europe refused to recognise. The war had to go on, whether they liked it or not—a fact which entailed government by a soldier. With the rest of his heritage, Bonaparte had to accept the necessity which had made the weak directory as warlike as the Convention. His term of power served merely to postpone the inevitable catastrophe.

Reforms.—His first work was to restore order and to regulate the administration of government. Here his lack of prejudice helped the first consul. As has already been said, being of French education, but not of French origin, he neither disliked nor regretted the old *régime*. He was thus able to adopt the strong points of the old monarchical system and reject the weaknesses of revolutionary democracy. The Revolution had made the system of election universal, in the civil service, in the magistracy, and

in the police: a fault which killed successive governments. Bonaparte replaced the elected committees by prefects and sub-prefects, thus re-establishing and multiplying the old *intendants*. Unwilling to restore completely the independence of the magistracy, of which the parlements had availed themselves against the crown, he gave the government the right to nominate magistrates, while making them, in the interests of justice, irremovable. Thus, making use of the experience both of the monarchy and of the revolution, Bonaparte framed the system known as the constitution of the year VIII. based on administrative centralization which subordinated the nation to the State, and which has been so convenient for governments that it has been kept in being by all the succeeding régimes. Altered only in detail, it subsists today.

At the outset Bonaparte justified the hopes aroused by his *coup d'état*. The mass of the people longed for peace at home and abroad. He appeared to fill the rôle of peacemaker. Having rid himself of Sieyès, he associated with himself, for form's sake, two other consuls, Cambacérès and Lebrun, men of ripe age and moderate views, the latter of whom had been secretary to Chancellor Maupeou under Louis XV. When a plebiscite was taken, the First Consul was approved by three million votes. He immediately reassured both the solid middle class, and the revolutionaries who had enriched themselves during the Revolution. He wiped out the last relics of Jacobinism, by suppressing the progressive forced loans, and the law of hostages. He re-opened the churches and pacified the Vendée by putting an end to religious persecution and thus indicating a forthcoming *concordat* with the Pope. With the help of a former official of the monarchy, Gaudin, who became duke of Gaeta, he reorganised the finances, and prepared the way for a return to a stable currency.

Marengo and Hohenlinden.—Abroad his task was more difficult. There is no reason to think that Bonaparte was not sincere in trying to put an end to hostilities, though he may have wished to prove to the peace party that peace was unobtainable. The proof, in any case, was quickly forthcoming. The emperor of Russia having retired from the coalition, it remained to deal with England and Austria. The first consul offered a cessation of hostilities. It was a mistake to think that England, so long as she remained mistress of the seas, would ever allow France to retain possession of the mouths of the Scheldt. Pitt refused. Then Bonaparte made another miscalculation. A smashing victory on the Continent would, he thought, compel England to yield. He persisted in this erroneous idea until Waterloo. His history henceforth is a striving for the impossible, *i.e.*, the capitulation of Great Britain on a point she had never admitted—the annexation of Belgium—by a France, which was powerless at sea.

Seven months after the *18 Brumaire*, he boldly crossed the Alps by the Great Saint Bernard to compel Austria to make peace. On June 14, 1800, the hardly won victory of Marengo made him once more master of Italy. Together with Moreau's victory at Hohenlinden in December, it forced the Emperor Francis to sign the treaty of Lunéville, by which Austria recognized all the conquests of the Revolution. The left bank of the Rhine became part of France, and was divided into departments. This was the triumph of Bonaparte and of the revolution. For the first time in history France had regained her "natural frontiers," those of Gaul as known to Caesar.

By the treaty of Lunéville, the British government lost her last Continental ally. The war was costing dear, and many people were weary of it. Trade was severely affected. The first consul, who knew this, resumed in appearance the preparations for invasion, which had been begun in 1797. When, after the fall of Pitt, negotiations were begun with the London cabinet, he strove to drive a bargain, renouncing all claims on Egypt. In March 1802, the treaty of Amiens was signed. It was, and could only be a truce, but the French saw in it definitive peace, and the prestige of the first consul was increased.

Extensions of Power.—In the midst of his success there was one seed of anxiety. He was in power only for ten years. Three had already passed, and opposition was beginning to make itself felt. A Jacobin conspiracy was discovered. Soon after he narrowly escaped being killed by an infernal machine. Former terrorists were thought to be responsible, but Fouché, the minister of police, found that the criminals were royalists instigated by the irreconcilable Cadoudal. Then the Tribunate instituted by Sieyès, opposed Bonaparte's favourite ideas; the Concordat with the Pope, the Order of the Legion of Honour, the Civil Code. Their opposition would become more formidable as the ten year period drew to a close. Definitely to establish the Consulate, and to make it safe from attack, permanence was desired. Thus by a natural progression opinion tended towards the revival of the monarchy in favour of the first consul. He himself was silent, asked for nothing, and let his friends work for him. This they did most effectively.

After the triumph of the peace of Amiens, they proposed a national token of gratitude. The Senate accorded only a prolongation of power for a further ten years. This was a discomfiture. Then Cambacérès thought of consulting the people whether Napoleon Bonaparte (his Christian name was beginning to be used officially) should be made consul for life. It was carried by three and a half million to less than ten thousand votes. The first consul also received the right to choose his successor (Aug. 1802). Although he then had no children, there was nothing to prevent him from choosing his son, if he should have one.

Hereditary monarchy was thus on the point of being re-established, after so many solemn protestations to the contrary. From that time the sovereigns of Europe began to regard Bonaparte as one of themselves. They watched him "climbing step by step towards the throne," though there were to be further happenings before he reached it. It would be an error to accuse him of having sought to gain the crown by means of a new war. The establishment of the empire was an indirect consequence of the renewal of hostilities in May 1803, the immediate cause of which was a dispute over Malta and the interpretation of the treaty of Amiens, though for reasons easily understood, and beyond the control of statesmen, peace could never have been more than a truce. Could England allow France to remain in permanent possession of the finest coast line and most valuable ports of the Continent from Rotterdam to Genoa? To put the question is to answer it. And we must remember that Napoleon had received Belgium and Holland in trust for the Revolution.

Counterplots.—France and England slowly prepared for a struggle which this time must be carried to the bitter end. The twice abandoned plan of invading Great Britain was again resumed, and a camp was formed at Boulogne. Meanwhile the irreconcilable royalists, encouraged by the first consul's new difficulties, conspired with General Pichegru to assassinate him. Georges Cadoudal, who had landed in France, succeeded in implicating the celebrated Moreau, jealous of the first consul. The discovery of this plot infuriated Bonaparte. He accused the *émigrés* of ingratitude, publicly affirmed his republican sympathies, and declared that the intention was to destroy the revolution in his person. He determined to strike.

A young prince of the house of Condé, the duke of Enghien, one of the Bourbons, was forcibly seized on the territory of the duchy of Baden, summarily tried and shot. Bonaparte has been universally condemned for this judicial murder, which set "a ditch filled with royal blood" between the older dynasty and the throne upon whose steps he stood. His regicide monarchy was no longer suspect even to the fiercest republicans. Just as the infernal machine had contributed to the success of the first plebiscite, the conspiracy of Cadoudal and Pichegru facilitated the proclamation of the empire. The first consul had escaped the conspirators, and the danger helped his cause.

THE FIRST EMPIRE

The consulate for life seemed too precarious; a Napoleonic dynasty would survive its founder. Since his enemies, who were the enemies of the revolution, wished to destroy him "he must be made king or emperor, so that heredity should reinforce his power by ensuring him of natural and unquestioned successors and, by rendering useless crimes against his person, should remove the temptation to commit them." (Thiers.)

Thus France returned to hereditary monarchy, approved by a

unanimous vote of the Senate, and by a plebiscite. The empire was proclaimed on May 18th, 1804, the title of emperor being chosen because the word king was inseparably connected with the Bourbons, and because it sounded more impressive, more military. It evoked, moreover, memories of Rome and of Charlemagne. And, like Charlemagne, Napoleon wished to be crowned by the Pope, not in Rome but in Paris. After some hesitation Pius VII. granted his request. On Dec. 2, at Notre Dame the amazing ceremony took place, and the soldier of the revolution became the anointed of the Lord. Moreover he took the crown from the hands of the Pope, and placed it on his own head. And Josephine the Creole adventuress, became empress. But Napoleon could dare all. He built up a new nobility, he gathered together a court. France approved of everything. When the wife of Marshal Lefebvre (the celebrated *Madame Sans Gêne*, who had been a washer-woman) became the duchess of Dantzig he dared even ridicule.

Boulogne, Ulm and Cadiz.—The empire united the old France with the new; in it revolutionary and monarchical ideas were combined. There was general satisfaction. Prosperity had returned with ordered government. No one troubled about the one weak point. The empire could not be really established, nor the conquests of the revolution assured, without the defeat of the British power. Napoleon did not forget it, and in the midst of his re-organization of home affairs, his thoughts were on the camp at Boulogne. He knew that to settle finally with England he must overcome her on her own ground, and must have therefore, were it only for one day, free passage across the Channel. A third coalition was forming. He could, he was sure, defeat its forces by land, but this new victory would be no more effective than earlier ones, so long as the British navy was undefeated. With the help of Admiral Decrès, Napoleon had laboured since the days of the consulate to re-establish the French navy, ruined by the Revolution. But a navy is not built in a day. Failure at Boulogne was to change the fortunes of the empire.

Yet the plan was bold and simple. France had two squadrons. The destruction of one mattered little if, while it fought, the other could slip into the Channel and for 24 hours assure the transport of the troops gathered at Boulogne. On this strategy everything turned; it failed. Villeneuve failed Napoleon, as Grouchy was to fail him at Waterloo. The admiral was uneasy about his equipment, his officers, and his raw and untrained crews. His anxiety was shared by Decrès, the minister of marine. Napoleon spent the month of Aug. 1805 in cruel suspense. Villeneuve, he learnt at last, had not dared to enter the Channel and instead of bearing towards Brest, was making sail to the south. Once more the invasion of England must be abandoned, or at least postponed. Austria was openly threatening, Russia was arming, Prussia could not be depended upon. Austria must be brought to the knees without delay. Napoleon broke up the camp at Boulogne, marched into Germany with amazing rapidity ("The emperor makes war with our legs," said his soldiers) and forced General Mack to surrender at Ulm on Oct. 19.

Two days later this magnificent victory, with all those which were to follow it, was nullified. Villeneuve, blockaded by Nelson in Cadiz, had tried to escape. The British fleet, though smaller in numbers, had destroyed the Franco-Spanish off Cape Trafalgar. From that day the French empire was doomed. Napoleon was faced with the hopeless task of subduing England, absolute mistress of the seas. All his future was governed by that impossibility.

Austerlitz and Jena.—Because he had not crossed the Straits of Dover, he was to go in vain even to Moscow. In vain he sought to triumph first over the Continental powers, hoping then to find the British government discouraged and in a mood for compromise. The Russians having offered battle, he defeated them, and also a fresh Austrian army, in the most brilliant of his victories, that of Austerlitz (Dec. 2, 1805), exactly a year after his coronation. In a few weeks the third coalition was wiped out.

The armies of France, under the single command of a man who was a military genius and an absolute sovereign, seemed invincible. Napoleon, and perhaps he alone, knew that no decision had been reached. He rejected Talleyrand's plan for a reconciliation with Austria, and, returning to the idea which had inspired his Egyptian expedition, planned to strike at England through the East. By the peace of Pressburg he made of a subjugated and diminished Austria a means of communication with Constantinople. The vision was taking shape. To realize it, however, he must dominate all Europe. Within a few years he exhausted the Empire in the attempt. With the conquest of Belgium as a starting point, the revolution urged its successor to vast enterprises, for which neither the military genius of Napoleon nor his political ability would suffice. It was not mania for conquest but the logical development of these schemes which led him to annexations and dangerous territorial adjustments which disquieted all Europe. His brother Joseph became king of Naples, his brother Louis king of Holland. He formed the states of Southern Germany into the Confederation of the Rhine, with himself as president. Prussia, charged with closing the Baltic to the English, was promised Hanover, and the Bourbons, dethroned in Naples, were to have the Balearic isles. After the death of Pitt, he tried to conciliate England by offering secretly to restore Hanover. These diplomatic moves served only to make him two enemies, Prussia, which he had humoured for so long, and Spain, a former ally.

The Prussian campaign saw another of the lightning strokes which he understood so well. The Prussian Army, which had lived on the reputation gained under the great Frederick, was routed at Jena (Oct. 1806). In a few weeks the defence had collapsed, and Napoleon was master of the greater part of Prussia.

The Subjugation of Europe.—Since Prussia had refused to lend herself to his schemes, he would make northern Germany another annex to his empire, himself closing the Baltic and eventually all Europe, to English commerce. From Berlin he promulgated the Continental blockade, an idea arising naturally out of the situation, simple, easy to set out on paper, but entailing the suppression of the independence of all the nations of Europe, since the prohibition of trade with England to be effective must be general. The Continental blockade was the consequence of and the counter-strike to Trafalgar.

But Napoleon was caught in a net from which there was no escape. He had set himself an endless task. After Ulm had to come Austerlitz, after Austerlitz, Jena. After Jena he had to complete the conquest of Prussia, and to complete it, to defeat Russia, penetrate further into the East, cross the Vistula. At Eylau (Feb. 8, 1807), three hundred leagues away from France, he fought in the snow a bloody and inconclusive battle. A new effort, the calling up of next year's conscripts was demanded of Frenchmen "that peace might be won." In June at Friedland, the *grande armée* was again victorious.

Once more Napoleon had the illusion that the goal was reached, that he was master of Europe and could hold England to ransom. The tzar Alexander, highly strung and impressionable, was now won over to the idea of an agreement with the emperor of the French for a policy of partition on 18th century lines. This time Turkey was to be divided instead of Poland. Napoleon was convinced that, allied with Russia against England, able to close the Mediterranean against her, threatening her even in India, he would force her to her knees. The meeting at Tilsit, and the conclusion of the pact of friendship between the emperor of the East and the emperor of the West, seemed to justify the costly victories which had led the French army as far as the Niemen.

Spain, Prussia and Austria.—The first disappointment was that the Franco-Russian alliance determined England to fight more fiercely than ever; her answer was a declaration of war against Russia, and the bombardment of Copenhagen. The Continental blockade everywhere led to increasing difficulties. Portugal showed no eagerness to shut out English trade. Junot had to be sent there with an army. Spain was also giving trouble, and Napoleon determined to drive the Bourbons from Madrid. As if he were transferring prefects, he placed his brother Joseph on the throne of Charles IV., and succeeded him at Naples by Murat, who had married Caroline Bonaparte. At the same time the occupation of the Papal States by General Miollis, charged with enforcing the blockade, embroiled him with the Pope. The

system drove Napoleon to increasing severity. To hold Germany and Italy, together with the Adriatic coasts, and the Spanish peninsula, would soon require a standing army of a million men, while the patience with which his conquests and his violence were endured would decrease in proportion to the dispersion of his troops.

Spain gave the signal for resistance. The Spanish people refused to recognise Joseph, and a wide spread insurrection broke out. When, in July 1808 General Dupont surrendered at Baylen, the Napoleonic empire suffered its first military reverse. The news resounded all over Europe. At the same time an English army landed in Portugal and Junot succumbed to superior numbers. Napoleon's desire to direct and control Spanish affairs had not only caused the English to be received as liberators, but had committed himself to an endless struggle against a people in arms. The uprising of the Spanish nation was infectious. In Prussia, in Tirol, in Dalmatia, patriotism was extolled, and the idea of a holy war for national independence took root and grew. In later days the emperor realized that Spain had been his first check, and that the limit of his power had been attained. In spite of a fresh interview at Erfurt, at which the two emperors paraded their friendship before an audience of kings, the Franco-Russian alliance languished. The partition of Turkey was hindered by the question of Constantinople, which neither emperor wished to see in the power of the other. Alexander was beginning to doubt the power of his new friend. Napoleon, feeling that the ill-success of his policy in Spain was injuring his prestige, determined himself to cross the Pyrenees, and re-establish Joseph in Madrid.

Incited by England and lavishly supplied with English money, Austria took advantage of his absence to re-enter the struggle. Napoleon had to return in haste from the Ebro to the Danube. The Austrian plans were carefully laid, and their opposition was far from negligible. Essling was a difficult, and Wagram (July 1809) a costly victory, but in both he carried the day.

Russia.—From these very successes, however, there arose a further complication. Napoleon had made use of Poniatowski and his Poles against the Austrians. Alexander, who, in any case, had remained neutral, feared that Napoleon was planning the reconstitution of Poland. Abandoning his former ally, he denounced the Continental blockade, and had in his turn to be encountered. The idea of conquering England by Europe and Asia, the sea by the land, had brought about a result which, though it seems at first absurd, was yet the logical conclusion.

It was with no light heart that Napoleon decided to carry the war into Russia. He still hoped that it might not be necessary, if Spain were subdued and if the United States, to whom he had ceded Louisiana and promised Florida, declared war on England, which, attacked in its vital interests by the Continental blockade, would at last sue for peace. There was no doubt that the blockade was having a disastrous effect on British trade; its results on the commerce of other nations were no less serious. Holland refused to enforce it, and Napoleon was obliged to resume control from his brother Louis, who had espoused the cause of his new subjects. He annexed the country, and divided it into departments, thus giving England a fresh reason for remaining under arms. In this way the Continental blockade led either to fresh wars or to expansions of territory which the English inevitably refused to recognise, since they had never recognised those revolutionary conquests which the new ones consolidated.

France was growing uneasy. Common sense made it clear that this extension of territory and of war could not go on indefinitely, and yet no end was in sight. Far-seeing members of the emperor's own circle, such as Talleyrand and Fouché, began to fear that affairs were going wrong. "If it only lasts," said Laetitia Ramolino, *Madame Mère*. Yet the empire never seemed so great, nor the future so secure as in 1810.

Marie-Louise.—Already on a level with kings, Napoleon in his second marriage equalled the proudest dynasties. The head of the house of Habsburg gave him the hand of his daughter. Josephine, though she was loved by the people and her dethronement regretted, was growing old and she had given him no heir. He was tired of her, and anxious to ensure the succession. The emperor of Austria must have shared his confidence in the future, since he was willing to accept the "Corsican ogre" as his son-in-law. The marriage contract with the archduchess was modelled on that of Louis XVI. and Marie-Antoinette, into whose family he was now admitted, in one of the most extraordinary episodes of even his life. The following year Marie-Louise bore him a son; the empire had an heir, who was given the title king of Rome, as the heir to the Holy Roman Empire had been named king of the Romans. But in 1811 Rome was but the capital of the department of the Tiber. The pope had been deported to Savona and was about to be imprisoned at Fontainebleau. By the Continental blockade the restorer of Catholicism in France had been led to alienate Catholics all over the world. Nevertheless, excommunicated, having driven the Bourbons from Naples and from Madrid, the man who 20 years before had been an insignificant officer with neither name nor fortune, married a daughter of the Habsburgs. Confident in his star, he carried all before him.

Though his marriage gratified his ambition, Napoleon had decided upon it only after the failure of negotiations for an alliance with a sister of Alexander. He would have preferred a Russian princess, for more than one old veteran of the Revolution, remembering Marie-Antoinette, asked why the "little corporal" should marry another "Austrian." But the Russian emperor was gradually disengaging himself from the alliance, on which Napoleon was ceasing to rely.

Moscow.—Realising that the Russians would never consent to the extension of the French empire, which under the necessity of the Continental blockade had ended by annexing the Hansa towns of Bremen and Hamburg, and making them the principal cities of two of its hundred and thirty departments, he saw that war was inevitable. French territory now stretched to the Baltic, and the nearer its boundaries approached those of Russia, the greater was the danger of conflict. Difficulties arose continually over Oldenburg, Poland, the East, and the reluctance of Russia to abandon trade with England. The two allied emperors were arming against each other. These preparations were themselves a further offence. Convinced that this new struggle had been decreed by fate, and that his work would not be accomplished till he had vanquished Russia as he had vanquished Prussia and Austria, Napoleon now assembled for the campaign of 1812 the greatest army which the world had yet seen, an army of "twenty nations" made up of contingents from all the peoples allied to or dependent on France, a sort of Western crusade against Asiatic Russia. By natural inclination, as much as by policy, Napoleon raised again for this crusade the battle cry of the Revolution, the liberation of nationalities, of which the reconstitution of Poland was to be the token. He forgot that the Spaniards were already fighting for their independence, and that the nationalism, awakened by principles of the Revolution, was stirring the people of Germany. Alexander, who could play many parts, also spoke the language of liberalism, invoked justice, enlisted on his side the countries defeated and subjugated by France or in rebellion against her, and prepared for peace with Prussia and Austria by complicity in the partition of the Polish provinces. Napoleon was thus to stake everything on the inevitable Russian campaign. Victorious, he would be master of the East, of Constantinople, of all Europe, and would at last force the English to capitulate. Defeated, he himself would have given the signal for the debacle. The war which began in 1792, having carried the French to the gates of Moscow was to return by a swift and violent revulsion to the gates of Paris.

In June 1812 the *grande armée* crossed the Niemen. According to their custom, the Russians declined battle. Alexander had said that he would retire if necessary beyond Tobolsk, while Napoleon imagined himself dictating peace from Moscow. The Russians set fire to the city, and made no peace. Then began a retreat which after the passage of the Beresina became a disaster. In the month of December, Ney and Gérard arrived at Königsberg almost alone. The *grande armée* had melted away. Realising the extent of the catastrophe, and its probable effects in Europe and in France itself, the emperor had secretly left the army, which was kept in ignorance of his departure. The news of General Malet's

conspiracy, which had reached him in Russia, had shown him how precarious was his position and how much weakened his prestige.

The Loss of Germany.—The subsequent history of the Empire is the story of a rapid return to the conditions under which Napoleon had assumed the dictatorship in 1799. The Republicans themselves on the *18th Brumaire* had entrusted him with the task of saving the Revolution and its conquests. To this end France had allowed him to take the crown, to found a dynasty, to overrun three-quarters of Europe and to raise countless armies. All in vain. In a few months he was back at his starting point.

The Spanish insurrection of 1809 had encouraged England to persevere, and had revived the resistance of the conquered peoples. The disasters of the Grand Army in 1813 spurred on his enemies still more. "A few more sacrifices," said the English, "and our end is accomplished." Not even the long hoped for declaration of war by the United States, due not to French diplomacy but to the doctrine of the freedom of the seas as opposed to the English "tyranny at sea," could affect the determination of the British government. Everything pointed to a vast change of fortune in favour of the cause of which England, at one moment, had remained the sole champion. Nationalist propaganda was bearing fruit in Germany. Prussia, while still protesting fidelity to Napoleon, had shifted her allegiance, and secretly reconstituted her army. A Prussian corps in French service, commanded by General York, went over to the Russians. Its defection made a great sensation in Germany and hastened the continued retreat to the Elbe of the remnants of the French army. The Prussian government then unmasked and, obedient to popular opinion, proclaimed a war of liberation and independence.

Napoleon chose to consider his Russian defeat as an accident. In Germany it would always be easy for him, he thought, to beat the Prussians and the Russians; having raised and trained a fresh army he did, in fact, beat them at Lutzen and at Bautzen. The campaign of 1813 opened well. He was, however, justly apprehensive of Austria, and instead of following up these fresh successes he agreed to an armistice, so as to be ready for the third adversary. A coalition of Austria, Prussia and Russia had no terrors for him. He wished to settle with it as quickly as possible, thinking that he held enough cards to secure even from England a favourable peace. The victory of Dresden (Aug. 27) seemed to justify this. But, one after the other, his generals, badly served by their contingents from the Germanic Confederation, were beaten in the field, and his plans were delayed. At Leipzig, where he had returned to prevent the junction of his three opponents, Napoleon fought a three days' battle (Oct. 16–19), during which his Saxon troops went over to the enemy. Having lost this immense battle, and all Germany with it, he had to fall back to the Rhine. In November what had been the *grande armée* entered Mainz, after fighting its way through the Bavarians who in their turn had betrayed him.

Was it possible, on the banks of the Rhine, to secure peace on the basis of "natural frontiers"? The question had been identical under the Revolution. Prussia showed herself at last as the German power most fiercely opposed to France, and England insisted on the renunciation of Antwerp. This was, as it had been during twenty years of war, the question at stake.

Disintegration.—Holland had risen against French rule. Belgium was tired of conscription and of taxes, and there also was awaking an old, invincible consciousness of nationality. The British government, well informed on the condition of France, was aware of her exhaustion. Everything, they knew, had been organized for conquest, nothing for defence. The Allies were much superior in numbers. Even within its own boundaries the Napoleonic empire was tottering. Their determination to finish the business once and for all carried even more weight than Prussia's hatred, and the negotiations which took place before the Allied entry into Paris were for that reason insincere. It had been clear since 1798 that, with England undefeated, France could make peace only on returning to her former frontiers.

No one knew better than Napoleon himself that he was, as the Convention and the directory had been, bound hand and foot by the war and its conquests. He must defend those conquests to the end, or perish with them, as the Revolution had perished. The very nature of his power and the conditions on which he had received it, forbade him that honourable and prudent peace which he has been vainly reproached for failing to achieve. First the allies would have none of it, though their unwillingness was veiled to give the impression in France that only the insensate ambition of the emperor stood in the way; secondly, no government of revolutionary origin could accept the former boundaries. The situation was the same as in 1799. "As things are," said Napoleon, "no one but a Bourbon can succeed me."

The Bourbons, however, succeeded him for another reason. When the Allies invaded France in 1814, they were not in agreement on the form of government. They had not made war for the re-establishment of the monarchy before or now. The Austrian emperor preferred the regency of his daughter Marie-Louise, which would have given him control of French policy. The emperor of Russia dreamed of a king of his making, such as Bernadotte, one of the luckiest adventurers of the Revolution, who by an unprecedented combination of circumstances had become crown prince of Sweden and had betrayed Napoleon. Prussia, concerned only with her own aggrandisement, cared little who ruled in France provided that she obtained her share of the spoils.

Thus Castlereagh, who wished to see France smaller, but free and in subjection neither to Austria nor to Russia, became convinced that a Bourbon monarchy alone would fulfil England's conditions, since, according to Albert Sorel, "this government of principles and not of expedients would be neither the debtor nor the client of any of the Allies." Unknown to, or uncomprehended by the French, this was the reason for the restoration, which to them seemed to be arbitrarily imposed by the enemy, though, in accordance with the English theory of the balance of power, it was intended to preserve their national independence.

Napoleon's campaign in France, the most brilliant of them all, was a barren masterpiece. Albert Sorel has compared his victories, Brienne, Champaubert, Montmirail, Montereau, to that of Valmy. The Allies hesitated and wondered whether to negotiate. But just as the Revolution had demanded that the enemy should quit French territory, so Napoleon insisted on the guarantee of "natural frontiers." He could do no less, but the object of the coalition was to deprive France of them. "We must reassume the uniform and the courage of '93," he said in Feb. 1814. He clung instinctively to the Revolution, and welcomed the proffered assistance of Carnot, former comrade of Robespierre, and one of the few revolutionaries who had held aloof from the empire. The allies on their side remembered that when, after Valmy, the invaders had retired behind the Rhine, Revolutionary France had decided to pursue them. This recollection stiffened their determination, and strengthened their alliance. The four powers bound themselves afresh by the pact of Chaumont, and resumed the offensive, determined to dictate terms of peace.

Everything was crumbling around Napoleon. With the last levies which France could give him, scarcely more than children, he again tried to hold back the enemy, then to outflank and defeat them. His plans failed for want of men. On March 30 the Allies were masters of Paris, and a German wrote from Montmartre, "Nine and a half centuries ago our emperor Otto planted his eagles on these hills."

Abdication.—On April 11, 1814, at Fontainebleau, Napoleon abdicated. Not only had his Senate, the child of the *Corps Législatif* of *Brumaire*, itself the child of the Convention, deserted him and declared for the Bourbons, but his marshals fiercely urged him to renounce his sovereignty and leave the country. They had returned to the position before the *18 Brumaire*, from which the Directory had sought to escape. It is again Albert Sorel who notes that the empire ended, as the consulate began, by one of those "days" which had overthrown so many revolutionary governments. On May 5, Louis XVIII. entered Paris, while the fallen emperor landed on the island of Elba where his sovereignty was recognized. The former master of Europe now reigned over a few square miles. But he was only forty-five and in the full force

of his powers. A man of such immense energy and such ardent imagination could not resign himself so easily to defeat.

Only 25 years separated the beginning of the revolutionary era from his fall. A quarter of a century, however crowded with events, is a short space of time. What had happened? In the part of its programme which included republican government, and "natural frontiers," the Revolution had doubly failed: first, when to save itself it had had recourse after the 18th *Brumaire* to a dictatorship, to absolute sovereignty, to the empire; and again when after incessant fighting for "natural frontiers," the empire had ended by laying France itself open to invasion. Conditions which the Revolution would never accept even though the refusal involved a military despotism, were now imposed. France was obliged to return to her former boundaries, and this involved the restoration of the Bourbons. It was the only possible solution, and there were few in 1814 who did not accept it. Talleyrand, who was far from being a legitimist, played a principal part in the restoration, simply because he realized that it was the only solution. Any government, whether republican or imperial, which sprang from the revolution, was doomed to war, and France had already waged war to the limit of her strength. The monarchy alone could assume the heavy responsibility of concluding peace on the terms offered. Hence when the French had forgotten the disasters and the despotism of the empire arose the reproach that the Bourbons had "returned in the baggage waggons of the enemy."

The return of Louis XVIII. was accompanied by the grant of the "Charter," and representative government. He did not restore the institutions of pre-revolutionary France, but on the contrary, retained those of Napoleon, of the year VIII., even confirming the greater number of his prefects in their office. It remained to make peace in Europe. Louis XVIII. and Talleyrand, making use of the jealousies which had arisen among the allies, sought to make the general settlement as favourable as possible to France. The Congress of Vienna was still sitting when, early in March 1815, the news came "like a bombshell" that "Bonaparte" had escaped from Elba. It had all to be done over again.

There are few examples in history of such sentimental and passionate episodes as the return from Elba. Though the good sense of the French protested against the adventure, it caught at their hearts. Napoleon brought with him so many memories, and with them the tricolor. The daring of his landing in France recalled the return from Egypt. He had only to appear, and almost all France rushed to support him. Yet moderate men realized that the emperor's new adventure was all but hopeless, and would end in a catastrophe even worse than that of 1814. Liberals regretted the loss of the "Charter." France was sick of war, and the abolition of conscription had been the most insistent demand made on the Bourbons. Napoleon maintained that he had been recalled by the people, universally dissatisfied with the restored monarchy. There was, of course, unavoidable friction between the old émigré society and the new. There were in particular soldiers who had held out alone in Germany, Holland and Italy, and had not returned to France till after the convention of April 23. These had not witnessed the invasion, and felt that the fall of the emperor had been undeserved. There was also to be reckoned with, the discontent of the officers who had been placed on half pay.

None of this was really serious, however. Only the presence of Napoleon himself, escaped from his island prison, could have brought about the flood of popular feeling by which he re-conquered France in three weeks. He had only to appear and all was forgotten, the disasters of yesterday and those which his return implied, the slaughter which had brought curses on his name, the detested conscription. Officers and men rallied round him. He had not lost his power of appealing to them, and he stirred their hearts by memories of past glory. After the first moments of hesitation the detachments first sent against him declared for him. Grenoble, then Lyons opened its gates. Marshal Ney, who had undertaken to apprehend him and to bring him back if necessary in a cage, wavered, was carried away, and fell into his arms.

The Hundred Days.—Having landed in the gulf of Juan with a handful of men on March 1, 1815, he was at the Tuileries on the 20th, and Louis XVIII. had fled to Ghent.

A hundred days: the adventure lasted no longer, and was doomed from the outset. Three months' madness. To understand why Napoleon, who, ten months before, had been deserted and denied by all, became the master of France in three weeks in a rush of passionate enthusiasm, we must take into account the change in himself, and the new rôle which he played in opposition to the Bourbons. He was not only a military genius. He was a supremely able politician, and his talents had been perfected during the revolution. He now awoke its memory, talking to the soldiers of glory and to the people of peace and liberty. The former despotic emperor returned a demagogue. Two things menaced him. There was first the fear that the allies would again take up arms, but that he assured the people would be prevented by his father-in-law, the emperor of Austria. Then there was his own despotism. But he told the peasants that they were threatened with the revival of tithes, seigniorial privileges and rights. "I come," he said, "to free you from bondage and serfdom." He who had restored the rights of the Church, and founded a new nobility now incited the mob against the nobles and the priests. To the Liberals he promised representative government, the freedom of the press, everything which Louis XVIII. had already granted, but with a new revolutionary tinge. The idea of a liberal Napoleon conformable with the principles of the Revolution, remained in men's minds. From it dates that alliance of the Bonapartists with the Liberals which disturbed the restoration and the reign of Louis Philippe, and paved the way to the era of Napoleon III.

Abroad the consequences of the return from Elba were no less grave. The allies at Vienna learned the news on March 13. They immediately declared the emperor an outlaw. The pact of Chaumont was renewed. Resumption of the war was certain, and new disasters probable for France. Talleyrand, the French representative at the Congress, was in a cruel position. Foreseeing the event, he associated himself with the allies in order at least to keep the conditions of the Treaty of Paris, and to prevent the next treaty from being made even more severe. It was easy afterwards to pillory this prudent decision, and to assert that the Bourbons had joined with the enemies of the French people. When those who had compromised themselves in the Hundred Days sought for an excuse, they used this treacherous argument.

DOWNFALL AND CAPTIVITY

Waterloo.—Napoleon had never held the illusion that the allies would permit him to reign, nor that he could reign, over a France reduced to its former boundaries. He was still subject to the law which had in the past driven him incessantly to battle. Outlawed by Europe, he prepared to fight. He could still command his followers, but the enthusiasm of the early days had evaporated and there were sinister forebodings. There were many abstentions from the plebiscite held, as before, to approve the supplementary Act to the constitution. The assembly of the *Champ de Mai* resuscitated as the festival of Federation, was gloomy. The spirit of the people was exhausted, their minds disturbed, and Napoleon's supporters uneasy. To prevent a new invasion, the Emperor left for Belgium on June 12 with the intention of separating Wellington and Blücher, who had a hundred thousand men more than he, and defeating them successively. In spite of a success at Ligny, he failed to prevent the junction of the English and the Prussians. This was partly due to what is usually called ill-fortune, but is really the resultant of many forces. Grouchy, a second-rate general to whom Napoleon had given a command in reward for political services, blundered, and remained inactive during the great battle which took place on June 18 at Waterloo—the name of a disaster unparalleled since Trafalgar. On his return to Paris on June 20 no other course but a second abdication was open to Napoleon. All was over. The Napoleonic drama culminated in disaster.

It would appear that in order to strike the imagination of mankind a hero's life should end with a great misfortune. If he had died a natural death in his palace, or fallen on the field of battle, Napoleon would never have become to posterity the figure we know. Lives like his must end in martyrdom, which crowns them with the pity caused by human suffering and the respect due

to misfortune. Saint Helena idealised the emperor's memory, and his gaolers unwittingly prepared for him a sort of poetic immortality. Though his imprisonment in a distant island was a punishment relatively slight as compared with the torture of Joan of Arc, and though the man who placed the imperial crown upon his own head had little in common with the young girl who led her king to his crowning at Reims, there is some similarity in the moral effect and the historical renown of their death. The last phase of Napoleon's life may be regarded as his transfiguration.

After Waterloo, the energy which his presence had re-awakened relaxed. On his return to Paris he felt himself abandoned. The Chamber declared itself against him, and appointed an executive commission to govern with the ministers. He must either forcibly dissolve it, or abdicate. He decided to abdicate in favour of his son, the king of Rome, and made known his intention of going to the United States. The executive commission replied that two frigates, then in waiting at Rochefort, were at his disposal, and requested him to hasten his departure. He remained a week longer at Malmaison, then, as a last despairing throw of the dice, offered his sword against the invaders as a simple general. He then undertook to leave for America. His offer was refused. He left Malmaison on June 29 and arrived at Rochefort on July 3.

The two frigates were there, but the "Bellerophon" and other English ships were cruising before the harbour and blocked the outlet. One hope was left, to slip past and get out to sea. Napoleon would not run the risk of arrest as a fugitive. Thanking all those who offered to help him to escape, he decided on a plan he had had in mind several days, which seemed to him to be the most worthy of him as having an element of greatness, namely to demand asylum from the British government. Maitland, the commander of the "Bellerophon," had let him know that the request would be well received. Thus Napoleon wrote his famous letter to the prince regent:—

"Your Royal Highness, Exposed to the factions which distract my country and to the enmity of the greatest powers of Europe, I have ended my political career, and I come, like Themistocles, to appeal to the hospitality of the British people. I put myself under the protection of their laws, and beg your royal highness, as the most powerful, the most determined and the most generous of my enemies, to grant me this protection."

The allies at this moment were in agreement on only one point of their treatment of Napoleon. There must be no new return from Elba, and it would be perhaps even easier to return from America. The victors, to tell the truth, did not know what to do with him, and every solution presented difficulties. Their secret hope was that he would commit suicide, or perish on his way, the victim of a "White Terror." Or they would have liked Louis XVIII. on his return to Paris to have him summarily tried, condemned and executed. "We wish," wrote Lord Liverpool to Castlereagh, "that the king of France would have Bonaparte shot or hanged. It would be the best end to the business." But no one wished to take the responsibility, and Louis XVIII. less than anyone else. And Alexander I. and Wellington were working to save Napoleon's life. So the fate of the man regarded as an outlaw, "outside human society," *hostis generis humani*, had still to be decided. By his surrender to England the "Corsican ogre" laid on her the task of custody which Lord Liverpool would willingly have left to others.

Louis XVIII., who had returned to Paris on July 9, was anxious for the matter to be settled as quickly as possible, without taking the odium on himself. He ordered the prefect of Rochefort to keep the ex-emperor on the frigate *La Saale*, and to give him up to Commander Maitland, on the latter's requisition. Napoleon thought it more dignified to surrender without waiting for summons or arrest. On July 15 wearing the green coat of the *chasseurs de la garde*, and the small hat, his favourite uniform, and that in which he is always popularly represented he went on board the "Bellerophon."

One wonders if he deceived himself as to his fate and believed that the British government would allow him to go to America, or to remain at liberty in England, which had always welcomed exiles and was looked on as a political asylum. He may have remembered Paoli and Theodore, king of Corsica for a brief period, who had come to London, to die. Strangely enough there has been found among his papers a short literary exercise, an imaginary letter from Theodore asking Walpole for protection. In his school exercise books is also the phrase "Saint Helena, a little island."

The Voyage.—If Napoleon had hoped to remain at liberty he was undeceived when the "Bellerophon" arrived at Plymouth. Admiral Keith delivered to him, in the name of the British government a letter which informed "General Bonaparte" that in order to deprive him of further opportunities of disturbing the peace of Europe, it was necessary to restrain his personal liberty, and that to this end Saint Helena had been chosen as his future residence. He might take with him three companions, from among those who had accompanied him to England, and a surgeon. The emperor, on receipt of the letter, protested that he was the guest and not the prisoner of the British government, and that the rights of hospitality were being violated in his person. He then resigned himself, and set an example of stoicism to his followers. He did no more than put into writing the verbal protest which he had made to Admiral Keith.

Napoleon took with him into his captivity General Bertrand, a former grand marshal of the palace, Count Montholon, aide de camp, and General Gourgaud, and a civilian, the count de Las Cases. Countess Bertrand and Countess Montholon were of the party, as well as Las Cases the younger, and several servants. On Aug. 7 they embarked on the "Northumberland," commanded by Admiral Cockburn, and almost immediately set sail. The voyage lasted more than two months. Napoleon preserved his impassibility, even though the officers and crew had been ordered to refrain from paying him marks of respect, and he was addressed merely as "General." On arriving at Saint Helena Cockburn even said to General Bertrand, "I know of no emperor living in this island, nor of any person with a right to that position, having, as you say, travelled with me on the Northumberland."

Reading was Napoleon's chief distraction, during this long and monotonous voyage which was bearing him for ever from France and from his family. He had read to him from the *Encyclopædia Britannica* everything concerning Saint Helena and the countries near which the ship was passing. After a turn on deck he would lean against a gun, which the midshipmen soon called "the emperor's gun," and talk at length of his past life, telling stories of his career. Las Cases, who kept a journal was thus led to begin his *Memorial of Saint Helena*. Soon Napoleon himself decided to dictate his recollections, beginning with his Italian campaign.

Saint Helena.—On Sunday, Oct. 15 the "Northumberland" dropped anchor before Saint Helena. Napoleon looked through his glasses at the island which was to be his tomb, without, says Las Cases, showing the slightest emotion, and then worked as usual. They landed the next day. The dwelling intended for the prisoner was called Longwood, and, as it was in bad repair and not ready for his reception he stayed temporarily at the small house "The Briars," of which Las Cases says: "The Emperor Napoleon, who was once so powerful, and master of so many crowns, found himself reduced to a little hovel a few square feet in dimensions, with neither curtains, shutters, nor furniture. He had to sleep, dress, eat, work, live there, and if there was cleaning to be done he had to go out of doors." Napoleon protested more than once against this "infamous treatment," against the fact that he was treated as a prisoner of war, though he had himself taken refuge under the English flag, and against the prohibition of news of his wife and son. In December, Longwood was ready at last, and the little company moved there, together with Doctor O'Meara of the Northumberland who had asked to share Napoleon's exile, since no other doctor was available. He also has written an interesting account of the captivity.

Longwood, which had been a farm, was larger and a little more comfortable than "The Briars." Napoleon remained there till his death, spending his time in talking over his past career, dictating his reminiscences, reading, doing a little gardening, riding in the narrow limits permitted him, and even in learning English, which

he read fairly fluently, but would never speak. His chief troubles were the prohibition of correspondence with his family, and the badness of the food. His imprisonment became still more rigorous when, in April 1816, Admiral Cockburn was replaced by Hudson Lowe. The new Governor, obsessed with the fear of losing his prisoner, and, seeing nothing but espionage and plans of escape, made himself detested. Under his petty persecution Napoleon remembered with regret the régime of Admiral Cockburn. First Las Cases, accused of having organised a correspondence with the outer world, was deported to the Cape; O'Meara, the next to go, was replaced by the Corsican doctor, Antommarchi. In 1818 Gourgaud, who could not agree with his companions, left Saint Helena. Only Bertrand and Montholon stayed till the end.

Napoleon's health was suffering. It is possible that the climate, the food and mental anguish assisted the tendency towards cancer which he inherited from his father. His strength rapidly declined. In March 1821, he took to his bed. In April he dictated his will. "It is my wish" he said "that my ashes shall be laid to rest on the banks of the Seine among the French people whom I have loved so well." He added "I am dying before my time, murdered by the English oligarchy and its hired assassin" (Hudson Lowe). He died on the morning of May 5 in his 52nd year. His body was dressed in his favourite uniform, that of the *chasseurs de la garde,* and covered with the cloak he had worn at Marengo. He was buried in a lonely spot near à spring shaded by two weeping willows. He had often walked there. "Here lies" was on the stone. No name.

The Napoleonic Legend.—He had said one day, "What a romance my life has been." Napoleon knew mankind too well, he was in fact too great an artist not to realise that his captivity and his martyrdom gave him a magnificent opportunity of impressing himself upon posterity. On that lonely rock he was seized by an idea as great as were his plans of campaign or the *Code civil.* He would prepare, if not for himself, at least for someone of his race, something better than a return from Elba. He foresaw the nineteenth century, and would catch its imagination. Two thousand leagues away from France he divined the medley of sentiment and emotion forming there:— Austerlitz and Waterloo, the triumph and humiliation of the tricolor, the Revolution of 1789 ending in the return of the Bourbons, all the longings for liberty and for glory which would torture the people of France. Buried desires would rise again, resuscitated by regret and the magic of remembrance. Napoleon had always known how to appeal to the French people. He had not lost the art.

So the *Memorial of Saint Helena* was to become the Gospel of Saint Helena. During the hundred days he had already allied himself with the Liberals and the Republicans. The great Carnot had wept on his shoulder after the second abdication. He spent his years of exile in reviving the Napoleonic legend, in confounding it with liberalism, in "changing the eagle's plumage." He dreamed sometimes that he was working for himself, and that the people aroused by his promises would drive out their Kings and come to deliver him. "We are martyrs to an immortal cause," he said. "We struggle against oppression and the voice of the nations is for us."

In the conversations which were published to the world by his companions in captivity, he made himself the apostle of a new political doctrine, which, inspired by the principles of 1789, had the character and the fascination of a religion. It was a vast idealistic programme, a declaration of the rights and duties of the French people, a reshaping of Europe on the principles of liberty, equality, fraternity and justice. He identified his cause with that of universal freedom. The peoples must be set free, and a holy alliance of nations substituted for a holy alliance of Kings. "There are" he said "strivings for nationhood which must be satisfied sooner or later." No people should be left under the domination of another, and different sections of the same race, which wish to unite, ought not in the future to be separated. "Though they are scattered there are in Europe more than thirty million Frenchmen, fifteen million Spaniards, fifteen million Italians and thirty million Germans. I should like to have made each of these peoples a single united nation." He re-told his own story, giving it a humanitarian and idealistic bias. He represented his dictatorship as that of a liberal, or "crowned Washington," a despot in spite of himself and for the world's good, waging war to found the United States of Europe. He called himself the Messiah of the Revolution whose name would be for the peoples "the emblem of their hopes."

This lofty incarnation triumphed. Popular imagination represented Napoleon at Saint Helena as on a sort of Mount Sinai. Béranger's songs, Victor Hugo's poems added to the glamour. In 1840 the government of Louis-Philippe obeyed the national will by sending the prince de Joinville to bring back the remains of the emperor. The "return of the ashes" was a historic day. Since then, Napoleon rests in the Invalides. Another poet, Lamartine, warned Louis-Philippe that this return foreshadowed another. And, indeed, thanks to the legend woven by his uncle, after the revolution of 1848, Louis Napoleon was elected president of the republic, and then restored the empire, accomplishing in foreign policy, by his support of Italian unity, the programme of nationalities, though the integration of Italy was not yet completed. Thus the Napoleon of Saint Helena survived.

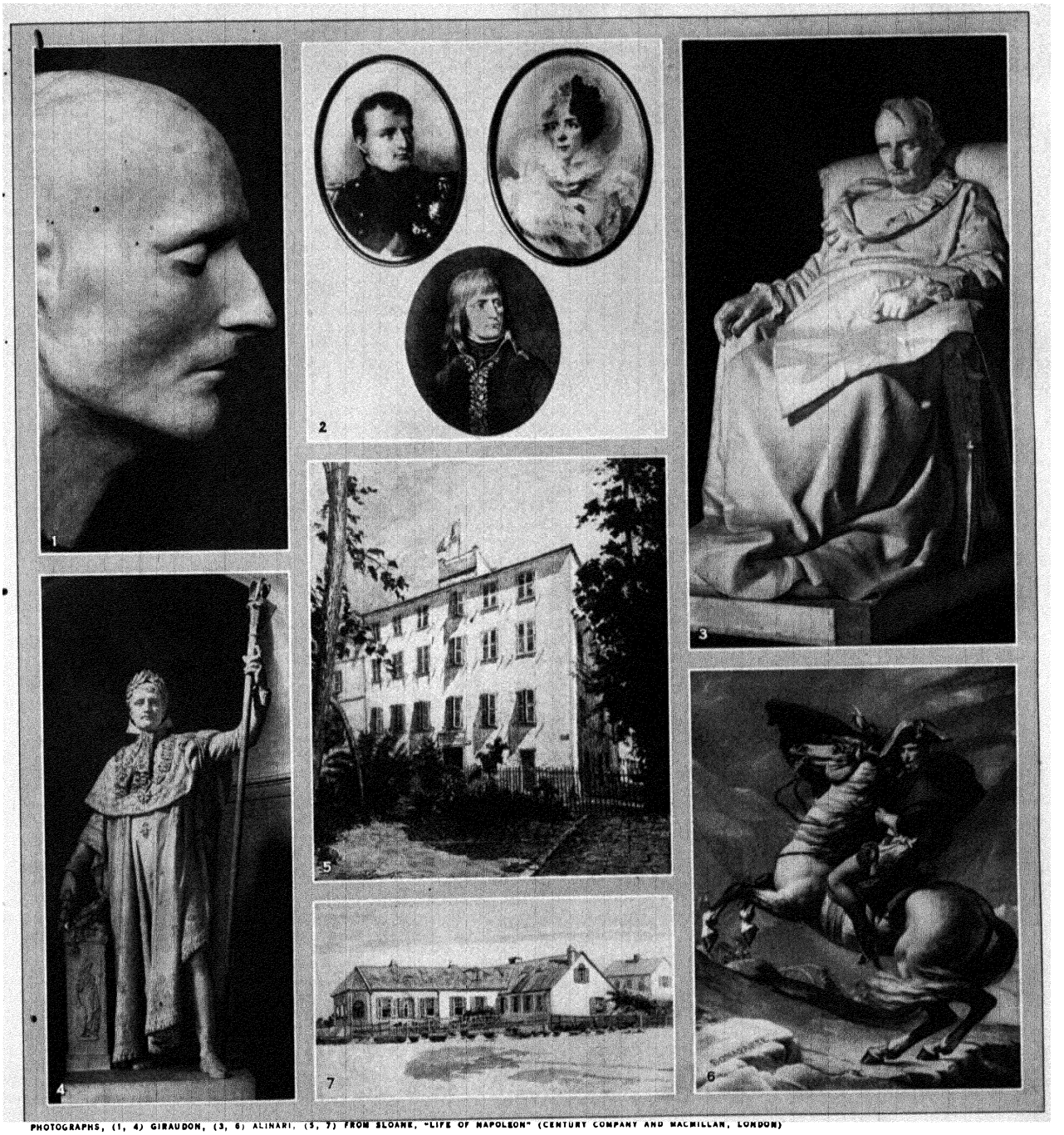
THE NAPOLEONIC RECORD

The Soldier.—We must now briefly consider this man, whose personality was in every respect far above the mean, as a commander and as a legislator—as soldier and sovereign.

His master concepts may be gathered from his various sayings. "The art of war" he said "is simple and wholly executive. There is nothing ideological about it." And again "The whole art of war consists of a careful and well-thought out defensive, together with a swift and bold offensive." Simplicity and rapidity are the dominating features both of his campaigns and his battles. "The art of war" he said at the beginning of his career "consists, with inferior forces, in always having larger forces than the enemy at the point of attack or defence." To do this rapidity of movement is required. "Energy, rapidity" was his constant admonition to subordinates. One must concentrate one's own forces, keep them together, lead the enemy to give battle in the most unfavourable conditions; then, when his last reserves are engaged, destroy him by a decisive attack and end the war as quickly as possible.

As Napoleon himself said, all these precepts could be compressed in a very small book. He had, in fact, a method, not a system. "One of the characteristic features of Napoleonic strategy," says Marshal Franchet d'Esperey, "is that, the goal once chosen and boldly chosen, the method does not vary, though, being supple, it adapts itself to circumstances." One might just as well say "the measure of the method is the commander's measure." Napoleon's power of rapidly summing up a situation and making his decision, explains his victories. As Clausewitz has well said: "On the field of battle everything depends on a decision made in a few minutes." Napoleon summed up everything, including himself, in the words: "No precise rules can be laid down. Everything depends on the character of the general, his abilities, his weakness, the quality of his troops, the range of their weapons, the weather and a thousand other circumstances which never repeat themselves." Hence before the battle his meticulous study of the position, of alternative suppositions, a keen examination of the psychology of his opponent, and the rigorous use of information, material and moral. The weak point was that everything depended on Napoleon. He saw everything, did everything, took account of the most insignificant details, himself directly gave all the orders. His lieutenants, having the habit of obedience, were merely executants who took no initiative. Berthier, although he held the position of chief of staff, said that he counted for nothing with the army. Therefore, an indisposition of the emperor was sufficient to disorganize the machine.

Then, from 1812 onwards, the number of troops involved became too large, and the commander's vision no longer sufficiently sure. It was a war of armies, not of army corps. The Napoleonic system began to give less favourable results. An exaggerated belief in his "star" and his genius, and his heavy demands on an exhausted France, explain the final catastrophe. He had long profited from the concentration of power in his own person. He



PHOTOGRAPHS, (1, 4) GIRAUDON, (3, 6) ALINARI, (5, 7) FROM SLOANE, "LIFE OF NAPOLEON" (CENTURY COMPANY AND MACMILLAN, LONDON)

NAPOLEON BONAPARTE

1. Death Mask of Napoleon, now in the Invalides, Paris
2. Upper left: miniature portrait of Napoleon in 1812, by Isabey. Upper right; miniature portrait of Josephine in 1813, by Isabey. Below: engraving by G. Fiesinger, after a miniature portrait of Napoleon by Guerin, deposited in the National Library, Paris, in 1799
3. "The Last Days of Napoleon," sculpture portrait by V. Vela; now at Versailles
4. "Napoleon I," statue by Philippe-Laurent Roland. In the Paris Institut
5. House in the Place Letizia, Ajaccio, Corsica, in which Napoleon Bonaparte was born. From the drawing by Eric Pape
6. "Napoleon Crossing the Alps," by J. L. David. At Versailles
7. "Longwood," Napoleon's residence at St. Helena. Drawing by Harry Pena, from a photograph belonging to L. C. Billings

himself rejoiced in being almost the only great captain to hold absolute authority over a rich and populous country, and command its resources both of men and money. Yet in spite of his enormous intellectual energy he gave way in the end under the burden. He insisted on regulating the minutest details of his government. Thus the decree which still governs the *Théâtre Français* was signed at Moscow. Moreover his empire was precarious. Founded on victory and success, it could not survive defeat. Remembering after Waterloo Louis XIV. unshaken by misfortune, he said, "If I had been my own grandson, I could have retreated as far as the Pyrenees."

The Sovereign.—Yet he did more than win and lose battles. He gave to France laws which for the most part still endure. We have seen that when he became first consul, France had fallen practically into anarchy. The ancient laws, excessively complicated, because they differed from province to province and were customary and traditional, had been wiped out by the revolution. The new laws, so far as they existed at all, were too revolutionary in character and unadapted to normal society. The *code civil* united what in Roman law and in tradition was best suited to France under the conditions engendered by the Revolution. It may be said to be a systemization of good sense, at the same time logical and historical. Napoleon had no legal training, and his share in the work should not be exaggerated, but he intervened continually with the dominating idea that, though the work of the revolution must not be undone, order must be restored in France. Here again he profited by his lack of prejudice and his trained intelligence. He carried out the transition from old to new France. Probably he alone could have re-established the conditions necessary to settled government without being accused of relinquishing the "civil victories of the revolution." He was able to reimpose indirect taxation and in particular food taxes, the most unpopular of all, the abolition of which had made it impossible to place the finances of the Republic on a sound basis.

The council of state, the public accounts office, the courts of justice, the universities, the rights of the *Banque de France*, all these were established, counterbalancing the work of the revolutionary demagogues, and they serve to this day as restraining influences on the occasional over-violence of democracy. On the other side of the picture we see excessive centralization which stifled provincial life and local characteristics, cast the whole country in the same mould, and made the State supreme over the entire people—a system singularly favourable to "étatisme." Thus as a legislator, and as a legendary figure, Napoleon appeared as the restorer of order and authority and the embodiment of progress.

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(J. BAI.)

NAPOLEON II.: *see* REICHSTADT, JOSEPH CHARLES, DUKE OF.

NAPOLEON III. [CHARLES LOUIS NAPOLEON BONAPARTE] (1808–1873), emperor of the French, was born on April 20, 1808, in Paris at 8 rue Cerutti (now rue Laffitte), and not at the Tuileries, as the official historians state. He was the third son of Louis Bonaparte (*see* BONAPARTE), brother of Napoleon I., and king of Holland (1806–10), and of HORTENSE DE BEAUHARNAIS (*q.v.*). Of the two other sons of Louis Bonaparte and Hortense, the elder, Napoleon Charles (1802–1807), died in infancy; the second, Napoleon Louis (1804–1831), died in the insurrection of the Romagna, leaving no children.

Exile of Hortense.—After Waterloo, Hortense, suspected by the Bourbons of having arranged the return from Elba, had to go into exile. The ex-king Louis, who now lived at Florence, had compelled her by a scandalous law-suit to give up to him the elder of her two children. With her remaining child she wandered, under the name of duchesse de Saint-Leu, from Geneva to Aix, Carlsruhe and Augsburg. In 1817 she bought the castle of Arenenberg, in the canton of Thurgau, on a wooded hill looking over the Lake of Constance. Hortense supervised her son's education in person. The young prince also studied at the gymnasium at Augsburg, and there he acquired his slight German accent.

In 1823 he accompanied his mother to Italy, visiting his father at Florence, and his grandmother Letitia at Rome, and dreaming with Le Bas on the banks of the Rubicon. He returned to Arenenberg to complete his military education under Colonel Armandi and Colonel Dufour, who instructed him in artillery and military engineering. At the age of twenty he was a "Liberal," an enemy of the Bourbons and of the treaties of 1815; but he was dominated by the cult of the emperor, and for him the liberal ideal was confused with the Napoleonic.

Revolution of 1830.—The July revolution of 1830, of which he heard in Italy, roused all his young hopes. He could not return to France, for the law of 1816 banishing all his family had not been abrogated. But the liberal revolution knew no frontiers. Italy shared in the agitation. He had already met some of the conspirators at Arenenberg, and it is practically established that he now joined the associations of the Carbonari. Following the advice of his friend the Count Arese and of Menotti, he and his brother were among the revolutionaries who in February 1831 attempted a rising in Romagna and the expulsion of the pope from Rome. They distinguished themselves at Civita Castellana, a little town which they took; but the Austrians arrived in force, and during the retreat Napoleon Louis, the elder son, took cold, followed by measles, of which he died. Hortense hurried to the spot and took steps which enabled her to save her second son from the Austrian prisons. He escaped into France, where his mother, on the plea of his illness, obtained permission from Louis Philippe for him to stay in Paris. But he intrigued with the republicans, and Casimir-Périer insisted on the departure of both mother and son. In May 1831 they went to London, and afterwards returned to Arenenberg.

For a time he thought of responding to the appeal of some of the Polish revolutionaries, but Warsaw succumbed (September 1831) before he could set out. Moreover the plans of this young and visionary *enfant du siècle* were becoming more definite. The duke of Reichstadt died in 1832. His uncle, Joseph, and his father, Louis, showing no desire to claim the inheritance promised them by the constitution of the year XII., Louis Napoleon henceforth considered himself as the accredited representative of the family. He endeavoured to define his ideas, and in 1833 published his *Rêveries politiques, suivies d'un projet de constitution*, and *Considérations politiques et militaires sur la Suisse;* in 1836, as a captain, in the Swiss service, he published a *Manuel d'artillerie*, in order to win popularity with the French army.

Strasbourg Conspiracy.—With the aid of his friend Fialin and of Eléonore Gordon, a singer, and of certain officers, such as Colonel Vaudrey, an old soldier of the Empire, commanding the 4th regiment of artillery, and Lieutenant Laity, he tried to bring about a revolt of the garrison of Strasbourg (Oct. 30, 1836). The conspiracy was a failure, and Louis Philippe, fearing lest he might make the pretender popular either by the glory of an acquittal or the aureole of martyrdom, had him taken to Lorient and put on board a ship bound for America, while his accomplices were brought before the court of assizes and acquitted (February 1837). The prince was set free in New York in April; by the aid of a false passport he returned to Switzerland in August, in time to see his mother before her death on Oct. 3, 1837.

At any other time this attempt would have covered its author with ridicule. Such, at least, was the opinion of the whole of the family of Bonaparte. But his confidence was unshaken, and in the woods of Arenenberg the romantic-minded friends who remained faithful to him still honoured him as emperor. And now the government of Louis Philippe, by an evil inspiration, began to

act in such a way as to make him popular. In 1838 it caused his partisan Lieutenant Laity to be condemned by the Court of Peers to five years' imprisonment for a pamphlet which he had written to justify the Strasbourg affair; then it demanded the expulsion of the prince from Switzerland, and when the Swiss government resisted, threatened war. Having allowed the July monarch to commit himself, Louis-Napoleon at the last moment left Switzerland voluntarily. All this served to encourage the mystical adventurer. In London, where he had taken up his abode, together with Arese, Fialin (says Persigny), Doctor Conneau and Vaudrey, he was at first well received in society, being on friendly terms with Count d'Orsay and Disraeli, and frequenting the *salon* of Lady Blessington. He was evolving his programme of government, and in 1839 wrote and published his book: *Des Idées napoléoniennes*, a curious mixture of Bonapartism, socialism and pacificism, which he represented as the tradition of the First Empire. He also noted the fluctuations of French opinion.

Boulogne Conspiracy.—The pretender, again thinking that the moment had come, formed a fresh conspiracy in 1840. With a little band of fifty-six followers he attempted to provoke a rising of the 42nd regiment of the line at Boulogne, hoping afterwards to draw General Magnan to Lille and march upon Paris. The attempt was made on Aug. 6, but failed; he saw several of his supporters fall on the shore of Boulogne, and was arrested together with Montholon, Persigny and Conneau. This time he was brought before the Court of Peers with his accomplices; he entrusted his defence to Berryer and Marie, and took advantage of his trial to appeal to the supremacy of the people, which he alleged, had been disregarded, even after 1830. He was condemned to detention for life in a fortress, his friend Aladenize being deported, and Montholon, Parquin, Lombard and Fialin being each condemned to detention for twenty years. On Dec. 15, the very day that Napoleon's ashes were deposited at the Invalides, he was taken to the fortress of Ham. On the whole the régime imposed upon him was mild. He corresponded with Louis Blanc, George Sand and Proudhon, and collaborated with the journalists of the Left, Degorge, Peauger and Souplet. For six years he worked very hard "at his University of Ham," as he said. He wrote some *Fragments historiques*, studies on the sugar-question, on the construction of a canal through Nicaragua, and on the recruiting of the army, and finally, in the *Progrès du Pas-de-Calais*, a series of articles on social questions which were later embodied in his *Extinction du paupérisme* (1844). But the same persistent idea underlay all his efforts. On May 25, 1846, he escaped to London, giving as the reason for his decision the dangerous illness of his father. On July 27 his father died.

Return to France.—He was again well received in London and he "made up for his six years of isolation by a furious pursuit of pleasure." The duke of Brunswick and the banker Ferrère interested themselves in his future, and gave him money, as did also Miss Howard, whom he later made comtesse de Beauregard, after restoring to her several millions. At the first symptoms of revolutionary disturbance he returned to France; on Feb. 25, he offered his services to the Provisional Government, but, on being requested by it to depart at once, resigned himself to this course. But Persigny, Mocquard and all his friends devoted themselves to an energetic propaganda in the press, by pictures and by songs. After May 15 had already shaken the strength of the young republic, he was elected in June 1848 by four departments, Seine, Yonne, Charente-Inférieure and Corsica. In spite of the opposition of the executive committee, the Assembly ratified his election. But he had learnt to wait. He sent in his resignation from London, merely hazarding this appeal: "If the people impose duties on me, I shall know how to fulfil them." This time events worked in his favour; the industrial insurrection of June made the middle classes and the mass of the rural population look for a saviour, while it turned the industrial population towards Bonapartism, out of hatred for the republican *bourgeois*.

Presidency of the Republic.—On Sept. 26 he was re-elected by the same departments; on Oct. 11 the law decreeing the banishment of the Bonapartes was abrogated; on the 26th he made a speech in the Assembly defending his position as a pretender, and cut such a sorry figure that Antony Thouret contemptuously withdrew the amendment by which he had intended to bar him from rising to the presidency. Thus he was able to be a candidate for this formidable power. The former rebel of the Romagna, the Liberal *Carbonaro*, was henceforth to be the tool of the priests. In his very triumph appeared the ultimate cause of his downfall. On Dec. 10 he was elected president of the Republic by 5,434,226 votes against 1,448,107 given to Cavaignac. On Dec. 20, he took the oath "to remain faithful to the democratic Republic . . . to regard as enemies of the nation all those who may attempt by illegal means to change the form of the established government." From this time onward his history is inseparable from that of France. But, having attained to power, he still endeavoured to realize his cherished project. All his efforts (Dec. 10, 1848 to Dec. 2, 1852) tended towards the acquisition of absolute authority, which he wished to obtain, ostensibly from the people.

It was with this end in view that he co-operated with the party of order in the expedition to Rome for the destruction of the Roman republic and the restoration of the pope (March 31, 1849), and afterwards in all the reactionary measures against the press and the clubs, and for the destruction of the Reds. But in opposition to the party of order, he defined his own personal policy. "The name of Napoleon," he said on this occasion, "is in itself a programme; it stands for order, authority, religion and the welfare of the people in internal affairs, and in foreign affairs for the national dignity."

In spite of this alarming assertion of his personal policy, he still remained in harmony with the Assembly (the Legislative Assembly, elected on May 28, 1849) in order to carry out "a Roman expedition at home," *i.e.*, to clear the administration of all republicans, put down the press, suspend the right of holding meetings and, above all, to hand over education to the Church. But he knew where to stop and how to keep up a show of democracy. When the Assembly, by the law of May 31, 1850, restricted universal suffrage and reduced the number of the electors from 9 to 6 millions, he was able to throw upon it the whole responsibility for this *coup d'état bourgeois*.

In fact, while trying to compass the destruction of the republican movement of the Left, he was taking careful steps to win classes. At his side were his accomplices, men ready for anything, whose only hopes were bound up with his fortunes, such as Morny and Rouher; his paid publicists, such as Romieu, the originator of the "red spectre"; his cudgel-bearers, the "Ratapoils" immortalized by Daumier, who terrorized the republicans.

Coup d'État.—He next entered upon that struggle with the Assembly, now discredited, which was to reveal to all the necessity for a change, and a change in his favour. In January 1851 he deprived Changarnier of his command of the garrison of Paris. "The Empire has come," said Thiers. The pretender would have preferred, however, that it should be brought about legally, the first step being his re-election in 1852. The Constitution forbade his re-election; therefore the Constitution must be revised. On the 19th of July the Assembly threw out the proposal for revision, thus signing its own death-warrant, and the *coup d'état* was resolved upon. He prepared for it systematically. The cabinet of Oct. 26, 1851 gave the ministry for war to his creature Saint-Arnaud. All the conspirators were at their posts—Maupas at the prefecture of police, Magnan at the head of the troops in Paris. At the Elysée, Morny, adulterine son of Hortense, a hero of the Bourse and successful gambler, supported his half-brother by his energy and counsels. The ministry proposed to abrogate the electoral law of 1850, and restore universal suffrage; the Assembly by refusing made itself still more unpopular. By proposing to allow the president of the Assembly to call in armed force, the questors revealed the Assembly's plans for defence, and gave the Elysée a weapon against it ("donnent barre contre elle à l'Elysée"). The proposition was rejected (November 17), but Louis-Napoleon saw that it was time to act. On Dec. 2 he carried out his *coup d'état*.

Proclamation as Emperor.—But affairs developed in a way which disappointed him. By dismissing the Assembly, by offering the people "a strong government," and re-establishing "a France

regenerated by the Revolution of '89 and organized by the emperor," he had hoped for universal applause. But both in Paris and the provinces he met with the resistance of the Republicans, who had reorganized in view of the elections of 1852. He struck at them by mixed commissions, deportations and the whole range of police measures. The *décrets-lois* of the year 1852 enabled him to prepare the way for the new institutions. On Dec. 2, 1852 he became in name what he was already in deed, and was proclaimed Emperor of the French.

The aim which the emperor had in view was, by a concentration of power which should make him "the beneficent motive force of the whole social order" (constitution of the 14th of January 1852; administrative centralization; subordination of the elected assemblies; control of the machinery of universal suffrage) to unite all classes in "one great national party" attached to the dynasty. His success, from 1852 to 1856, was almost complete. The nation was submissive, and a few scattered plots alone showed that republican ideas persisted among the masses. As "restorer of the overthrown altars," he won over the "men in black," among them Veuillot, editor-in-chief of *l'Univers*, and allowed them to get the University into their hands. By the aid of former Orleanists, such as Billault, Fould and Morny, and Saint-Simonians such as Talabot and the Pereires, he satisfied the industrial classes, extended credit, developed means of communication, and gave a strong impetus to the business of the nation. By various measures, such as subsidies, charitable gifts and foundations, he endeavoured to show that "the idea of improving the lot of those who suffer and struggle against the difficulties of life was constantly present in his mind." His was the government of cheap bread, great public works and holidays. The imperial court was brilliant. The emperor, having failed to obtain the hand of a Vasa or Hohenzollern, married, on Jan. 29, 1853, Eugénie de Montijo, comtesse de Teba, aged twenty-six and at the height of her beauty.

Foreign Policy.—France was "satisfied" in the midst of order, prosperity and peace. The foreign policy of the Catholic party, by the question of the Holy Places and the Crimean War (1853–1856), gave him the opportunity of winning the glory which he desired, and the British alliance enabled him to take advantage of it. In January 1856 he had the good fortune to win a diplomatic triumph over the new tsar, Alexander II. It was at Paris (February 25–March 30) that the conditions of peace were settled. The emperor was now at the height of his power. He appeared to the people as the avenger of 1840 and 1815, and the birth to him of a son, Eugène Louis Jean Joseph, on March 16, 1856, assured the future of the dynasty. It was then that, strong in "the esteem and admiration with which he was surrounded," and "foreseeing a future full of hope for France," he dreamed of realizing the Napoleonic ideal in its entirety. This disciple of the German philologists, this crowned *Carbonaro*, the friend of the archaeologists and historians who were to help him to write the *Histoire de César*, dreamed of developing the policy of nationalism, and of assisting the peoples of all countries to enfranchise themselves.

From 1856 to 1858 he devoted his attention to the Rumanian nationality, and supported Alexander Cuza. But it was above all the deliverance of Italy which haunted his imagination. But the Catholics feared that the Italian national movement, when once started, would entail the downfall of the papacy; and in opposition to the emperor's Italian advisers, Arese and Prince Jerome Napoleon, they pitted the empress, who was frivolous and capricious, but an ardent Catholic. Napoleon III. was under his wife's influence, and could not openly combat her resistance. It was the Italian Orsini who, by attempting to assassinate him as a traitor to the Italian nation on Jan. 14, 1858, gave him an opportunity to impose his will indirectly by convincing his wife that in the interests of his own security he must "do something for Italy." Events followed each other in quick succession, and now began the difficulties in which the Empire was to be irrevocably involved. Not only did the Italian enterprise lead to strained relations with Great Britain, the alliance with whom had been the emperor's chief support in Europe, and compromised its credit; but the claims of parties and classes again began to be heard at home.

The Italian war aroused the opposition of the Catholics. After Magenta (June 4, 1859), it was the fears of the Catholics and the messages of the empress which, even more than the threats of Prussia, checked him in his triumph and forced him into the armistice of Villafranca (July 11, 1859). But the spread of the Italian revolution and the movement for annexation forced him again to intervene. He appealed to the Left against the Catholics by the amnesty of April 17, 1859. His consent to the annexation of the Central Italian states, in exchange for Savoy and Nice (Treaty of Turin, March 24, 1860) exposed him to violent attacks on the part of the ultramontanes, whose slave he had practically been since 1848. At the same time, the free-trade treaty with Great Britain (January 5, 1860) aroused a movement against him among the industrial *bourgeoisie*.

From this time onward, in face of a growing opposition, anxiety for the future of his régime paralysed his initiative. Placed between his Italian counsellors and the empress, he was ever of two minds. His plans for remodelling Europe had a certain generosity and grandeur; but internal difficulties forced him into endless manoeuvre and temporization, which led to his ruin. Thus in October 1862, after Garibaldi's attack on Rome, the clerical coterie of the Tuileries triumphed. But the replacing of M. Thouvenel by M. Drouin de Lhuys did not satisfy the more violent Catholics, who in May 1863 joined the united opposition. Thirty-five opposers of the government were appointed, Republicans, Orleanists, Legitimists or Catholics. The emperor dismissed Persigny, and summoned moderate reformers such as Duruy and Béhic. But he was still possessed with the idea of settling his throne on a firm basis, and uniting all France in some glorious enterprise which should appeal to all parties equally, and "group them under the mantle of imperial glory." From January to June 1863 he sought this appearance of glory in Poland, but only succeeded in embroiling himself with Russia. Then, after Syria and China, it was the "great inspiration of his reign," the establishment of a Catholic and Latin empire in Mexico, enthusiasm for which he tried in vain from 1863 to 1867 to communicate to the French.

But while the strength of France was wasting away at Puebla in Mexico, Bismarck was founding German unity. In August 1864 the emperor, held back by French public opinion, which was favourable to Prussia, and by his idea of nationality, allowed Prussia and Austria to seize the duchies of Schleswig and Holstein. After his failure in Poland and Mexico and in face of the alarming presence of Germany, only one alliance remained possible for Napoleon III., namely with Italy. He obtained this by the convention of the 15th of September 1864 (involving the withdrawal of the French troops from Rome). But the Catholic party redoubled its violence, and the pope sent out the encyclical *Quanta Cura* and the *Syllabus*, especially directed against France. In vain the emperor sought in German affairs a definitive solution of the Italian question. At Biarritz he prepared with Bismarck the Franco-Prussian alliance of April 1866; and hoped to become arbiter in the tremendous conflict which was about to begin. But Königgrätz came as a bolt from the blue to ruin his hopes. French interests called for an immediate intervention. But he resigned himself to the annexation by Prussia of northern Germany. "Now," said M. Drouin de Lhuys, "we have nothing left but to weep."

The Third Party.—Henceforth the brilliant dream, a moment realized, the realization of which he had thought durable, was at an end. The Empire had still an uncertain and troubled brilliancy at the Exhibition of 1867. But Berezowski's pistol shot, which accentuated the estrangement from the tsar, and the news of the death of Maximilian at Queretaro, cast a gloom over the later fêtes. In the interior the industrial and socialist movement, born of the new industrial development, added fresh strength to the Republican and Liberal opposition. The moderate Imperialists felt that some concessions must be made to public opinion. In opposition to the absolutist "vice-emperor" Rouher, whose influence over Napoleon had become stronger and stronger since the death of Morny, Émile Ollivier grouped the Third Party. Anxious, changeable and distraught, the emperor made the Liberal

concessions of Jan. 19, 1867 (right of interpellation), and then, when Ollivier thought that his triumph was near, he exalted Rouher (July) and did not grant the promised laws concerning the press and public meetings till 1868. The opposition gave him no credit for these tardy concessions. There was an epidemic of violent attacks on the emperor; the publication of the *Lanterne* and the Baudin trial, conducted by Gambetta, were so many death-blows to the régime. The *Internationale* developed its propaganda. The election of May 1869 resulted in 4,438,000 votes given for the government, and 3,355,000 for the opposition, who also gained 90 representatives. The emperor, disappointed and hesitating, was slow to return to a parliamentary régime. It was not till December that he instructed Ollivier to "form a homogeneous cabinet representing the majority of the Corps Législatif" (ministry of the 2nd of January 1870). But, embarrassed between the *Arcadiens*, the partisans of the absolute régime, and the republicans, Ollivier was unable to guide the Empire in a constitutional course. At the Tuileries Rouher's counsel still triumphed. It was he who inspired the ill and wearied emperor, now without confidence or energy, with the idea of resorting to the *plébiscite*. "To do away with the risk of a revolution," "to place order and liberty upon a firm footing," "to ensure the transmission of the crown to his son," Napoleon III. again sought the approbation of the nation. He obtained it with brilliant success, for the last time, by 7,358,786 votes against 1,571,939, and his work now seemed to be consolidated.

War With Prussia.—A few weeks later it crumbled irrevocably. Since 1866 he had been pursuing an elusive appearance of glory. Since 1866 France was calling for "revenge." He felt that he could only rally the people to him by procuring them the satisfaction of their national pride. Hence the mishaps and imprudences of which Bismarck made such an insulting use. Hence the negotiations of Nikolsburg, the "note d'aubergiste" (innkeeper's bill) claiming the left bank of the Rhine, which was so scornfully rejected; hence the plan for the invasion of Belgium (August 1866), the Luxemburg affair (March 1867), from which M. de Moustier's diplomacy effected such a skilful retreat; hence the final folly which led his government into the war with Prussia (July 1870).

The war was from the first doomed to disaster. It might perhaps have been averted if France had had any allies. But Austria, a possible ally, could only join France if satisfied as regards Italy; and since Garibaldi had threatened Rome (Mentana, 1867), Napoleon III., yielding to the anger of the Catholics, had again sent troops to Rome. Negotiations had taken place in 1869. The emperor, bound by the Catholics, had refused to withdraw his troops. It was as a distant but inevitable consequence of his agreement of December 1848 with the Catholic party that in 1870 the emperor found himself without an ally.

His energy was now completely exhausted. Successive attacks of stone in the bladder had ruined his physique; while his hesitation and timidity increased with age. The influence of the empress over him became supreme. On leaving the council in which the war was decided upon the emperor threw himself, weeping, into the arms of Princess Mathilde. The empress was delighted at this war, which she thought would secure her son's inheritance.

Deposition.—On July 28 father and son set out for the army. They found it in a state of utter disorder, and added to the difficulties by their presence. The emperor was suffering from stone and could hardly sit his horse. After the defeat of Reichshoffen, when Bazaine was thrown back upon Metz, he wished to retreat upon Paris. But the empress represented to him that if he retreated it would mean a revolution. An advance was decided upon which ended in Sedan. On Sept. 2 Napoleon III. surrendered with 80,000 men, and on the 4th of September the Empire fell. He was taken as a prisoner to the castle of Wilhelmshöhe, near Cassel, where he stayed till the end of the war. After the intrigues of Bazaine, of Bismarck, and of the empress, the Germans having held negotiations with the Republic, he was *de facto* deposed. On March 1, the assembly of Bordeaux confirmed this deposition, and declared him "responsible for the ruin, invasion and dismemberment of France."

Restored to liberty, he retired with his wife and son to Chislehurst in England. Unwilling even now to despair of the future, he still sought to rally his friends for a fresh propaganda. He had at his service publicists such as Cassagnac, J. Amigues and Hugelmann. He himself also wrote unsigned pamphlets justifying the campaign of 1870. It may be noted that, true to his ideas, he did not attempt to throw upon others the responsibility which he had always claimed for himself. He dreamed of his son's future. But he no longer occupied himself with any definite plans. He interested himself in pensions for workmen and economical stoves. At the end of 1872 his disease became more acute, and a surgical operation became necessary. He died on Jan. 9, 1873, leaving his son in the charge of the empress and of Rouher. The young prince was educated at Woolwich from 1872 to 1875, and in 1879 took part in the English expedition against the Zulus in South Africa, in which he was killed. By his death vanished all hope of renewing the extraordinary fortune which for twenty years placed the descendant of the great emperor, the *Carbonaro* and dreamer, at once obstinate and hesitating, on the throne of France.

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NAPOLEON, a village of north-western Ohio, U.S.A., on the Maumee river and Federal highway 24, 36 m. S.W. of Toledo; county seat of Henry county. It is served by the Detroit, Toledo and Ironton and the Wabash railways. Pop. (1920) 4,143 (94% native white). It is the trade centre of a grain-growing district, a railway division point, and has a number of factories.

NAPOLEON, a round game of cards (known colloquially as "nap"). Any number may play. The cards rank as at whist, and five are dealt to each player. The deal being completed, the player to the dealer's left looks at his hand and declares how many tricks he would play to win against all the rest, the usual rule being that more than one must be declared; in default of declaring he says "I pass," and the next player has a similar option of either declaring to make more tricks or passing, and so on all round. A declaration of five tricks is called "going nap." The player who declares to make most has to try to make them, and the others, but without consultation, to prevent him. The declaring hand has the first lead, and the first card he leads makes the trump suit. The players, in rotation, must follow suit if able. If the declarer succeeds in making at least the number of tricks he stood for he wins whatever stakes are played for; if not he loses. If the player declaring nap wins he receives double stakes all round; if he loses he only pays single stakes all round. Sometimes, however, a player is allowed to go "Wellington" over "nap," and even "Blücher" over "Wellington." In these cases the caller of "Wellington" wins four times the stake and loses twice the stake, the caller of "Blucher" receives six times and loses three times the stake. Sometimes a player is allowed to declare *misère*, *i.e.*, no tricks. This ranks, as a declaration, between three and four, but the player pays a double stake on three, if he wins a trick, and receives a single on three if he takes none.

NAPOLEONIC CAMPAIGNS. The era of the Revolutionary and Napoleonic Wars falls into two main divisions, the first of which (1792–1801) is dealt with under the heading FRENCH REVOLUTIONARY WARS. In the present article are described the campaigns in central and eastern Europe, directed by Napoleon—no longer one amongst many French generals, nor even a simple *primus inter pares*, but "Emperor" in the fullest sense—between the years 1805 and 1814. Napoleon's short

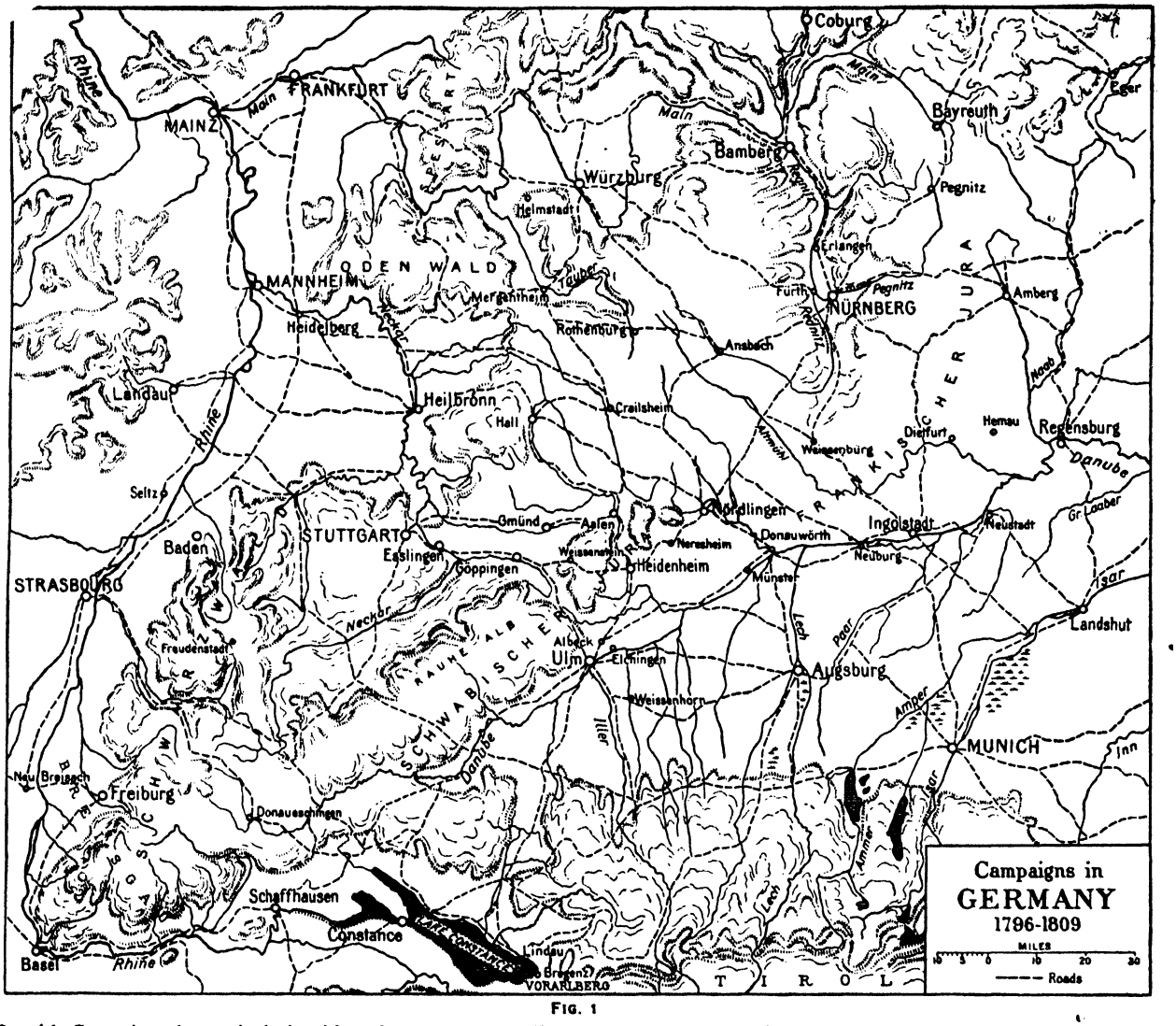

FIG. 1

Spanish Campaign of 1809 is dealt with under PENINSULAR WAR (this article covering the campaigns in Spain, Portugal and southern France 1808–1814), and for a discussion of the events that led to the final drama of Waterloo the reader is referred to WATERLOO CAMPAIGN.

The campaigns described below are therefore—

(*a*) The Austrian War of 1805 (Ulm and Austerlitz).
(*b*) The Conquest of Prussia and the Polish Campaign (Jena, Auerstädt, Eylau and Friedland).
(*c*) The Austrian war of 1809 (Eckmühl, Aspern and Wagram).
(*d*) The Russian War of 1812 (Borodino and the retreat from Moscow).
(*e*) The German "War of Liberation," culminating in the Battle of the Nations around Leipzig.
(*f*) The last campaign in France, 1814.

The naval history of 1803–1815 includes the culmination and the sequel of the struggle for command of the sea which began in 1793 and continued for more than a decade with results increasingly disappointing to the ambitions of Napoleon, finally reaching a decisive climax on the day of Trafalgar.

THE CAMPAIGN OF 1805

This may be regarded as a measure of self-defence forced upon Napoleon by the alliance of Russia (April 11), Austria (August 9) and other powers with Great Britain. The possibility had long been before the emperor, and his intention in that event to march straight on Vienna by the valley of the Danube is clearly indicated in his reply (November 27, 1803) to a Prussian proposal for the neutralization of the South German states. In this he says, "It is on the road from Strasbourg to Vienna that the French must force peace on Austria, and it is this road which you wish us to renounce." When, therefore, on Aug. 25, 1805, he learnt definitely that Villeneuve (see *Naval Operations* below) had failed in his purpose of securing the command of the Channel, which was the necessary preliminary to the invasion of England, it was but the affair of a few hours to dictate the dispositions necessary to transfer his whole army to the Rhine frontier as the first step in the march which he had determined to make to the Danube. On the date of this decision the army actually lay in the following positions:—

I.	Corps	Bernadotte	Hanover (Göttingen)
II.	,,	Marmont	Holland
III.	,,	Davout	Camp of Boulogne and other points on the English Channel
IV.	,,	Soult	
V.	,,	Lannes	
VI.	,,	Ney	
VII.	,,	Augereau	
Guard		Bessières	Paris

The corps were, however, by no means fit for immediate service. Bernadotte's corps in Hanover was almost in the position of a

beleaguered garrison, and the marshal could only obtain his transport by giving out that he was ordered to withdraw to France. Marmont and Davout were deficient in horses for cavalry and artillery, and the troops in Boulogne, having been drawn together for the invasion of England, had hardly any transport at all, as it was considered this want could be readily supplied on landing. The composition of the army, however, was excellent. The generals were in the prime of life, had not yet learnt to distrust one another, and were accustomed to work under the emperor and with one another. The regimental officers had all acquired their rank before the enemy and knew how to manage their men, and of the men themselves nearly two-thirds had seen active service. The strength of the army lay in its infantry, for both cavalry and artillery were short of horses, and the latter had not yet acquired mobility and skill in manoeuvring. Napoleon's determination to undertake the invasion of England has often been disputed, but it is hard to imagine what other operation he contemplated, for the outbreak of hostilities with his continental enemies found him ill-supplied with intelligence as to the resources of the country he had then to traverse. To remedy this, Murat and other general officers as well as minor agents were sent ahead and instructed to travel through South Germany in plain clothes with a view to collecting information and mastering the topography. The emperor was, moreover, imperfectly acquainted with the degree of preparation of his adversaries' designs, and when he dictated his preliminary orders he was still unaware of the direction that the allies' advance would assume. On Aug. 26, however, he learnt that 100,000 Russians were about to enter Bohemia thence to unite with an Austrian army of 80,000 near the junction of the Inn and Danube, and this information drove him to alter the general direction of his advance so as to traverse the defiles of the Black Forest north of the Neckar, cavalry only observing the passes to the south.

Austrian Army.—The Austrians after the defeats of 1800 had endeavoured to reorganize their forces on the French model, but they were soon to learn that in matters of organization the spirit is everything, the letter very little. They had copied the organization of the French corps, but could find no corps commanders fit to assume the responsibility for these commands. As always in such conditions, the actual control of the smallest movements was still centralized in the hands of the army commanders, and thus the rate of marching was incredibly slow. They had decided that in future their troops in the field should live by requisition, and had handed over to the artillery, which needed them badly, a large number of horses thus set free from the transport service, but they had not realized that men accustomed to a regular distribution of rations cannot be transformed into successful marauders and pillagers by a stroke of the pen; and they had sent away the bulk of their army, 120,000 under their best general, the archduke Charles, into Italy, leaving Mack von Leiberich in Germany, nominally as chief of the staff to the young Prince Ferdinand, but virtually in command, to meet the onset of Napoleon at the head of his veterans. Mack had the distinction of having risen from the ranks in the most caste-ridden army in Europe.

The March on Ulm.—The outbreak of the campaign was hastened by the desire of the Austrian government to feed their own army and leave a bare country for Napoleon by securing the resources of Bavaria. It was also hoped that the Bavarians with their army of 25,000 men would join the allies. In the latter hope they were deceived, and the Bavarians under General Wrede slipped away to Bamberg in time. In the former, however, they were successful, and the destitution they left in their wake almost wrecked Napoleon's subsequent combinations. Mack's march to Ulm was therefore a necessity of the situation, and his continuance in this exposed position, if foolhardy against such an adversary, was at any rate the outcome of the high resolve that even if beaten he would inflict crippling losses upon the enemy. Mack knew that the Russians would be late at the rendezvous on the Inn. By constructing an entrenched camp at Ulm and concentrating all the available food within it, he expected to compel Napoleon to invest and besiege him, and he anticipated that in the devastated country his adversary would be compelled to separate and thus fall an easy prey to the Russians. For that blow he had determined to make his own army the anvil. But these views obviously could not be published in army orders, hence the discontent and opposition he was destined to encounter.

Movements of the French.—It was on Sept. 21 that Napoleon learnt of Mack's presence in Ulm. On that date his army had crossed the Rhine and was entering the defiles of the Black Forest. It was already beginning to suffer. Boots were worn out, greatcoats deficient, transport almost unattainable and, according to modern ideas, the army would have been considered incapable of action.

On Sept. 26 its deployment beyond the mountains was complete, and as Napoleon did not know of Mack's intention to stay at Ulm and had learned that the Russian advance had been delayed, he directed his columns by the following roads on the Danube, between Donauwörth and Ingolstadt, so as to be in a position to intervene between the Austrians and the Russians and beat both in detail.

	Sept. 28	Oct. 6	Oct. 9	Oct. 10
Bernadotte	Würzburg	Anspach	Nürnberg	Regensburg
Marmont	Würzburg	Anspach	Nürnberg	Regensburg
Davout	Mannheim	Mergentheim	Anspach	Dietfurt
Ney	Selz	Crailsheim	Weissenburg	Ingolstadt
Lannes	Strassburg	Gmünd	Nördlingen	Neuburg
Soult	Landau	Aalen	Donauwörth	

On Oct. 7 this movement was completed—the Austrians abandoned the Danube bridges after a show of resistance, retreating westward—and Napoleon, leaving Murat in command of the V. and VI. corps and cavalry to observe the Austrians, pressed on to Augsburg with the others so as to be ready to deal with the Russians. Learning, however, that these were still beyond striking radius, he determined to deal with Mack's army first, having formed the fixed conviction that a threat at the latter's communications would compel him to endeavour to retreat southwards towards Tirol. Bernadotte in his turn became an army of observation, and Napoleon joining Murat with the main body marched rapidly westward from the Lech towards the Iller.

Austrian Plans.—Mack's intentions were not what Napoleon supposed. He had meanwhile received (false) information of a British landing at Boulogne, and he was seriously deceived as to the numbers of Napoleon's forces. He was also aware that the exactions of the French had produced deep indignation throughout Germany and especially in Prussia whose neutrality had been violated. All this, and the almost mutinous discontent of his generals and his enemies of the court circle, shook his resolution of acting as anvil for the Russians, of whose delay also he was aware, and about Oct. 8 he determined to march out north-eastward across the French lines of communication and save his sovereign's army by taking refuge if necessary in Saxony. Believing implicitly in the rumours of a descent on Boulogne and of risings in France which also reached him, and knowing the destitution he had left behind him in his movement to Ulm, when he heard of the westward march of French columns from the Lech he told his army, apparently in all good faith, that the French were in full march for their own country.

Actually the French at this moment were suffering the most terrible distress—up to the Danube they had still found sufficient food for existence, but south of it, in the track of the Austrians, they found nothing. All march discipline disappeared, the men dissolved into hordes of marauders and even the sternest of the marshals wrote piteous appeals to the emperor for supplies, and for permission to shoot some of their stragglers. But to all these Berthier in the emperor's name sent the stereotyped reply—"The emperor has ordered you to carry four days' provisions, therefore you can expect nothing further—you know the emperor's method of conducting war."

Action of Albeck or Haslach.—Meanwhile Murat, before the emperor joined him, had given Mack the desired opening. The VI. corps (Ney) should have remained on the left bank of the

Danube to close the Austrian exit on that side, but by mistake only Dupont's division had been left at Albeck, the rest being brought over the river. Mack on the 8th had determined to commence his withdrawal, but fortune now favoured the French. The weather during the whole of October had been unusually wet, the swollen Danube overflowed the low ground and the roads had become quagmires. On the south bank, owing to better natural drainage and a drier subsoil, movement was fairly easy, but the Austrians found it almost impossible. On Oct. 11, when they began their march, the road along the Danube was swept into the river, carrying with it several guns and teams, and hours were consumed in passing the shortest distances. At length in the afternoon they suddenly fell upon Dupont's isolated division at Albeck, which was completely surprised and severely handled. The road now lay completely open, but the Austrian columns had so opened out owing to the state of the roads that the leading troops could not pursue their advantage—Dupont rallied and the Austrians had actually to fall back towards Ulm to procure food.

Elchingen.—For three more days Mack struggled with an unwilling staff and despondent men to arrange a further advance. During these very three days, through a succession of staff blunders, the French failed to close the gap, and on the morning of Oct. 14 the armies, each renewing its advance, came in contact at the bridge of Elchingen. This bridge, all but a few road-bearers, had been destroyed, but now the French gave an example of that individual gallantry which was characteristic of the old revolutionary armies. Running along the beams under a close fire a few gallant men forced their way across. The floor of the bridge was rapidly relaid, and presently the whole of the VI. corps was deploying with unexampled rapidity on the farther side. The Austrians, still in their quagmire, could not push up reinforcements fast enough, and though Mack subsequently alleged deliberate obstruction and disobedience on the part of his subordinates, the state of the roads alone suffices to explain their defeat. Only the right column of the Austrians was, however, involved; the left under General Werneck, to whom some cavalry and the archduke Ferdinand attached themselves, did indeed succeed in getting away, but without trains or supplies. They continued their march, famished but unmolested, until near Heidenheim they suddenly found themselves confronted by what from the diversity of uniforms they took to be an overwhelming force; at the same time the French cavalry sent in pursuit appeared in their rear. Utterly exhausted by fatigue, Werneck with his infantry, some 8,000 strong, surrendered to what was really a force of dismounted dragoons and foot-sore stragglers improvised by the commanding officer on the spot to protect the French treasure chests, which at that moment lay actually in the path of the Austrians. The young archduke with some cavalry escaped.

Mack Surrounded.—The defeat at Elchingen on Oct. 14 sealed the fate of the Austrians, though Mack was still determined to endure a siege. As the French columns coming up from the south and west gradually surrounded him, he drew in his troops under shelter of the fortress and its improvised entrenched camp, and on the 15th he found himself completely surrounded. On the 16th the French field-guns fired into the town, and Mack realized that his troops were no longer under sufficient control to endure a siege. When, therefore, next morning, negotiations were opened by the French, Mack, still feeling certain that the Russians were at hand, agreed to an armistice and undertook to lay down his arms if within the next twenty-one days no relief should arrive. To this Napoleon consented, but hardly had the agreement been signed when he succeeded in introducing a number of individual French soldiers into the fortress, who began rioting with the Austrian soldiery. Then, sending in armed parties to restore order and protect the inhabitants, he caused the guards at the gates to be overpowered, and Mack was thus forced into an unconditional surrender.

On Oct. 22, the day after Trafalgar, the remnant of the Austrian army, 23,000 strong, laid down its arms. About 5,000 men under Jellachich had escaped to Tirol, 2,000 cuirassiers with Prince Ferdinand to Eger in Bohemia, and about 10,000 men under Werneck had surrendered at Heidenheim. The losses in battle having been insignificant, there remain some 30,000 to account for—most of whom probably escaped individually by the help of the inhabitants, who were bitterly hostile to the French. Napoleon now hastened to rejoin the group of corps he had left under Bernadotte in observation towards the Russians, for the latter were nearer at hand than even Mack had assumed. But hearing of his misfortune they retreated before Napoleon's advance along the right bank of the Danube to Krems, where they crossed the river and withdrew to an entrenched camp near Olmütz to pick up fresh Austrian reinforcements. The severe actions of Dürrenstein (near Krems) on Nov. 11, and of Hollabrünn on Nov. 16, in which Napoleon's marshals learned the tenacity of their new opponents, and the surprise of the Vienna bridge (November 14) by the French, were the chief incidents of this period in the campaign.

Campaign of Austerlitz.—Napoleon continued down the right bank to Vienna, where he was compelled by the condition of his troops to call a halt to refit his army. After this was done he continued his movement to Brünn. Thither he succeeded in bringing only 55,000 men. He was again forced to give his army rest and shelter, under cover of Murat's cavalry. The allies now confronted him with upwards of 86,000 men, including 16,000 cavalry. About Nov. 20 this force commenced its advance, and Napoleon concentrated in such a manner that within three days he could bring over 80,000 French troops into action around Brünn, besides 17,000 or more Bavarians under Wrede. On the 28th Murat was driven in by the allied columns. That night orders were despatched for a concentration on Brünn in expectation of a collision on the following day; but hearing that the whole allied force was moving towards him he decided to concentrate south-east of Brünn, covering his front by cavalry on the Pratzen heights. Meanwhile he had also prepared a fresh line of retreat towards Bohemia, and, certain now of having his men in hand for the coming battle, he quietly awaited events.

The allies were aware of his position, and still adhering to the old "linear" system, marched to turn his right flank (*see* AUSTERLITZ). As soon as their strategic purpose of cutting him off from Vienna became apparent, the emperor moved his troops into position, and in the afternoon issued his famous proclamation to his troops, pointing out the enemy's mistakes and his plan for defeating them. At the same time he issued his orders for his first great battle as a supreme commander. The battle of Austerlitz began early next morning and closed in the evening with the thorough and decisive defeat of the allies.

PRUSSIAN AND POLISH CAMPAIGNS

Around the Prussian army, and particularly the cavalry, the prestige of Frederick the Great's glory still lingered; but the younger generation had little experience of actual warfare, and the higher commanders were quite unable to grasp the changes in tactics and in the conduct of operations which had grown out of the necessities of the French Revolution. The individual officers of the executive staff were the most highly trained in Europe, but there was no great leader to co-ordinate their energies. The total number of men assigned to the field army was 110,000 Prussians and Saxons. They were organized in corps, but their leaders were corps commanders only in name, for none were allowed any latitude for individual initiative. Ill-judged economies had undermined the whole efficiency of the Prussian army. Two-thirds of the infantry and one-half of the cavalry were allowed furlough for from ten to eleven months in the year. The men were unprovided with greatcoats. Most of the muskets had actually seen service in the Seven Years' War, and their barrels had worn so thin with constant polishing that the use of full charges at target practice had been forbidden. Above all, the army had drifted entirely out of touch with the civil population. The latter, ground down by feudal tradition and law, and at the same time permeated by the political doctrines of the late 18th century, believed that war concerned the governments only, and formed no part of the business of the "honest citizen." In this idea they were supported by the law itself, which protected the civilian against the soldier, and forbade even in war-time the requisition-

ing of horses, provisions and transport, without payment. Up to the night of the battle of Jena itself, the Prussian troops lay starving in the midst of plenty, whilst the French everywhere took what they wanted. This alone was a sufficient cause for all the misfortunes which followed.

During the campaign of Austerlitz Prussia, furious at the violation of her territory of Anspach, had mobilized, and had sent Haugwitz as ambassador to Napoleon's headquarters. He arrived on Nov. 30, and Napoleon, pleading business, put off his official reception till after the battle of Austerlitz. Of course the ultimatum was never presented, as may be imagined; Haugwitz returned and the king of Prussia demobilized at once. But Napoleon, well knowing the man he had to deal with, had determined to force a quarrel upon Prussia at the earliest convenient opportunity. His troops therefore, when withdrawn from Austria, were cantoned in south Germany in such a way that, whilst suspicion was not aroused in minds unacquainted with Napoleonic methods, they could be concentrated by a few marches behind the Thuringian forest and the upper waters of the Main. Here the Grande Armée was left to itself to recuperate and assimilate its recruits, and it is characteristic of the man and his methods that he did not trouble his corps commanders with a single order during the whole of the spring and summer.

As the diplomatic crisis approached, spies were sent into Prussia, and simultaneously with the orders for preliminary concentration the marshals received private instructions, the pith of which cannot be better expressed than in the following two quotations from Napoleon's correspondence:—

"Mon intention est de concentrer toutes mes forces sur l'extrémité de ma droite en laissant tout l'espace entre le Rhin et Bamberg entièrement dégarni, de manière à avoir près de 200,000 hommes réunis sur un même champ de bataille; mes premières marches menacent le coeur de la monarchie prussienne" (No. 10,920). "Avec cette immense supériorité de forces réunis sur un espace si étroit, vous sentez que je suis dans la volonté de ne rien hasarder et d'attaquer l'ennemi partout où il voudra tenir. Vous pensez bien que ce serait une belle affaire que de se porter sur cette place (Dresden) en *un bataillon carré de 200,000 hommes*" (Soult, No. 10,941).

Advance of the Grande Armée.—On Oct. 7 the *Grande Armée* lay in three parallel columns along the roads leading over the mountains to Hof, Schleiz and Kronach; on the right lay the IV. corps (Soult) about Bayreuth, with his cavalry in rear, and behind these the VI. corps (Ney) at Pegnitz; in the centre, Bernadotte's I. corps from Nordhalben, with the III. corps (Davout) Lichtenfels; Guard and headquarters, Bamberg. The left column was composed of the V. (Lannes) at Hemmendorf, with the VII. (Augereau) extending south to the Main at Burgebrach.

Napoleon's object being surprise, all the cavalry except a few vedettes were kept back behind the leading infantry columns and these latter were ordered to advance, on the signal being given, in "masses of manoeuvre," so as to crush at once any outpost resistance which was calculated upon the time required for the deployment of ordinary marching columns. This order has never since found an imitator, but deserves attentive study as a masterpiece (*see* H. Bonnal, *Manoeuvre d'Iéna*).

To meet the impending blow the Prussians had been extended in a cordon along the great road leading from Mainz to Dresden, Blücher was at Erfurt, Rüchel at Gotha, Hohenlohe at Weimar, Saxons in Dresden, with outposts along the frontier. An offensive move into Franconia was under discussion, and for this purpose the Prussian staff had commenced a lateral concentration about Weimar, Jena and Naumburg when the storm burst upon them. The emperor gathered little from the confused reports of their purposeless manoeuvres, but, secure in the midst of his "battalion square" of 200,000 men, he remained quite indifferent, well knowing that an advance straight on Berlin must force his enemy to concentrate and fight, and as they would bring at most 127,000 men on to the battlefield the result could hardly be doubtful. On Oct. 9 the cloud burst. Out of the forests which clothe the northern slopes of the Thuringer Wald the French streamed forth, easily overpowering the resistance of the Prussian outposts on the upper Saale, and once the open country was reached the cavalry under Murat trotted to the front, closely followed by Bernadotte's corps as "general advance guard." The result of the cavalry scouting was, however, unsatisfactory. On the night of the 10th, the emperor was still unaware of the position of his principal foe, and Murat with Bernadotte behind him was directed on Gera for the 11th, the remainder of the army continuing along the roads previously assigned to them.

In the meanwhile, however, the Saxons had been moving from Naumburg through Gera on Jena, Hohenlohe was near Weimar, and all the other divisions of the Prussian army had closed in a march eastwards, the idea of an offensive to the southward which Napoleon had himself attributed to them having already disappeared.

Reaching Gera at 9 A.M. Murat reported the movement of the Saxons on the previous day, but omitted to send a strong detachment in pursuit. The traces of the Saxons were lost, and Napoleon, little satisfied with his cavalry, authorized Lasalle to offer up to 6,000 frs. reward for information of the Prussian point of concentration. At 1 A.M. of the 12th Napoleon issued his orders: Murat and Bernadotte via Zeitz to Naumburg; Davout (III. corps and a dragoon division) also to Naumburg; Lannes to Jena, Augereau following; Soult to Gera.

In the meantime the Prussians were effecting their concentration. Rüchel, who with 15,000 men had been sent into the mountains as an advance guard for the projected offensive, was recalled to Weimar, which he reached on the 13th. The main body were between Weimar and Apolda during the 12th, and the Saxons duly effected their junction with Hohenlohe in the vicinity of Vierzehnheiligen, whilst the latter had withdrawn his troops, all but some outposts from Jena, to the plateau about Capellendorf, some 4m. to the N.W. The whole army, of over 120,000 men, could therefore have been concentrated against Lannes and Augereau by the afternoon of the 13th, whilst Soult could



FIG. 2.—JENA CAMPAIGN

only have intervened very late in the day, and Davout and Bernadotte were still too distant to reach the battlefield before the 14th. All the French corps, moreover, were so exhausted by their rapid marches over bad roads that the emperor actually ordered (at 1 A.M. on the 13th) a day of rest for all except Davout, Bernadotte, Lannes and Murat.

The Prussian headquarters, however, spent the 12th and 13th in idle discussion, whilst the troop commanders exerted themselves to obtain some alleviation for the suffering of their starving men. The defeats undergone by their outpost detachment had

profoundly affected the nerves of the troops, and on the afternoon of the 11th, on the false alarm of a French approach, a panic broke out in the streets of Jena, and it took all the energy of Hohenlohe and his staff to restore order. On the morning of the 12th the Saxon commanding officers approached Hohenlohe with a statement of the famishing condition of their men, and threatened to withdraw them again to Saxony. Hohenlohe pointed out that the Prussians were equally badly off, but promised to do his best to help his allies. Urgent messages were sent off to the Commissary von Goethe (the poet), at Weimar for permission to requisition food and firewood. These requests, however, remained unanswered, and the Prussians and Saxons spent the night before the battle shivering in their miserable bivouacs.

The 13th of October.—During the early morning of the 13th the reports brought to Napoleon at Gera partially cleared up the situation, though the real truth was very different from what he supposed. However, it was evident that the bulk of the Prussians lay to his left, and instructions were at once despatched to Davout to turn westward from Naumburg towards Kösen and to bring Bernadotte with him if the two were still together. The letter, however, ended with the words "but I hope he is already on his way to Dornburg." Now Bernadotte had neglected to keep the emperor informed as to his whereabouts. He was still with Davout, but, concluding that he had missed an order directing him to Dornburg, he thought to conceal his error by assuming the receipt of the order evidently alluded to in the last words, and as a result he marched towards Dornburg, and his whole corps was lost to the emperor at the crisis of the next day's battle.

On the road from Gera to Jena Napoleon was met by intelligence from Lannes announcing his occupation of Jena and the discovery of Prussian troops to the northward. Knowing the emperor's methods, he wisely restrained the ardour of his subordinates and asked for instructions whether to attack or wait. The emperor rode forward rapidly, reached Jena about 3 P.M., and with Lannes proceeded to the Landgrafenberg to reconnoitre. From this point his view was, however, restricted to the immediate foreground, and he only saw the camps of Hohenlohe's left wing. At this moment the Prussians were actually on parade and ready to move off to attack, but just then the "evil genius" of the Prussian army, Massenbach, an officer of the Headquarters Staff, rode up and claiming to speak with the authority of the king and commander-in-chief, induced Hohenlohe to order his troops back to camp. Of all this Napoleon saw nothing, but from all reports he came to the conclusion that the whole Prussian army was actually in front of him, and at once issued orders for his whole army to concentrate towards Jena, marching all night if need be. Six hours earlier his conclusion would have been correct, but early that morning the Prussian headquarters, alarmed for the safety of their line of retreat on Berlin by the presence of the French in Naumburg, decided to leave Hohenlohe and Rüchel to act as rear-guard, and with the main body to commence their retreat towards the river Unstrutt and the Eckhardtsberge where Massenbach had previously reconnoitred an "ideal" battlefield. This belief in positions was the cardinal principle of Prussian strategy in those days. The troops had accordingly commenced their march on the morning of the 13th, and now at 3 P.M. were settling down into bivouac; they were still but a short march from the decisive field.

Battle of Jena.—On the French side, Lannes' men were working their hardest, under Napoleon's personal supervision, to make a practicable road up to the Landgrafenberg, and all night long the remaining corps struggled through darkness towards the rendezvous. By daybreak on the 14th, the anniversary of Elchingen, upwards of 60,000 men stood densely packed on the narrow plateau of the mountain, whilst, below in the ravines on either flank, Soult on the right, and Augereau on the left, were getting into position. Fortunately a dense fog hid the helpless masses on the Landgrafenberg from sight of the Prussian gunners. Hohenlohe had determined to drive the French into the ravine at daybreak, but had no idea as to the numbers in front of him. For want of room, only a few Prussian battalions were sent forward, and these, delaying their advance till the fog had sufficiently lifted, were met by French skirmishers, and small columns, who rapidly overlapped their flanks and drove them back in confusion. Hohenlohe now brought up the remainder of his command, but in the meanwhile the French had poured across the neck between the Landgrafenberg and the main plateau, and the troops of Soult and Augereau were working up the ravines on either hand. In view of these troops the Prussian line, which had advanced faultlessly as if on parade, halted to prepare its bayonet attack by fire, and, once halted, it was found impossible to get them to go on again. The French, who had thrown themselves into houses, copses, etc., picked off the officers, and the flanks of the long Prussian lines swayed and got into confusion. The rival artilleries held each other too thoroughly to be able to spare attention to the infantry, whilst the Prussian cavalry, which had forgotten how to charge in masses of eighty or more squadrons, frittered away their strength in isolated efforts. By 10 A.M. the fourteen battalions which had initiated this attack were outnumbered by three to one, and drifted away from the battlefield. Their places were taken by a fresh body, but this was soon outnumbered and outflanked in its turn. By 2 P.M. the psychological moment had come, and Napoleon launched his guards and cavalry to complete the victory and initiate pursuit. Rüchel's division now arrived and made a most gallant effort to cover the retreat, but their order being broken by the torrent of fugitives, they were soon overwhelmed by the tide of the French victory and all organized resistance had ceased by 4 P.M.

Briefly summarized, the battle came to this—in four successive efforts the Prussians failed because they were locally outnumbered. This was the fault of their leaders solely, for, except for the last attack, local superiority was in each case attainable. Organization and tactics did not affect the issue directly, for the conduct of the men and their junior officers gave abundant proof that in the hands of a competent leader the "linear" principle of delivering one shattering blow would have proved superior to that of a gradual attrition of the enemy here, as on the battlefields of the Peninsula and at Waterloo, and this in spite of other defects in the training of the Prussian infantry which simultaneously caused its defeat on the neighbouring field of Auerstädt.

Battle of Auerstädt.—Here the superiority of French mobility showed its value most conclusively. Davout in obedience to his orders of the previous morning was marching over the Saale at Kösen, when his advanced guard and that of the Prussian main army came unexpectedly in contact. The latter with at least 50,000 men was marching in two columns, and ought therefore to have delivered its men into line of battle twice as fast as the French, who had to deploy from a single issue, and whose columns had opened out in the passage of the Kösen defile and the long ascent of the plateau above. But the Prussians attacked at the old regulation speed of seventy-five paces to the minute, and the French manoeuvred at the quick or double of 120 or 150. The consequence was that the French always succeeded in reinforcing their fighting line in time to avert disaster. Nevertheless by mid-day their strength was well-nigh exhausted, whilst the Prussian reserve, eighteen battalions of guards under Kalckreuth, stood intact and ready to engage. But at the critical moment the duke of Brunswick fell mortally wounded, and Scharnhorst, his chief of the staff, was at the time absent on another part of the field. Meanwhile rumours from the battlefield at Jena, magnified as usual, began to reach the staff, and these may possibly have influenced Kalckreuth, for when called upon to attack with his eighteen battalions and win the day, he declined to move without the direct order of the commander-in-chief to do so, alleging that it was the duty of a reserve to cover the retreat and he considered himself personally responsible to the king for the guards entrusted to his care. Even then the day might possibly have been saved had Blücher been able to find even twenty squadrons accustomed to gallop together, but the Prussian cavalry had been dispersed amongst the infantry commands, and at the critical moment it proved impossible for them to deliver a united and decisive attack.

Seeing further efforts hopeless, Scharnhorst in the duke's name initiated the retreat and the troops withdrew north-west towards Buttelstedt, almost unmolested by the French, who this day had

gear, or for the cavalry to replace their jaded horses from captured Prussian resources, he set Davout in motion towards Warsaw on Nov. 2, and the remainder of the army followed in successive echelons as rapidly as they could be despatched.

The cavalry, moving well in advance, dispersed the Prussian depots and captured their horses, as far as the line of the Vistula, where at last they encountered organized resistance from the

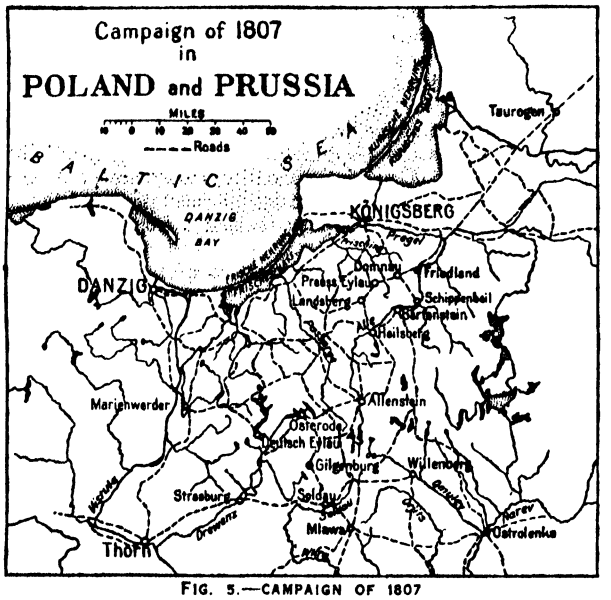

FIG. 5.—CAMPAIGN OF 1807

outposts of Lestocq's little corps of 15,000 men—all that was left of Frederick the Great's army. These, however, gave way before the threat of the advancing French and, after a few trifling skirmishes, Davout entered Warsaw on Nov. 30, being followed by the V., IV., and Guard corps during the succeeding fortnight, whilst the VI. and VII. were echeloned to their left, and the VIII. (Mortier) and IX. (Jerome Napoleon) and X. (Lefebvre), all new formations since the outbreak of the war, followed some marches in the rear. Jerome's corps was composed of the Bavarians, Württembergers and Badensers.

Behind these all Prussia was overrun by newly formed units, (3rd and 4th battalions) raised from depot companies, conscripts for 1807, and old soldiers rejoining after sickness or wounds. Napoleon caused these to be despatched to the front immediately after their formation. He had much territory to occupy, and on the long march of on an average 85 days, he considered that they could be organized, equipped and drilled *en route*.

Pultusk.—The Russians meanwhile had been moving slowly forward in two bodies, one under Bennigsen (50,000), the other under Buxhowden (25,000), and the French being at this time in Warsaw, they took up threatening positions about Pultusk, Plock and Prassnitz. From this triangle they harried the French communications with Berlin, and to secure a winter's rest for his men Napoleon determined to bring them to action. On Dec. 23 operations were commenced, but the difficulties of securing information and maintaining communication between the respective columns, so unlike what any of the French had previously encountered, led to a very partial success. The idea had been to induce the Russians to concentrate about Pultusk and, turning their position from its left, ultimately to cut them off from Russia, and if possible to surround them. But in this new and difficult country the emperor found it impossible to time his marches. The troops arrived late at their appointed positions, and after a stubborn rearguard action at Pultusk itself and undecisive fighting elsewhere (Golymin and Soldau) the Russians succeeded in retreating beyond the jaws of the French attack, and Napoleon for the first time found that he had exceeded the limit of endurance of his men. Indeed, the rank and file bluntly told him as much as he rode with the marching columns. Yielding to the inevitable, but not forgetting to announce a brilliant victory in a bulletin, he sent his troops into winter quarters along the Passarge and down the Baltic, enjoining on his corps commanders most strictly to do nothing to disturb their adversary.

Campaign of Eylau.—Bennigsen, now commanding the whole Russian army which with Lestocq's Prussians amounted to 100,000, also moved into winter quarters in the area Deutsch Eylau-Osterode-Allenstein, and had every intention of remaining there, for a fresh army was already gathering in Russia, the first corps of which had reached Nur about 50m. distant from the French right.

Unfortunately, Ney with his VI. corps about Gilgenberg had received the most poverty-stricken district in the whole region, and to secure some alleviation for the sufferings of his men he incautiously extended his cantonments till they came in contact with the Russian outposts. Apparently seeing in this movement a recommencement of hostilities, Bennigsen concentrated his troops towards his right and commenced an advance westwards towards Danzig, which was still in Prussian hands. Before his advance both Ney and Bernadotte (the latter, between Ney and the Baltic, covering the siege of Danzig) were compelled to fall back. It then became necessary to disturb the repose of the whole army to counter the enemy's intentions. The latter by this movement, however, uncovered his own communication with Russia, and the emperor was quick to seize his opportunity. He received the information on Jan. 28. His orders were at once issued and complied with so rapidly that by the 31st he stood prepared to advance with the corps of Soult, Ney, Davout and Augereau, the Guard and the reserve cavalry (80,000 men on a front of 60m.) from Myszienec through Willenberg to Gilgenberg; whilst Lannes on his right towards Ostrolenka and Lefebvre (X.) at Thorn covered his outer flanks.

Bernadotte, however, was missing, and this time through no fault of his own. His orders and the despatch conveying Napoleon's instructions fell into the hands of the Cossacks, and just in time Bennigsen's eyes were opened. Rapidly renouncing his previous intentions, he issued orders to concentrate on Allenstein; but this point was chosen too far in advance and he was anticipated by Murat and Soult at that place on Feb 2. He then determined to unite his forces at Joukendorf, but again he was too late. Soult and Murat attacked his rearguard on the 3rd, and Bennigsen, learning from his Cossacks that the French corps were designing to swing round and enclose him, he withdrew by a night march and ultimately succeeded in getting his whole army, with the exception of Lestocq's Prussians, together in the strong position along the Alle, the centre of which is marked by Preussisch-Eylau. The opportunity for this concentration Bennigsen owed to the time gained for him by his rearguard at Joukendorf, for this had stood just long enough to induce the French columns to swing in to surround it, and the next day was thus lost to the emperor as his corps had to extend again to their manoeuvring intervals. The truth is that the days were too short and the roads too bad for Napoleon to carry out the full purpose his "general advance guard" was intended to fulfil. It was designed to hold the enemy in position by the vigour of its attack, thus neutralizing his independent will power and compelling him to expend his reserves in the effort to rescue the troops engaged. But in forests and snowdrifts the French made such slow progress that no sufficient deployment could be made until darkness put a stop to the fighting. Thus, when late on Feb. 7, 1807 Murat and Soult found the enemy's rearguard near Eylau (*q.v.*) the fighting was severe but not prolonged. This time, however, Bennigsen, with over 60,000 men in position and 15,000 Prussians expected to arrive next morning, had no desire to avoid a battle, and deployed for action.

During the night Augereau and the Guards had arrived, and Ney and Davout were expected on either flank in the forenoon. This time the emperor was determined that his enemy should not escape him, and about 8 A.M. ordered Soult and Augereau on the left and right respectively to assail the enemy, Murat and the Guards remaining in the centre as reserve. Napoleon's own forces thus became the "general advance guard" for Ney and

Davout, who were to close in on either side and deliver the decisive stroke. But here too the weather and the state of the roads operated adversely, for Ney came up too late, while Davout, in the full tide of his victorious advance, was checked by the arrival of Lestocq, whose corps Ney had failed to intercept, and the attack of Augereau's corps (VII.), made in a blinding snowstorm, failed with appalling loss. Bennigsen, however, drew off on Ney's arrival, and the French were too much exhausted to pursue him. Again the emperor had to admit that his troops could do no more, and bowing to necessity, he distributed them into winter quarters, where, however, the enterprise of the Cossacks, who were no strangers to snow and to forests, left the outposts but little repose. A protracted period of rest followed, during which the emperor exerted himself unremittingly to re-equip, reinforce and supply his troops. Hitherto he had been based on the entrenched camp of Warsaw, but he had already taken steps to organize a new line of supply and retreat via Thorn, and this was now completed. At the same time Lefebvre was ordered to press the siege of Danzig with all vigour, and on May 5, after a most gallant resistance, Kalckreuth, who redeemed here his failure of Auerstädt, surrendered. English assistance came too late. By the beginning of June the French had more than made good their losses and 210,000 men were available for field service.

Heilsberg and Friedland.—Meanwhile Bennigsen had prepared for a fresh undertaking, and leaving Lestocq with 20,000 Prussians and Russians to contain Bernadotte, who lay between Braunsberg and Spandau on the Passarge, he moved southwards on the 2nd, and on June 3 and 4 he fell upon Ney, driving him back towards Guttstadt, whilst with the bulk of his force he moved towards Heilsberg, where he threw up an entrenched position. It was not till the 5th that Napoleon received tidings of his advance, and for the moment these were so vague that he contented himself by warning the remainder of his forces to be prepared to move on the 6th. Next day, however, all doubts were set at rest, and as the Russians advanced south of Heilsberg, he decided to wheel his whole force to the right, pivoting on the III. corps, and cut Bennigsen off from Königsberg and the sea. On the 8th the VI., III., VIII. and Guard corps, together with a new cavalry reserve corps under Lannes, in all 147,000, stood ready for the operation, and with Murat and Soult as general advanced guard the whole moved forward, driving the Russian outposts before them. Bernadotte, who was to have attacked Lestocq, again failed to receive his orders and took no part in the following operations.

Murat attacked the Russians, who had halted in their entrenched position, on the 11th and drove in their outposts, but did not discover the entrenchments. Meanwhile Soult had followed with his infantry in close support, and the emperor himself arriving, ordered him to attack at once. Now the Russians uncovered their entrenchments, and in the absence of artillery preparation Soult's leading troops received most severe punishment. Fresh troops arriving were sent in to his support, but these also proved insufficient, and darkness alone put an end to the struggle, which cost the French 12,000 killed and wounded.

Bennigsen, however, learning that his right was threatened by the III. corps, and not having as yet completed his concentration, retreated in the night to Bartenstein, and the following day turned sharp right towards Schippenbeil. The emperor now pressed on towards Friedland, where he would completely control the Russian communications with Königsberg, their immediate base of supply, but for once the Russians outmarched him and covered their movement so successfully that for the next three days he seems to have completely lost all knowledge of his enemy's whereabouts. Lestocq in the meantime had been forced northwards towards Königsberg, and Soult with Murat was in hot pursuit. The III., VI., VIII. and Guard corps followed the main road towards Königsberg, and the former had reached Mühlhausen, the remainder were about Preussisch-Eylau, when Latour Maubourg's dragoons sent in intelligence which pointed to the presence of Bennigsen about Friedland. This was indeed the case. The Russians after passing Schippenbeil had suddenly turned northwards, and on the evening of the 13th were taking up a strong position on the river Alle with Friedland as a centre.

What followed presents perhaps the finest instance of the Napoleonic method. The enemy lay direct to his right, and Murat, the IV. and III. corps had well overshot the mark. Lannes's reserve corps (cavalry), to whom Latour Maubourg reported, lay at Domnau some 10m. to the right. The latter at once assumed the rôle of advanced guard cavalry and was ordered to observe the enemy at Friedland, Ney following in close support. Davout was turned about and directed on the enemy's right, and the VIII. corps (Mortier), the Guards and the reserve cavalry followed as main body. On the 14th (the anniversary of Marengo) Lannes carried out his rôle of fighting advanced guard or screen, the emperor's main body gradually came up, and the battle of Friedland (*q.v.*), notable chiefly for the first display of the new artillery tactics of the French, ended with a general attack about 5 P.M. and the retreat of the Russians, after severe losses, over the Alle. Lestocq was, meanwhile, driven through Königsberg (which surrendered on the 15th) on Tilsit, and now that he was no longer supported by the Russians, the Prussian commander gave up the struggle.

THE AUSTRIAN WAR OF 1809

Ever since Austerlitz the Austrian officers had been labouring to reconstitute and reform their army. Much had been done to create an efficient staff, but though the idea of the army corps command was now no new thing, the senior generals entrusted with these commands were far from having acquired the independence and initiative of their French opponents. Hence the extraordinary slowness of their manoeuvres, not because the Austrian infantry were bad marchers, but because the preparation and circulation of orders was still far behind the French standard. The infantry adopted the highly manoeuvrable formations of the French—skirmishers and columns—but it was easier to adopt the formations than to acquire the initiative which gave these their vital energy. The light cavalry had been much improved and the heavy cavalry on the whole proved a fair match for their opponents.

After the peace of Tilsit the Grande Armée was gradually withdrawn behind the Rhine, leaving only three commands, totalling 63,000 men, under Davout in Prussia, Oudinot in west central Germany, and Lefebvre in Bavaria, to assist the princes of the Confederation of the Rhine in the maintenance of order and the enforcement of the French law of conscription, which was rigorously insisted on in all the States comprised in this new federation. In exchange for the subsistence of the French troops of occupation, a corresponding number of these new levies were moved to the south of France, where they commenced to arrive at the moment when the situation in Spain became acute. The Peninsular War (*q.v.*) called for large forces of the old *Grande Armée* and for a brief period Napoleon directed operations in person; and the Austrians took advantage of the dissemination and weakness of the French forces in Germany to push forward their own preparations with renewed energy.

But they reckoned without the resourcefulness of Napoleon. The moment news of their activity reached him, whilst still in pursuit of Sir John Moore, he despatched letters to all the members of the Confederation warning them that their contingents might soon be required, and at the same time issued a series of decrees to General Clarke, his war minister, authorizing him to call up the contingent of 1810 in advance, and directing him in detail to proceed with the formation of 4th and 5th battalions for all the regiments across the Rhine. By these means Davout's, Oudinot's and Lefebvre's commands were augmented, whilst in February and March new corps were formed and rapidly pushed towards the front.

On his return from Spain, seeing war imminent, he issued a series of march orders (which deserve the closest study in detail) by which on April 15 his whole army was to be concentrated for manoeuvres between Regensburg, Landshut, Augsburg and Donauwörth, and sending on the Guard in wagons to Strassburg, he despatched Berthier to act as commander-in-chief until his

own arrival.

Austrian Offensive.—The position of assembly was excellently chosen, but unfortunately the Austrians took the initiative. On April 9 their main body of six corps crossed the Inn between Braunau and Passau and simultaneously two additional corps moved from Pilsen in Bohemia on Regensburg. At this moment Davout was entering Regensburg with his leading troops, the remainder still some marches in rear, and it was evident that the whole concentration could no longer be carried out before the Austrians would be in a position to intervene. Berthier received the news while still on his way to the front, and quite failed to grasp the situation. Reaching Donauwörth at 8 P.M. on April 13, he ordered Davout and Oudinot to remain at Regensburg, whilst Lefebvre and Wrede (Bavarians) who had fallen back before the Austrians were directed to reoccupy Landshut. This was in direct contradiction to the instructions Napoleon had given on March 28 in view of this very emergency. Davout obeyed, but remonstrated. On the 16th Berthier went on to Augsburg, where he learned that Lefebvre's advanced troops had been driven out of Landshut, thus opening a great gap seventy-six miles wide between the two wings of the French army. Meanwhile Napoleon, who had left Paris at 4 A.M. on April 13, was hastening towards the front, but remained still in ignorance of Berthier's doings until on the 16th at Stuttgart he received a letter from the Marshal dated the 13th, which threw him into consternation. In reply he immediately wrote: "You do not inform me what has rendered necessary such an extraordinary measure which weakens and divides my troops" —and—"I cannot quite grasp the meaning of your letter yet, I should have preferred to see my army concentrated between Ingolstadt and Augsburg, the Bavarians in the first line, with the duke of Danzig in his old position, until we know what the enemy is going to do. Everything would be excellent if the duke of Auerstädt had been at Ingolstadt and the duke of Rivoli with the Württembergers and Oudinot's corps at Augsburg, . . . so that just the opposite of what should have been done has been done" (C. N. to Berthier, Ludwigsburg, 16th April).

Napoleon Takes Command.—Having despatched this severe reprimand he hastened on to Donauwörth, where he arrived at 4 A.M. on the 17th, hoping to find Berthier, but the latter was at Augsburg. Nevertheless, at 10 A.M. he ordered Davout and Oudinot to withdraw at once to Ingolstadt; and Lefebvre and Wrede on the right to support the movement. About noon Berthier returned and after hearing his explanation Masséna received orders to move from Augsburg toward Ingolstadt. "To-morrow will be a day of preparation spent in drawing closer together, and I expect to be able by Wednesday to manoeuvre against the enemy's columns according to circumstances."

Meanwhile the Austrians had approached so near that by a single day's march it would have been possible to fall upon and crush by superior numbers either wing of the French army, but though the Austrian light cavalry successfully covered the operations of the following troops they had not yet risen to a conception of their reconnoitring mission, and the archduke, in ignorance of his opportunity and possessed, moreover, with the preconceived idea of uniting at Regensburg with the two corps coming from Bohemia, moved the bulk of his forces in that direction, leaving only a covering body against Davout altogether insufficient to retain him. Davout, however, had left a garrison of 1,800 men in Regensburg, who delayed the junction of the Austrian wings until the 20th inst., and on the same day the emperor, having now reunited his whole right wing and centre, overwhelmed the covering detachments facing him in a long series of disconnected engagements lasting forty-eight hours, and the archduke now found himself in danger of being forced back into the Danube. But with the Bohemian reinforcements he had still four corps in hand, and Napoleon, whose intelligence service in the difficult and intersected country had lamentably failed him, had weakened his army by detaching a portion of his force in pursuit of the beaten right wing, and against the archduke's communications.

Eckmühl.—When, therefore, the latter, on the 22nd, marched southward to reopen his communications by the defeat of the enemy's army, he actually reached the neighbourhood of Eckmühl with a sufficient numerical superority had he only been prompt enough to seize his opportunity. But the French had been beforehand with him. Napoleon, who had personally taken part in the fighting of the previous day, and followed the pursuit as far as Landshut, whence he had despatched Masséna to follow the retreating Austrians along the Isar, seems to have realized about

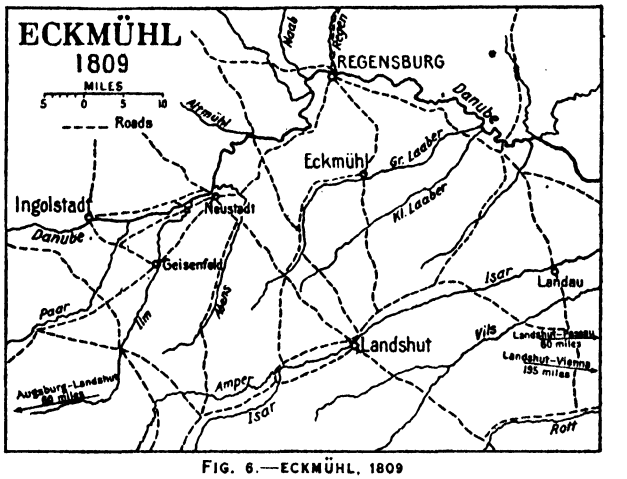

FIG. 6.—ECKMÜHL, 1809

3 A.M. in the morning that it was not the main body of the enemy he had had before him, but only its left wing, and that the main body itself must still be northward towards Regensburg. Issuing orders to Davout, Oudinot and his cavalry to concentrate with all speed towards Eckmühl, he himself rode back along the Regensburg road and reached the battle-field just as the engagement between the advance troops had commenced. Had the Austrians possessed mobility equal to that of the French the latter should have been overwhelmed in detail, but whilst the French covered 17 and 19m. the Austrians only marched 10, and, owing to their defective assimilation of the new tactical training the troops actually on the ground could not hold out long enough for their reserves to arrive. The retreat of the front lines involved the following ones in confusion, and presently the whole mass was driven back in considerable disorder. It seemed as if nothing could save the Austrians from complete disaster, but at the critical moment the emperor, yielding to the protestations of his corps commanders, who represented the excessive fatigue of their troops, stopped the pursuit, and the archduke made the most of his opportunity to restore order amongst his demoralized men and crossed to the north bank of the Danube during the night.

On the following morning the French reached Regensburg and at once proceeded to assault its mediaeval walls, but the Austrian garrison bravely defended it till the last of the stragglers was safely across on the north bank. It was here that, for the only time in his career, Napoleon was slightly wounded. Then, leaving Davout to observe the archduke's retreat, the emperor himself rode after Masséna, who with the major portion of the French army was following the Austrian weaker wing under Hiller. The latter was not so shaken as Napoleon believed, and turning at bay at Ebelsberg inflicted a severe check on its pursuers. Thus covered by his rearguard Hiller gained space and time to pass his troops over to the north bank of the Danube and remove all boats on the river. This left the direct road to Vienna open, and Napoleon, hoping to find peace in the enemy's capital, pushed the whole of his army down the right bank, and with Murat's cavalry entered the city on May 12, after somewhat severe resistance lasting three days. Meanwhile the archduke and Hiller, both now unmolested, effected their junction in the vicinity of Wagram, picketing the whole line of the Danube with their outposts and collecting all the boats.

Aspern and Wagram.—The reconnaissance of the river was at once taken in hand by the French upon their arrival in Vienna, and a point opposite the island of Lobau selected for the crossing.

Thanks to the Austrian precautions it took four days to collect the necessary material to span the main branch of the river, here some 2,000yd. across, and though Napoleon personally spurred on all to activity nearly four days more were required for its construction. It was not till the night of May 19 that orders for the passage were finally issued, and during the night the troops commenced to occupy the island of Lobau. Surprise, of course, was out of the question, but the Austrians did not attempt to dispute the passage, their object being to allow as many French as they felt they could deal with to pass over and then to fall on them. Thus on May 21 the battle of Aspern (*q.v.*) or Essling began. It ended on the night of the 22nd with the defeat of Napoleon, the first ever inflicted upon him. The French retreated into the island of Lobau. By nightfall upwards of 100,000 men, encumbered with at least 20,000 wounded, were crowded together on the little island scarcely a mile square, short of provisions and entirely destitute of course of all hospital accessories. The question then arose whether the retreat was to be continued across the main stream or not, and for the second time in his career Napoleon assembled his generals to take their opinion. They counselled retreat, but having heard them all he replied, in substance: "If we leave here at all we may as well retire to Strassburg, for unless the enemy is held by the threat of further operations he will be free to strike at our communications and has a shorter distance to go. We must remain here and renew operations as soon as possible."

Immediate orders were despatched to summon every available body of troops to concentrate for the decisive stroke. Practically the lines of communication along the Danube were denuded of combatants, even Bernadotte being called up from Passau, and the viceroy of Italy, who driving the archduke Johann before him (action of Raab) had brought up 56,000 men through Tirol, was disposed towards Pressburg within easy call. The arsenal of Vienna was ransacked for guns, stores and appliances, and preparations in the island pushed on as fast as possible. By the end of June 200,000 troops were stationed within call, and on July 4 the French began to cross over to the left bank of the Danube. The events which followed are described under WAGRAM. The great battle at this place, fought on July 5 and 6, ended in the retirement of the Austrians. The only other event which occurred before peace was made was an unimportant action at Znaym on July 11.

THE RUSSIAN WAR OF 1812

Whilst the campaign of 1809 had shaken the faith of the marshals and the higher ranks in the infallibility of the emperor's judgment, and the slaughter of the troops at Aspern and Wagram had still further accentuated the opposition of the French people to conscription, the result on the fighting discipline of the army had, on the whole, been for good. The panics of Wagram had taught men and officers alike a salutary lesson. Aware of the growing feeling against war in France, Napoleon had determined to make his allies not only bear the expenses of the coming campaign, but find the men as well, and he was so far master of Europe that of the 363,000 who on June 24 crossed the Niemen no less than two-thirds were Germans, Austrians, Poles or Italians. But though the battlefield discipline of the men was better, the discipline in camp and on the march was worse, for the troops were no longer eager to reach the battlefield, and marched because they were compelled, not of their own goodwill. The result was apparent in a sudden diminution in mobility, and a general want of punctuality which seriously influenced the course of the campaign. On the other hand, the Russians, once their fatherland was invaded, became dominated by an ever-growing spirit of fanaticism, and they were by nature too obedient to their natural leaders, and too well inured to the hardships of campaigning, to lose their courage in a retreat.

By the middle of June 1812 the emperor had assembled his army along the line of the Niemen. On the extreme right stood the Austrian contingent under Schwarzenberg (34,000 men). Next, centring about Warsaw, a group of three corps (70,000 men) under the chief command of Napoleon's brother Jerome. Then the main army under Napoleon in person (220,000 men; with 80,000 more under the viceroy of Italy on his right rear); and on the extreme left at Tilsit a flanking corps, comprising the Prussian auxiliary corps and other Germans (in all 40,000 strong). The whole army was particularly strong in cavalry; out of the 450,000, 80,000 belonged to that arm, and Napoleon, mindful of the lessons of 1807, had issued the most minute and detailed orders for the supply service in all its branches, and the forwarding of reinforcements, no less than 100,000 men being destined for that purpose in due course of time.

Information about the Russians was very indifferent; it was only known that Prince Bagration (with 43,000 men) lay grouped about Wolkowysk; Barclay de Tolly (who had about 130,000) about Vilna; and on the Austrian frontier lay a small corps under Tormassov (40,000) in process of formation, while far away on the Turkish frontiers hostilities with the sultan retained Tschitschagov with 50,000 more. Of the enemy's plans Napoleon knew nothing, but, in accordance with his usual practice, the dispositions he had chosen met all immediate possible moves.

Opening of the Campaign.—On June 24 the passage of the Niemen began in torrid heat which lasted for a few days. The main army, with the emperor in person, covered by Murat and the cavalry, moved on Vilna, whilst Jerome on his right rear at once threatened Bagration and covered the emperor's outer flank. From the very first, however, the inherent weakness of the vast army, and the vicious choice of time for the beginning of the advance, began to make themselves felt. With crops still green, and nothing else available as forage for the horses, an epidemic of colic broke out amongst them, and in ten days the mounted arms had lost upwards of one-third of their strength; men died of sunstroke in numbers, and serious straggling began. Still everything pointed to the concentration of the Russians at Vilna, and Jerome, who on July 5 had reached Grodno, was ordered to push on. But Jerome proved quite inadequate to his position, listening to the complaints of his subordinates as to want of supplies and even of pay; he spent four whole days in absolute inertia, notwithstanding the emperor's reprimands. Meanwhile the Russians covered by stubborn rearguards made good their retreat—Barclay towards the entrenched camp of Drissa on the Dvina, Bagration towards Mohilev.

The emperor's first great *coup* thus failed. Jerome was replaced by Davout, and the army resumed its march, this time in the hope of surrounding and overwhelming Barclay, whilst Davout dealt with Bagration. The want of mobility, particularly in the cavalry,

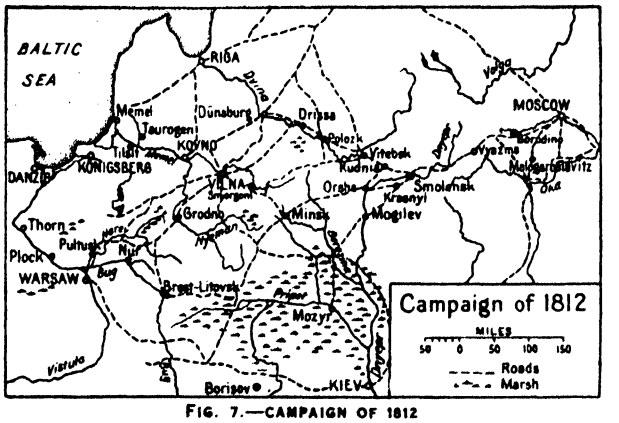

FIG. 7.—CAMPAIGN OF 1812

now began to tell against the French. With horses only just recovering from an epidemic, they proved quite unequal to the task of catching the Cossacks, who swarmed round them in every direction, never accepting an engagement but compelling a constant watchfulness for which nothing in their previous experience had sufficiently prepared the French.

Before their advance, however, the Russian armies steadily retired. Barclay from Vilna via Drissa to Vitebsk, Bagration—narrowly evading Davout—from Wolkowysk to Mohilev. Again arrangements were made for a Napoleonic battle; behind Murat's

cavalry came the "general advanced guard" to attack and hold the enemy, whilst the main body and Davout were held available to swing in on his rear. Napoleon, however, failed to allow for the psychology of his opponents, who refused to be drawn into engagements and steadily withdrew from every position when the French gained touch with them. Thus the manoeuvre against Vitebsk again miscarried, and Napoleon found himself in a far worse position, numerically and materially, than at the outset of the campaign. Then he had stood with 420,000 men on a front of 160m., now he had only 229,000 men on a 135m. front; he had missed three great opportunities of destroying his enemy in detail, and in five weeks, during which time he had only traversed 200m., he had seen his troops reduced numerically at least one-third, and, worse still, his army was now far from being the fighting machine it had been at the outset.

Meanwhile the Russians had not lost a single gun and the *moral* of their men had been improved by the result of the many minor encounters with the enemy; further, the junction of Bagration and Barclay was now assured in the vicinity of Smolensk. Towards this place the French advance was now resumed, and the Russian generals at the head of a united force of 130,000 men marched forward towards Rudnia to meet them. Here, however, the inefficiency of the Russian staff actually saved them from the disaster which must certainly have overtaken them had they realized their intention of fighting the French. The Russians marched in two columns, which lost touch of one another, and as it was quite impossible for either to engage the French single-handed, they both retired again towards Smolensk, where with an advanced guard in the town itself—which possessed an old-fashioned brick *enceinte* not to be breached by field artillery alone—the two columns reunited and deployed for action behind the unfordable Dnieper.

Murat and Ney as "general advanced guard" attacked the town in the morning of Aug. 16, and the main body was swung round to place itself on the Russian rear astride the road to Moscow. The whole of the 17th was required to complete the movement, and as soon as its purpose was sufficiently revealed to the Russians the latter determined to retreat under cover of night. Their manoeuvre was carried out with complete success, and then began a series of rearguard actions and nocturnal retreats which completely accomplished their purpose of wearing down the French army. The Russian government, however, failed to see the matter in its true light, and Marshal Kutusov was sent to the front to assume the chief command. His intention was to occupy a strong position and fight one general action for the possession of Moscow, and to this end he selected the line of the Kalatscha where the stream intersects the great Moscow road.

Borodino.—Here he was overtaken by Murat and Ney, but the French columns had straggled so badly that four whole days elapsed before the emperor was able to concentrate his army for battle and then could only oppose 128,000 men to the Russians' 110,000. About 6 A.M. on Sept. 7 the battle (*see* BORODINO) began, but Napoleon was suffering from one of those attacks of illness and depression which henceforth became such an important factor in his fate. Till about midday he followed the course of the action with his usual alertness; then he appears to have been overcome by a kind of stupor and allowed his marshals to fight by themselves. There was no final decisive effort as at Wagram and the Guard was not even called on to move. Ultimately the sun went down on an undecided field on which 38,000 Russians and 25,000 French had fallen, but the moral reaction on the latter was far greater than on the former. Kutusov continued his retreat, and Murat with his now exhausted horsemen followed as best he might. Sebastiani, commanding the advanced guard, overtook the Russians in the act of evacuating Moscow, and agreed with the latter to observe a seven hours' armistice to allow the Russians to clear the town, for experience had shown the French that street fighting in wooden Russian townships always meant fire and the consequent destruction of much-needed shelter and provisions. Towards nightfall Napoleon reached the scene, and the Russians being now clear the troops began to enter, but already fires were observed in the farther part of the city. Napoleon passed the night in a house in the western suburb and next morning rode to the Kremlin, the troops moving to the quarters assigned to them, but in the afternoon a great fire began and, continuing for two days, drove the French out into the country again.

The emperor was now in the direst perplexity. Kutusov was hovering on the outskirts of the city, his main body at Kaluga, some marches to the south-west, where he was in full communication with the richest portion of the empire; and now news arrived that St. Cyr, who had relieved Macdonald on his extreme left, had only 17,000 men left under arms against upwards of 40,000 Russians under Witgenstein; and to the south Tschitschagov's army, being no longer detained on the Turkish frontier, where peace had been made, was marching to join Tormassov about Brest-Litovsk with forces which would bring the total of the two well over 100,000 men. Meanwhile Schwarzenberg's force opposing these had dwindled to a bare 30,000.

The French army was thus disposed almost in an equilateral triangle with sides of about 570m., with 95,000 men at the apex at Moscow opposed to 120,000, 30,000 about Brest opposite 100,000, and 17,000 about Drissa confronted by 40,000, whilst in the centre of the base at Smolensk lay Victor's corps, about 30,000. From Moscow to the Niemen was 550 miles. In view of this situation Napoleon on Oct. 4 sent General Lauriston to the Russian headquarters to treat. While waiting his return Murat was enjoined to skirmish with Kutusov, and the emperor himself worked out a scheme to assume the offensive with his whole army towards St. Petersburg, calling in Victor and St. Cyr on the way. This project was persisted with, until on the 18th Murat was himself attacked and severely handled (action of Tarutino or Vinkovo). On the morning of the 19th the whole army moved out to accept this challenge, and the French were thoroughly worsted on the 24th in the battle of Maloyaroslavetz.

The Retreat from Moscow.—Then began the celebrated retreat. It has generally been forgotten that the utter want of march discipline in the French, and not the climatic conditions, was responsible for the appalling disasters which ensued. Actually the frost came later than usual that year, Oct. 27, and the weather was dry and bracing; not till Nov. 8 did the cold at night become sharp. Even when the Beresina was reached on Nov. 26, the cold was far from severe, for the slow and sluggish stream was not frozen over, as is proved by the fact that Eblé's pioneers worked in the water all through that terrible day. But the French army was already completely out of hand, and the degree to which the panic of a crowd can master even the strongest instinct of the individual is shown by the conduct of the fugitives who crowded over the bridges, treading hundreds under foot, whilst all the time the river was easily fordable and mounted men rode backwards and forwards across it.

To return to the actual sequence of events. Kutusov had been very slow in exploiting his success of the 24th and indeed had begun the pursuit in a false direction; but about Nov. 2, headquarters of the French being at Vyazma, the Cossacks became so threatening that the emperor ordered the army to march (as in Egypt) in hollow square. This order, however, appears only to have been obeyed by the Guards, with whom henceforward the emperor marched.

Kutusov had now overtaken the French, but fortunately for them he made no effort to close with them, but hung on their flank, molesting them with Cossacks and picking up stragglers. Thus the wreck of the *Grande Armée*, now not more than fifty thousand strong, reached Smolensk on the 9th and there rested till the 14th. The march was then resumed, the Guard leading and Ney commanding the rearguard. Near Krasnoi on the 16th the Russian advanced guard tried to head the column off. Napoleon halted a whole day to let the army close up; and then attacked with his old vigour and succeeded in clearing the road, but only at the cost of leaving Ney and the rearguard to its fate. By a night march of unexampled daring and difficulty Ney succeeded in breaking through the Russian cordon, but when he regained touch with the main body at Orcha only 800 of his 6,000 men were still with him (21st).

The Beresina.—From here Napoleon despatched orders to Victor to join him at Borisov on the Beresina. The cold now gave

way and thaw set in, leaving the country a morass, and information came that Tschitschagov from the south had reached Borisov. He now selected Viesselovo as the point of passage and at 1 A.M. on the 23rd sent orders to Oudinot to march thither and construct bridges. In the execution of these orders Oudinot encountered the Russian advanced guard near Borisov and drove the latter back in confusion, though not before they had destroyed the existing bridge there. This sudden reassumption of the offensive threw Tschitschagov into confusion. Thus time was gained for Victor also to come up and for Oudinot to construct the bridges at Studienka near the above-mentioned place, but a spot in many respects better suited for the purpose. Thither therefore Napoleon sent his pontonniers under General Eblé, but on their arrival they found that no preparations had been made and much time was lost. Meanwhile Victor, in doubt as to the real point of passage, had left the road to Studienka open to Wittgenstein, who had followed hard on his heels.

By 4 P.M. on the 26th the bridges were finished and the passage began, but not without resistance by the Russians, who were gradually closing in. The crossing continued all night, though interrupted from time to time by failures of the bridges. All day during the 27th stragglers continued to cross, covered by such combatants as remained under sufficient discipline to be employed. At 8 A.M. on the 28th, however, Tschitschagov and Wittgenstein moved forward on both banks of the river to the attack, but were held off by the splendid self-sacrifice of the few remaining troops under Ney, Oudinot and Victor, until about 1 P.M. the last body of regular troops passed over the bridges, and only a few thousand stragglers remained beyond the river.

The number of troops engaged by the French that day cannot be given exactly. Oudinot's and Victor's men were relatively fresh and may have totalled 20,000, whilst Ney can hardly have had more than 6,000 of all corps fighting under him. How many were killed can never be known, but three days later the total number of men reported fit for duty had fallen to 8,800 only.

Final Operations.—Henceforward the retreat of the army became practically a headlong flight, and on Dec. 8, having reached Smorgoni and seeing that nothing further could be done by him at the front, the emperor handed over the command of what remained to Murat, and left for Paris to organize a fresh army for the following year. Travelling at the fullest speed, he reached the Tuileries on the 18th, after a journey of 312 hours. After the emperor's departure the cold set in with increased severity, the thermometer falling to 23°. On Dec. 8, Murat reached Vilna, whilst Ney with about 400 men and Wrede with 2,000 Bavarians still formed the rearguard; but it was quite impossible to carry out Napoleon's instructions to go into winter quarters about the town, so that the retreat was resumed on the 10th and ultimately Königsberg was attained on Dec. 19 by Murat with 400 Guards and 600 Guard cavalry dismounted. Meanwhile on the extreme French right Schwarzenberg and his Austrians had drifted away towards their own frontier, and the Prussian contingent, which under Yorck formed part of Macdonald's command about Riga, had entered into a convention with the Russians at Tauroggen (Dec. 30) which deprived the French of the last support upon their left. Königsberg thus became untenable, and Murat fell back to Posen, where on Jan. 10 he handed over his command to Eugène Beauharnais and returned to Paris. The Russian pursuit practically ceased at the line of the Niemen, for the Russian troops also had suffered terrible hardships and a period of rest had become an absolute necessity.

The War of Liberation.—The Convention of Tauroggen became the starting-point of Prussia's regeneration. As the news of the destruction of the *Grande Armée* spread, and the appearance of countless stragglers convinced the Prussian people of the reality of the disaster, the spirit generated by years of French domination burst out. For the moment the king and his ministers were placed in a position of the greatest anxiety, for they knew the resources of France and the boundless versatility of their arch-enemy far too well to imagine that the end of their sufferings was yet in sight. To disavow the acts and desires of the army and of the secret societies for defence with which all north Germany was honeycombed would be to imperil the very existence of the monarchy, whilst an attack on the wreck of the *Grande Armée* meant the certainty of a terrible retribution from the new armies now rapidly forming on the Rhine.

But the Russians and the soldiers were resolved to continue the campaign, and working in collusion they put pressure on the not unwilling representatives of the civil power to facilitate the supply

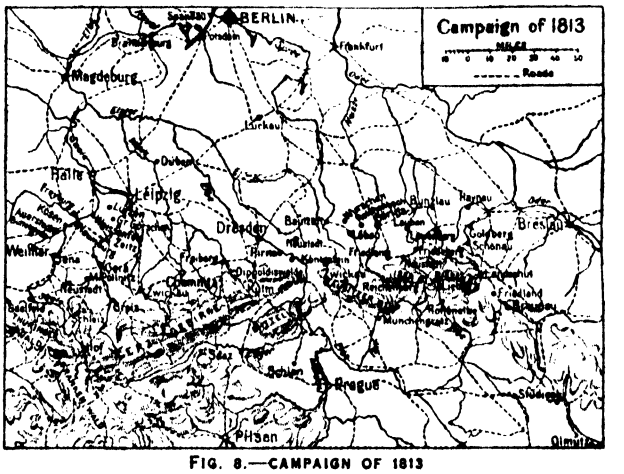

FIG. 8.—CAMPAIGN OF 1813

and equipment of such troops as were still in the field; they could not refuse food and shelter to their starving countrymen or their loyal allies, and thus by degrees the French garrisons scattered about the country either found themselves surrounded or were compelled to retire to avoid that fate. Thus it happened that the viceroy of Italy felt himself compelled to depart from the positive injunctions of the emperor to hold on at all costs to his advanced position at Posen, where about 14,000 men had gradually rallied around him, and to withdraw step by step to Magdeburg, where he met reinforcements and commanded the whole course of the lower Elbe.

Napoleon's Preparations.—Meanwhile the emperor in Paris had been organizing a fresh army for the reconquest of Prussia. Thanks to his having compelled his allies to fight his battles for him, he had not as yet drawn very heavily on the fighting resources of France, the actual percentage of men taken by the conscriptions during the years since 1806 being actually lower than that in force in continental armies of the early twentieth century. He had also created in 1811–12 a new National Guard, organized in "cohorts" to distinguish it from the regular army, and for home defence *only*, and these by a skilful appeal to their patriotism and judicious pressure applied through the prefects, became a useful reservoir of half-trained men for new battalions of the active army. Levies were also made with rigorous severity in the states of the Rhine Confederation, and even Italy was called on for fresh sacrifices. In this manner by the end of March upwards of 200,000 men were moving towards the Elbe,[1] and in the first fortnight of April they were duly concentrated in the angle formed by the Elbe and Saale, threatening on the one hand Berlin, on the other Dresden and the east.

The allies, aware of the gradual strengthening of their enemy's forces but themselves as yet unable to put more than 200,000 in the field, had left a small corps of observation opposite Madgeburg and along the Elbe to give timely notice of an advance towards Berlin; and with the bulk of their forces had taken up a position about Dresden, whence they had determined to march down the course of the Elbe and roll up the French from right to left. Both armies were very indifferently supplied with information, as both were without any reliable regular cavalry capable of piercing the screen of outposts with which each endeavoured to conceal his disposition, and Napoleon, operating in a most unfriendly country, suffered more in this respect than his adversaries.

[1] Napoleon always gave their number as 300,000, but this was never attained.

On April 25 Napoleon reached Erfurt and assumed the chief command. On this day his troops stood in the following positions: Eugène, with Lauriston's, Macdonald's and Regnier's corps, on the lower Saale; Ney in front of Weimar, holding the defile of Kösen; the Guard at Erfurt, Marmont at Gotha, Bertrand at Saalfeld, and Oudinot at Coburg, and during the next few days the whole were set in motion towards Merseburg and Leipzig, in the now stereotyped Napoleonic order, a strong advanced guard of all arms leading, the remainder—about two-thirds of the whole—following as *masse de manoeuvre*, this time, owing to the cover afforded by the Elbe on the left, to the right rear of the advanced guard.

Meanwhile the Russians and Prussians had concentrated all available men and were moving on an almost parallel line, but somewhat to the south of the direction taken by the French. On May 1 Napoleon and the advance guard entered Lützen. Wittgenstein, who now commanded the allies in place of Kutusov, hearing of his approach, had decided to attack the French advanced guard, which he took to be their whole force, on its right flank, and during the morning had drawn together the bulk of his forces on his right in the vicinity of Gross-Görschen and Kaya.

Battle of Lützen.—About 9 A.M. on May 2 he began an attack on the French advance guard in Lützen, whilst the remainder of his army was directed against Napoleon's right and rear. Just as the latter were moving off the heads of the French main body suddenly appeared, and at 11 A.M. Napoleon, then standing near the Gustavus Adolphus monument on the field of Lützen, heard the roar of a heavy cannonade to his right rear. He realized the situation in a moment, galloped to the new scene of action, and at once grouped his forces for decisive action—the gift in which he was supreme. Leaving the leading troops to repulse as best they might the furious attack of both Russians and Prussians, and caring little whether they lost ground, he rapidly organized for his own control a battle-reserve. At length when both sides were exhausted by their efforts he sent forward nearly a hundred guns which tore asunder by their case-shot fire the enemy's line and marched his reserve right through the gap. Had he possessed an adequate cavalry force the victory would have been decisive. As it was, the allies made good their retreat and the French were too exhausted for infantry pursuit.

Perhaps no battle better exemplifies the inherent strength of the emperor's strategy, and in none was his grasp of the battlefield more brilliantly displayed, for, as he fully recognized, "These Prussians have at last learnt something—they are no longer the wooden toys of Frederick the Great," and, on the other hand, the relative inferiority of his own men as compared with his veterans of Austerlitz called for far more individual effort than on any previous day. He was everywhere, encouraging and compelling his men—it is a legend in the French army that the persuasion even of the imperial boot was used upon some of his reluctant conscripts, and in the result his system was fully justified, as it triumphed even against a great tactical surprise.

Bautzen.—As soon as possible the army pressed on in pursuit, Ney being sent across the Elbe to turn the position of the allies at Dresden. This threat forced the latter to evacuate the town and retire over the Elbe, before blowing up the stone bridge across the river. Napoleon entered the town hard on their heels, but the broken bridge caused a delay of four days, there being no pontoon trains with the army. Ultimately on May 18 the march was renewed, but the allies had continued their retreat in leisurely fashion, picking up reinforcements by the way. Arrived at the line of the Spree, they took up and fortified a very formidable position about Bautzen (*q.v.*). Here, on the 20th, they were attacked and fixed by Napoleon; but the intended decisive coup by which Ney was to arrive on their right rear on the 21st missed its mark owing to Ney's want of initiative and rigid adherence to the letter of his orders. As a result the allies were able to break off the action at their own time and retire in such good order that the emperor failed to capture a single trophy as proof of his victory. The enemy's escape annoyed him greatly, the absence of captured guns and prisoners reminded him too much of his Russian experiences, and he redoubled his demands on his corps commanders for greater vigour in the pursuit. This led the latter to push on without due regard to tactical precautions, and Blücher took advantage of their carelessness when at Haynau (May 26), with some twenty squadrons of Landwehr cavalry, he surprised, rode over and almost destroyed Maison's division. The material loss inflicted on the French was not very great, but its effect in raising the *moral* of the raw Prussian cavalry and increasing their confidence in their old commander was enormous.

Still the allies continued their retreat and the French were unable to bring them to action. In view of the doubtful attitude of Austria, Napoleon became alarmed at the gradual lengthening of his lines of communication and opened negotiations. The enemy, having everything to gain and nothing to lose thereby, agreed finally to a six weeks' suspension of arms. This was perhaps the gravest military error of Napoleon's whole career, and his excuse for it, "want of adequate cavalry," was the strongest testimony as to the value of that arm.

As soon as a suspension of arms (to Aug. 15) had been agreed to, Napoleon hastened to withdraw his troops from the dangerous position they occupied with reference to the passes leading over the mountains from Bohemia, for he entertained no doubt now that Austria was also to be considered as an enemy. Finally he decided to group his corps round Görlitz and Bautzen whence they could either meet the enemy advancing from Breslau or fall on his flank over the mountains if he attempted to force his way into Saxony by the valley of the Elbe. This latter manoeuvre depended, however, on his maintenance of Dresden, and to this end he sent the I. Corps up the Elbe to Pirna and Königstein to cover the fortifications of Dresden itself. His instructions on this point deserve the closest study, for he foresaw the inevitable attraction which a complete entrenched camp would exercise even upon himself, and, therefore, limited his engineers to the construction of a strong bridge head on the right bank and a continuous enceinte, broken only by gaps for counter attack, around the town itself.

Then he turned his attention to the plan for the coming campaign. Seeing clearly that his want of an efficient cavalry precluded all ideas of a resolute offensive in his old style, he determined to limit himself to a defence of the line of the Elbe, a position of waiting from which he could make a spring, of not more than a few days' duration, at any target the enemy might present.

Reinforcements had been coming up without ceasing and at the beginning of August he calculated that he would have 300,000 men available about Bautzen and 100,000 along the Elbe from Hamburg via Magdeburg to Torgau. With the latter he determined to strike the first blow, by a concentric advance on Berlin (which he calculated he would reach on the 4th or 5th day), the movement being continued thence to extricate the French garrisons in Küstrin, Stettin and Danzig. The moral effect, he promised himself, would be prodigious, and there was neither room nor food for these 100,000 elsewhere. Towards the close of the armistice he learned the general situation of the allies. The crown prince of Sweden (Bernadotte), with his Swedes and various Prussian levies, 135,000 in all, lay in and around Berlin and Stettin; and knowing his former marshal well, Napoleon considered Oudinot a match for him. Blücher with about 95,000 Russians and Prussians was about Breslau, and Schwarzenberg, with nearly 180,000 Austrians and Russians, lay in Bohemia. In his central position at Bautzen he felt himself equal to all his enemy's combinations.

Dresden.—The advance towards Berlin began punctually with the expiration of the armistice, but with the main army he himself waited to see more clearly his adversaries' plans. At length becoming impatient he advanced a portion of his army towards Blücher, who fell back to draw him into a trap. Then the news reached him that Schwarzenberg was pressing down the valley of the Elbe, and, leaving Macdonald to observe Blücher, he hurried back to Bautzen to dispose his troops to cross the Bohemian mountains in the general direction of Königstein, a blow which would have had decisive results. But the news from Dresden, where the construction of the defences was still incomplete, was so alarming that at the last moment he changed his mind, and

sending Vandamme alone over the mountains, he hurried with his whole army to the threatened point. This march remains one of the most extraordinary in history, for the bulk of his forces moved, mainly in mass and across country, 90m. in 72 hours, entering Dresden on the morning of the 27th, only a few hours before the attack of the allies commenced. For the events which followed *see* DRESDEN (*battle*).

Dresden was the last great victory of the First Empire. By noon on Aug. 27 the Austrians and Russians were completely beaten and in full retreat, the French pressing hard behind them, but meanwhile Napoleon himself again succumbed to one of his unaccountable attacks of apparent intellectual paralysis. He seemed unaware of the vital importance of the moment, crouched shivering over a bivouac fire, and finally rode back to Dresden, leaving no specific orders for the further pursuit. The allies, however, continued to retreat, but unfortunately Vandamme, with his single corps and unsupported, issued out of the mountains on their flank, threw himself across their line of retreat near Kulm, and was completely overwhelmed by sheer weight of numbers (29th). In spite of this misfortune, Napoleon could claim a brilliant success for himself, but almost at the same moment news reached him that Oudinot at Grossbeeren near Berlin, and Macdonald on the Katzbach opposed to Blücher, had both been severely defeated.

Napoleon's Movements.—During the next two days the emperor examined his situation and, after discussing on paper the respective hypotheses of a spring at Prague or at Berlin, summed up in favour of the second. But his consideration of this project was interrupted by news which indicated that the consequences of Macdonald's defeat had been far more serious to the *moral* of that command than he had imagined. He immediately rode over to establish order, and his manner and violence were so improper that Caulaincourt had the greatest difficulty in concealing the scandal. Blücher, however, hearing of his arrival, at once retreated and the emperor followed, thus uncovering the passes over the Bohemian mountains, a fact of which Schwarzenberg was quick to take advantage. Learning of his approach, Napoleon again withdrew to Bautzen. Then hearing that the Austrians had counter-marched and were again moving towards Dresden, he hastened back there, concentrated as many men as could conveniently be handled, and advanced beyond Pirna and Königstein to meet him. But the Austrians had no intention of attacking him, for time was now working on their side and, leaving his men to starve in the exhausted district, the emperor again returned to Dresden, where for the rest of the month he remained in an extraordinary state of vacillation. On Oct. 4 he again drew up a review of the situation, in which he apparently contemplated giving up his communications with France and wintering in and around Dresden, though at the same time he was aware of the distress amongst his men for want of food.

Campaign of Leipzig.—In the meanwhile Blücher, Schwarzenberg and Bernadotte were working round his flanks. Ney, who had joined Oudinot after Grossbeeren, had been defeated at Dennewitz (Sept. 6), the victory, won by Prussian troops solely, giving the greatest encouragement to the enemy. Suddenly Napoleon's plans are again reviewed and completely changed. Calling up St. Cyr, whom he had already warned to remain at Dresden with his command, he decided to fall back towards Erfurt, and go into winter quarters between that place and Magdeburg, pointing out that Dresden was of no use to him as a base and that if he had a battle, he had much better have St. Cyr and his men with him than at Dresden. He then on Oct. 7 drew up a final plan, and this he immediately proceeded to put into execution, for he was now aware of the danger threatening his line of retreat from both Blücher and Schwarzenberg and the North Army; yet only a few hours afterwards the portion of the order relating to St. Cyr and Lobau was cancelled and the two were finally left behind at Dresden. From the 10th to the 13th Napoleon lay at Düben, again a prey to the most extraordinary irresolution, but on that day he thought he saw his opportunity. Blücher was reported near Wittenberg, and Schwarzenberg was moving slowly round to the south of Leipzig. The North Army under Bernadotte, unknown to Napoleon, lay on Blücher's left around Halle. The emperor decided to throw the bulk of his force on Blücher, and, having routed him, turn south on Schwarzenberg and sever his communications with Bohemia. His concentration was effected with his usual sureness and celerity, but whilst the French moved on Wittenberg, Blücher was marching to his right, indifferent to his communications as all Prussia lay behind him. This move on the 14th brought him into touch with Bernadotte, and now a single march forward of all three armies would have absolutely isolated Napoleon from France; but Bernadotte's nerve failed him, for on hearing of Napoleon's threat against Wittenberg he decided to retreat northward, and not all the persuasions of Blücher and Gneisenau could move him. Thus if the French movement momentarily ended in a blow in the air, it was indirectly the cause of their ultimate salvation.

The "Battle of the Nations."—On the 15th Napoleon concentrated his forces to the east of Leipzig, with only a weak detachment to the west, and in the evening the allies were prepared to attack him. Schwarzenberg had 180,000 men available at once and 60,000 on the following day; Blücher had about 60,000, but Bernadotte now could not arrive before the 18th.

Napoleon prepared to throw the bulk of his force upon Schwarzenberg and massed his troops south-east of the town, whilst Schwarzenberg marched concentrically against him down the valleys of the Elster and Pleisse, the mass of his troops on the right bank of the latter and a strong column under Giulay on the left working round to join Blücher on the north. The fighting which followed was most obstinate, but the Austrians failed to make any impression on the French positions, and indeed Giulay felt himself compelled to withdraw to his former position. On the other hand, Blücher carried the village of Möckern and came within a mile of the gates of the town. During the 17th there was only indecisive skirmishing, Schwarzenberg waiting for his reinforcements coming up by the Dresden road, Blücher for Bernadotte to come in on his left, and by some extraordinary oversight Giulay was brought closer in to the Austrian centre, thus opening for the French their line of retreat towards Erfurt, and no information of this movement appears to have been conveyed to Blücher. The emperor when he became aware of the movement, sent the IV. corps to Lindenau to keep the road open. On the 18th the fighting was resumed and by about noon Bernadotte came up and closed the gap to the N.E. of the town between Blücher and the Austrians. At 2 P.M. the Saxons, who had remained faithful to Napoleon longer than his other German allies, went over to the enemy. All hope of saving the battle had now to be given up, but the French covered their retreat obstinately and by daybreak next morning one-half of the army was already filing out along the road to Erfurt which had so fortunately been left for them.

It took Blücher time to extricate his troops from the confusion into which the battle had thrown them, and the garrison of Leipzig and the troops left on the right bank of the Elster still resisted obstinately—hence no direct pursuit could be initiated, and the French, still upwards of 100,000 strong, marching rapidly, soon gained distance enough to be reformed. Blücher followed by parallel and inferior roads on their northern flank, but Schwarzenberg knowing that the Bavarians also had forsaken the emperor and were marching under Wrede, 50,000 strong, to intercept his retreat, followed in a most leisurely fashion. Blücher did not succeed in overtaking the French, but the latter, near Hanau, found their way barred by Wrede with 50,000 men and over 100 guns in a strong position. To this fresh emergency Napoleon and his army responded in most brilliant fashion. As at Krasnoi in 1812, they went straight for their enemy and after one of the most brilliant series of artillery movements in history, directed by General Drouot, they marched right over their enemy, practically destroying his whole force. Henceforward their march was unmolested, and they reached Mainz on Nov. 5.

THE CAMPAIGN IN FRANCE IN 1814

When the last of the French troops had crossed to the western bank of the Rhine, divided counsels made their appearance at the headquarters of the allies. Everyone was weary of the war, and

many felt that it would be unwise to push Napoleon and the French nation to extremes. Hence a prolonged halt arose, utilized by the troops in renewing their equipment and so forth, but ultimately the Young German party, led by Blücher and the principal fighting men of the army, triumphed, and on Jan. 1, 1814, the Silesian army (50,000) began its passage of the Rhine at Kaub. They were to be supported by Schwarzenberg with 200,000 men,

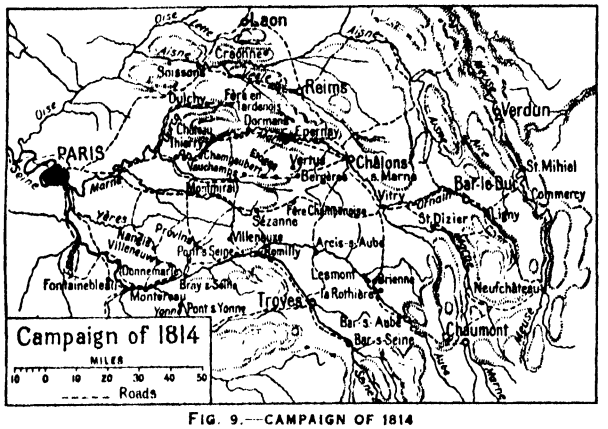

FIG. 9.—CAMPAIGN OF 1814

who was to advance by Basel and Neu Breisach to the south, and Bernadotte with the Northern army, about 120,000, was to move in support on the right flank through the Netherlands and Laon; this force was not yet ready and did not, in fact, reach the latter place till March. To meet these forces the emperor could not collect 200,000 men in all, of whom upwards of 100,000 were held by Wellington on the Spanish frontier, and 20,000 more were required to watch the debouches from the Alps. Hence less than 80,000 remained available for the east and north-eastern frontier. If, however, he was weak in numbers, he was now again operating in a friendly country, able to find food almost everywhere and practically indifferent as to his communications.

On Jan. 25 Blücher entered Nancy, and, moving rapidly up the valley of the Moselle, was in communication with the Austrian advanced guard near La Rothière on the afternoon of the 28th. Here his headquarters were surprised and he himself nearly captured by a sudden rush of French troops, and he learnt at the same time that the emperor in person was at hand. He accordingly fell back a few miles next morning to a strong position covering the exits from the Bar-sur-Aube defile. There he was joined by the Austrian advance guard, and together they decided to accept battle—indeed they had no alternative, as the roads in rear were so choked with traffic that retreat was out of the question. About noon Feb. 2 Napoleon attacked them, but the weather was terrible, and the ground so heavy that his favourite artillery, the mainstay of his whole system of warfare, was useless and in the drifts of snow which at intervals swept across the field, the columns lost their direction and many were severely handled by the Cossacks. At nightfall the fighting ceased and the emperor retired to Lesmont, and thence to Troyes, Marmont being left to observe the enemy.

Montmirail.—Owing to the state of the roads, more perhaps to the extraordinary lethargy which always characterized Schwarzenberg's headquarters, no pursuit was attempted. But on Feb. 4 Blücher, chafing at this inaction, obtained the permission of his own sovereign to transfer his line of operations to the valley of the Marne; Pahlen's corps of Cossacks were assigned to him to cover his left and maintain communication with the Austrians. Believing himself secure behind this screen, he advanced from Vitry along the roads leading down the valley of the Marne, with his columns widely separated for convenience of subsistence and shelter—the latter being almost essential in the terrible weather prevailing. Blücher himself on the night of the 7th was at Sézanne, on the exposed flank so as to be nearer to his sources of intelligence, and the rest of his army were distributed in four small corps at or near Épernay, Montmirail and Étoges; reinforcements also were on their way to join him and were then about Vitry.

In the night his headquarters were again surprised, and he learnt that Napoleon himself with his main body was in full march to fall on his scattered detachments. At the same time he heard that Pahlen's Cossacks had been withdrawn forty-eight hours previously, thus completely exposing his flank. He himself retreated towards Étoges endeavouring to rally his scattered detachments, but Napoleon was too quick for him and in three successive days he defeated Sacken at Montmirail, Yorck at Champ Aubert and Blücher and his main body at Étoges, pursuing the latter towards Vertus. These disasters compelled the retreat of the whole Silesian army, and Napoleon, leaving Mortier and Marmont to deal with them, hurried back to Troyes with his main body to strike the flank of Schwarzenberg's army, which had meanwhile begun its leisurely advance, and again at Mormant on Feb. 17, Montereau the 18th and Méry the 21st, he inflicted such heavy punishment upon his adversaries that they fell back precipitately to Bar-sur-Aube.

In the meantime Blücher had rallied his scattered forces and was driving Marmont and Mortier before him. Napoleon, as soon as he had disembarrassed himself of Schwarzenberg, countermarched his main body and moving again by Sézanne, fell upon Blücher's left and drove him back upon Soissons. This place had been held by a French garrison, but had capitulated only twenty-four hours beforehand, a fact of which Napoleon was naturally unaware. The Silesian army was thus able to escape, and marching northwards combined with Bernadotte at Laon—this reinforcement bringing the forces at Blücher's disposal up to over 100,000 men. On March 7 Napoleon fell upon the advance guard of this force at Craonne and drove it back upon Laon, where a battle took place on the 9th. Napoleon was here defeated, and with only 30,000 men at his back he was compelled to renounce all ideas of a further offensive, and he retired to rest his troops at Reims. Here he remained unmolested for a few days, for Blücher was struck down by sickness, and in his absence nothing was done. On March 14, however, Schwarzenberg, becoming aware of Napoleon's withdrawal to Reims, again began his advance and had reached Arcis-sur-Aube when the news of Napoleon's approach again induced him to retreat to Brienne.

The Allies March on Paris.—Thus after six weeks' fighting the allies were hardly more advanced than at the beginning. Now, however, they began to realize the weakness of their opponent, and, still more, the weakening of his political stability. Napoleon, coincidently, aware of the limitations of a strategy of continual parrying, was seized with the idea of a decisive coup against Schwarzenberg's communications. He determined to move eastward to St. Dizier, rally what garrisons he could find, and raise the whole country against the invaders, and had actually started on the execution of this plan when his instructions fell into the enemy's hands and his projects were exposed. The Czar Alexander called a council of war at which General Toll in opposition to his seniors, urged that instead of following Napoleon the allies should disregard the threat to their rear and advance by forced marches on Paris, whose people were reported to be "tired of the war and of Napoleon." His arguments for this moral objective won over the Czar and at his instigation the allies marched straight for the capital. Marmont and Mortier with what troops they could rally took up a position on Montmartre heights to oppose them, but seeing further resistance to be hopeless they gave way on March 31, just as Napoleon, with the wreck of the Guards and a mere handful of other detachments, was hurrying across the rear of the Austrians towards Fontainebleau to join them.

This was the end of the First Empire. The story of the WATERLOO CAMPAIGN is told under its own heading.

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NAVAL OPERATIONS

The Peace of Amiens in 1802 was productive of but a brief truce. Napoleon's ambitions and actions were such as quickly to re-awaken European suspicions, and his refusal to evacuate the Netherlands was alone enough to arouse England and cause her to declare war on him as early as May 18, 1803. From then onwards, for over two years, the war took the form of a gigantic scheme, on the part of Napoleon, for an invasion of England—a scheme which led to the movements known as the Trafalgar Campaign which, in its turn, led to the Battle of Trafalgar. Boulogne was chosen as the base for the French operations; along the coast on either side an army of some 150,000 men was encamped, and specially-constructed flat-bottomed boats for their transport were brought from all parts of France. The army was given constant practice in embarkation and disembarkation, and, in the meantime, it proved impossible for the British ships to do much damage to this armament owing to the shallow water on the coastline. In order, however, to carry through his scheme successfully, Napoleon had got to obtain at least a temporary control of the Channel, and this meant either defeating the British fleet on equal terms in action, or, by some means, causing the various parts of it to scatter on some wild-goose chase, so giving himself the chance to bring every available ship to the Channel and overwhelm the British fleet there by sheer weight of numbers. French fleets were stationed at Brest, Rochefort, L'Orient and Toulon; all of them were watched by British blockading squadrons. From the end of 1804, when Spain entered the war on his side, Napoleon was able to add to this total Spanish squadrons at Corunna, Ferrol, Cadiz and Cartagena, all of which the British blockaded. The total number of ships at Napoleon's command was about 60, the English had an approximately equal number employed in blockading them. His plan, then, took the form of attempting to elude these blockading squadrons and make them scatter to various parts of the world in search of his escaped squadrons which would, after concentrating at a given rendez-vous, return to the Channel to crush Cornwallis and the English Channel Fleet, if indeed that had not scattered too, after the presumed escape of the Brest Fleet which it was blockading. In either case Napoleon might hope to achieve his object—control of the Channel for long enough to enable him to take his troops across, while the British squadrons returned from the various parts of the world to which he seemed to think they might sail. The scheme was an exceedingly weak one, and postulated a gross ignorance of naval strategy on the part of that country that had been its greatest exponent. The British Admiralty upset it by a single order. The various blockading squadrons, if they were eluded by the squadrons they were blockading, were to fall back on Cornwallis. Thus if all the French squadrons united at the appointed rendez-vous (which was Martinique) and sailed for the Channel, they would merely find Cornwallis with an equally concentrated fleet, and the extent of the British concentration would depend on, and be equal to, that of the French.

The first move occurred in January 1805 when the Rochefort squadron [illegible] but it proved an isolated effort. On March 30, however, Admiral Villeneuve used a gale to elude Nelson who was watching him off Toulon, and got clear away with eleven ships which he increased to eighteen by picking up the Cadiz Squadron, reaching Martinique on May 14. He was joined on June 1, by two ships from Rochefort, but no others put in an appearance. He should have waited until nearly the end of the month before sailing back to Europe to try and pick up those squadrons which failed to join him, preliminary to making for Brest, whence Admiral Gantheaume was trying unsuccessfully to emerge from time to time. Only a week later, however, information reached Villeneuve that Nelson was already in the West Indies in search of him, and he decided to make for European waters immediately. Nelson, after having been evaded off Toulon should, according to his orders, have fallen back on Cornwallis, but he preferred, not for the first time, to follow his own course. It has often been said that Villeneuve induced Nelson to follow him and that, in doing so, the latter was playing into Napoleon's hands. The foolishness of this can be seen in the fact that the mere information that Nelson was in the neighbourhood caused Villeneuve to make for home a considerable time before he was due to depart, and any hope of a West Indian concentration was thus lost. When Napoleon hoped that the English blockading squadrons would scatter, he meant to places where the French had not gone. Foiled by false information of his hope of catching Villeneuve, Nelson sent a fast brig home to warn the Admiralty of the former's return, and himself sailed for Gibraltar. The Admiralty despatched Sir Robert Calder to intercept Villeneuve; this he did, off Finisterre, and, in a not very satisfactory action, fought in a fog, deprived him of two Spanish battleships, but let him make Ferrol. Here the French Admiral received reinforcements, and his next move, according to his programme, should have been to make for the Channel in an attempt to unite with the Brest fleet. But he conceived, rightly, that Napoleon's scheme had already been foiled and that his task would be impossible; thus when he left Ferrol he made, not for the Channel, but for Cadiz. Here he was blockaded by Nelson and Collingwood. The Trafalgar Campaign, as a campaign, was over, and the invasion scheme was a failure. Napoleon broke up his camp and marched his troops against Austria. A natural corollary of the Trafalgar Campaign was the battle of Trafalgar, but it must be realised that it was the former that saved England from invasion. In the autumn Napoleon needed a fleet in the Mediterranean and ordered Villeneuve to proceed there. The latter, after a protest, attempted to comply, and was beaten, as all the world knows, on Oct. 21, 1805 with a loss of twenty ships.

The victory of Trafalgar, while it did not end the war, conferred upon England the complete command of the sea. Thereafter naval activity was most pronounced, and the British Navy was employed in numerous undertakings in all parts of the world; but it becomes impossible to trace out any broad policy. It only remains to point out some of the more prominent incidents. Napoleon's operations with Russia produced some naval activity. England attempted to assist that country when in 1807 Napoleon was preparing a final blow against her, by forcing the Dardanelles —Turkey being then allied with France. Admiral Duckworth was selected for the operation, and he actually silenced the batteries in the Straits and appeared off Constantinople. There he was helpless for lack of bombships, and had to retire under a damaging fire. Later in the same year the third coalition against France came to a final end when Napoleon and the Tsar of Russia signed the Treaty of Tilsit, by which they agreed to cease war and both plot for England's overthrow. One scheme they hatched was to seize all the neutral fleets in Europe and employ them against their common enemy. The largest neutral navy was Denmark's, and Canning, having providentially heard of this peculiar arrangement, anticipated a Franco-Russian breach of Danish neutrality by sending Admiral Gambier to "borrow" this fleet for the duration of the war. Gambier bombarded Copenhagen and returned with 70 out of 72 of the Danes' fighting ships.

Napoleon's Berlin and Milan Decrees, by which he hoped to break England's merchant marine, and England's reply with the Orders in Council also gave the British many opportunities to

show its command of the sea. Napoleon forbade continental countries to import British goods either in British or foreign ships. England in turn seized neutral ships that called at a continental port without also calling at a British port. The struggle forced England to open new markets in the East and in South America, but several countries rebelled against Napoleon's system and England was always ready to help. The revolt of Portugal began in 1808 and produced the Peninsular War which ought to be thought of as partly a naval operation, for the fleet took off the army after Corunna, was always behind Wellington's lines at Torres Vedras, and finally followed, as nearly as possible, his victorious advance. The revolt of Austria in 1809 produced the combined expedition against Antwerp, commanded by Admiral Strachan and Lord Chatham, which hoped to find some sympathy among the Netherlanders for their Austrian ex-rulers. Walcheren and Flushing were captured, but the expedition had to retreat after the collapse of Austria. Finally, England's resistance to Napoleon's decrees involved her in 1812 in war with America who considered herself illtreated in the matter of the seizure of ships. The British lost many single-ship actions with the Americans—their only success being that of the "Shannon" over the "Chesapeake," but America let her very natural jubilation rather blind her to the fact that her coasts were blockaded without serious challenge.

This is but a small selection from the numerous incidents that make up the naval side of the Napoleonic War after Trafalgar. The main point is that British sea supremacy was unchallenged after that battle, and the British Navy remained Napoleon's worst enemy to the end, for it was the British "Bellerophon" which intercepted him when, after Waterloo, he sought to escape to America to carve out an empire in a new world.

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(G. A. R. C.; J. G. B.)

NAPOLEONITE, also called corsite, because the stone is found in Corsica, is a variety of diorite characterized by orbicular structure. The grey matrix of the rock has the normal appearance of a diorite but contains many rounded lumps 1 or 2in. in diam., which show concentric zones of light and dark colours. In these spheroids also a distinct and well-marked radial arrangement of the crystals is apparent. The centre of the spheroid is usually white or pale grey and consists mainly of felspar; the same mineral makes the pale zones while the dark ones are rich in hornblende and pyroxene. The felspar is a basic variety of plagioclase (anorthite or bytownite). Though mostly rounded, the spheroids may be elliptical or subangular; sometimes they are in contact with one another but are usually separated by small areas of massive diorite. When cut and polished the rock makes a beautiful ornamental stone.

Spheroidal structure is found in other diorites and in quite a number of granites in Sweden, Russia, America, Sardinia, Ireland, etc. It is by no means common, however, and usually occurs in only a small part of a granitic or dioritic mass, being sometimes restricted to an area of a few square yards. In most cases it is found near the centre of the outcrop; it arises evidently from intermittent and repeated crystallization of the rock-forming minerals in successive stages, a process which would be favoured by complete rest, allowing of supersaturation of the magma by one of the components. Rapid crystallization would follow, producing deposits on any suitable nuclei, and the crystals then formed might have a radial disposition on the surfaces on which they grew. The magma might then be greatly impoverished in this particular substance, and another deposit of a different kind would follow, producing a zone of different colour. The nucleus for the spheroidal growth is sometimes an early porphyritic crystal, sometimes an enclosure of gneiss, etc., and often does not differ essentially in composition from the surrounding rock. When spheroids are in contact their inner zones may be distinct, while the outer are common to both individuals, having the outlines of a figure eight. This proves that growth was centrifugal, not centripetal.

(J. S. F.)

NAPRAVNIK, EDWARD (1839–1915), Czech conductor and composer, was born at Beisht in Bohemia on Aug. 26, 1839. He was thrown on his own resources while still young and only obtained his musical education by means of great determination. In 1861 he went to Petersburg (Leningrad) as conductor to Prince Youssipov. Through the influence of Liadov he obtained a post at the Marinsky theatre and in 1869 succeeded him as first conductor there. Under his direction the famous opera-house became the home of Russian opera and ballet, where the works of Glinka, Tschaikovsky, Rimsky-Korsakoff and Glazounov had a permanent place in the repertoire. He died on Nov. 10, 1915. Napravnik wrote several operas, including *Francesca di Rimini*, op. 71; four symphonies and other orchestral works; chamber and piano music; and dramatic choral works.

NAQUET, ALFRED JOSEPH (1834–1916), French chemist and politician, was born at Carpentras (Vaucluse) on Oct. 6, 1834. In 1863 he was made professor of medicine in Paris, and of chemistry in Palermo. In 1867 he was imprisoned for 15 months and lost his professorships for his share in a secret society, and in 1869 took refuge in Spain on the prosecution of his book, *Religion, propriété, famille*. He took part in the revolution of Sept. 4, 1870, and became secretary of the commission of national defence, sitting on the extreme Left in the National Assembly. Re-elected to the Chamber of Deputies he agitated against the marriage laws. By his efforts in the Senate, where he sat from 1883, in 1886 divorce became legal after three years of definite separation, on the demand of one of the parties concerned. In 1890 he resigned from the Senate and took his seat with the Boulangist deputies in the Chamber of Deputies. He wrote *Principes de chimie fondés sur les théories modernes* (1865); *Socialisme collectiviste et socialisme libéral* (1890; Eng. trans., 1891); *Loi du divorce* (1903) and other scientific and political works.

NARA, an important water channel in Sind, India, probably representing a former bed of the Indus, though now traversing the desert far east of the river. It is now a perennial stream 262 m. long, with 631 m. of canals, and irrigates an area of over ¼ million acres.

NARA, a town of Japan, in the province of Yamato, 25½ m. from Osaka by rail. Pop. (1925) 54,643. It lies on the slope of a range of picturesque hills, beautifully wooded with cryptomerias and evergreen oaks. Nara remained the metropolis during seven consecutive reigns (709 to 784), and its seventy-five years of favoured existence sufficed for the building and furnishing of several imposing shrines and temples, for the laying out of a noble park and for the casting of a colossal image of Buddha. Not much is known of the Nara palace in its original form, but many of the articles and ornaments used by its inmates survive in a celebrated collection which, during nearly twelve hundred years, had been preserved in a store-house (Shoso-in) near the temple of Todai-ji, which was completed about 750. Worthy of close attention are two effigies of Brahma and Indra preserved among the relics of Kobuku-ji, which, with Kasuga-no-Miya, Ni-gwatsu-do and Todai-ji, constitute the chief religious edifices. These figures, sculptured in wood, have suffered much from the ravages of time. At the shrine of Kasuga is performed a religious dance called Kagura, in which the costumes and gestures of the dancers are doubtless the same as those of twelve centuries ago. Kasuga-no-Miya was founded in 767, and its chapels with their rough red-painted log-work afford fine examples of primitive Japanese architecture. A railway now gives access to the town, but every effort is made to preserve all the ancient features of Nara.

NARBADA, a river of India. It is traditionally regarded as the boundary between Hindustan proper and the Deccan. It rises on the summit of Amarkantak hill in Rewa state, and for the first 200 m. of its course winds among the Mandla hills, which

form the head of the Satpura range; then at Jubbulpore, passing through the "Marble Rocks," it enters its proper valley between the Vindhyan and Satpura ranges, and pursues a direct westerly course to the Gulf of Cambay. Its total course through the Central Provinces and Gujarat amounts to about 800 m., and it falls into the sea in the Bombay district of Broach. It receives the drainage of the northern slopes of the Satpuras, but not that of the Vindhyan tableland, the streams from which flow into the Ganges and Jumna. After leaving the Central Provinces, the river widens out in the fertile district of Broach, with an average breadth of ½ m. to 1 m. Below Broach city it forms an estuary which is 13 m. broad where it enters the Gulf of Cambay. The Narbada is nowhere utilized for irrigation, and navigation is confined to the lower section. In the rainy season boats of considerable size sail about 60 m. above Broach city. In sanctity the Narbada ranks only second to the Ganges among the rivers of India, and along its whole course are special places of pilgrimage. The most meritorious act that a pilgrim can perform is to walk from the sea to the source of the river and back along the opposite bank.

The Narbada has given its name to a division of the Central Provinces, comprising the five districts of Narsinghpur, Hoshangabad, Nimar, Betul and Chindwara. Area, 18,534 sq.m.; pop. (1921) 2,013,021.

NARBONNE, a city of France, capital of an arrondissement in the department of Aude, in a vine-growing plain 5 m. from the Mediterranean, 37 m. E. of Carcassonne. Pop. (1926) 25,440. Narbonne was the capital of the Volcae Tectosages. There the Romans in 118 B.C. founded their first colony in Gaul, named *Narbo Martius;* they built great works to protect the city from inundation and to improve its port, situated on a lake now filled up. The capital of Gallia Narbonensis, the seat of a proconsul and a station for the Roman fleet, Narbo Martius became the rival of Massilia. But the division of Gallia Narbonensis into two provinces lessened its importance. Alans, Suevi, Vandals, each held the city, and at last, in 413, it was occupied by the Visigoths, whose capital it afterwards became. In 719, after a siege of two years, it was captured and extended by the Saracens. Charles Martel, after the battle of Poitiers, and Pippin the Short, in 752, were both repulsed from its walls; but on a new attempt, after an investment of seven years, the Franks again forced their way into Narbonne. Charlemagne made the city the capital of the duchy of Gothia, and divided it into three lordships—one for the bishop, another for a Frankish lord, and the third for the Jews. In the 13th century the archbishopric was seized by the pope's legate, Arnaud Amaury, who took the title of viscount of Narbonne, Simon de Montfort, however, deprived him of this dignity, receiving from Philip Augustus the duchy of Narbonne along with the county of Toulouse. By his expulsion of the Jews Philip the Fair hastened the decay of the city; and about the same period the Aude, which had formerly been diverted by the Romans, ceased to flow towards Narbonne and the harbour was silted up. United to the French crown in 1507, Narbonne was enclosed by a new line of walls under Francis I., but had the last portions of its ramparts demolished in 1870. The archbishopric was founded about the middle of the 3rd century, its first holder being Sergius Paulus; it was suppressed in 1790. The Robine canal, a branch of the Canal du Midi, divides Narbonne into the *bourg* and the *cité*. The former 13th century cathedral (St. Just), consists only of a choir 130 ft. high and transept. The towers (194 ft. high) at each end of the transept date from 1480. The apse of the cathedral was formerly joined to the fortifications of the archiepiscopal palace, and the two buildings are still connected by a mutilated cloister of the 14th and 15th centuries. Part of the palace now serves as *hôtel de ville,* and the palace garden contains many fragments of Roman work; the Musée Lapidaire in the Lamourguier buildings has similar Roman remains. The church of St. Paul, though partly Romanesque, is for the south of France a rare example of a building of the early 13th century in the Gothic style of the north. It possesses some ancient Christian sarcophagi and fine Renaissance wood carving. Narbonne has a subprefecture, tribunals of first instance and of commerce, a board of trade arbitrators and a chamber of commerce. It has a good trade in wine and spirituous liquors, salt, tartar, almonds and leather. The industries include cooperage, sulphur-refining, brandy-distilling and the manufacture of bricks and tiles.

NARBOROUGH, SIR JOHN (d. 1688), English naval commander, was descended from an old Norfolk family. He received his commission in 1664, and in 1666 was promoted lieutenant for gallantry in the action with the Dutch fleet off the Downs in June of that year. After the peace he was chosen to conduct a voyage of exploration in the South Seas. He set sail from Deptford on Nov. 26, 1669, and entered the Straits of Magellan in October 1670 but returned home in June 1671 without accomplishing his original purpose. A narrative of the expedition was published in 1694 under the title *An Account of several late Voyages and Discoveries to the South and North.* During the second Dutch War Narborough was second captain of the lord high-admiral's ship the "Prince," and distinguished himself at Southwold Bay in May 1672. In 1675 he was sent to suppress the Tripoline piracies, and by the bold expedient of despatching gun-boats into the harbour of Tripoli at midnight and burning the ships he induced the bey to agree to a treaty. Shortly after his return he undertook a similar expedition against the Algerines. In 1680 he was appointed commissioner of the navy, an office he held till his death in 1688.

See J. Charnock, *Biographia Navalis,* vol. i. (6 vols., 1794–98).

NARCEINE, one of the alkaloids (*q.v.*) of opium. It belongs to the meconylisoquinoline group and is closely related to narcotine (*q.v.*), being formed, for example, by the action of caustic soda on narcotine methochloride.

$$C_{22}H_{23}O_7N{\cdot}CH_3Cl + NaHO = C_{22}H_{23}O_7N + NaCl$$

Narcotinemethochloride *Narceine.*

NARCISSUS, in Greek mythology, son of the river god Cephissus and the nymph Leiriope, distinguished for his beauty. The seer Teiresias told his mother that he would have a long life, provided he never looked upon his own features. His rejection of the love of the nymph Echo (q.v.), or of his lover Ameinias, drew upon him the vengeance of the gods. Having fallen in love with his own reflection in the waters of a spring, he pined away (or killed himself) and the flower that bears his name sprang up on the spot where he died. According to Pausanias, Narcissus, to console himself for the death of a favourite twin sister, his exact counterpart, sat gazing into the spring to recall her features by his own.

It is a very plausible suggestion of Frazer (*Golden Bough,* iii. p. 94) that this story is to be connected with the widespread belief that it is unlucky, or even fatal, to see one's own reflection. This superstition existed in Greece, *see* Iamblichus, *Protrept.,* 21; Boehm, *de Symbolis Pythagoreis,* p. 51 (1905); Artemidorus, *Oneirocr.* ii., 7 (p. 91, 1, Hercher).

Hence is derived the term *narcissism,* used by psychologists, especially Freudians, for a morbid condition in which the subject is intensely interested in his own body.

BIBLIOGRAPHY.—*See* Ovid, *Metam.* iii. 341–510; Pausanias ix. 31, 7; Conon, *Narrationes,* 24; F. Wieseler, *Narkissos* (1856); Greve in Roscher's *Lexikon der Mythologie.*

NARCISSUS (d. A.D. 54) was a freedman of Claudius, and his secretary *ab epistulis.* Narcissus and Messallina between them exercised an unbounded influence over the emperor, and arranged the execution or exile of their opponents almost at pleasure. Narcissus was sent to Britain to subdue the mutiny of the soldiers of A. Plautius. He was not well received, but the mutiny subsided. Narcissus was almost solely responsible for the ultimate downfall of Messallina in the Silius affair. It was he who made Claudius alarmed for his own safety, who succeeded in hardening him against Messallina's appeals, and who finally gave the order for her execution when Claudius hesitated. For this he received the insignia of praetor. Eventually he made a false move over Claudius' second marriage, for which he supported Aetia Petina, and further antagonized Agrippina by backing the claims of Brittannicus to the throne. As a result he was put to death on Nero's accession in A.D. 54. Narcissus' importance is an early example of the power of the freedmen-secretaries of the emperor's household, and represented the first step towards the transforma-

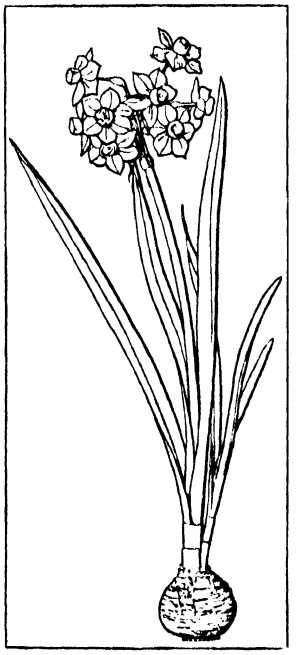
tion of the emperor's personal staff into an imperial civil service. *See* Suc. *Ann.* xi., xii., xiii., 1.; Dio Cass. ix.; Suet. *Claudius.*

NARCISSUS, a genus of bulbous plants belonging to the family Amaryllidaceae, natives of central Europe, and the Mediterranean region; one species *N. Tazetta,* extends through Asia to Japan. From some of these, by cultivation and hybridization, have arisen the very numerous modern varieties. The plants have long narrow leaves springing from the bulb and a central scape bearing one or more generally large, white or yellow, drooping or inclined flowers. The flowers are regular, with a perianth springing from above the ovary, tubular below, with spreading segments and a central corona; the six stamens are inserted within the tube. The most interesting feature botanically is the "corona" or "cup," which springs from the base of the flower-segments and this gives the special character to the flower.

There are five well-marked sections:

(1) The hoop-petticoat narcissi, sometimes separated as the genus *Corbularia,* are not more than from 3 to 6 in. in height, and have grassy foliage and yellow or white flowers. These have the coronet in the centre of the flower very large in proportion to the other parts, and much expanded, like the old hooped petticoats. They are now all regarded as varieties or forms of the common hoop-petticoat, *N. Bulbocodium,* which has comparatively large bright yellow flowers.

(2) A second group is that of the Pseudonarcissi, constituting the genus *Ajax* of some botanists, of which the daffodil, *N. Pseudonarcissus* is the type. The daffodil is common in woods and thickets in most parts of the north of Europe. Its leaves are about 1 ft. in length and 1 in. in breadth, and have a blunt keel and flat edges. The stem is about 18 in. long and the spathe single-flowered. The flowers are large, yellow, scented and a little drooping, with a corolla deeply cleft into six lobes and a bell-shaped corona which is crisped at the margin; they appear in March or April. In this species the corona is also very large and prominent.



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NARCISSUS (NARCISSUS TAZETTA)

(3) Another group, the mock narcissi or star daffodils, with coronets of medium size, includes the fine and numerous varieties of *N. incomparabilis,* one of which, with large, double flowers, is known as butter-and-eggs; *N. odorus,* known as the campernelle jonquil, has two to four uniform bright yellow flowers, and is considered a hybrid between *N. Jonquilla* and *N. Pseudonarcissus.*

(4) The polyanthus or bunch narcissi form another well-marked group, whose peculiarity of producing many flowers on the stem is indicated by the name. In these the corona is small and shallow as compared with the perianth. *N. Tazetta* is the type of this group. They are general favourites amongst spring flowers. The "Chinese sacred lily" or "joss flower" is a form of *N. Tazetta.* The jonquil, *N. Jonquilla,* with yellow flowers, a native of south Europe and Algeria, is also grown in pots for early flowering, but does well outside in a warm border.

(5) There remains another little group, the poet's or pheasant's-eye narcissi (*N. poeticus*), in which the perianth is large, spreading and conspicuous, and the corona very small and shallow. These pheasant's-eye narcissi, of which there are several well-marked varieties, blossom in succession during April and May, and all do well in the open borders as permanent hardy bulbs.

See F. W. Burbridge, *The Narcissus* (1875); a scientific treatment of the genus will be found in J. G. Baker's *Handbook of Amaryllideae* (1888); *see* also Nicholson, *Dictionary of Gardening* (1886); and J. Weathers, *Practical Guide to Garden Plants* (1901); Sanders, *Encyclopaedia of Gardening* (1912); L. H. Bailey, *The Standard Cyclopedia of Horticulture* (1915–27).

NARCOTICS, a general term for substances which in healthy animals produce lethargy or stupor, that may pass into unconsciousness with complete paralysis, and end in death. Certain substances of this class are used in medicine for the relief of pain (anodynes), whilst another group produce profound sleep (hypnotics). In one sense, anaesthetics are narcotics, but, as they are usually volatile substances causing unconsciousness for a short time, they are separated from the true narcotics, the effects of which are more lasting. The same substances are sometimes classed as anodynes and at other times as hypnotics. For example, small doses of opium, or of one or other of its preparations, relieve pain, whilst larger doses act as hypnotics, causing deep sleep passing into coma. Cannabis Indica, belladonna and hyoscyamus, are also anodyne in their action. The chief narcotics are dealt with separately (*see* OPIUM; BHANG; HASHISH; BELLADONNA). Others are:—

Stramonium.—The leaves and seed of the *Datura Stramonium* or thorn apple, the alkaloidal constituent being daturine, a variable mixture of hyoscine and atropine. The physiological action is almost identical with belladonna. Poisoning is usually due to children eating the seeds; the lethal dose is unknown.

Hyoscyamus, the leaves of the *Hyoscyamus niger* or henbane (*q.v.*). The active principle is hyoscyamine. The physiological action is similar to that of belladonna, but the action of hyoscyamus on the heart is more powerful: $\frac{1}{60}$ gr. of hyoscyamine produces sleepiness and dryness of the mouth; ½ gr. by subcutaneous injection has been fatal. The treatment of hyoscyamus poisoning is similar to that of stramonium.

Hops (*Humulus Lupulus*), containing the active principle lupuline, and *Lactucarium,* the juice of *Lactuca virosa* (lettuce), containing an alkaloid lactucine, are very feeble narcotics, causing heaviness and sleep if taken in large doses.

Chloral Hydrate is a pure hypnotic which in larger doses is a powerful narcotic, producing prolonged sleep with depression of the cardiac and motor centres. It is an intrinsic cardiac poison, the heart being arrested in diastole, with coincident respiratory failure. Chloral hydrate is not uniform in its action, some people manifesting great susceptibility to the drug. It is safe in small doses of 10 to 20 grs. It is difficult to say what is a lethal dose. Cases are recorded of recovery after 336grs. taken with an equal amount of potassium bromide and even after a dose of 595grs., but in susceptible persons 10 to 15grs. have produced toxic symptoms and death has occurred after doses of from 30 to 45 grs. If seen early, the treatment is an emetic, but if the poison should have been already absorbed, stimulants, hot coffee, strychnine or digitalin hypodermically, with perhaps artificial respiration, may be required.

Alcohol in large quantities is a strong narcotic. The treatment is washing out the stomach to prevent the absorption of the poison and the use of strychnine hypodermically.

NARCOTINE. Though narcotine is a physiologically active opium alkaloid (*see* ALKALOID) and was at one time used as a remedy for malaria, it is no longer of therapeutical importance except as a source of its derivative cotarnine, the hydrochloride of which is used in medicine as an internal styptic. Narcotine, $C_{22}H_{23}O_7N$, was probably obtained by Derosne in 1803, but was first isolated in a pure state by Robiquet in 1817. It crystallizes from alcohol in long colourless needles, melts at 176°–198° C in chloroform, and is nearly insoluble in water, sparingly soluble in cold alcohol, but readily so in benzene or ethyl acetate. It also dissolves in weak alkaline solutions and forms unstable salts with acids: the salts are dextro-rotatory, *i.e.,* the rotation is opposite in kind to that of the base. Narcotine is hydrolysed by dilute nitric acid to opianic acid, $C_{10}H_{10}O_5$, and *cotarnine,* $C_{12}H_{15}O_4N$. The former represents the meconyl residue (*see* ALKALOIDS) of narcotine, whilst cotarnine represents the isoquinoline portion

of the original alkaloid. Cotarnine crystallizes from benzene in small needles, melts at 132° C, is easily soluble in alcohol or ether and sparingly so in cold water. With acids it forms salts, losing a molecule of water at the same time, a circumstance of considerable importance in settling details of the intimate structure of cotarnine. Thus the hydrochloride has the formula $C_{12}H_{13}O_3N,HCl,2H_2O$, melts at 197° C, and crystallizes in pale yellow needles.

NARDINI, PIETRO (1722–1793), Italian violinist and composer, was born at Fibiana in Tuscany in 1722. He studied violin and composition at Leghorn and later became a pupil of Tartini at Padua. For 15 years he held an appointment at the court of Stuttgart as solo violinist. In 1767 he settled at Leghorn and was with Tartini in his last illness. He became music director to the duke of Tuscany in 1770 and enjoyed great fame as a performer and composer. He died at Florence on May 7, 1793. Nardini is remembered as Tartini's most famous pupil, and as the composer of many graceful compositions for the violin. His music is melodious and eminently playable, and has an educational value in respect of technique. Modern reprints of the sonatas are found in Alard's *Maitres classiques,* in David's *Hohe Schule des Violinspiels,* and in Jensen's *Classische Violinmusik.*

NARES, SIR GEORGE STRONG (1831–1915), English Arctic explorer, son of a captain in the navy, was educated at the Royal Naval college at New Cross, and entered the navy in 1846. He served on the Australian station, was mate of the "Resolute" in the Arctic expedition of 1852, and then served in the Crimea. He was then employed in surveying work on the north-east coast of Australia and in the Mediterranean. While in command of the "Challenger" (1872–74), in the famous voyage of deep-sea exploration round the world, he was ordered home to take command of the Arctic expedition which set sail in the spring of 1875 in the ships "Alert" and "Discovery." For his services he was made K.C.B. (1876). Two years later he was sent in command of the "Alert" to survey Magellan strait. He retired from active service in 1886, and became a vice-admiral in 1892. He died at Surbiton, Surrey, on Jan. 15, 1915. (*See* POLAR REGIONS.)

He published *Reports on ocean soundings and temperature* (1874–75); and *Narrative of a Voyage to the Polar Sea during 1875–76* (1878, 2 vols.).

NAREW, BATTLES OF THE. The battles on the river Narew, north-east of Warsaw, in July and Aug. 1915, were a part of the great offensive planned by Falkenhayn against Russia. During May and June, Mackensen had driven the Russian armies in Galicia from Tarnów on the Dunajec to the east of Lemberg (*see* DUNAJEC SAN; LEMBERG). In July the group of armies under his command was directed north-east towards Brest-Litovsk against the communications of the Russian forces which still held the Warsaw salient (*see* BREST-LITOVSK). Hindenburg, who commanded the group of armies on the northern part of the Eastern Front, was now ordered to strike a blow on the north side of the salient. Falkenhayn hoped thus by driving in the flanks of the salient to cut off large numbers of Russians in its apex about Warsaw. The realization of this hope depended, of course, on the rapidity with which the flanks could be forced.

Rival German Plans.—The operation against the Narew line is of interest because of the controversy it provoked between the two men who had most influence on German strategy during the war, Falkenhayn and Ludendorff. The former was at this time chief of the German Great General Staff, and thus responsible for the supreme direction of the war; the latter was chief of staff to Hindenburg. Ludendorff had long cherished the idea of a Napoleonic manoeuvre against the Russian rear by Kovno and Wilno on Minsk, and considered the proposed Narew offensive as timid and ineffectual; Falkenhayn, with heavier responsibilities on his shoulders, mistrusted both the feasibility and the expedience of the Wilno adventure. He could not afford to become so deeply involved in the Eastern theatre as to be unable to withdraw troops to meet the coming offensive in the West. After a discussion of the alternative plans held in the presence of the kaiser, Falkenhayn's views were approved; and Hindenburg was ordered to carry out the Narew attack.

A formidable water barrier protects Russian Poland against invasion from East Prussia, formed by the Niemen, the Bobr, the Narew and the lower course of the Bug, and thence the Vistula to the frontier. The Russians had fortified this river line. Besides the fortresses of Kovno and Grodno, Osoweic, Lomza and Nowa-Georgiewsk, there were fortified bridge-heads on the Narew at Ostroleka, Rozan, Pultusk and Zegrze. Though the river was fordable in the summer at many points, marshes along its length increased its effectiveness as an obstacle.

The German Attack.—Gallwitz's army, which was to make the attack, comprised six corps (14 divisions). Opposite to it, on the lower Vistula, lay the Russian 1. Army (Litvinov) with three corps and a cavalry corps.

The tactical details of the fighting are not of any special interest. On July 13 Gallwitz delivered his first attack on the approximate line Przasnysz-Ciechanów, aiming at Pultusk. The Russians, over-weighted both in numbers and heavy artillery, at once fell back more than half-way to the Narew line. They were attacked again on July 15, and during July 18 and 19 withdrew across the river, the Russian XII. Army on their right conforming to the movement. Reinforcements had now arrived and resistance stiffened. Though the Germans stormed the bridge-heads of Pultusk and Rozan on July 23, and secured crossings over the river, their further progress was limited by violent Russian counter-attacks, and they were unable to reach the line Wyszków-Ostrów (on the lower Bug), at which they were aiming. An attempt to force a passage further east at Ostroleka on July 30 failed, and it was not until Aug. 4 that this bridge-head fell. Losses were heavy on both sides; but the Russians had secured time and space sufficient to evacuate the Warsaw salient without danger.

Hindenburg and Ludendorff naturally claimed that the result of the battle vindicated their opinion on the mistaken strategy of the Supreme Command. Falkenhayn retorted that the operations would have had the desired effect of intercepting the Russian retreat had Hindenburg used the full force available and given Gallwitz 20 divisions instead of 14. It seems doubtful, however, whether the communications would have allowed the effective employment of so large a force.

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NARNI (anc. Umbrian *Nequinum,* Rom. *Narnia*), a town and episcopal see of the province of Perugia, Italy, 65 m. N. of Rome by rail. Pop. (1921) 5,544 (town), 14,014 (commune). It is picturesquely situated on a lofty rock (787 ft.). The cathedral and the portico of S. Maria Impensole are Romanesque; the former has some good Renaissance sculptures. There are other interesting churches and some picturesque Gothic houses and palaces. There are factories of linoleum and calcium carbide.

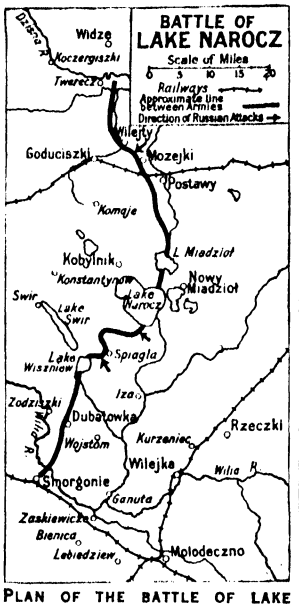
The Umbrian Nequinum was taken by the Romans in 299 B.C., and a colony planted there against the Umbrians. It was situated on the Via Flaminia, and one of the finest bridges of antiquity crosses the river below the town. The original main road ran to Nuceria by Mevania; a branch by Interamna and Spoletium joined it at Forum Flaminii. According to some authors, the emperor Nerva was born at Narnia. The town played a considerable part in military history. In the middle ages Narni was under the papal power. It was the birthplace of the well-known condottiere Erasmo Gattamelata (d. 1443), whose statue by Donatello is at Padua.

See G. Eroli, *Miscellanea Storica Narnese* (2 vols., Narni, 1858–1862), and other works by the same author.

NAROCZ, BATTLE OF LAKE. Lake Narocz, in Lithuania, 62m. E.N.E. of Wilno (Vilna), gives its name to a great offensive by the Russian 2nd Army in the spring of 1916. (*See* WORLD WAR: *Section viii.* and MAP.)

General Situation on the Eastern Front.—The river Pripet formed the dividing line between the German and Austrian commands. At the beginning of March there were 42 German and

two Austrian divisions on the front north of the Pripet, the total length of which was about 250 miles. The Russians had organized their armies into three groups: the northern (12th and 5th Armies) on the Dvina, the western (1st, 2nd, 10th, 4th and 3rd Armies) extending to south of the Pinsk marshes and the south-western (8th, 11th, 7th and 9th Armies) up to the Rumanian border. Their main strength was concentrated on the northern and western fronts, where it had been decided that the principal efforts of the year should be made. The losses of 1915 in men and material had been made good; guns and munition were available on a larger scale than previously, though still insufficient for the requirements of trench warfare.



PLAN OF THE BATTLE OF LAKE NAROCZ, MARCH 18, 1916

Plan of Operations.—The general idea of the battle was for the 2nd Army to attack on either side of Lake Narocz, where the German line formed a slight salient; the two wings were eventually to join and to continue their advance westwards to Panevežys (some 80m. N. of Wilno [Vilna] and 100m. W. of the original line), where the 5th Army, which was to attack from the Jakobstadt bridgehead on the Dvina, was to join them. The operation seems to have been planned originally to take place later in the year, when all the Allies proposed to attack simultaneously. But on Feb. 21 the German assaults on Verdun began, and the Russians chivalrously hurried on their preparations and attacked to relieve the pressure on the French, at the worst possible time of the year—when the annual thaw, which renders all communications practically impossible for a period, might be expected at any moment.

Description of the Terrain.—Lake Narocz (8m. by 6m.) is the largest of a whole series of small lakes in which the tributaries of the Wilia and the Dzisna rise. It drains into the River Narocz, which flows south to join the Wilia east of Smorgonie. The greater part of the trench line between Dvinsk and Smorgonie (over 100m. in a straight line) was protected by lake, stream or marsh, and stretches of dry ground wide enough for a large scale offensive were few. On either side of Lake Narocz, however, were gaps of four miles or so in the water line, where the terrain was comparatively favourable for attack, though communications were poor. The northern gap was ten miles to the north of Lake Narocz; the southern was between the lake itself and Lake Wiszniew.

Dispositions of the Opposing Forces.—The 2nd Army was divided into three groups: the right group (under Gen. Plyeshkov), opposite the northern gap, consisted of three corps and a cavalry corps; the centre group (under Gen. Sirelius), of two corps; and the left group (under Gen. Baluev), of three corps. Four corps were available behind these groups to exploit any success gained. The right and left groups were to attack the north and south faces of the salient respectively, while the centre group assisted by minor assaults and demonstrations. The army commander, Smirnov, fell sick just before the battle and his place was taken by Gen. Ragoza.

The 2nd Army was opposed by Von Eichorn's 10th Army on a front of some 85 miles, comprising 11 divisions and two cavalry divisions. The Germans were aware of the Russian concentration.

The Russian Attacks.—A thaw set in on March 17, but the offensive was nevertheless begun on the 18th. After a bombardment of several hours, massed infantry attacks were made both by Plyeshkov's group north of Lake Narocz and by Baluev's group in the south. In the thickly wooded and enclosed terrain the insufficiently trained Russian infantry soon lost cohesion, and their assaults were ill-timed and disjointed. Though the German first-line trenches were in several cases occupied, they could not be held under the concentrated fire of the German artillery, which was extremely skilfully handled. By nightfall the Russians were back in their original positions, having suffered very heavy casualties without result. After two days of further artillery preparation and minor attacks intended to mislead the enemy, renewed heavy assaults were made on the nights of March 19–20 and 20–21.

On Plyeshkov's front no ground was permanently gained in spite of terrible losses, but Baluev's group in the south made an advance of over a mile on a front of about 2½ miles. The weather conditions were by now terrible; it thawed from the 17th to the 22nd, and the whole area of operations became a sea of mud. The battle was, however, continued till March 27, when the Russians at last desisted from their fruitless and costly attacks. In April a German counterstroke retook all the ground gained by Baluev. Meanwhile the attacks of the 5th Army from Jakobstadt, March 21–26, were equally unsuccessful and almost equally wasteful of life.

Results of the Operations.—The operations resulted in a complete and disastrous failure for the Russians. Their losses were over 100,000 and they accomplished nothing. The offensive did not cause the Germans to move a single man from the Western Front, and so brought no relief to the French. Both time and place were ill-chosen; the staff work was bad; and the artillery, in spite of a greater concentration of heavy guns on a narrow front and a more liberal expenditure of ammunition than ever before, failed to give proper support to the infantry, who, as usual, paid the price in terrible losses. The result was, in fact, a bitter disillusionment to the Russian high command, to the Russian soldier and to the Russian people.

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NARRA or **ASANÁ,** the local names (Philippine dialect) applied to some of the best timber trees, *Pterocarpus indicus, P. echinatus* and *P. blancoi* (family Leguminosae) in the Philippine archipelago. The wood is commonly known as "Philippine mahogany," and is in great demand for cabinet-work; it is usually of a beautiful red or rose colour, often variegated with yellow, and is hard and heavy. The trunk is surrounded (or, occasionally, supported) by huge buttresses extending outward and upward for 10 to 20 ft.; these are sometimes made into table-tops, the pattern of the grain and the colouring being hardly equalled by any other timber. The wood-cells contain a peculiar substance: a minute chip placed in a bottle of water soon gives an opalescent colour to the liquid. Narra is known as Burmese rosewood, Andaman redwood and Kiabooca-wood.

NARRAGANSETT PIER, a summer resort of Washington county, Rhode Island, U.S.A., on the west shore of Narragansett bay, 25 m. S. of Providence. It is on Federal highway 1, and is served by the Narragansett Pier railroad, connecting at Kingston (9 m. N.W.) with the New York, New Haven and Hartford. The town of Narragansett, in which it is situated, had a resident population of 1,357 in 1925 (State census). "The Pier" consists of a group of hotels, a casino and a bathing pavilion, on a crescent-shaped beach (one of the finest on the Atlantic coast), and an avenue (lined on both sides with palatial summer "cottages") running down the rocky promontory to Point Judith (5 m. S.), where there is a lighthouse and a country club. Narragansett Pier was so named from the wharves built late in the 18th century to provide a port for southern Rhode Island, but none of them are left. Development as a summer resort began about the middle of the 19th century, and the railroad from Kingston was completed in 1876. It has always had a considerable number of visitors from the South.

NARSES (*c.* 478–573), an important officer of Justinian, in the 6th century. He was a eunuch of Persamenia, and apparently born about 478. If the statement that he died at the age of ninety-five be correct, he was probably brought young to Constantinople,

and attained a footing in the *officium* of the grand chamberlain. He rose to be one of the three "chartularii," a position involving the custody of the archives of the household. Hence, probably in middle life, he became "praepositus sacri cubiculi."

In 532 the insurrection known as the Nika broke out in Constantinople, when for some hours the throne of Justinian seemed doomed to overthrow. It was saved partly by the courage of his wife, Theodora, and partly by the timely prodigality of Narses, who stole out into the capital, and with large sums of money bribed the leaders of the "blue" faction, which was aforetime loyal to the emperor, to shout as of old "Justiniane Auguste tu vincas." He defeated Totila in 552, with whom fell the last hopes of the Gothic kingdom of Italy.

NARSINGHGARH, an Indian state in the Bhopal agency of Central India. Area 734 sq.m.; pop. (1921) 101,426. The chief, whose title is raja, is a Rajput of the Umat clan. The state was founded about 1681 by a minister of Rajgarh, who compelled the ruler of that state to transfer to him half his territory. The town of Narsinghgarh had a population in 1921 of 8,762.

NARTHEX, in architecture, a long, narrow porch, usually colonnaded or arcaded, at the entrance of a church. In the early days of Christianity it was the only portion of the church to which catechumens and penitents were admitted. Occasionally an additional vestibule exists within the church building proper. In this case, the inner vestibule is called the narthex and the outer porch an exonarthex. The narthex is common in basilican, Byzantine and some Romanesque churches, particularly in Italy; in the Gothic period its use had almost entirely disappeared, but during the Renaissance it is again found, although its ritual usage had entirely died out, and it had become a simple porch or vestibule.

NARVA, a seaport of Estonia in 59° 23′ N., 28° 12′ E., on the Narova river, 8 m. above its entry into Narva Bay on the Gulf of Finland. Pop. (1926) 27,000. With it is associated Narva-Joessu (Hungerburg) in 59° 28′ N., 28° 2′ E. Pop. 3,000. Vessels loading wood lie at anchor in the latter and load from lighters, while steamers of 15½ to 16 ft. draught can load in its harbour. The chief imports are cotton, rye, salt, herrings and coal and the exports textiles, timber (pit-props, battens, etc.), spirits and bricks. The textile mills at Narva utilizing the waterfalls on the river escaped the general destruction following 1914, partly because until the 1917 revolution the mills were executing orders for the Russian Ministry of War. The cotton mills were closed for two years but are working now, though only 2,000 workers are employed as against 11,000 in 1914. The woollen, flax and jute mills are similarly reduced. Russia was previously the chief market, but has now dropped out and in view of Estonia's development as a dairy producing country, the textile industry may not revive. Founded by the Danes in 1223, the town changed hands betwen the Teutonic Knights, Danes, Swedes and Russians until its capture by Peter the Great in 1704, after which it remained under Russian rule until Estonia obtained independence in 1918–1920.

NARVACAN, a municipality (with administration centre and 28 *barrios* or districts) of the province of Ilocos Sur, Luzon, Philippine Islands, near the coast and on the main road 13 m. S.S.E. of Vigan, the provincial capital. Pop. (1918) 23,071. It lies in a level valley surrounded by mountains and the climate is cool and healthy. The soil in the vicinity is fertile, and produces rice, corn, cotton, tobacco, maguey and sugar. Cotton is woven by the women and sold to the mountain peoples. In 1918, Narvacan had 92 household industry establishments, with outputs valued at 32,400 pesos. The 15 schools were all public. The language spoken is Ilocano.

NARVAEZ, PÁNFILO DE (*c.* 1480–1528), Spanish adventurer, born at Valladolid. He helped Velasquez in the reduction of Cuba and was put at the head of the force sent to the Aztec coast to compel Cortes to renounce his command. He was defeated by his compatriot and made prisoner (1520). On his return to Spain he obtained from Charles V. a grant of Florida as far as the river of Palms: landing near Pensacola bay in April 1528, he struck inland with some 300 of his followers and reached "Apalache" on June 25. Disillusioned in their hopes of fabulous wealth, they made for the coast, arriving in July at the Bahia de los Caballos, at or near St. Mark's. Having built rude boats, the much-reduced company sailed on Sept. 22, for Mexico, but the vessel which carried Narvaez perished in the storm. His lieutenant, Cabeza de Vaca, and three others ultimately reached the Gulf of California by way of Texas. (*See* FLORIDA.)

See W. H. Prescott, *Conquest of Mexico;* H. H. Bancroft, *Mexico* (1882–90); *Naufragio de Alvaro Nunez Cabeza de Vaca* (Bib. de Autores Esp., xxii.).

NARVAEZ, RAMÓN MARÍA (1800–1868), Spanish soldier and statesman, born at Loja, Granada on Aug. 4, 1800. He served under Mina in Catalonia in 1822. As one of the Conservative supporters of Isabella II. he achieved great popularity by his victory over Gomez, the Carlist general, near Arcos, in Nov. 1836, and after clearing La Mancha of brigands in 1838 he was appointed captain-general of Old Castile, and commander-in-chief of the army of reserve. After taking part in the Seville insurrection (1840) against Espartero and the Progresista party, he fled to France and planned with Maria Cristina the expedition of 1843, which led to the overthrow of his adversary. Prime minister, field-marshal, and duke of Valencia in 1844, his reactionary policy culminated in his having to quit office in Feb. 1846. He became ambassador at Paris, returned in 1847 to preside over the council of ministers and resigned in 1848 through misunderstandings with Maria Cristina. His ministry succeeded that of O'Donnell in 1856–57, 1864–65 and in July 1866. He died at Madrid April 23, 1868.

NARVIK or **VICTORIAHAVN,** an ice-free seaport on the Ofoten Fjord of the north-west coast of Norway, in Nordland *amt* (county), 68° 30′ N. Pop. (1927) 7,150. It is wholly modern, developed by the construction and completion (1903) of the Lapland railway, the most northerly in the world. There are extensive quays, from which is shipped the iron ore from Kiruna and other Swedish mining districts traversed by the line. Narvik is 167 m. N.W. of Gellivara, and 982 N. by W. of Stockholm by the railway.

NARWHAL, a cetacean (*Monodon monoceros*), characterized by the presence in the male of a long horn-like tusk. In the adult of both sexes there are only two teeth, both in the upper jaw, which lie horizontally side by side, and in the female remain throughout life concealed in cavities of the bone. In the male the right tooth usually remains similarly concealed, but the left is immensely developed, attaining a length equal to nearly that of the entire animal. It projects forwards from the head in the form of a cylindrical or slightly tapering, pointed tusk, composed of ivory, with a central cavity reaching almost to the apex, without enamel, and with the surface marked by grooves and ridges running in a left-handed spiral. Occasionally both left and right tusks are developed. In young animals several small additional teeth are present, but these generally disappear soon after birth.

The head is short and rounded; the fore limbs or paddles are small and broad, and (as in the Beluga) a dorsal fin is wanting. The general colour is dark grey variously marbled and spotted with grey.

The narwhal is an Arctic whale rarely seen south of 65° N. lat. Like most cetaceans it is gregarious and usually met with in "schools" of 15 or 20 individuals. Its food appears to be cuttlefishes, small fishes and crustaceans. The purpose served by the tusk is uncertain. The narwhal is extremely playful, individuals frequently elevating their tusks and crossing them with each other as in fencing. They have never been known to charge and pierce the bottom of ships with their weapons as the swordfish does. The ivory of the tusk is of good quality, but owing to the central cavity, only fitted for the manufacture of objects of small size. The entire tusks are sometimes used for decorative purposes. (*See* CETACEA.)

NASCIMENTO, FRANCISCO MANOEL DE (1734–1819), Portuguese poet, known as Filinto Elysio, his "Arcadian" name, though he was never a member of the Arcadia and later was a leader of the revolt against it, was born in Lisbon, the son of a lighterman. As a boy he acquired an extensive knowledge

of national literature and folklore, the foundation of his rich Portuguese vocabulary and of a deep and enduring patriotism. He was ordained priest in 1754, and became treasurer of the Chagas church in Lisbon. Nascimento was soon the centre of a literary group which opposed the ruling group of the Arcadia, and fought for the recognition of Camoens as the greatest of Portuguese poets. But in June 1778 an order was issued by the inquisition for the arrest of Nascimento on the ground of heterodoxy and the reading of "modern philosophers who follow natural reason." He escaped to a French ship in the harbour, found his way to Havre and then to Paris, where he spent the rest of his life, with the exception of five years in the house of the Portuguese ambassador at The Hague. Lamartine addressed an ode to him; he enjoyed the esteem of Chateaubriand; and his admirers at home, who imitated him extensively, were called after him *Os Filintistas*. Exile and suffering had enlarged his ideas and given him a sense of reality, making his best poems those he wrote between the ages of 70 and 85, and when he died it was recognized that Portugal had lost her foremost contemporary poet.

Garrett declared that Nascimento was worth an academy in himself by his knowledge of the language, adding that no poet since Camoens had rendered it such valuable services; but his truest title to fame is that he brought literature once more into touch with the life of the nation. By his life, as by his works, Nascimento links the 18th and 19th centuries, the Neo-Classical period with Romanticism. Wieland's *Oberon* and Chateaubriand's *Martyrs* opened a new world to him, and his *contos* or scenes of Portuguese life have a real romantic flavour; they are the most natural of his compositions, though his noble patriotic odes—those "To Neptune speaking to the Portuguese" and "To the liberty and independence of the United States"—are the most quoted and admired. On leaving Portugal, he abandoned the use of rhyme as cramping freedom of thought and expression; nevertheless, his highly-polished verses are generally robust to hardness and overdone with archaisms.

BIBLIOGRAPHY.—The most useful edition of his collected works is that in 22 vols., 1830–40. *See* Innocencio da Silva, *Diccionario bibliographico Portuguez*, ii. 446–457 and ix. 332–336; also Pereira da Silva, *Filinto Elysio e a sua Epoca* (Rio, 1891); and Dr. Theophilo Braga, *Filinto Elysio* (Oporto, 1891).

NASEBY, a village of Northamptonshire, England, 7m. S.S.W. of Market Harborough, famous as the scene of the battle of June 14, 1645, which decided the issue of the first Civil War (*see* GREAT REBELLION). The army of King Charles I. was less than 10,000 strong, while the "New Model" army of the parliament, commanded by Sir Thomas Fairfax, numbered some 13,000. Yet it was not without considerable hopes of victory that the Royalists drew up for battle, for although Lieutenant-General Cromwell had made the New Model cavalry formidable indeed, the Royalist foot had become professionalized in several years of war, whereas the Parliamentarian foot was newly organized, and in part at least but half-trained. Fairfax and Cromwell, however, were still more confident, and with better reason. The battlefield lies between Naseby and Sibbertoft (3m. N. of Naseby) and is an undulating ridge which, near the centre of England, forms the "divide" between the Avon and the Welland rivers. Across this ridge the two armies were drawn up, the New Model facing north and the king's army south, the horse on the flanks and the foot in the centre of each army.

At the first shock the Royal foot asserted its superiority over the opposing infantry, four out of five regiments in the first line were broken, and Skippon, the major-general of the foot, was wounded. But Fairfax's regiment held its ground, until the second line of infantry advanced and re-established the front. Meantime the Royalist right wing of horse, led by Prince Rupert, had completely routed the horse of Colonel Ireton which opposed them. But the victors as usual indulged in a disorderly pursuit, and attempted to overpower the baggage guard of the enemy near Naseby village. Their incoherent attack was repulsed, and when Rupert, gathering as many of his men as he could, returned to the battlefield, the decisive stroke had been delivered by Cromwell and the right wing of Parliamentary horse. In front of him, in somewhat broken ground, was Sir Marmaduke Langdale's cavalry, which the lieutenant-general with his own well-trained regiments scattered after a short, fierce encounter. Cromwell's "godly" troopers did not scatter in pursuit. A few squadrons were ordered to keep the fugitives on the run, and with the rest, and such of Ireton's broken troops as he could gather, Cromwell attacked the Royalist centre in rear while Fairfax and his foot pressed it in front. Gradually the Royalist infantry, inferior in numbers, was disintegrated into small groups, which surrendered one after the other. But one brigade, called the "Bluecoats," held out to the last, and was finally broken by a combined charge of Fairfax's regiment of foot, led by Cromwell, and the general's personal escort, led by Fairfax himself, who captured a colour with his own hand. The remnant of the king's army, re-formed by Rupert, stood inactive and irresolute while its infantry was being destroyed and then fled. The spoils included 100 standards and colours and the king's private papers. But more important than trophies was the practical annihilation of the last field army of which the king disposed. Half the Royalists were captured, and about 1,000 fell in the battle and the pursuit which followed it. In addition all the artillery and the muskets (to the number of 8,000) and ammunition without which the king could scarcely create a new army, fell into the hands of the victors.

NASH, PAUL (1889-), British painter, was born in London on May 11, 1889, and educated at St. Paul's School and at the Slade School. His first exhibition was given in 1911, but he was comparatively little known until an exhibition of his western front war pictures (1918), the fruit of his work as an official artist 1917–18; several of these are in the Imperial War Museum, London. He then attracted attention as a landscape painter of individuality and charm, a somewhat mannered technique giving way gradually to a freer expression; he gave an important exhibition in London in 1924. He also produced some interesting woodcuts and book illustrations, such as the wood engravings, "Genesis" (1924). He was instructor of design at the Royal College of Art, South Kensington.

NASH, RICHARD (1674–1762), English dandy, better known as "Beau Nash," was born at Swansea on Oct. 18, 1674. He was educated at Carmarthen grammar school and at Jesus college, Oxford. He obtained a commission in the army, which however, he soon exchanged for the study of law at the Temple. Here among "wits and men of pleasure" he came to be accepted as an authority in regard to dress, manners and style. When the members of the Inns of Court entertained William III. after his accession, Nash conducted the pageant at the Middle Temple. He was offered knighthood, but he declined the honour, unless accompanied by a pension. The pension was not given and Nash turned gamester. In 1705 he succeeded Captain Webster as master of the ceremonies at Bath. Under his régime Bath became the leading fashionable watering-place. He drew up a new code of rules for the regulation of balls and assemblies, abolished the habit of wearing swords in places of public amusement and brought duelling into disrepute, induced gentlemen to adopt shoes and stockings in parades and assemblies instead of boots, reduced refractory chairmen to submission and civility, and introduced a tariff for lodgings. Through his exertions a handsome assembly-room was also erected, and the streets and public buildings were greatly improved. Nash adopted an outward state corresponding to his nominal dignity. He wore an immense white hat as a sign of office, and a dress adorned with rich embroidery, and drove in a chariot with six greys, laced lackeys and French horns. When the act of parliament against gambling was passed in 1745, he was deprived of an easy though uncertain means of subsistence, but the corporation afterwards granted him a pension of six score guineas a year, which, with the sale of his snuff-boxes and other trinkets, enabled him to support a certain faded splendour till his death on Feb. 3, 1762. He was honoured with a public funeral at the expense of the town. He was a man of strong personality, and considerably more able than Beau Brummel, whose prototype he was.

See Oliver Goldsmith, *Life of Richard Nash* (1762); Lewis Melville, *Bath under Beau Nash* (1908), with full list of authorities.

NASHE (or NASH), **THOMAS** (1567–1601), English poet, playwright and pamphleteer, was born at Lowestoft in 1567. His father belonged to a Herefordshire family, and is vaguely described as a "minister." Nashe spent 6 years, 1582–1588, at St. John's College, Cambridge, taking his B.A. degree in 1586. On leaving the university he tried, like Greene and Marlowe, to make his living in London by literature. It is probable that his first effort was *The Anatomie of Absurditie* (1588) which was perhaps written at Cambridge, although he refers to it as a forthcoming publication in his preface to Greene's *Menaphon* (1589). In this preface, addressed to the gentlemen students of both universities, he makes boisterous ridicule of the bombast of Thomas Kyd and the English hexameters of Richard Stanihurst, but does not forget the praise of many good books. Nashe was really a journalist born out of due time; he boasts of writing "as fast as his hand could trot"; he had a brilliant and picturesque style which, he was careful to explain, was entirely original; and in addition to his keen sense of the ridiculous he had an abundance of miscellaneous learning.

As there was no market for his gifts he fared no better than the other university wits who were trying to live by letters. But he found an opening for his ready wit and keen sarcasm in the famous Martin Marprelate controversy. His share in this war of pamphlets cannot now be accurately determined, but he has been credited, on doubtful evidence, with the following: *A Countercuffe given to Martin Junior* (1589), *Martins Months Minde* (1589), *The Returne of the renowned Cavaliero Pasquill and his Meeting with Marforius* (1589), *The First Parte of Pasquils Apologie* (1590), and *An Almond for a Parrat* (1590). He edited an unauthorized edition of Sidney's poems in 1591, and *A Wonderfull Astrologicall Prognostication,* in ridicule of the almanac-makers, by "Adam Fouleweather," which appeared in the same year, has been attributed to him. *Pierce Penilesse, His Supplication to the Divell,* published in 1592, shows us his power as a humorous critic of national manners, and tells incidentally how hard he found it to live by the pen. It seems to Pierce a monstrous thing that brainless drudges wax fat while "the seven liberal sciences and a good leg will scarce get a scholar bread and cheese."

In this pamphlet, too, Nashe began his attacks upon the Harveys by assailing Richard, who had written contemptuously of his preface to Greene's *Menaphon.* Greene died in September 1592, and Richard's brother, Gabriel Harvey, at once attacked his memory in his *Foure Letters,* at the same time adversely criticizing *Pierce Penilesse.* Nashe replied, both for Greene and for himself, in *Strange Newes of the intercepting certaine Letters,* better known, from the running title, as *Foure Letters Confuted* (1592), in which all the Harveys are violently attacked. The autumn of 1592 Nashe seems to have spent at or near Croydon, where he wrote his satirical masque of *Summers Last Will and Testament* at a safe distance from London and the plague. He afterwards lived for some months in the Isle of Wight under the patronage of Sir George Carey, the governor. In 1593 he wrote *Christs Teares over Jerusalem,* in the first edition of which he made friendly overtures to Gabriel Harvey. These were, however, in a second edition, published in the following year, replaced by a new attack, and two years later appeared the most violent of his tracts against Harvey, *Have with you to Saffron-walden, or, Gabriell Harveys Hunt is up* (1596). In 1599 the controversy was suppressed by the archbishop of Canterbury.

After Marlowe's death Nashe prepared his friend's unfinished tragedy of *Dido* (1596) for the stage. In the next year he was in trouble for a play, now lost, called *The Isle of Dogs,* for only part of which, however, he seems to have been responsible. The "seditious and slanderous matter" contained in this play induced the authorities to close for a time the theatre at which it had been performed, and Ben Jonson (*q.v.*) and others were imprisoned. Apparently Nashe escaped. Besides his pamphlets and his play-writing, Nashe turned his energies to novel-writing. He may be regarded as the pioneer in the English novel of adventure. He published in 1594 *The Unfortunate Traveller, Or the Life of Jack Wilton,* the history of an ingenious page who was present at the siege of Térouenne, and afterwards travelled in Italy with the earl of Surrey. It tells the story of the earl and Fair Geraldine, describes a tournament held by Surrey at Florence, and relates the adventures of Wilton and his mistress Diamante at Rome after the earl's return to England. The detailed, realistic manner in which Nashe relates his improbable fiction resembles that of Defoe.

His last work is entitled *Lenten Stuffe* (1599) and is nominally "in praise of the red herring," but really a description of Yarmouth, to which place he had retired after the trouble over *The Isle of Dogs.* Nashe's death is referred to in Thomas Dekker's *Knight's Conjuring* (1607), a kind of sequel to *Pierce Penilesse.* He is there represented as joining his boon companions in the Elysian fields "still haunted with the sharp and satirical spirit that followed him here upon earth." Had his patrons understood their duty, he would not, he said, have shortened his days by keeping company with pickled herrings. The date of his death is fixed by an elegy on him printed in Fitzgeffrey's *Affaniae* (1601).

The works of Thomas Nashe were edited by Dr. A. B. Grosart in 1883–85, and by Ronald B. McKerrow (1904–1910). *See* also *English Novel in the Time of Shakespeare,* by J. J. Jusserand (Eng. trans., 1890); and F. G. Harman, *Gabriel Harvey and Thomas Nashe* (Ouseley, 1923).

NASHUA, a city of southern New Hampshire, U.S.A., on the Merrimack river at the mouth of the Nashua, 15 m. S. of Manchester and 40 m. N.W. of Boston; one of the county seats of Hillsboro county. It is on Federal highway 3, and is served by several divisions of the Boston and Maine railroad. Pop. (1920) 28,379 (31% foreign-born white, including 4,385 French-Canadians and 1,067 Greeks). Nashua is beautifully situated in an amphitheatre of hills and mountains. There is abundant water-power, and the city has extensive manufactures (notably of cotton goods, paper, asbestos shingles and refrigerators) with an output in 1925 valued at $44,541,707. A U.S. fish hatchery is near by. A settlement known as Indian Head was established here in 1665. In 1803 it was incorporated as the village of Nashua, and in 1836 the town of Dunstable (in which it was situated) took the same name. The town of Nashville was set off from the town of Nashua in 1842, but the two were reunited in 1853 under a city charter.

NASHVILLE, the capital city of Tennessee, U.S.A., a port of entry, and the county seat of Davidson county; on the Cumberland river in the north-central part of the State. It is on Federal highways 31, 41 and 70; has a municipal airport; and is served by the Louisville and Nashville, the Nashville, Chattanooga and St. Louis and the Tennessee Central railways, motor-bus lines and river packets. Pop. 118,342 in 1920 (30% negroes and 98% native-born); estimated locally at 147,000 in 1928, with an additional 30,000 in the adjacent suburbs. The city covers 21½ sq.m., on hills and bluffs averaging 500 ft. above sea-level, in a vast undulating elliptical valley of 5,450 square miles. The surrounding country is a blue-grass region of great fertility. Within 25 m. of the city practically everything is raised that is needed for food and clothing, and most of the necessities of life are manufactured. Seven bridges cross the river. On the highest hill stands the State House, a fine example of pure Greek architecture, with a cupola 205 ft. high. The tomb of President Polk is in the capitol grounds, and 11 m. east of the city is "The Hermitage," the beautiful plantation home of President Jackson. In Centennial park, where the Tennessee Centennial Exposition was held in 1897, is a copy of the Parthenon. Mt. Olivet cemetery contains a beautiful monument to the Confederate soldiers, surrounded by 2,000 of their graves, and north of the city is a National cemetery where 16,862 Federal soldiers are buried. A memorial to the soldiers and sailors of the World War (covering two blocks and containing a large auditorium) was erected by the city, the county and the State, at a cost of $2,600,000. The Tennessee State fair is held at Nashville annually, and many of the State institutions are situated here, including the Confederate Soldiers' Home, the Industrial school, the school for the blind, the Middle Tennessee hospital for the insane, the penitentiary, and the Training and Agricultural school for boys. The public parks cover 2,100 ac.; the hotels have 1,500 guest-rooms; there are 257 churches, includ-

ing a Roman Catholic cathedral, 36 public schools and 40 under private auspices. The city's assessed valuation for 1928 was $169,623,822. Since 1913 it has operated under a commission form of government.

Nashville is one of the foremost educational centres in the South. Vanderbilt university (founded in 1873 by Commodore Vanderbilt, who contributed $1,000,000 towards its funds, and whose son and grandsons have given over $2,000,000) has grounds and buildings valued at $5,652,724, productive funds of $10,000,000 and an enrolment (1927–28) of 1,401. Its medical school has been housed since 1925 in a well equipped and comprehensive plant, built with grants from the General Education Board and the Carnegie Corporation and earlier gifts from Andrew Carnegie. The George Peabody college for Teachers (opened as a normal school in 1875) has an endowment of $4,133,000 and an enrolment (1928) of 3,858. Fisk university (for negroes), founded in 1865 by the American Missionary Association and the Western Freedmen's Aid Commission, has buildings and grounds valued at $500,000, endowment funds of nearly $300,000, and an annual enrolment of about 700. The Fisk Jubilee Singers, sent out first in 1871 to raise money for a dormitory for women, have sung in most of the large cities of America and Europe. Nashville is the seat also of the Agricultural and Industrial State college and the Meharry Medical college (both for negroes).

Among the most important manufacturing industries are printing and publishing (especially of religious periodicals and books), coffee-roasting, and the manufacture of stoves and furnaces, hardwood flooring, fertilizers, cloth and paper bags, boots and shoes, self-raising flour, furniture, knit goods, building materials, wooden and paper boxes, work garments, shirts, soft collars, women's dresses and underwear, brick, mattresses, tobacco and snuff, steel barges, feather pillows, chewing gum and clinical thermometers. Two of the railroads have shops here, employing together over 3,000 persons. The factory output in 1928 was valued at $100,000,000. Nashville is the seat of a branch of the Federal Reserve Bank. Bank debits in 1927 aggregated $1,090,140,000.

History.—In Nov. 1779, James Robertson and eight companions, who had set out in February from the Watauga settlements in eastern Tennessee to establish an "advance guard of civilization" in the rich central basin, arrived at the spot where Nashville now stands, and decided to make it the site of the new settlement. They were joined a few months later by their wives and children and other pioneers, under Col. John Donelson. The town (called Nashborough until its incorporation in 1784) was named after either Abner Nash, then governor of North Carolina, or his brother Francis, a Revolutionary general, killed at Germantown. In 1806 it was chartered as a city. From 1812 (except from 1815 to 1826) the legislature met at Nashville, and in 1843 it was made the State capital. On June 3, 1850, it was the scene of the Southern, or Nashville, Convention, attended by 100 delegates from nine States, which denounced the Wilmot Proviso and (at an adjourned meeting in November) expressed disapproval of the Compromise Measures and asserted the right of the South to secede. For the battle of Nashville (1864) *see* below. During the World War the Government established the Old Hickory Powder plant in the wilderness across the river, constructing large factory buildings and a village to accommodate 30,000 persons. (X.)

BATTLE OF NASHVILLE

During the Civil War Nashville was captured by the Federals (Feb. '62) after the fall of Fort Donelson and remained in their hands till the end. The battle of Nashville was fought (Dec. 15–16, '64) between a Federal army under G. H. Thomas and *Hood's* Army of Tennessee, and resulted in the complete overthrow of the Confederates. *Hood* had reached the Tennessee at Tuscumbia at the end of October, but waited there three weeks to accumulate a stock of supplies and enable *Forrest's* cavalry to join him. This delay proved fatal to his chance of capturing Nashville, before Thomas, whom Sherman had left to meet *Hood's* invasion whilst he himself "marched to sea," could concentrate sufficient forces for its defence. Thomas had under his command two corps and about 5,000 cavalry under Wilson, in addition to the local garrisons dispersed along the lines of communication from Chattanooga to the Ohio. Until a third corps under A. J. Smith reached him from Missouri (Nov. 30), he can hardly be said to have had a field army at all. *Hood* intended, after capturing Nashville, to invade Kentucky and carry the war to the Ohio. He even contemplated the possibility of marching through the Cumberland mountains to *Lee's* help and attacking Grant. He advanced from the Tennessee (Nov. 21) and endeavoured to outflank Schofield, whom Thomas had placed at Pulaski, 80 m. from Nashville, with the IV. Corps and one division of the XXIII., and about 4,000 cavalry to retard *Hood's* advance, and cut him off from Columbia, where the Nashville railway crossed the Duck river. But Cox's division, by a forced march, saved Columbia from capture by *Forrest*. Wishing to preserve the railway bridge for use when the Federals should take the offensive, Schofield, who had been reinforced by two more infantry brigades, tried to hold on to the south bank, but *Forrest* crossed with his cavalry above the town (Nov. 28), and driving Wilson's mounted troops away from the Franklin road, opened the way for *Hood's* infantry to cut off Schofield's retreat. Next day seven Confederate divisions crossed the river and advanced towards Spring Hill, 11 m. in Schofield's rear, where only a single division was covering the movement of the Federal trains. *Hood* here lost the greatest opportunity offered to any general in the war. He allowed Schofield to escape and make good his retreat to Franklin, on the Harpeth. Schofield was obliged to make another stand there to get his trains across the river. *Hood* made a furious and ill-prepared assault on the strong Federal position late in the afternoon (Nov. 30). The battle raged till 9 P.M., when *Hood* called off his troops, which had suffered terrible losses, and Schofield reached Nashville next day. *Hood's* last chance of conducting a successful offensive was gone, but he continued to follow Schofield and appeared before Nashville (Dec. 2). He believed that retreat would be more demoralizing to his troops than an honourable defeat, and the trans-Mississippi reinforcements promised by the President might yet arrive. Thomas was almost ready to take the offensive. Besides Smith's corps he had just received Steedman's "provisional division" from Chattanooga. He could now put into the field a force probably double the size of *Hood's*. But he needed a few more days in order to remount his large cavalry force, which was intended to play a decisive part in *Hood's* annihilation. Grant grew impatient at the delay. He had expected Thomas to stop *Hood* south of the Duck river, but *Hood* had reached the Cumberland. He bombarded Thomas with telegrams, demanding an immediate attack. Just as Thomas was ready, a storm of freezing rain came on, which covered the ground with a sheet of ice and prevented military operations till a thaw came. Grant ordered (Dec. 9) that Thomas should be superseded by Schofield; suspended the order the same day; ordered (Dec. 13) Logan to Nashville to take command, unless Thomas had moved in the meantime; finally, set out himself to Washington (Dec. 15), intending to go on to Nashville. But the thaw came (Dec. 14) and Thomas attacked next day.

Hood's line ran from the Chattanooga railway on the right across the Franklin and Granny White turnpikes to the Hillsboro' road. His left was sharply refused, extending 1,000 yards behind a stone wall alongside that road. He had thrown up some redoubts on detached hills beyond his left, and established a strong skirmish line along his front, terminating on Montgomery hill, close to the Hillsboro' road. But the line was too long to be held by his attenuated force, and his left was very much "in the air." Having detached *Forrest* with two cavalry divisions to raid the Chattanooga railway, he had but one division left to watch the wide gap between his left and the river. Thomas's plan of battle was to make a grand left wheel with his right wing, consisting of Wilson's 12,000 cavalry, fighting dismounted, and Smith's corps, which should outflank and crush the enemy left, whilst Steedman's division held their right fast by a vigorous demonstration. The IV. Corps under Wood was to storm Montgomery hill and press in upon the Confederate salient on the Hillsboro' road. Schofield's corps was at first held in reserve,

but was finally thrown in between Wilson's and Smith's corps. Had not the Federal advance been delayed by fog in the early morning, *Hood* would probably have been completely defeated on the 15th. His whole left wing was driven back in great confusion to the Granny White turnpike. Darkness stopped the pursuit, but *Hood*, who dared not retreat because *Forrest* could not rejoin for at least 24 hours, during the night formed a fresh and much shorter line 2 m. further back, each flank resting upon a hill. *Cheatham's* corps was shifted from the right to the left, which again was sharply bent back just beyond the Granny White turnpike, and extended to the Brentwood hills along a line of lesser heights. *S. D. Lee's*, which had scarcely fired a shot the previous day, held the right, and *A. P. Stewart's*, after its heavy defeat, was placed in the centre. But again Wilson's dismounted troopers, fighting their way through the smaller hills, turned the Confederate left, and getting into its rear attacked from behind, whilst Schofield and Smith assaulted its front. Under this double pressure *Cheatham's* corps broke and with its flight *Hood's* resistance collapsed, although earlier in the day an attack by Wood and Steedman on the right had been handsomely repulsed. His army fled down the Franklin turnpike, the only line of retreat left. But two brigades, which retained their organization, and *Chalmers's* cavalry division held the Brentwood hill's passes long enough to enable the larger part of *Hood's* army to escape. The Federals took up the pursuit next day, hoping to intercept the flying enemy on the Duck river, but *Forrest*, who rejoined *Hood* at Columbia, organized a rearguard with his cavalry and eight infantry brigades under *Walthall*, and covered the retreat to the Tennessee, which was recrossed (Dec. 27). Thomas's fighting force at Nashville numbered between 50,000 and 55,000 men; his casualties were just over 3,000. *Hood* estimated his own force at 23,000, but this is almost certainly an understatement; some authorities put it as high as 39,000. He made no return of his casualties, but stated that they were "very small." But Thomas captured nearly 4,500 prisoners in the battle itself, and many more were taken during the ten days' pursuit.

(W. B. Wo.)

NASI, JOSEPH (16th century), Jewish statesman and financier, was born in Portugal of a Jewish (Marano) family. Emigrating from his native land, he founded a banking house in Antwerp. Despite his financial and social prosperity there, he felt it irksome to be compelled to wear the guise of Catholicism, and determined to settle in a Mohammedan land. After two troubled years in Venice, Nasi betook himself to Constantinople. Here he proclaimed his Judaism, and married his beautiful cousin Reyna. He rapidly rose to favour, the sultans Suleiman and Selim promoting him to high office. He founded a Jewish colony at Tiberias which was to be an asylum for the Jews of the Roman Campagna. In 1566 when Selim ascended the throne, Nasi was made duke of Naxos. He had deserved well of Turkey, for he had conquered Cyprus for the sultan. Nasi's influence was so great that foreign powers often negotiated through him for concessions which they sought from the sultan. Thus the emperor of Germany, Maximilian II., entered into direct correspondence with Nasi; William of Orange, Sigismund August II., king of Poland, also conferred with him on political questions of moment. On the death of Selim in 1574, Nasi receded from his political position, but retained his wealth and offices, and passed the rest of his life at Belvedere (Constantinople). He died in 1579.

See Graetz, *History of the Jews* (Eng. trans.), vol. iv. chs. xvi.–xvii.; *Jewish Encyclopedia*, ix. 172. (I. A.)

NASIK, a town and district of British India, in the central division of Bombay. The town is on the Godavari river, connected by a tramway (6 m.) with Nasik Road railway station, 107 m. N.E. of Bombay. Pop. (1921) 38,230. It is a very holy place of Hindu pilgrimage, being 18 m. from the source of the Godavari, and a large number of Brahman priests live here. Shrines and temples line the river banks, and in the vicinity there are a number of sacred caves, among which those of Pandu Lena are the most noteworthy. They are ancient Buddhist caves dating from the 3rd century before Christ to the 6th century after, with numerous inscriptions of the highest historical value. Nasik has manufactures of brass and copper ware, and there is a government distillery at Nasik Road.

The District of Nasik has an area of 5,877 sq.m. With the exception of a few villages in the west, the whole district is situated on a tableland from 1,300 to 2,000 ft. above sea-level. The western portion is hilly, and intersected by ravines. The eastern tract is open, fertile and well cultivated. The Sahyadri range stretches from north to south; the watershed is formed by the Chander range, which runs east and west. All the streams to the south of that range are tributaries of the Godavari. To the north of the watershed, the Girna and its tributary the Mosam flow through fertile valleys into the Tapti. The Girna Left Bank Canal, irrigating some 4,000 acres, was opened in 1909. It contains several old hill forts, the scenes of many engagements during the Mahratta wars. Nasik district became British territory in 1818 on the overthrow of the peshwa. The population in 1921 was 832,576. The principal crops are millet, wheat, pulse, oil-seeds and cotton and fine grapes and vegetables are grown. There is a trade in copper and brass ware, and sugar cane. There are railway workshops at Igatpuri. At Sharanpur is a Christian village, with an orphanage of the Church Missionary Society. The district is crossed by the main line of the Great Indian Peninsula railway.

NASMYTH, ALEXANDER (1758–1840), Scottish portrait and landscape painter, was born in Edinburgh on Sept. 9, 1758. He studied at the Trustees' Academy under Runciman, and became apprenticed as heraldic painter to a coach-builder. At the age of 16 he attracted the attention of Allan Ramsay, who took him to London, and employed him upon the subordinate portions of his works. Nasmyth returned to Edinburgh in 1778, and was soon largely patronized as a portrait painter. He also assisted Mr. Miller of Dalswinton, as draughtsman, in his mechanical researches and experiments; and through his generosity was able to go to Italy, where he remained two years. On his return he painted the portrait of Burns, now in the Scottish National Gallery and well known through Walker's engraving. Nasmyth's pronounced Liberal opinions gave offence to many of his aristocratic patrons, and led to the diminution of his practice as a portraitist. In his later years, accordingly, he worked mainly at landscapes, and occasionally at scene-painting. He has been styled the "father of Scottish landscape art." His subjects are carefully finished and coloured, but are wanting in boldness and freedom.

Nasmyth was also largely employed by noblemen throughout the country in the improving and beautifying of their estates, in which his fine taste rendered him especially skilful. As an architect, he is known for his designs for the Dean Bridge, Edinburgh, and the graceful circular temple covering St. Bernard's Well. Nasmyth died in Edinburgh on April 10, 1840. His youngest son, James, was the well-known inventor of the steam-hammer. His eldest son, Patrick (1787–1831), became a clever landscapist.

For an account of the Nasmyth family *see* James Nasmyth's *Autobiography* (1883).

NASMYTH, JAMES (1808–1890), Scottish engineer, inventor of the steam-hammer, was born in Edinburgh on Aug. 19, 1808, and was the youngest son of Alexander Nasmyth, the "father of Scottish landscape art." He started business in Manchester on his own account in 1834, and in a few years he was at the head of the prosperous Bridgewater foundry at Patricroft, from which he was able to retire in 1856 with a fortune. The invention of the steam-hammer, with which his name is associated, was actually made in 1839, a drawing of the device appearing in his note-book, or "scheme-book," as he called it, with the date Nov. 24 of that year. It was designed to meet the difficulty experienced by the builders of the "Great Britain" steamship in finding a firm that would undertake to forge the large paddle-wheel shaft required for that vessel, but no machine of the kind was constructed till 1842. In that year Nasmyth discovered one in Schneiders' Creuzot works, and he found that the design was his own and had been copied from his "scheme-book." Apparently, however, he was anticipated in the idea by James Watt. Nasmyth did much for the improvement of machine-tools, and his inventive genius devised many new appliances—a planing-machine ("Nasmyth steam-arm"), a nut-shaping machine, steam pile-driver, hydraulic machinery for various purposes, etc. On his retirement

he lived at Penshurst in Kent, and amused himself with the study of astronomy, and especially of the moon, on which he published a work, *The Moon considered as a Planet, a World and a Satellite,* in conjunction with James Carpenter in 1874. He died in London on May 7, 1890.

His *Autobiography* (edit. Samuel Smiles) was published in 1883.

NASR-ED-DIN [NÁṢIRU'D-DIN] (1829–1896), shah of Persia, was born on April 4, 1829. His mother, a capable princess of the Kajar family, persuaded Shah Mohammed, his father, to appoint him heir apparent, in preference to his elder brothers; and he was accordingly made governor of Azerbaijan. His succession to the throne, Oct. 13, 1848, was vigorously disputed, especially by the followers of the reformer El Bab, upon whom he wreaked terrible vengeance. In 1855 he reestablished friendly relations with France, and coming under the influence of Russia, signed a treaty of amity on Dec. 17 with that power, but remained neutral during the Crimean War. In 1856 he seized Herat, but a British army under Outram landed in the Persian gulf, defeated his forces and compelled him to evacuate the territory. The treaty of peace was signed at Paris, on March 4, 1857, and to the end of his reign he treated Great Britain and Russia with equal friendship. In 1866 the shah authorized the passage of the telegraph to India through his dominions and reminted his currency in the European fashion. In 1873, and again in 1889, he visited England in the course of his three sumptuous journeys to Europe, 1873, 1878, 1889.

The only results of his contact with Western civilization appear to have been the proclamation of religious toleration, the institution of a postal service, accession to the postal union and the establishment of a bank. He gave the monopoly of tobacco to a private company, but was soon compelled to withdraw it in deference to the resistance of his subjects. Abstemious in habits, and devoted to music and poetry, he was a cultured, able and well-meaning ruler, and his reign, already unusually long for an Eastern potentate, might have lasted still longer had it not been for the unpopular sale of the tobacco monopoly, which was probably a factor in his assassination at Teheran on May 1, 1896, by a member of the Babi faction. He was succeeded by his son Muzaffar-ed-din.

NASRIDES, THE, of Granada, were the last of the Mohammedan dynasties in Spain. They ruled from 1232 to 1492. The dynasty was of remote Arabic origin, but its immediate source was the mountain range of the Alpujarra, and the founder was Yusuf (or Yahia) I'Nasr, a chief who was engaged in conflict with the family of Beni-Hud, once kings at Saragossa, who held the fortress of Granada. Yusuf's nephew (or son) Mohammed completed the defeat of the Beni-Hud largely by the help of the king of Castile, to whom he did homage and paid tribute. From Mohammed I., called el Ghalib, *i.e.,* the Conqueror (1238–73), to Mohammed XI., called Boabdil, and also the little king "El Rey Chico" by the Christians, who lost Granada in 1492, there are counted 29 reigns of the Nasrides, giving an average of nine years. But there was not the same number of sultans, for several of them were expelled and restored two or three times. There were also contemporary reigns in different parts, and tribal or local rivalries between plain and hill, and the chief towns, Granada, Malaga and Guadix. The dissensions of the Nasrides reached their greatest pitch of fury during the very years in which the Catholic sovereigns were conquering their territory piecemeal, 1482–92.

See M. Lafuente Alcantara, *Historia de Granada* (Granada, 1884); S. Lane-Poole, *The Mohammedan Dynasties* (1894).

NASSAU, a territory of Germany, now forming the bulk of the government district of Wiesbaden, in the Prussian province of Hesse-Nassau, but until 1866 an independent and sovereign duchy of Germany. It consists of a territory, 1,830 sq.m. in area, divided into two nearly equal parts by the river Lahn and bounded on the south and west by the Main and Rhine, on the north by Westphalia and on the east by Hesse. The southern half is almost entirely occupied by the Taunus mts., while to the north of the Lahn is the barren Westerwald. The valleys and low-lying districts, especially the Rheingau, are very fertile, producing abundance of grain, flax, hemp and fruit; but by far the most valuable product of the soil is its wine. Nassau is one of the most thickly wooded regions in Germany, and its forests yield good timber and harbour large quantities of game while the rivers abound in fish. There are upwards of a hundred mineral springs in the district; the best known are those of Wiesbaden and Ems. Other mineral wealth of Nassau includes iron, lead, copper, building stone, coals, slate, a little silver and a bed of malachite. Manufactures are unimportant, but brisk trade is carried on by rail and river in wine, timber, grain and fruit. There are few places of importance besides the above-named spas; Höchst is the only manufacturing town. Wiesbaden is the capital of the government district as it was of the duchy.

History.—During the Roman period the whole of the district of Nassau was occupied by the Mattiaci and later by the Alamanni. The latter were subdued by the Franks under Clovis at the end of the 5th century, and at the partition of Verdun in 843 the country became part of the East Frankish or German kingdom. Christianity seems to have been introduced in the 4th century. The founder of the house of Nassau is usually regarded as a certain Drutwin (d. 1076), who built a castle on a hill overlooking the Lahn, near the present town of Nassau. Drutwin's descendant Walram (d. 1198) took the title of count of Nassau, and placed his lands under the immediate suzerainty of the German king; previously he had been a vassal of the archbishop of Trier. Then in 1255 Walram's grandsons, Walram and Otto, divided between them their paternal inheritance, which had been steadily increasing in size. Walram took the part of Nassau lying on the left bank of the Lahn and made Weisbaden his residence; Otto took the part on the right bank of the river and his capital was Siegen. The brothers thus founded the two branches of the house of Nassau.

The fortunes of the Ottonian, or younger line, belong mainly to the history of the Netherlands. William the Silent, the best known of this line, and his descendants were called princes of Orange-Nassau, and this line became extinct when the English king William III. died in 1702. The descendants of Count John, his brother, remained rulers of Nassau until 1806, when the reigning prince, William VI., was deprived of his lands because he refused to join the Confederation of the Rhine. Some of them were given in 1815 to the other main line of the family, the one descended from Count Walram. In 1815 William VI. became king of the Netherlands as William I., and was compensated for this loss by the grant of parts of Luxemburg and the title of grand-duke. When in 1890 William's male line died out Luxemburg, like Nassau, passed to the descendants of Count Walram. In the female line he is now represented by the queen of the Netherlands.

The territories possessed by the other branch of the house of Nassau were partitioned several times, and only in 1816 was the whole of Nassau united under the rule of Frederick William of Nassau-Weilburg as duke of Nassau. In 1866 Duke Adolph espoused the cause of Austria, sent his troops into the field, and asked the landtag for money. This was refused; Adolph was soon a fugitive before the Prussian troops, and on Oct. 3, 1866, Nassau was formally incorporated with the kingdom of Prussia.

For the history of Nassau *see* Hennes, *Geschichte der Grafen von Nassau bis 1255* (Cologne, 1843); von Schütz, *Geschichte des Herzogtums Nassau* (Wiesbaden, 1853); von Witzleben, *Genealogie und Geschichte der Fürstenhauses Nassau* (Stuttgart, 1855); F. W. T. Schliephake and K. Menzel, *Geschichte von Nassau* (Wiesbaden, 1865–89); the *Codex diplomaticus nassoicus,* ed. K. Menzel and W. Sauer (1885–87); and the *Annalen des Vereins für nassauische Altertumskunde und Geschichtsforschung* (1827 f.).

NAST, THOMAS (1840–1902), American caricaturist, was born on Sept. 27, 1840, in Landau, Germany. His mother took him to New York in 1846. He studied art there with Theodore Kaufmann and at the school of the National Academy of Design. At the age of 15 he became a draughtsman for *Frank Leslie's Illustrated Newspaper;* three years later for *Harper's Weekly.* In 1860 he went to England for the *New York Illustrated News* and soon afterwards joined Garibaldi in Italy as artist for *The Illustrated London News.* His first serious work was the cartoon "Peace" in 1862, directed against those in the North who opposed the prosecution of the Civil War. This and his other car-

toons during the Civil War and Reconstruction days were published in *Harper's Weekly;* they attracted great attention, and Nast was called by President Lincoln "our best recruiting sergeant." Even more able were Nast's cartoons against the Tweed Ring conspiracy in New York city, his caricature of Tweed being the means of the latter's identification and arrest at Vigo. He had been an ardent Republican in his earlier years; but his advocacy of civil service reform and his distrust of Blaine forced him to become a Mugwump and in 1884 an open supporter of the Democratic Party, from which in 1892 he returned to the Republican Party. He had lost practically all of his earnings by the failure of Grant and Ward, and in May, 1902, was appointed consul general at Guayaquil, Ecuador, where he died on Dec. 7, in the same year. He did some painting in oil and some book illustrations, but his fame rests on his caricatures and political cartoons. Nast introduced the donkey to typify the Democratic Party, the elephant to typify the Republican Party, and the tiger to typify Tammany Hall.

See A. B. Paine, *Thomas Nast, his Period and his Pictures* (1904).

NASTURTIUM or **INDIAN CRESS,** *Tropaeolum majus,* a perennial climber, native of Peru, but in cultivation treated as a hardy annual. It climbs by means of the long stalk of the peltate leaf which is sensitive to contact like a tendril. The irregular flowers have five sepals united at the base, the dorsal one produced into a spur; of the five petals the two upper are slightly different and stand rather apart from the lower three; the eight stamens are unequal and the pistil consists of three carpels which form a fleshy fruit. The flowers are sometimes eaten in salads, and the leaves and young green fruits are pickled in vinegar as a substitute for capers.

The dwarf form known as Tom Thumb (*T. m. nanum*), is an excellent bedding or border flower, growing about a foot high. Other fine annual tropaeolums are *T. Lobbianum* with long spurred orange flowers and numerous varieties; and *T. minus,* a kind of miniature *T. majus* with yellow, scarlet and crimson varieties.

The genus *Tropaeolum* (family Tropaeolaceae), native to South America and Mexico, includes about 50 species of generally climbing annual and perennial herbs with orange, yellow, rarely purple or blue, irregular flowers; *A. peregrinum* is the well-known canary creeper. The flame nasturtium with brilliant scarlet blossoms is *T. speciosum* from Chile; it has tuberous roots, as have also such well-known perennials as *T. polyphyllum, T. pentaphyllum.* The *Nasturtium* of botanists is a genus of plants of the family Cruciferae; *N. officinale* is the water-cress.

NATAL, a province of the Union of South Africa, is bounded by the Indian ocean, by the Umtamvuna and Umzimkulu rivers, which divide it from the Griqualand East division of Cape Colony, by the Drakensberg, which separates it from Basutoland, the Orange Free State, and part of the Transvaal, and by the Pongola river, the Lebombo range, and, for a short distance, a line of latitude, which mark it off from the Transvaal, Swaziland and Portuguese East Africa. Natal, in this extended and official sense, includes Zululand and Amatongaland. The northern boundary of Natal proper for part of the way is the Tugela. The sea board from the mouth of the Umtamvuna to the mouth of the Tugela is 166 m., and from the Tugela to the Portuguese border near Ore Point, 210 miles. Its total area is 35,284 sq.m., or 7·47% of the Union, while it carries a little over 20% of the Union's population. The area of Natal proper is 24,910 sq. miles.

Geologically, the country consists of a monoclinal fold affecting Karroo rocks. Along the axis, which runs more or less north and south, these have been eroded and the underlying rocks of the Swaziland system (granite, schists, etc.) have been exposed along a fairly continuous belt, which can be followed from a point, 5 or 6 m. inland from Port Shipstone, through Inchanga, the Valley of a Thousand Hills, and on into Zululand, where their area broadens out. A great part of the country is formed of horizontal, or gently inclined shales and sandstones, among which numerous sills of dolerite are intercalated. Erosion, attacking these beds, has produced a distinctly terraced topography. The hills are often steep-sided and flat-topped.

Conventially, three zones are distinguished: (*a*) the Coast belt below 1,000 ft., which is about 20 m. wide behind Durban, and which narrows southward, and widens considerably when followed northward and into Zululand. (*b*) The Midlands, between 2,000 and 4,000 feet. (*c*) The Highlands from 4,000 ft. to the foot of the Drakensberg. This classification is over simplified, but may serve as a rough indication of the build of the country. The rivers, owing to rejuvenation, have cut deep valleys in their lower courses, with the result that the topography of the coast belt and part of the midlands is very broken. In their middle, and in part of their upper courses, the rivers flow in broad, open valleys. Owing to their high average gradient, and the numerous waterfalls, due to the outcropping of hard beds of sandstone and dolerite, and also to their low winter level, they are all unnavigable, except for stretches of 3 or 4 m. at the mouths of the Umkomaas and Umzimkulu. The dominant topographical feature is the great barrier of the Drakensberg (*q.v.*), which rises to over 10,000 ft., and from which several secondary ranges run out toward the coast. The Lebombo range, in the north runs from north to south, and is caused by the outcrop of resistant lavas. Rivers, such as the Usutu and the Pongola cut across this escarpment in great "poorts."

Climate and Vegetation.—These are described under UNION OF SOUTH AFRICA. Owing to the range of altitude from sea-level to 5,000 or 6,000 ft. at the foot of the Drakensberg, there is a wide range of climate, which is further complicated by the varied topography. Always, however, the sub-tropical coast belt stands out as a distinct natural region, with its humid heat, small temperature ranges and its sub-tropical vegetation and production. Inland, the winter drought becomes more clearly marked and frosts more frequent and severe during the winter nights. The chief rain-bearing wind is from the south-west. A very characteristic feature of the Natal climate is the "hot winds," which are usually most frequent in spring and summer. They appear to be due to the flow of air being drawn toward depressions passing southward along the coast. They blow from the north-west and are heated by compression as they descend the escarpments. The temperature often rises above 90° and the relative humidity may fall to 30. A hot wind may blow for a few hours, or for two or three days. It causes great clouds of dust, and all doors and windows in the houses have to be closed. Usually these winds change suddenly, or are replaced by a cool, moist wind from the south-west, which often brings greatly appreciated rain, or sometimes, in the higher districts, snow.

In addition to the trees, shrubs and grasses, described elsewhere, mention may be made of the flowers, which are often beautiful. Some of these, like the red bush lily, grow in the shade of the patches of bush. Others are more tolerant of light, and are to be found in the open. Among these are the fire lily, which blooms in the early spring before the grasses have grown beyond a few inches, the agapanthus, the arum lily along the streams, the gladioli, etc. A very common grassland flower, and one that blooms late, when the grasses are tall, is the leonotis, which attains a height of 5 or 6 ft., and has terra-cotta to orange-coloured flowers. Many a hillside in early spring is enlivened by the flowers of the aloes, in various shades of red. The delightfully rich crimson of the Kafir boom blossoms is peculiarly characteristic of much of Natal.

Fauna.—(*See* also UNION OF SOUTH AFRICA.) Some of the smaller buck have increased of late years, owing to the cover afforded them by the large wattle plantations. Jackals are undesirably numerous in some of the upland districts, and they often destroy many lambs. Otters occur in some of the rivers. Snakes are common. The chief sporting birds are the quail, partridge and guinea fowl. About 450 sq.m. of country have been set aside as game reserves, in which no animals may be killed at any time. There are several such reserves, one near Giants' Castle, to protect the surviving eland, and one on the Mkusi, in Zululand, where the inyala (buck) still survives, as well as impala, the Zululand suni, etc. Reserves have been established in the Klip River and the Umgeni districts. In addition, several animals and birds have been declared royal game, and cannot be shot

or captured. They include the white, or square-lipped, rhinoceros, which is still found in Zululand, the elephant, female eland, the impala, inyala, roan antelope, springbok, sassaby; crested crane, Stanley crane, etc.

Population.—The natives (*see* AMAZULU, KAFIRS, etc.) numbered (1921) 1,139,804, and constituted nearly 80% of the total population. About half of them live under tribal conditions on locations, which are saturated with population, under present conditions of skill and methods of exploitation. The other half live on farms, owned by Europeans, on Crown lands, or in the towns. In 1921 the Asiatic population numbered 141,649. It is largely concentrated in the coastal belt. Originally imported as indentured labourers for the sugar plantations, many of these Indians have become small market gardeners, or have taken employment in hotels and domestic service or industry, where they supply much of the unskilled and semi-skilled labour. The British elements constitute the majority of the white population, English predominating. The "northern districts," Utrecht and Vryheid, however, are chiefly Dutch in population, language and religion. In recent years the percentage of Dutch to the total population has probably increased, owing to the considerable numbers employed in the Government services, such as railways, police, etc. There is a definite German group, centred about New Hanover, and retaining its own language. Scandinavian settlers about the Umzimkulu, and in Durban, especially connected with the whaling industry, contribute a very valuable element to the population. There is also an appreciable French element, which originally migrated to Natal, largely from Mauritius, in connection with the sugar industry, though it is no longer confined to that industry. The number of "coloured" people in Natal is quite small, the "mixed and others" in 1921 numbering about 11,000.

Towns.—Apart from Pietermaritzburg, the capital, and Durban (*q.v.*), the only port and the largest centre, the towns of Natal are quite small. Only four, in addition to the two just mentioned, have a white population of over 2,000. They are: Ladysmith, whites (1926) 3,547; total (1921) 6,783, which is now a railway centre of some importance; Glencoe, whites (1926) 2,927; total (1921), 1,212, including 552 whites, a railway junction, and near the coal fields; Vryheid, whites (1926) 2,842; total (1921) 4,019; and Newcastle, whites (1926) 2,355; total (1921) 5,767. The last two towns are also near coal mines, and Newcastle is developing an iron and steel industry.

Communications.—Railway construction has been greatly handicapped by the varied topography. The main line from Durban to the Transvaal climbs to 1,808 ft. at Krautzkloof (23 m.), 3,006 ft. at Thornville Junction (61 m.), drops to 2,218 at Pietermaritzburg (73 m.), rises to 3,702 at Hilton Road (84 m.), to 4,807 at Nottingham Road (116 m.), drops to 3,280 ft. at Colenso (185 m.), and rises again to 5,429 ft. at Volksrust, just over the Transvaal border, and to 5,520 at Van Reenens, just within the Orange Free State. From the main system a line runs from Durban along the coast southward to Port Shepstone, and northward as far as the Pongola in Zululand to serve the sugar cane area. From Pietermaritzburg a line with two short branches has been constructed to Krantzkop through the wattle belt. Another runs south westward across the grain of the country to open up East Griqualand; from Glencoe Junction a line, running through Dundee and Vryheid, carries large quantities of coal. There are a few other smaller lines, which can be seen on a map. As in other parts of the world, the railways are feeling the effect of motor competition along some stretches. The journey by road from Pietermaritzburg to Durban is shorter and quicker than by rail.

Agriculture.—The coast belt is sharply marked off from the rest of the country. It produces sugar, bananas, pineapples, citrus fruit, etc. Practically all the cane grown is of the Uba variety. In 1926 there were 231,967 ac. under this crop, and the production of sugar for the year 1925–26, was 239,851 tons (*i.e.*, of 2,000 lb.). The industry now satisfies the requirements of the South African market, and has a surplus for export. Among the by-products are molasses, used for cattle feeding, and also exported, motor spirit, produced from the molasses, methylated spirits, ether and wax. Rather more than 3,000 ac. in the Kearsney-Stanger area are devoted to tea growing. In 1925–26 the production of green leaf was 4,000,000 lb., of manufactured tea 852,799 lb. The industry shows little sign of growing. The rest of Natal is devoted to mixed farming, with increasing stress being laid on dairying. Maize thrives particularly well in the Midlands, but little of this grain is exported, because it is often sold by the white farmers to the natives, whose own food production is insufficient. Between 2,000 and 6,000 ft. the Australian black wattle is grown, especially in the mist belts along the escarpments. From the bark an extract is made which is used in tanning. The poles supply the mines with pit props, and the towns with much of their domestic fuel. There is a wattle belt, fairly well defined in the midlands of Natal, through the middle of which runs the Richmond-Pietermaritzburg-Greytown-Krantzkop railway. The wattle plantations cover 220,000 ac., and in 1926 the quantity of bark exported from the country was over 90,000 tons, Great Britain, Belgium, Germany and Japan being the chief customers. Wattle extract is also exported. Cotton growing appears to have passed the experimental stage. It is being grown in some of the northern and eastern districts of Natal and in Zululand. In 1925–26, 41,000 ac. were being cultivated for this crop. The growing of tobacco has been stimulated by the introduction of a preferential tariff for Empire tobacco in Great Britain in 1925.



BY COURTESY OF E. G. MORSE

'RICKSHA "BOY" OF DURBAN, NATAL

The chief mineral produced in the country is coal. Many of the deposits have been metamorphosed by the intrusion of dolerite, but large quantities are available for exploitation. The chief coalfield is in the Klip River and Newcastle districts, centring about Dundee. Mines are also active in the Vryheid and Utrecht districts. The expense of the long railway journey to the coast, on the average about 240 m., is partially counterbalanced by the nearness of the coal to the surface. In 1926 the output was over five million tons. At Waschbank the following by-products are being produced: tar, sulphate of ammonia, light creosote oil and naphtha. Tar is also being made.

Education.—For higher education *see* UNION OF SOUTH AFRICA. The direction of public education, other than higher education, rests with the Provincial Education Department, subject to the control of the provincial administration. At its head is the superintendent of education. The department has direct management of primary and of some secondary schools, and makes grants to various private schools, which maintain the same standard as the Government schools. Fees are charged for pupils in the secondary schools. Special schools are provided for native, coloured and Indian children. Attendance is compulsory for children between 7 and 15, who live within the three-mile limit. A Government training college for teachers is situated in Pietermaritzburg. In the latter city there is also a technical institute, and in Durban a technical college. In addition to the Government schools, there are several good schools in the province, both for boys and girls, which are modelled on the English public school. An agricultural college, connected with a Government experimental farm, was opened in 1906 at Cedara, 14 m. from Pietermaritzburg.

To meet some of the requirements of the non-European population, there were, in 1925, 492 State and State-aided schools for natives, 52 for Asiatics, and 22 for other non-Europeans. These were attended by 31,247 natives, 8,520 Asiatics and 2,025 coloured pupils. (*See* also UNION OF SOUTH AFRICA.) (R. U. S.)

HISTORY

Vasco da Gama on his voyage to India sighted the bluff at the entrance to the bay now forming the harbour of Durban on Christmas Day 1497 and named the country Terra Natalis. Da Gama made no landing here and, like the rest of South Africa, Natal was neglected by the Portuguese, whose nearest settlement was at Delagoa bay. The first detailed accounts of the country were received from mariners. In 1684 an English ship put into Port Natal (as the bay came to be known) and purchased ivory from the natives, who, however, refused to deal in slaves. In May 1685 another English ship the "Good Hope" was wrecked in crossing the bar at Port Natal and in Feb. 1686 the "Stavenisse," a Dutch East Indiaman, was wrecked a little farther south. Survivors of both vessels lived for nearly a year at Port Natal and there built a boat in which they made the voyage to Cape Town in twelve days. They brought with them three tons of ivory. This fact and their reports of the immense herds of elephants which roamed the bush led Simon van der Stell, then governor at Cape Town to despatch (1689) the ship "Noord" to Port Natal, with instructions to her commander to open up a trade in ivory and to acquire possession of the bay. The bay was "purchased" from the chief of the Amatuli tribe, for about £50 worth of goods. No settlement was then made and in 1705 the son of the chief repudiated the bargain. In 1721 the Cape Government did form a settlement at the bay, but it was soon afterwards abandoned. Thereafter for nearly a hundred years Natal was again neglected by white men.

From the records of the 17th and 18th centuries it is apparent that the people then inhabiting Natal were Bantu-negroes of the Kafir (Ama Xosa) branch. The most numerous and most powerful tribe appeared to be the Abambo, while the Amatuli occupied a considerable part of the coast-land. These Kafirs seem to have been more given to agriculture and more peaceful than their neighbours in Caffraria and Cape Colony. But the quiet of the country was destroyed by the inroads of Chaka, the chief of the Zulus (*see* ZULULAND). Chaka between 1818 and 1820 ravaged the whole of what is now known as Natal, and after beating his foes in battle, butchered the women, children and old men, incorporating the young men in his impis. The population was greatly reduced and large areas left without a single inhabitant. By right of conquest Chaka became undisputed master of the country.

First British Settlement.—Such was the situation when the first British settlement was made in Natal, Cape Colony having passed meanwhile from Dutch to British possession. In 1823 Francis George Farewell, formerly a lieutenant in the British navy, with other merchants of Cape Town, formed a company to trade with the natives of the south-east coast. In the brig "Salisbury," commanded by James S. King, who had been a midshipman in the navy, Farewell visited Port Natal, St. Lucia and Delagoa Bays. He was so impressed with the possibilities of Natal both for trade and colonization that he resolved to establish himself at the port. He went thither with ten companions, among them Henry Francis Fynn. All the rest save Farewell and Fynn speedily repented of their adventure and returned to the Cape, but the two who remained were joined by three sailors, John Cane, Henry Ogle and Thomas Holstead, a lad. Farewell, Fynn and others went to the royal kraal of Chaka, and, having cured him of a wound and made him various presents, obtained a document, dated Aug. 7, 1824, ceding to "F. G. Farewell and company entire and full possession in perpetuity" of a tract of land including "the port or harbour of Natal." On the 27th of the same month Farewell hoisted the Union Jack at the port and declared the territory he had acquired a British possession. In 1825 he was joined by King, who had meantime visited England and had obtained from the Government a letter of recommendation to Lord Charles Somerset, governor of the Cape, granting King permission to settle at Natal. Farewell, King and Fynn made independent settlements at various parts of the bay, where a few Amatuli still lingered. They lived, practically, as Kafir chiefs, trading with Chaka and gathering round them many refugees from that monarch's tyranny. Early in 1828 King, accompanied by two of Chaka's indunas, voyaged in the "Elizabeth and Susan," a small schooner built by the settlers, to Port Elizabeth. He appears to have been coldly received by the authorities. Soon after his return to Natal King died, and in the same month (Sept. 1828) Chaka was murdered by his brother Dingaan. In the December following Farewell went in the "Elizabeth and Susan" to Port Elizabeth. On this occasion the authorities confiscated the schooner on the ground that it was unregistered and that it came from a foreign port. Farewell was not daunted, and in Sept. 1829 set out to return overland to Port Natal. He was, however, murdered in Pondoland by a chief who was at enmity with the Zulus. Fynn thus became leader of the whites at the port, Dingaan declaring him to be his representative and "great chief of the Natal Kafirs." In 1834, however, Fynn accepted a post under the Cape government and did not return to Natal for many years. It was in this year that a petition from Cape Town merchants asking for the creation of a British colony at Natal was met by the statement that the Cape finances would not permit the establishment of a new dependency.

The next step was taken by the settlers at the port, who in 1835 resolved to lay out a town, which they named Durban, after Sir Benjamin d'Urban, then governor of Cape Colony. The settlers, who numbered about 50, sent a memorial to the governor calling attention to the fact that they were acknowledged rulers over a large tract of territory south of the Tugela, and asking that this territory should be proclaimed a British colony under the name of Victoria and that a governor and council be appointed. To all these requests no official answer was returned. The settlers had been joined in the year named (1835) by Captain Gardiner, a naval officer, whose chief object was the evangelization of the natives. With the support of the traders he founded a mission station in the hills (which he named Berea) overlooking the bay. In 1837 Gardiner was given authority by the British Government to exercise jurisdiction over the traders. They, however, refused to acknowledge Gardiner's authority, and from the Cape government he received no support.[1] It was not until their hand was forced by the occupation of the interior by Dutch farmers that the Cape authorities at length intervened.

The Dutch and Dingaan.—The British settlers had, characteristically, reached Natal mainly by way of the sea; the new tide of immigration was by land—the *voortrekkers* streamed through the passes of the Drakenberg, bringing with them their wives and children and vast herds of cattle. The reasons which caused the exodus from the Cape are discussed elsewhere (*see* SOUTH AFRICA, UNION OF, and CAPE COLONY); here it is only necessary to point out that those emigrants who entered Natal shared with those who settled elsewhere an intense desire to be free from British control. The first emigrant Boers to enter the country were led by Pieter Retief (*c.* 1780–1838), a man of Huguenot descent and of marked ability, who had suffered severely in the Kafir wars. Passing through the almost deserted upper regions Retief arrived at the bay in Oct. 1837. He went thence to Dingaan's kraal with the object of securing a formal cession of territory to the Dutch farmers. Dingaan consented on condition that the Boers recovered for him certain cattle stolen by another chief; this task Retief accomplished, and with the help of the Rev. F. Owen, an Anglican missionary then living at Dingaan's kraal, a deed of cession was drawn up in English and signed by Dingaan and Retief on Feb. 4, 1838. Two days after the signature of the deed Retief and all of his party, 66 whites, besides Hottentot servants, were treacherously murdered by Dingaan's orders. The Zulu king then commanded his impis to kill all the Boers who had entered Natal. The Zulu forces crossed the Tugela the same day, and the most advanced parties of the Boers were massacred, many at a spot near where the town of Weenen now stands, its name (meaning wailing or weeping) commemorating the event. In one week after the murder of Retief

[1] Captain Allen Francis Gardiner (1794–1851) left Natal in 1838, subsequently devoting himself to missionary work in South America, being known as the missionary to Patagonia. He died of starvation in Tierra del Fuego.

600 Boers—men, women and children—had been killed by the Zulus. The English settlers at the bay with a following of some 700 natives, made an attempt to aid the Boers, but in a fight on April 7 they were overwhelmed and only four Europeans escaped to the bay.

After the Zulus retired, fewer than a dozen Englishmen returned to live at the port; the missionaries, hunters and other traders went back to the Cape. Meanwhile the Boers, who had repelled the Zulu attacks on their laagers, had been joined by others from the Drakenberg, and about 400 men under Hendrik Potgieter and Piet Uys advanced to attack Dingaan. On April 11, however, they fell into a trap and with difficulty cut their way out. Among those slain were Piet Uys and his son Dirk, aged 15, who rode by his side. Towards the end of the year the Boers received reinforcements, and in December 460 men set out under Andries Pretorius to avenge themselves on the Zulus. On Sunday Dec. 16 (1838) while laagered near the Umslatos river, they were attacked by over 10,000 Zulus. The Boers had firearms, the Zulus their assegais only, and after a three hours' fight the Zulus were totally defeated, losing thousands killed, while the farmers' casualties were under a dozen. (This memorable victory is annually commemorated by the Boers as Dingaan's Day, while the Umslatos, which ran red with the blood of the slain, was renamed Blood river.) Dingaan fled, the victorious Boers entered the royal kraal, gave decent burial to the skeletons of Retief and his party, and regarded themselves as now undisputed masters of Natal.

Returning south, Pretorius and his commando were surprised to learn that Port Natal had been occupied on Dec. 4 by a detachment of the 72nd Highlanders. In sanctioning the occupation of the port the British Government of the day had no intention of making Natal a British colony, but wished to prevent the Boers establishing an independent republic upon the coast with the possibility of complications with other European powers. After remaining at the port just over a year the Highlanders were withdrawn, on Christmas Eve 1839. Meanwhile the Boers had founded Pietermaritzburg and made it the seat of their volksraad. They rendered their power in Natal absolute, for the time, in the following month, when they joined with Panda, Dingaan's brother, in another attack on the Zulu king. Dingaan was utterly defeated and soon afterwards perished, Panda becoming king in his stead by favour of the Boers.

Had the affairs of the Boer community been managed with prudence and sagacity they might have established an enduring state. But their impatience of control, reflected in the form of government adopted, led to disastrous consequences. Legislative power was vested, nominally, in the volksraad (consisting of 24 members), while the president and executive were changed every three months. But whenever any measure of importance was to be decided a meeting was called of *het publiek*, that is, of all who chose to attend, to sanction or reject it and, naturally enough, the result was a condition of anarchy. While such was the domestic state of affairs the settlers cherished large territorial views. They had declared themselves an independent state under the title of "the republic of Port Natal and adjacent countries" (commonly called the republic of Natalia or Natal), and sought (Sept. 1840) from Sir George Napier at the Cape an acknowledgment of their independence by Great Britain. Sir George, being without definite instructions from England, could at first give no decisive answer. Having at length received an intimation from London that the queen "could not acknowledge the independence of her own subjects, but that the trade of the emigrant farmers would be placed on the same footing as that of any other British settlement, upon their receiving a military force to exclude the interference with or possession of the country by any other European power," Sir George communicated this decision to the volksraad in Sept. 1841. The Boers, who strongly resented the contention of the British that they could not shake off British nationality though beyond the bounds of any recognized British possession, after very brief consideration firmly rejected Napier's overtures.

An incident which happened at this time greatly encouraged the Boers to persist in their opposition. In March 1842 a Dutch vessel sent out by G. G. Ohrig, an Amsterdam merchant who sympathized warmly with the cause of the emigrant farmers, reached Port Natal, and its supercargo, J. A. Smellekamp (a man who subsequently played a part in the early history of the Transvaal and Orange Free State), without any authority, concluded a treaty with the volksraad assuring them of the protection of Holland. The Natal Boers were firmly persuaded that Holland would aid them in resisting Great Britain.

Dick King's Ride.—On May 4 following Captain T. C. Smith with a force of 263 men who, at Sir George Napier's orders had marched overland from Cape Colony, reached Durban without opposition, and encamped at the base of the Berea hills. The Boers, cut off from their port, called out a commando of some 300 to 400 men under Andries Pretorius and gathered at Congella at the head of the bay. After repulsing an attack on their camp the Boers captured the harbour and settlement, and on May 31 blockaded the British camp. Meanwhile an old Durban resident, Richard (commonly called Dick) King, had undertaken to convey tidings of the perilous position of the British force to the commandant at Graham's Town. He started on the night of the 24th, and escaping the Boer outposts rode through the dense bush and across the bridgeless rivers of Caffraria at peril of his life from hostile natives and wild beasts, and in nine days reached his destination—a distance of nearly 600m. by the route to be followed. This remarkable ride was accomplished with one change of mount, obtained from a missionary in Pondoland. A comparatively strong force under Colonel A. J. Cloete was at once sent by sea to Port Natal, and on June 26 Captain Smith was relieved. Within a fortnight Colonel Cloete had received the submission of the volksraad at Pietermaritzburg. The burghers represented that they were under the protection of Holland, but this plea was peremptorily rejected by the commander of the British forces.

The British Government of the day, the second Peel administration, held that the establishment of a colony in Natal would be attended with little prospect of advantage, but in deference to the strongly urged views of Sir George Napier, Lord Stanley (Secretary of State for the Colonies), in a despatch of Dec. 13, received in Cape Town on April 23, 1843, consented to its annexation. The institutions adopted were to be as far as possible in accordance with the wishes of the people, but it was a fundamental condition "that there should not be in the eye of the law any distinction or disqualification whatever, founded on mere difference of colour, origin, language or creed"—a condition not kept in later years. Sir George then appointed Henry Cloete (a brother of Col. Cloete) as special commissioner to explain to the Natal volksraad the decision of the government. Cloete whose task was one of great difficulty and delicacy behaved with the utmost tact and on Aug. 8, 1843, the Natal volksraad unanimously agreed to the terms proposed by Lord Stanley. Many of the Boers who would not acknowledge British rule trekked once more over the mountains into what are now the Orange Free State and Transvaal provinces. At the end of 1843 there were not more than 500 Dutch families left in Natal.

A BRITISH COLONY

Although proclaimed a British colony in 1843, and in 1844 declared a part of Cape Colony, it was not until the end of 1845 that an effective administration was installed with Martin West as lieutenant-governor, and the power of the volksraad finally came to an end. In that year the external trade of Natal, almost entirely with Cape Colony, was of the total value of £42,000—of which £32,000 represented imported goods.

The new administration found it hard to please the Dutch farmers, who among other grievances resented what they considered the undue favour shown to the natives, whose numbers had been greatly augmented by the flight of refugees from Panda. The natives were settled in 1846 in locations and placed under the general supervision of Sir (then Mr.) Theophilus Shepstone (*q.v.*). Sir Harry Smith, newly appointed governor of the Cape, met, on the banks of the upper Tugela, a body of farmers preparing to recross the Drakensberg—which had been fixed as the

northern frontier—and by remedying their grievances induced many of them to remain in Natal. By the migration of the others the whites were again considerably reduced, but the Boers who remained were contented and loyal, and through the arrival of 4,500 emigrants from England in the years 1848–1851 and by subsequent immigration from oversea the colony became overwhelmingly British in character.

From the time of the coming of the first considerable body of British settlers dates the development of trade and agriculture in the colony, followed somewhat later by the exploitation of the mineral resources of the country. At the same time schools were established and various churches began or increased their work in the colony. Dr. Colenso, appointed bishop of Natal, arrived in 1854. In 1856 the dependence of the country on Cape Colony was put to an end and Natal constituted a distinct colony with a legislative council of 16 members, 12 elected by the inhabitants and four nominated by the crown. At the time the white population exceeded 8,000. While dependent on the Cape, ordinances had been passed establishing Roman-Dutch law as the law of Natal, and save where modified by legislation it remained in force.

Indian Coolies Introduced.—The British settlers soon realized that the coast lands were suited to the cultivation of tropical or semi-tropical products, and from 1852 onward sugar, coffee, cotton and arrow-root were introduced, tea being afterwards substituted for coffee. The sugar industry soon became of importance, and the planters were compelled to seek for large numbers of labourers. The natives, at ease in their locations, did not volunteer in sufficient numbers, and recourse was had to coolie labour from India. The first coolies reached Natal in 1860. They came under indentures, but at the expiration of their contract were allowed to settle in the colony. Up to 1869 some 5,000 Indians had come to Natal. Immigration then ceased but was resumed in 1874. This bringing in of Indians proved one of the most momentous steps taken in the history of South Africa, for the Indian population rapidly increased, the "free" Indians becoming market gardeners, farmers, hawkers, traders, and in time serious competitors of the whites. But in 1860 and for many years afterwards these consequences were not foreseen, and alone among the South African states Natal offered a welcome to Asiatics.

In 1867 R. W. Keate (1814–73) became lieut.-governor, a post which he filled until 1872. His administration is notable, not so much for internal affairs but because he twice acted as arbitrator in disputes in which the Boer states were involved. In a dispute between the Transvaal and the Orange Free State he decided (Feb. 1870) that the Klip river and not the upper Vaal was the frontier stream. A more famous decision, that known as the Keate Award, was given in Oct. 1871. It concerned the south-western frontiers of the Transvaal, and the award, which was against the Transvaal pretensions, had important effects on the history of South Africa (*see* GRIQUALAND and TRANSVAAL).

During all this time little was done to alter the condition of the natives. There was scarcely an attempt to copy the policy, then followed in Cape Colony, of encouraging the education and civilization of the black man. Neither was Natal faced with the Cape problem of a large half-caste population. While the opportunity of educating and training a docile people was in the main neglected, savage abuse of power by their chiefs was prevented. Under the superintendence of Shepstone the original refugees were quiet and contented. This ideal lot, from the native point of view, drew such numbers of immigrants from disturbed districts that with the natural increase of population in 30 years the native inhabitants increased from about 100,000 to fully 350,000. New generations grew up almost as ignorant as their fathers, but not with the same sense of dependence upon the white men. In this way was sown the seed of future trouble between the two races. The first serious collision between the natives and the government occurred in 1873. The Amahlubi, one of the highest in rank of the Bantu tribes of South Africa, fleeing from the cruelties of Panda, had been located by the Natal government under their chief Langalibalele (*i.e.*, the great sun which shines and burns) in 1848 at the foot of the Drakenberg with the object of preventing the Bushmen who dwelt in the mountains plundering the upland farmers. Here the Amahlubi prospered, and after the diamond fields had been discovered many of the young men who had been to Kimberley brought back firearms. These Langalibalele refused to register, and entered into negotiations with several tribes with the object of organizing a general revolt. Prompt action by Sir Benjamin Pine, then lieut.-governor of the colony, together with help from the Cape and Basutoland, prevented the success of Langalibalele's plan, and his own tribe, numbering some 10,000 persons, was the only one which rebelled. The chief was captured, and exiled to Cape Colony (Aug. 1874). Permitted to return to Natal in 1886, he died in 1889.

The Colenso Affair.—Meantime the colony had weathered a severe commercial crisis brought on in 1865 through over-speculation and the neglect of agriculture, save along the coast belt. But the trade over berg largely developed on the discovery of the Kimberley diamond mines, and the progress of the country was greatly promoted by the substitution of the railway for the ox wagon as a means of transport. On Jan. 1, 1876, Sir Henry Bulwer, who had succeeded Wolseley as governor, turned the first sod of a new State-owned railway which was completed as far as Maritzburg in 1880. At this date the white inhabitants numbered about 20,000. But besides a commercial crisis the colony had been the scene of an ecclesiastical dispute which attracted widespread attention. Bishop Colenso (*q.v.*), condemned in 1863 on a charge of heresy, ignored the authority of the court of South African bishops and was maintained in his position by decision of the privy council in England. This led to a division among the Anglican community in the colony and the consecration in 1869 of a rival bishop, who took the title of bishop of Maritzburg. (Reunion of the Anglican body in Natal was effected in 1910.) Colenso's bold advocacy of the cause of the natives—which he maintained with vigour until his death (in 1883)—attracted almost equal attention. His native name was Usobantu (*father of the people*).

For some years Natal, in common with the other countries of South Africa, had suffered from the absence of anything resembling a strong government among the Boers of the Transvaal, neighbours of Natal on the north. The annexation of the Transvaal to Great Britain, effected by Sir Theophilus Shepstone in April 1877, would, it was hoped, put a period to the disorders in that country. But the new administration at Pretoria inherited many disputes with the Zulus, disputes which were in large measure the cause of the war of 1879. For years the Zulus had lived in amity with the Natalians, from whom they received substantial favours, and in 1872 Cetywayo (*q.v.*), on succeeding his father Panda, had given assurances of good behaviour. These promises were not kept for long, and by 1878 his attitude had become so hostile towards both the Natal and Transvaal governments that Sir Bartle Frere, then High Commissioner for South Africa, determined on his reduction. During the war (*see* ZULULAND) Natal was used as the British base, and the Natal volunteers rendered valuable service in the campaign, which, after opening with disasters to the British forces, ended in the breaking of the Zulu power.

Majuba.—Scarcely had the colony recovered from the shock of the Zulu War than it was involved in the uprising of the Transvaal Boers (1880–81). The Natalians were intensely British in sentiment, and resented deeply the policy adopted by the Gladstone administration. At Ingogo, Majuba and Laing's Nek, all of them situated within the colony, British forces had been defeated by the Boers; and the treaty of retrocession was regarded in Natal as an unworthy surrender of British rights. The Natalians nevertheless made up their minds to shape their policy in conformity with that settlement. It was not long before their patience was once more severely taxed. Transvaal Boers, taking advantage of the disputes among the petty Zulu chiefs set up by Sir Garnet Wolseley after the war of 1878–79, intervened (in 1883) and as a reward for the assistance they had rendered to one of the combatants, demanded and annexed 8,000 sq.m. of country, which they styled the "New Republic." This interference by the Transvaal in Zululand affairs gave great offence in Natal. The "New Republic," reduced in area, however, to fewer

than 2,000 sq.m., was nevertheless recognized by the British Government in 1886, and in 1888 its consent was given to the territory (the Vryheid district) being incorporated with the Transvaal. Meanwhile in 1887, the remainder of Zululand had been annexed to Great Britain (*see* ZULULAND).

Effect of Discovery of Gold.—In 1884 the discovery of gold in De Kaap Valley, and on Moodie's farm in the Transvaal, caused a considerable rush of colonists from Natal to that country. Natal not only sent her own colonists to the new fields, but also offered the nearest route for prospectors from Cape Colony or from Europe. Two years later the Rand goldfields were proclaimed, and the tide of trade which had already set in with the Transvaal steadily increased. In this year (1886) the railway reached Ladysmith, and in 1891 it was completed to the Transvaal frontier at Charlestown, the section from Ladysmith northward opening up the Dundee and Newcastle coalfields. Thus a new industry was added to the resources of the colony.

The demand which the growing trade made upon the one port of Natal, Durban, encouraged the colonists to redouble their efforts to improve their harbour.

Harbour works had been begun in 1857, but it was chiefly due to the energy of one of Natal's most distinguished sons, Harry Escombe, that Durban was transformed into a modern port. From 1881 to 1893 Escombe was chairman of the Harbour Board.

SELF-GOVERNMENT

For many years there had been an agitation among the colonists for self-government. In 1882 the colony was offered self-government coupled with the obligations of self-defence. The offer was declined, but in 1883 the legislative council was remodelled so as to consist of 23 elected and 7 nominated members. In 1890 the elections to the council led to the return of a majority in favour of accepting self-government, and in 1893 a bill in favour of the proposed change was passed and received the sanction of the imperial Government. At the time the white inhabitants numbered about 50,000. The electoral law was framed to prevent more than a very few Indians and natives obtaining the franchise. Sir John Robinson (1839–1903) who had gone to Natal in 1850, was a leading journalist in the colony and had been a member of the legislative council since 1863, became the first premier and colonial secretary, with Harry Escombe as attorney-general. The year that witnessed this change in the constitution was also notable for the death of Sir Theophilus Shepstone, Natal's most prominent citizen. Sir John Robinson remained premier until 1897, a year marked by the annexation of Zululand to Natal. In the following year Natal entered the Customs Union already existing between Cape Colony and the Orange Free State.

The Anglo-Boer War.—Natal watched with anxiety the increasing tension between the Transvaal and the Cape Colony, and its citizens suffered, equally with other *Uitlanders*, the disabilities imposed by the Pretoria government. As early as May 1899 the Natal ministry officially intimated its belief that the Transvaal would go to war, and while promising every support possible to the imperial Government, expressed anxiety for the defence of the frontier. On Oct. 11, 1899 war broke out, and Natal was invaded by the Boers. The story of the war is told elsewhere (*see* SOUTH AFRICAN WAR; SOUTH AFRICA, UNION OF). A small number of the Dutch colonists joined the enemy but there was no general rebellion among them and the promise that Natal would assist the imperial Government was amply redeemed.

One result of the war was an addition to the territory of Natal of a small part of the Transvaal, namely the district of Vryheid, the district of Utrecht and a portion of the district of Wakkerstroom. As to Vryheid, "in handing over this district to the administration which controls the rest of Zululand, his majesty's Government," wrote Joseph Chamberlain (then Secretary of State for the Colonies), under date March 1902, "feel that they are reuniting what ought never to have been separated." A claim by Natal to annex portions of the Harrismith and Vrede districts of the Free State was, however, disallowed. The districts which were added to Natal contained about 6,000 white inhabitants (mostly Dutch), and some 92,000 natives, and had an area of nearly 7,000 sq.m., so that this annexation meant an addition to the white population of Natal of about one-tenth, to her native population of about one-tenth also, and to her territory of about one-fourth. The territories were formally transferred to Natal in Jan. 1903.

Native Affairs: The 1906 Revolt.—The period following the war was succeeded by commercial depression. The Government met the crisis by renewed energy in harbour works, railway constructions and the development of the natural resources of the country. A railway to the Zululand coalfields was completed in 1903, and in the same year a line was opened to Vryheid in the newly annexed territories. In Aug. 1903 Sir Alfred Hime, who had been premier since June 1899 resigned and was succeeded by Mr. (afterwards Sir) George Sutton, the founder of the wattle industry in Natal and one of the pioneers in the coal-mining industry. In May 1905 Sir George Sutton was replaced by a coalition ministry under C. J. Smythe, while in 1906 Sir Ralph Moor became premier. These changes of ministry reflected, chiefly, differences concerning the treatment of commercial questions and the policy to be adopted towards the natives. Towards those Dutch colonists who had joined the enemy during the war leniency was shown, all rebels being pardoned. The attitude of the natives both in Natal proper and in Zululand caused much disquiet. The chief concern of the Natal government was to remodel their native policy where it proved inadequate. During 1903–04 a Native Affairs' commission, representative of all the South African states, had obtained much evidence on the status and conditions of the natives. Among its recommendations was the direct political representation of natives in the colonial legislatures on the New Zealand model, and the imposition of direct taxation upon natives. Carrying out this last recommendation Natal passed in 1905 an act imposing a poll-tax of £1 on all males over 18 in the colony, except indentured Indians and natives paying hut-tax (which was 14s. a year). Every European was bound to pay the tax. In 1906 a serious rebellion broke out in the colony, attributable ostensibly to the poll-tax, and spread to Zululand. An incident which marked the beginning of this rebellion brought the Natal ministry into sharp conflict with the imperial Government (the Campbell-Bannerman administration). Twelve natives were to be shot by order of a court martial for killing, at Byrnetown, two Europeans, who had been sent to enforce the collection of the poll-tax. On the day before that fixed for the execution Lord Elgin, then Secretary of State for the colonies, intervened and directed the governor to postpone the execution of the sentence. Thereupon the Natal ministry resigned, giving as their reason the importance of maintaining the authority of the colonial administration at a critical period, and the constitutional question involved in the interference by the imperial authorities in the domestic affairs of a self-governing colony. After a day's delay, during which the governor of Natal, Sir Henry McCallum, reiterated his concurrence, already made known in London, in the justice of the sentence passed on the natives, Lord Elgin gave way (March 30). The Natal ministry thereupon remained in office. The guilty natives were shot on April 2. It was at this time that Bambaata, a chief in the Greytown district who had been deposed for misconduct, kidnapped the regent appointed in his stead. He was pursued and escaped to Zululand, where he received considerable help. He was killed in battle in June, and by the close of July 1906 the rebellion was at an end. As has been stated, it was ostensibly attributable to the poll-tax, but the causes were more deep-seated. Though somewhat obscure they may be found in the growing sense of power and solidarity among all the Bantu tribes of South Africa. There were moreover special local causes such as undoubted defects in the Natal administration. (*See* Governor's despatch, June 21, 1906, printed in the Blue Book, Cd. 3247.) Many Natalians regarded Dinizulu, the son of Cetewayo, as the inciter of the rebellion and after a series of murders of whites in Zululand in 1907, and evidences of continued unrest among the natives the Natal Government itself became convinced that Dinizulu was implicated in a rebellious movement. A force under Sir Duncan McKenzie (who had suppressed the 1906 revolt) entered Zulu-

land. Thereupon Dinizulu surrendered (Dec. 1907) without opposition, and was removed to Maritzburg. He was eventually (1909) found guilty only on the minor charge of harbouring rebels.

The inter-colonial commission had dealt with the native question as it affected South Africa as a whole; it was felt that a more local investigation was needed, and in Aug. 1906 a strong commission was appointed to inquire into the condition of the Natal natives. The commission, whose report was published in Aug. 1907, declared that the chasm between the native and white races had been broadening for years and that the efforts of the administration to reconcile the Bantus to the changed conditions and to convert them into an element of strength had been ineffective. Among other proposals for a more liberal and sympathetic native policy the commission urged the creation of a native advisory board entrusted with very wide powers. "Personal rule," they declared, "supplies the keynote of successful native control" —a statement amply borne out by the influence over the natives exercised by Sir T. Shepstone. The unrest in Zululand delayed action being taken on the commission's report. But in 1909 an act was passed which placed native affairs in the hands of four district commissioners, gave to the minister for native affairs direct executive authority and created an advisory council for native affairs on which non-official members had seats.

Concurrently with the efforts to reorganize their native policy the colony also endeavoured to deal with the Asiatic question. The rapid growth of the Indian population from about 1890 caused much disquiet among the majority of the white inhabitants, who viewed with especial anxiety the activities of the "free," *i.e.*, unindentured Indians. Several acts had already been passed imposing restrictions upon Indians, and in 1908 a strong commission was appointed to inquire into the whole subject. This commission reported in 1909, its general conclusion being that in the interests of Natal the importation of indentured Indian labour should not be discontinued. For sugar, tea and wattle growing, farming, coal-mining and other industries indentured Indian labour appeared to be essential. Nothing further was done in Natal up to the establishment of the Union of South Africa, when all questions specially or differentially affecting Asiatics were withdrawn from the competence of the provincial authorities.

Union and After.—Not long after the conclusion of the war of 1899–1902 the close commercial relations between the Transvaal and Natal led to suggestions for a union of the two colonies, but these suggestions were not seriously entertained. The federation or union of all the colonies was a different and more reasonable measure; and this matter was formally reopened by the Cape ministry in 1906. The movement for union rapidly gained strength, and a national convention to consider the matter met in Durban in Oct. 1908. In Natal, especially among the older colonists, who feared that in a united South Africa Natal interests would be overborne, the proposals for union were met with suspicion and opposition, and the Natal ministry felt bound to submit the question to the people. A referendum act was passed in April 1909, and in June following the electors by 11,121 votes to 3,701 decided to join the Union. (*See* SOUTH AFRICA, UNION OF.) Meanwhile it was agreed by the Cape, Transvaal and Natal Governments that, subject to Natal entering the Union, its share of the Rand import trade should be 25% before and 30% after the establishment of the Union. Previously Natal had only 22½% of the traffic, and this agreement led to a revival in trade. The closing months of Natal's existence as a separate colony thus found her peaceful and prosperous. On the establishment of the Union on May 31, 1910, Natal entered it as an original province, Sir Ralph Moore, the premier, becoming a member of the first Union cabinet.

The change from the status of a self-governing colony to a province of the Union affected Natal politically more closely than any other province, since in it alone were the great majority of the white inhabitants of British descent. The firm attachment of Natalians to the British connection continued an unchanging factor in the South African situation. Provincial administration was, however, largely carried on upon non-party lines. An exception occurred in 1927 when not a single candidate opposed to the inclusion of the Union Jack in the national flag of the Union was returned to the provincial council. About 70% of the total expenditure of the council is on education. Sir George Plowman, who had filled the office of administrator with great ability since 1918 was succeeded as administrator in 1928 by H. Gordon Watson.

The Indian Problem.—Of the 161,339 British Indians in the Union in 1921, no fewer than 141,336 lived in Natal. Besides labourers, there were many Indians engaged in professions and commerce. White South Africans in general opposed the further increase of Asiatics in the Union; while, in 1911, the Indian Government, long dissatisfied with the attitude of Natal to Indians, prohibited the recruitment of indentured coolies. The Indians both in Natal and the Transvaal complained of many grievances, and their cause was championed by M. K. Gandhi, then resident in South Africa. Arising out of the agitation, riots and disturbances occurred in Natal in 1913. In 1914 the Union Government passed legislation intended to prevent Indian immigration into South Africa and to prevent Asiatics already in the Union leaving the province in which they lived. The Smuts-Gandhi agreement of that year was designed to guard the vested interests of Indians already in the Union. The attitude of the white inhabitants of Natal was shown by the borough ordinance passed by the provincial council in Jan. 1924, debarring Indians in future from acquiring the municipal franchise. This ordinance was held up by the Union Government for consideration, but in Dec. 1924, assent to its operation was given. The parliamentary franchise was, with few exceptions, already confined to whites. In 1925 there were 38,547 parliamentary electors, of whom only 24 were Indian. In 1927 an agreement on the Indian question was reached by the Union Government and the Government of India, which led to an amelioration of the condition of Indians in Natal.

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NATAL, a city and port of Brazil and capital of the State of Rio Grande do Norte, on the right bank of the Rio Potengy, or Rio Grande do Norte, about 2 m. above its mouth. The population of the municipality in 1920 was 30,696. Natal is the starting-point of the railway which extends on down the coast to Pernambuco and Maceió, and is a port of call for coastwise steamers, which usually anchor outside the bar. The harbour has been improved and the Brazilian government uses the port as a naval depot. The only industry of note is the manufacture of cotton, but the exports (chiefly sugar and cotton) are large. Natal was founded in 1597 as a military post to check an illicit trade in Brazil-wood. In 1633 it was occupied by the Dutch, who remained until 1654. It became the capital of a province in 1820.

NATCHEZ, a noted tribe of lower Mississippi river, near the present city of Natchez, who after massacring the French in their territory in 1729, were defeated by them, the remnants taking refuge with the Chickasaw, and later with the Creek and Cherokee. Allied in general culture to the Muskogian tribes (*q.v.*), they had developed a sun worship with a perpetual fire in a temple, and a caste division into "suns," nobles, honoured men and commoners or "stinkards." This system was matrilineal and exogamic, "suns" marrying "stinkard" wives and having honoured children, whereas "sun" women married "stinkard" husbands and had "sun" children. The head "sun" had power of life and death over all others, and was followed in death by his spouses, attendants and voluntary victims. The origin of these anomalous customs is not clear. *See* J. R. Swanton, *Bur. Am. Ethn. Bull.* 43 (1911).

NATCHEZ, a city of Mississippi, U.S.A., on the Mississippi river, near the southern boundary of the State; county seat of

Adams county. It is on Federal highway 61, and is served by the Illinois Central, the Mississippi Central and the Missouri Pacific railways, ferries to Vidalia, La., river steamers and barges. Construction of a bridge across the Mississippi, to carry both highway and railway traffic, has been authorized. Pop. (1920) 12,608 (54% negroes); estimated locally at 16,000 in 1928. Except for the docks and river-front warehouses, the city is built on bluffs 200 ft. above the river. There are three parks overlooking the river, and in the heart of the city is the Confederate Memorial park. On a neighbouring bluff is a National cemetery. Jefferson Military college (chartered 1802), one of the oldest schools in the south-west, is 6 m. from the city. In the neighbourhood are many beautiful estates, including "Gloster," the home of Winthrop Sargent, first governor of the territory; "Monmouth," the seat of Gen. Quitman; "Somerset" and "Oakland," long in the Chotard family; and "The Briars," girlhood home of Varina Howell, the wife of Jefferson Davis. There are Indian mounds in the vicinity. Natchez is a trade centre and an important shipping point for cotton and other agricultural products. It has box factories, cottonseed-oil and cotton textile mills, fruit-cake and coffee-roasting factories, with a total output in 1925 valued at $3,312,856. Natural gas is piped in from the Louisiana fields.

The Natchez Indians were living here when La Salle and De Tonty visited them in 1682, and when Le Moyne de Bienville in 1716 built a fort, which he named Rosalie, for the duchess of Pontchartrain. In 1764 Ft. Rosalie passed from the French to the English and was renamed Panmure; in 1779 it was turned over to the Spaniards; in 1798 it was occupied by U.S. troops. The city was chartered in 1803. It was the capital of Mississippi from 1798–1802 and from 1817–21. The first cottonseed-oil mill was built here in 1834. On May 7, 1840, a large part of the city was destroyed by a tornado. At the opening of the Civil War Natchez was a centre of culture and wealth, and an important port of call throughout the golden days of river traffic. It surrendered to Union forces during the Vicksburg campaigns.

NATHANAEL, THE APOSTLE. *See* APOSTLE.

NATICK, a town of Middlesex county, Massachusetts, U.S.A., 18 m. W.S.W. of Boston, at the S.E. end of Cochituate lake. It is served by the Boston and Albany railroad. Pop. (1925) 12,871 (State census). Its varied factory products were valued at $3,826,547 in 1925. Natick is the Indian name ("our land" or "hilly land") of the tract (originally part of Dedham) granted to John Eliot in 1650 for the "praying" Indians. Until 1719 the Indians held the land in common, and for some years the community was governed (in accordance with Exodus xviii.) by "rulers of tens," "rulers of fifties" and "rulers of hundreds." The town owns a copy of Eliot's Indian Bible. An Eliot monument was erected in 1847 near the site of the Indian church. Natick was incorporated as a town in 1781.

NATIONAL ANTHEMS. In *Europe* the chief national anthems are: *The United Kingdom,* "God Save the King" (*see* below); *France,* "The Marseillaise" (*q.v.*) by Rouget de Lisle; *Germany,* formerly "Heil dir im Siegeskranz," words by Balthazar Gerhard Schumacher, music of "God Save the King"; but since the Revolution, "Lied der Deutschen," (Deutschland, Deutschland, Deutschland über Alles, über Alles in der Welt); *Switzerland,* "Ruft du, mein Vaterland," music "God Save the King"; *Italy,* "The Royal March" by G. Gabbetti; *Austria,* formerly "Gott erhalte unsern Kaiser," words by L. L. Haschke, music by Haydn, since the World War "Oesterreichische Bundeshymne," words by Karl Renner, music by Wilhelm Kienzl; *Hungary,* "Isten ald meg a Magyart"; *Belgium,* "La Brabançonne," by F. Campenhout; *Holland,* "Wien Nierlansch"; *Denmark,* "Heil dir, dem Liebenden," words by H. Harries, music of "God Save the King," and "King Kristian stod ved hojen mast," words by Ewald, music by Hartman; *Sweden,* "Ur Svenska hjertans"; *Russia,* formerly "Bozhe Zaria chrany," words by J. J. Canas, music by D. Jenko; since the Revolution, the "Internationale," words by E. Pottier; *Rumania,* "Traeasca Regale," words by V. Alexandri, music by E. A. Hübsch; *Spain,* "Himno de Riego," music by Herta; *Norway,* "Ja Vi Elsker Dette Landet" (Yes, We Love This Country); *Czechoslovakia,* "Kde Domor Muj" (Where Is My Native Land?) which is the Czech anthem; the Slovak population sings "Nad Tatrou Se Blyska" (Lightning above the Mountains); *Bulgaria,* "Shoumi Maritza" (The Bubbling Maritza); *Greece,* "Ethnicos Ymnos" (The People's Hymn, which has been beautifully translated into English by Rudyard Kipling); *Serbia,* "Srpska Himna," (The Serbian Hymn); *Turkey,* "Istiklal Marsi" (The March of Independence); *China,* "The Song of the Kuomintang"; *Japan,* "Kimigayo" (In the Reign of our Emperor), the tune of which Sullivan adapted in the prelude to the light opera *The Mikado; Canada,* "The Maple Leaf Forever." In the *United States,* "The Star Spangled Banner" (1814; words by F. S. Key, music by J. S. Smith) and "Hail Columbia" (1798; words by Joseph Hopkinson, music by Fyles) share the duties of a national anthem, while the tune of "God Save the King" is sung to words beginning "My Country, 'Tis of Thee," by Samuel F. Smith (1808–1895).

The most celebrated of all national anthems is the English "God Save the King," which is said to have been first sung as his own composition by Henry Carey in 1740; a version was assigned by W. Chappell (*Popular Music*) to the *Harmonia Anglicana* of 1742 or 1743, but no copy exists and this is now doubted. Words and music were printed in the *Gentleman's Magazine* for October 1745. There has been much controversy as to the authorship, which is complicated by the fact that earlier forms of the air and the words are recorded. Such are an "Ayre" of 1619, attributed to John Bull, who has long been credited with the origin of the anthem; the Scottish carol, "Remember, O thou man," in Ravenscroft's *Melismata,* 1611; the ballad "Franklin is fled away" (printed 1669; and a piece in Purcell's *Choice Collection for the Harpsichord* (1696). The words or part of them are also found in various forms from the 16th century.

The question was discussed in Richard Clarke's *Account of the National Anthem* (1822), and was reinvestigated by W. H. Cummings in his *God save the King* (1902). Carey and Bull, in the general opinion of musical historians, divide the credit; but in his *Minstrelsy of England* (1901) Frank Kidson introduced a new claimant, James Oswald, a Scotsman who settled in London in 1742, and worked for John Simpson, the publisher of the early copies of "God Save the King," and who became chamber composer to George III. What appears to be certain is that 1745 is the earliest date assignable to the substantial national anthem as we know it, and that both words and music had been evolved out of earlier forms. Bull's is the earliest form of the air; Carey's claim to the remodelling of the anthem rests on an unauthoritative tradition; and, on general probabilities, Oswald is a strong candidate. The tune was adopted by Germany and by Denmark before the end of the 18th century.

NATIONAL BANK OF COMMERCE IN NEW YORK was established in 1839 at a time when the Federal charter of the Bank of the United States had expired and the need in New York of an institution of large capital to finance the current undertakings of manufacturers and merchants was felt by many business men.

The original capital of the bank was $5,000,000, the full amount of which however was not paid in until 1852. Increased to $10,000,000 in 1856, the capital was raised to $25,000,000 following consolidations with the National Union Bank in 1900 and the Western National Bank in 1903. The bank's growth is indicated by the following figures:

Date	Capital paid in	Surplus and undivided profits	Loans, discounts and investments	Total deposits
May 13, 1839	$ 1,199,280	$ 4,211	$ 1,270,505	$ 831,392
May 8, 1865	10,000,000	2,836,563	15,925,186	12,615,071
June 29, 1900	10,000,000	7,029,293	60,959,379	65,423,628
June 30, 1910	25,000,000	15,893,079	138,840,979	181,854,933
June 30, 1920	25,000,000	31,533,152	329,868,021	370,448,229
June 30, 1928	25,000,000	46,295,159	505,408,375	571,473,934

In both its domestic and foreign business the bank's attitude has been one of co-operation with other institutions through the development of strong correspondent relations. It maintains its own representatives in London, Paris and Berlin and in 1919 it organized the French American Banking Corporation in conjunc-

tion with the First National Bank of Boston and the Comptoir National d'Escompte de Paris. A Trust Department was established in 1923. (S. E. W.)

. NATIONAL BANK OF EGYPT. The National Bank of Egypt was founded by Sir Ernest Cassel in collaboration with a financial group in Egypt. It was established in 1898 by Khedivial Decree and was given the sole right of Note Issue. The head office is at Cairo and there are many branches in the rest of Egypt and the Sudan. There is also a London office at 6 and 7, King William Street, E.C. 4. Besides the board in Egypt, there is a London Committee. The first governor was Sir Elwin Palmer, who was succeeded by Sir F. Rowlatt.

The principal object of the bank, outside ordinary banking functions, was to act as bankers to the Egyptian Government and to provide a satisfactory paper currency. It had originally a department for making small loans to the *fellaheen* on security of mortgage, but this grew to such dimensions that it was handed over to a separate institution, the Agricultural Bank of Egypt.

Before the war, the note issue was based half on gold, half on securities approved by the Government. It attained a total of some £3,000,000 in 1913. On the outbreak of the World War, the notes were made a forced legal tender, and in October 1916, British Treasury bills deposited at the Bank of England were authorized as security in place of gold. The total issue ran to over £70,000,000 in 1919, and is now over £30,000,000.

The capital of the National Bank of Egypt is now £3,000,000 fully paid, with reserves of £2,775,000. (S. C. P.)

NATIONAL BETTER BUSINESS BUREAU, INC., organized in 1912 as the National Vigilance Committee of the Associated Advertising Clubs of the World, "to promote honesty, truthfulness and reliability in the sale of merchandise, securities and services, discourage fraudulent and deceptive methods in business and thereby to increase public confidence in advertising, salesmanship and business generally."

The better business bureau movement is participated in by 10,000 industrial, financial and mercantile institutions. Its financial support comes from all fields. Besides the 42 better business bureaux the National bureau is aided by securities commissioners, chambers of commerce, prosecuting officials, newspapers, banks, brokers and investment houses and, for special mining and oil problems, State mining officials, oil inspectors and geologists.

The work of the bureau is divided into three operating groups: financial, merchandise and publicity. The financial section's work is educational, corrective and punitive. It is educational in that it aims to conserve the savings of investors through the distribution of facts relative to financial offerings; it is corrective in that it investigates practices which are contrary to sound business procedure and adjusts them by moral suasion or if necessary, publicity, while in the punitive field it concentrates upon the development of facts regarding unsound projects, co-operating closely with State and Federal officials in the enforcement of existing laws. The bureau's merchandise work centres upon co-operation with 26 specific industries to correct misleading advertising and trade practices by formulating standards of fair play for buyer and seller. Investigation and exposure of merchandise frauds supplement this programme, the chief value of which lies in the help it offers to legitimate interests in business to organize, thus isolating the dishonest practitioner.

NATIONAL BISCUIT COMPANY, THE, a United States biscuit manufacturing company, was incorporated on Feb. 3, 1898, under the laws of New Jersey with a charter valid for 99 years. This company was the result of the merger of the New York Biscuit company, American Biscuit and Manufacturing company and the United States Baking company, together with a number of smaller concerns. Originally capitalized at $55,000,000, the authorized capital stock in 1922 was $85,000,000, of which $25,000,000 was 7% preferred stock and $60,000,000 ($25.00 par value) common stock. There was outstanding as of Jan. 1, 1928, $24,804,500 preferred stock and $51,163,000 of common stock. The company was among the first to encourage purchase of its stock by its employees, having put such a plan into effect as early as 1901.

Prior to 1898, biscuit and crackers had been sold in boxes, barrels, crates and other large containers with the resulting liability to staleness before the stock was disposed of to consumers. The new company inaugurated the package for biscuit with its "Uneeda Biscuit." The company now produces more than 400 varieties of biscuit as well as bread and cake manufactured through its subsidiary, the National Bread company, organized to take over this branch of the business. There are 40 cracker bakeries located in 30 cities of the United States, including a bakery in York, Pa., devoted exclusively to the manufacture of pretzels. There is also a cracker bakery in Toronto, Ontario, operated by a subsidiary called "National Biscuit Company (Canada) Limited." National Biscuit company maintains and operates its own machine shops in which it develops and improves mechanical means to perform all the productive operations. Further economy is achieved through ownership of the National Milling company at Toledo, O., where a large portion of the flour used by the company is manufactured, and by the manufacture of box-board and cartons by the company's paperboard mill and carton factory at Marseilles, Ill. The company's general offices are in New York city. (C. A. V.)

NATIONAL BOARD OF FARM ORGANIZATIONS, THE, a board established in the United States in 1917 for the purpose of giving to the various agricultural organizations and cooperative associations of the country a common voice in matters where they have a common interest. It has been influential in connection with much agricultural legislation. Its constituent members in 1929 were: The National Cooperative Milk Producers' Federation, The Farmers' Educational and Cooperative Union of America, The Pennsylvania State Grange, and The Farmers' Equity Union.

NATIONAL CITY BANK OF NEW YORK, THE, was organized under charter from the State of New York on June 16, 1812 as the City Bank, with a paid-in capital of $800,000, its origin being closely associated with the dissolution of the First Bank of the United States. Samuel Osgood, first U.S. postmaster-general, was its first president. With the passage of the National Banking Act in 1865, the City Bank became a part of the new national system and at that time its name was changed to the National City Bank of New York.

Engaged primarily in the financing of commerce, the growth and development of the institution has kept pace with the expansion of American industry and trade. As late as 1892, 80 years after its organization, its capital stood at 1 million dollars, surplus and undivided profits of scarcely 2½ millions and deposits of but 20 millions. Commencing with the early years of the present century, the growth became more marked. The capital was increased in 1900 from $1,000,000 to $10,000,000, and two years later from $10,000,000 to $25,000,000, where it stood until 1920 when, with deposits of approximately $700,000,000, its capital was again increased to $40,000,000 and its capital structure, including surplus and undivided profits, for the first time exceeded $100,000,000, with total resources in excess of $1,000,000,000. In Apr., 1929, the National City Bank with capital at $100,000,000, surplus and undivided profits of $111,000,000, deposits of $1,349,024,386 and total resources of $1,847,705,548 merged with the Farmers Loan and Trust Co., capital $10,000,000, surplus and undivided profits of $23,212,698, deposits of $170,436,931 and total resources of $219,050,022, to make an institution with resources exceeding $2,000,000,000, the largest bank in the western hemisphere and third largest in the world. The name of the larger bank was retained.

With the passage of the Federal Reserve Act, this bank was the first of American institutions to establish foreign branches throughout the world, such branches in 1928 numbering 88 in 22 foreign countries. In 1921, under changes in law which then took place, branch expansion in the city of New York became possible and 28 local branches were established in 1928.

Affiliated with the banks and owned ratably by the shareholders of the bank, is the National City Company, an originating and distributing investment banking organization with a capital structure in excess of $100,000,000. (C. E. Mi.)

NATIONAL CONFEDERATION OF EMPLOYERS' ORGANIZATIONS. This institution is the employers' central organization in Great Britain for dealing with general labour questions on behalf of employers as a whole. Its constitution covers all questions arising out of industrial relations, but it does not deal with commercial questions.

Prior to the convening of the National Industrial Conference of Employers and Employed in 1919 by the prime minister, there was no central machinery for joint consultation on the employers' side between the employers' federations in the individual industries dealing with labour questions, and the confederation was set up to meet the need. The confederation's membership is confined to the central employers' federations dealing with labour questions in the various individual industries, and the federations within its membership cover industries employing over seven million workpeople.

In its national sphere, the confederation is officially recognized by the Government and by the various Government departments which deal with labour questions (*e.g.*, Ministry of Labour, Home Office, Ministry of Health, etc.). The subjects it deals with are varied, including factory law, unemployment and health insurance, workmen's compensation, hours and conditions of work and trade boards. The confederation also submits evidence for employers before royal commissions and Government committees. In its international sphere, the confederation is recognized by the Government as the industrial organization "most representative of employers" under Article 389 of the Treaty of Versailles. In that capacity it nominates the British employers' delegate to attend the annual International Labour Conferences held under the treaty, and its representative is a member of the governing body of the International Labour Office.

NATIONAL CONVENTION, THE. In the United States the National Convention is the political agency of the major parties which nominates the party candidates for president and vice president, adopts the platform, and performs other party functions. The first national nominating convention in the United States was that of the old Federalist Party which met in New York in Sept., 1812, and endorsed for the presidency De Witt Clinton, the candidate of the peace Republicans. This gathering, however, had no influence on the displacement of the congressional nominating caucus by the national convention. The Anti-Masonic Party met in national convention at Baltimore in Sept., 1831. This convention was composed of 112 delegates for 13 States and adopted "An Address to the People of the United States." The National Republican or Whig Party followed with a convention at Baltimore in December of the same year, with each State entitled to a delegation the size of the electoral vote of the State. A system of State and local correspondence committees was authorized. The Democratic Party held its first national convention in Baltimore in May, 1832, for the purpose of nominating Martin Van Buren for vice president, as the running mate to President Jackson. Since then the national convention has been the recognized method of selecting presidential and vice presidential candidates.

While the number of delegates in the early conventions fluctuated, ordinarily each State was limited to a vote equal to its electoral college strength. Eventually twice as many delegates were sent as there were electors, and finally each delegate was given an entire vote. The Democratic Party now allows twice as many delegates to each State as there are presidential electors with six each to Alaska, the Canal Zone, the District of Columbia, Hawaii, the Philippine islands and Porto Rico and two to the Virgin islands, making a total of 1,100 for the convention of 1928.

The Republicans formerly had a similar representation, but this was reduced in 1913 in order to lessen the influence of delegates from the normally Democratic States of the South, and again changed in 1921. The Republicans now allow four delegates from each State at large, with two additional where a representative in Congress is chosen from the State at large. In addition, the Republicans allow three more from each State at large where a majority of the electoral vote of the State went to the party at the preceding presidential election. Each congressional district is allowed one delegate, and an additional delegate from each district casting 10,000 votes for the Republican electoral ticket at the last presidential election or the same number of votes for the party candidate for representative in Congress at the last congressional election. Two delegates each are chosen by Alaska, the District of Columbia, Hawaii, the Philippine islands and Porto Rico. There were 1,089 delegates in the Republican convention of 1928. There are as many alternates as delegates who vote in the absence of the delegates.

In the December or January preceding the convention, the national committee of each party meets in Washington and issues the call for the next national convention. At this time the allotment of delegates is made and the State committees are instructed as to how they are to be chosen. A convention city also is selected, giving consideration to auditorium facilities, hotel accommodations, financial donations and political benefits. The convention delegates are elected by State and district conventions and under the terms of presidential primary laws, according to State statutes and party rules and by State party committees. They are either instructed as to presidential preference or are sent uninstructed; some are instructed as to vice president. Prior to the convening of the convention, usually in June or July, the national committee meets to make final arrangements for the convention. A temporary roll of convention delegates is made and a temporary organization is suggested for the convention.

The chairman of the national committee calls the convention together and the first question is on temporary organization. After temporary organization has been effected, the temporary chairman makes a "key-note" speech sounding the campaign issues. Then the committees on rules and procedure, credentials, permanent organization, and platform and resolutions are appointed, each delegation having one member on each committee.

After the adoption of rules and the report on credentials, a permanent organization is effected. The permanent chairman also speaks in outline of the campaign issues. The convention then proceeds to nominate candidates and adopt a platform. Nominations for president are made by calling the roll of delegations. Seconding speeches often are made. A majority vote is necessary to nominate in the Republican convention while the Democrats require two-thirds. After the candidate for president is nominated, a choice for vice president is made along the same procedure. A platform is adopted either before, during or after the nominations. Committees on notification of the two candidates are named and the convention adjourns after authorizing the national committee to fill any vacancies on the ticket.

The national committee, composed of a man and woman from each State and territory, assumes office upon adjournment of the convention, the members being selected by the delegations or by State conventions or primaries if so authorized by State statutes or party rules or by State conventions.

See C. E. Merriam, *The American Party System* (1922); R. C. Brooks, *Political Parties and Electoral Problems* (1927); E. M. Sait, *American Parties and Elections* (1927); H. R. Bruce, *American Parties and Politics* (1927); Stuart Lewis, *Party Principles and Practical Politics* (1928), and *Readings in Party Principles and Practical Politics* (1928). (S. Le.)

NATIONAL COUNCIL OF EVANGELICAL FREE CHURCHES, a voluntary association of British Nonconformist churches for co-operation in religious, social and civil work. It was the outcome of a unifying tendency displayed during the latter part of the 19th century. About 1890 the proposal that there should be a Nonconformist Church Congress analogous to the Anglican Church Congress was seriously considered, and the first was held in Manchester on the 7th of November 1892. In the following year it was resolved that the basis of representation should be neither personal (as in the Anglican Church Congress) nor denominational, but territorial; and the name of the organization was changed from Congress to National Council as soon as the assembly ceased to be a fortuitous concourse of atoms, and consisted of duly appointed representatives from the local councils of every part of England. The local councils consist of representatives of the Congregational and Baptist Churches, the Methodist Churches, the Presbyterian Church of England, the Free Episcopal Churches, the Society of Friends, and such other Evan-

gelical Churches as the National Council may at any time admit. The constitution states the following as the objects of the National Council: To facilitate fraternal intercourse and co-operation among the Evangelical Free Churches; to assist in the organization of local councils; to encourage devotional fellowship and mutual counsel concerning the spiritual life and religious activities of the Churches; to advocate the New Testament doctrine of the Church, and to defend the rights of the associated Churches; to promote the application of the law of Christ in every relation of human life. Although the objects of the Free Church councils are thus in their nature and spirit religious rather than political, there are occasions on which action is taken on great national affairs. The movement differs essentially from the Evangelical Alliance, inasmuch as its unit is not an individual, private Christian, but a definitely organized and visible Church. The essential doctrine of the movement is a particular doctrine of churchmanship which regards the Lord Jesus Christ as the sole and Divine Head of every branch of the Holy Catholic Church throughout the world.

The Report of the National Free Church Council is published at the headquarters of the organization, the Memorial Hall, Farringdon Street, London E. C. The Report for 1927–28 shows that England, Wales and the Channel Islands have been covered with a network of Councils, each of which elects its representatives to the annual gathering. The movement has spread to Australia, New Zealand, South Africa, Jamaica, the United States of America and India.

NATIONAL DEBT, the financial obligations of a State, as distinct from the obligations of its individual members. The very use of the word debt, however, makes it advisable to indicate a few important distinctions between national and individual indebtedness. In the case of the debt of an individual, there is invariably an obligation to repay at some period the whole of the principal and in the meantime to maintain a certain rate of interest. In the case of national debts there is great variation in the form of the obligation. More frequently there obtains the same rule for ultimate repayment of the principal; indeed, there is often an obligation to repay at a certain date a larger sum than has been originally raised. Such loans usually take the form of the borrowing State paying a comparatively small rate of interest, the loan itself being issued at a discount, *e.g.*, a country instead of borrowing a loan for £100,000,000 in 5%'s at par, *i.e.*, at the price of £100 for £100 of stock, might issue a loan in the shape of 4%'s at 80, covenanting to repay at a certain date at par. In such an instance what is called the "flat" yield to the investor, *i.e.*, the actual rate of interest received each year on each £100 invested might be the same as in the case of the 5% loan at par, namely 5%. Ultimately, however, the investor would in reality have obtained a rather better yield, because at the date of the maturity of the loan he would receive £100 for every £80 invested. Correspondingly, the borrowing country might have incurred a greater cost in its debt service, because while the actual interest due each year would be smaller, the amounts to be set aside for ultimate extinction of the loan would be greater.

Various Forms of Borrowing.—A State may resort to a form of borrowing which is impossible to the private individual by making its loans in what is known as lottery form, the lender, which is another name for the applicant for the loan, accepting some low rate of interest in return for the chance of winning a financial prize by a system of drawings of numbers. Such loans have been both numerous and popular in France and in some other continental countries where patriotism and cupidity combined have often resulted in the raising of very large amounts in lottery loans. A State enjoying good credit can with little difficulty borrow enormous sums without any undertaking at all to repay the principal at a particular date. The explanation is to be found in two further points which also demonstrate the difference between State and private borrowing. It will easily be seen that the better the credit of the borrower the more ready will be the lender to advance for a lengthy period, and because the credit of the State is usually the highest credit of all there is seldom difficulty in procuring loans for an almost interminable period. A further explanation, however, is to be found in the fact that the loans themselves form what is known as marketable securities, that is to say, the holder of them is able at any time to convert his holding quickly into cash by selling it to some other individual. Moreover, in the United Kingdom and in some other countries it is customary for all long-dated Government stocks to be trustee securities, which means that they are in the class in which trustees are specially authorized to invest trust money. This again in its turn means that trustees usually seek for stocks which are not redeemable at some early date. Therefore, in the case of the British Government it has been quite customary for many hundreds of millions to be raised on terms making the stocks practically irredeemable. The form in the prospectus is usually to say that the stock will be redeemable on and after a certain date at the option of the State, which means, of course, that the Government may, or may not, redeem after that date, according to its own convenience. It is interesting, however, to note that the possibilities of even the best States borrowing for an indefinite period may vary according to circumstances. No better illustration of this can be furnished than in certain events in the history of the British national debt. Thus for many years previous to about 1894, British consols, which formed this class of perpetual debt, were so popular that even when the rate of interest was as low as 2¼%, the stock rose in the year 1894 to over 114. That remarkable price was due to the great prosperity of the State and the magnificent credit enjoyed by the British Government, and also to the fact that money market conditions produced a temporary famine in high-class investment stocks, which gave to consols a fictitious value. Then came a combination of circumstances which exerted a very different influence. Under the Goschen conversion (1888), consols, which then bore 3% interest, were converted into stock carrying 2¼% until 1903, and 2½% thereafter. When the year 1903 arrived, holders realized, as they had not done in advance, the lower yield of their holdings, and at that particular time other circumstances, among which the Boer War was one, conspired to bring down all investment stocks, including consols, so that even before the World War Britain's premier stock had fallen to about 71. (The lowest point ever touched by consols was 47¼ in the year 1798.) The fictitious character of the high price of 1894 should, of course, have been realized at the time but, as a matter of fact, the plunge downwards in the market price of so sound a stock gave a shock to confidence in irredeemable securities, and when borrowing in the Boer War became necessary, and still more when colossal sums had to be raised in the World War, it was practically impossible to raise loans which did not carry with them a fixed date of redemption. Once, again, however, in the year 1928, when not only was confidence returning, but high-class investment securities were becoming scarce, the irredeemable form of stock again began to be popular, so that in that year the most representative British Government stocks were the 3½% conversion loan and the new 4% consols, in both of which the date of redemption was optional to the Government.

Converting into Lower Interest.—A further feature of national, as distinct from individual debts, is to be found in the manner in which a State is frequently able by means of a rise in its general credit to make terms with its creditors in a way which, if not impossible, is at all events seldom practised by the individual. A State, for example, may in times of stress or emergency, have borrowed a large amount in a 5% form, the loans running for anything from 25 years upwards. Long before the time of redemption arrives, however, the State may have become so prosperous that its credit is really on a 4% or 3½% basis. It is, therefore, in a position to raise fresh money on, say a 3½% basis, repaying the old loan and making a big saving in the annual interest charge. Moreover, the State when it issued its, say, 50 year loan, would have been careful to protect itself by retaining the option to repay at some earlier date, if desired. Therefore, when such conditions arise, the State is in a position to issue a kind of ultimatum to its lenders offering to convert the old loan into perhaps a 3½% issue, failing the acceptance of which repayment takes place. Simultaneously with such offer of conversion,

new subscribers to the 3½% loan are usually approached, with the result that under skilful guidance, the 5% debt, long before the final date of repayment, becomes changed into a security carrying a lower rate of interest. Finally, another vital distinction between national and individual debts will certainly be found in the fact that whereas debts between private citizens are recoverable by legal process, such process is seldom enforceable against the State, although it is perfectly true that a State may suffer in its credit in the same way as an individual and can even become bankrupt.

Size of Debts.—Although exceptions might be cited, it may be said broadly that the smaller the national debt in proportion to the resources and the population, the sounder is the position of the national finances, and the higher the standing of the national credit. Considering the question of national debt, quite apart from the special exigencies of War requirements, it can be said that national debts may be necessary in the case of a new country to develop its resources and instances such as Australia and Argentina might be cited where a growth in national debts and in developments of the country's resources and in national prosperity has proceeded *pari passu*. That may be true without lessening the fact that an excessive national debt may bring disaster. Especially when a State is developing its resources on external loans, that is loans raised in other countries, the adverse effect upon its foreign exchange of the large remittances abroad, to meet the service of the debt, may react unfavourably upon the prosperity of the country itself. In that respect, however, much will depend upon whether the borrowing State is rich in resources of an exportable character.

Origin of National Debts.—The origin of the national debts of countries varies considerably and while wars invariably occasion heavy State borrowing some of the newer countries have borrowed—usually externally—to develop their natural resources. Such loans are generally of a reproductive character and so long as the interest rate is not unduly high, or unduly large in proportion to the population, they may often be said to have strengthened the economic position of the borrowing country, though it is well that the annual service of the loan should contain what is known as a sinking or amortisation fund, that is a fund designed to re-pay the loan within a given period of years. Loans raised for war purposes on the other hand, however, necessary for preserving the very existence of a nation, are not of the reproductive order, the proceeds being paid away in powder and shot, and the service of the loans usually acts as a drag upon the borrowing country for many a year. Moreover, war loans usually have the additional drawback of having been raised upon usurious terms, and the borrowing nation generally makes the loans short-dated, in the hope of being able to fund them during the more prosperous times of peace. As an instance of countries which have raised large loans not for war, but for the purpose of self-development, Australia, Canada, Argentina and Brazil might be cited, while older countries such as Great Britain, France and Germany can trace most of their national debts to war and even the United States debts have been largely based on the same cause, although just previous to the World War, the United States had well nigh repaid the whole of her national debt and with the exception of China, had almost the smallest per capita debt in the world.

Forms of Debts.—The internal part of the national debt of a country can usually again be sub-divided into funded, short term and floating debt. Normally the greater part of any national debt of any magnitude such as that of Great Britain for example, is funded or (*see* CONSOLS) is in stock virtually irredeemable other than at the option of the State. In the case of a great increase in debt due to a war, however, it is not unusual to find a great part of the debt in short-dated form and even in floating obligations. The former term generally applies to debt where maturity dates range roughly from anything between five and thirty years, while floating debt is usually applicable to bonds of not more than 3 years' duration, Treasury bills of a few months' duration or to ways and means advances. (*See* FLOATING DEBT.)

Internal and External Debts.—The national debt of a country can usually be divided into internal and external debts. A moment's thought will show that large external, even more than internal, debt, may be a handicap to a State. If a country has a large internal debt, it may mean that much money has been expended either in war or in unproductive enterprise and that by reason of high taxation to pay the interest, industrial progress is hampered. Still the money represented by the interest remains, as it were, in the family, the payments constituting a transfer from one pocket to another. In the case of an external debt, however, whatever advantages may have accrued from the original employment of the sum borrowed—and if the cause has been a great war, the advantage other than political is seldom of an enduring kind—there remains during the lifetime of the loan a large annual payment to the creditor country which may prove a serious embarrassment to the debtor owing to the effect on the exchange between the two countries. In old-established countries, such as Great Britain, external indebtedness was unknown to the present generation until the World War, when considerable debts to foreign countries were incurred. However, in the case of Great Britain most of these have been repaid, with the exception of the large debt of about £900,000,000 to the United States. In newer countries, however, external debt often constitutes an outstanding feature, the older and wealthier countries having financed the development of their natural resources of the new areas, thereby creating conditions of prosperity enabling the borrowing country to meet the annual interest and sinking funds. Properly conceived such loans are an instance of capital creating new and real wealth. Not infrequently, however, such borrowing proceeds too rapidly and a country although rich in resources is unable for a time to meet its debt charges. Speaking generally, it should be the aim of a country to raise its loan requirements as far as possible internally, even if a slightly higher rate of interest has to be paid.

Debt v. Taxation.—A fruitful subject of discussion among economists with regard to public debt is the extent to which even in emergency the State should resort to borrowing, instead of applying increased taxation, though obviously in times of great emergency, such as war, there must be a limit to taxation pure and simple, for if applied beyond the immediate resources of the tax-payer, a credit in some form or another is inevitable; indeed experience shows that whether a State borrows extensively or over-taxes the community, an expansion in banking credits usually follows. Moreover it has often been urged that a public debt affords a convenient form of investment, especially to those who desire full security for their investment, rather than a high rate of interest. A good case can be made out for the profitable return of monies spent on military and naval defence, such monies being largely in the nature of insurance premiums, and because they add to the feeling of general security, may be said to contribute directly to industrial and financial activities and prosperity in the countries responsible for such expenditure. Save only in the rarest cases however, such expenditure should be met out of revenue, the expenditure being not only of a recurring character, but one where payment out of capital would often lead to profligate and unprofitable outlay.

Danger of Peace Time Borrowing.—Apart from war, or other grave emergencies, a well-organized State ought to have within itself the means of meeting all its ordinary expenses, otherwise the State is in danger of imperilling its credit and moreover making it difficult to borrow on favourable terms when the hour of crisis comes. To some slight extent this was even noticeable in the case of Great Britain at the outbreak of the World War. Not that the credit of Britain at that moment was other than high when compared with that of other nations, but owing to the fact that for some years previously there had been prodigal outlays for social requirements, involving high taxation. British credit as expressed in the price of consols had declined to a level which was not merely distressing to holders of that security, but was a matter of disturbance to bankers and economists, who affirmed that in the event of any sudden crisis arising, the results might be serious. Moreover, in the years immediately preceding the World War, Finance Ministers in Great Britain

had been less rigid with regard to the application of realized securities to debt redemption, and that in its turn had adversely affected consols. Accordingly as noted in another paragraph, Great Britain had to raise her first long-dated war loan in 3½%'s at the then low price of 95

Capital Assets.—In arriving at the total national liabilities of a country, it is necessary to turn to the statement of assets which is usually presented separately. The total is not usually deducted from the national debt, but it has nevertheless to be borne in mind. In the case of countries where undertakings such as railways and harbours are owned by the State and are revenue producing, such assets constitute a very important item in the national balance sheet and it is not infrequent to find that when such countries are raising external loans, great emphasis is laid upon these assets as an offset to the national debt. In the case of Great Britain a conservative policy is adopted and, in the national debt return of 1927, the total estimated assets are given as only £115,850,000, some of the principal items being the value of Suez Canal shares (owned by the Government) and advances to the unemployment fund. If, however, to these assets were added the liabilities of foreign countries, a total of over £2,000,000,000 would have to be added, including loans from France and Russia. Similarly, as pointed out elsewhere, the United States against its greatly increased internal debt has to set enormous sums due from Great Britain and her Allies in the World War. In the sense, therefore, of these cross currents of war indebtedness, this form of assets constituted an important item in the national balance sheets at the beginning of the year 1928.

BRITISH NATIONAL DEBT

That the national debt of Great Britain is of comparatively recent date is seen from the fact that at the time of the advent of William III. to the throne the total debt was only about £85,000 borrowed on tallies in anticipation of duties on French linens. The increase of debt during his reign was considerable, while the American War of 1775–1786 added about £120,100,000 and the great French wars lasting through the years 1793–1815 added a further £604,000,000 and in 1817 the British national debt reached its highest point for many years, the funded and unfunded debts together making up a total of £848,000,000. From that time a gradual diminution occurred as the result of a steady application of sinking funds and by 1894, and previous to the Boer War, the amount had been reduced to about £635,000,000. During the period of the Boer War, there was a further considerable addition to the national debt and although substantial repayments had been effected previous to the outbreak of the World War, the total deadweight debt at the beginning of 1914 was about £650,000,000. During the World War, the debt went up by leaps and bounds, not only because of the direct cost of the conflict to Great Britain, but because also of the extent to which she financed the cost of the war to her Allies and especially France and Russia. Two years after the conclusion of the war the maximum total of the British war debt was reached, the amount being about £7,830,000,000 but even at the beginning of 1928 the total deadweight debt was about £7,527,000,000. The greater part of this debt was internal, but about £1,100,000,000 was on account of war indebtedness to other countries, chiefly the United States of America. Included in the unfunded debt at the beginning of 1928 was an item of £362,000,000 representing national savings certificates repayable virtually on demand. Strangely enough this is not sectionized in the official Treasury statements as floating debt, though it would certainly appear to come under that category. The origin of this particular form of debt goes back to the period of the World War when war savings certificates were sold on the basis of 15/6d for £1 certificates redeemable at £1 five years hence, the amount to be held by any one holder being restricted to £500. After the war, the issue of certificates upon somewhat less favourable terms was continued, but the name was changed to national savings certificates. Of the national debt of Great Britain no less than £6,900,000,000 is directly the result of the World War and striking evidence is furnished not only of the cost of a great war but of the years of financial disturbance following, by the fact that ten years after the conclusion of peace only a comparatively small part of the total debt had been funded. At one time in 1919 the floating debt, as expressed in Treasury bills and ways and means advances (short term loans from Government departments or the Bank of England) was no less than £1,338,000,000 and the greater part of the reduction effected in the debt in the following decade took the form of the cancellation of floating debt. At the beginning of the fiscal year 1928, the actual floating debt had been reduced to £716,000,000. During the years 1920–28 inclusive something over £500,000,000 in sinking fund monies was applied to debt redemption in various forms and the explanation of why so small a reduction was accomplished in what is known as the total deadweight debt was due to the fact that many of the conversion operations were effected in lower interest yielding stocks, but offered at a discount. A better idea, therefore, of the effect of the redemption of old debt and the funding operations is to be obtained by noting that whereas the annual service on the British debt apart from sinking funds for 1920–1 was about £342,000,000 the amount required for 1928 was about £304,000,000.

The Recent Growth of British Debt.—Previous to the World War, the national debt of Great Britain passed through many phases and was the subject of many conversion schemes, the last and most notable being the Goschen conversion scheme of 1888 already referred to. These phases and conversion operations, however, fade into insignificance when compared with the additions to, and changes in, the national debt, which occurred during the years of the World War, and the years immediately following. The first increase in the national debt after the outbreak of war assumed the form of large issues of Treasury bills, and these were destined to rise to a maximum level of about £1,300,000,000. The first long-dated loan was created during the latter part of 1914, and consisted of a 3½ per cent war loan for £350,000,000. It was offered at the price of 95 per cent and at the time of issue the yield was regarded as fairly high for a British government stock. Much of it, however, was believed to have been taken up by the Bank of England, and it was found later that greater effort and more attractive terms were necessary to raise the huge sums required for the war. In the same (fiscal) year, short-term Exchequer bonds for £50,000,000 were placed, while the issues in the next year included a 4½ per cent war loan for £900,000,000, the operation, however, including some large conversions of old consols and outstanding annuities, and a part of the 3½ per cent war loan issued in the previous year. In the year 1916, the issue of war savings certificates commenced, which were destined to add more than £300,000,000 to the national debt. The largest single loan operation, however, during the war was that effected in 1917, when the 5 per cent war loan was created to the amount of £2,067,218,744. Of that total, cash subscriptions represented £836,454,260, the rest representing conversions of other loans. This loan which was destined to be the largest individual stock in the national debt, was not however a funding operation, the loan being definitely redeemable in 1947, the Government retaining the right to repay it in 1929 and thereafter. Its distinctive feature was the non-deduction at the source of income tax from the half-yearly interest. In that same year, a 4 per cent war loan to the amount of £52,000,000 was created, of which, however, only £22,000,000 was cash subscriptions, the rest representing conversion operations. In the same year, Exchequer bonds to the amount of £417,000,000 were created, and war certificate sales totalled over £100,000,000. Throughout the years of the World War, and up to and including the year 1920, the new sinking fund was entirely suspended. In 1918, the final year of the World War, national war bonds were sold to the amount of over £640,000,000 and Exchequer bonds for smaller amounts were placed. In that year, however, much of the borrowing was to repay Treasury bills. In 1919, although the war was concluded, war expenditure continued, and short-term national war bonds, carrying with them certain conversion rights, were issued to the amount of £1,045,000,000.

The Peak Year.—The year 1920 marked the zenith of Britain's national debt, and although many of the loans raised during that year were in the nature of conversion operations, a great deal of

new money was raised and as in some of the previous loans, new features had to be introduced to ensure a ready absorption. Owing to the high rate of income tax, which touched 6/- in the £., one Government loan took the form of 4 per cent stock, tax-free, while in the case of yet another loan privileges were given to make payment for death duties with the bonds reckoned at their par value. Again, in 1920, 4 per cent Victory bonds were issued at the price of 85, having the right to be redeemed at par in a series of drawings each year and also carrying the right to be tendered for death duties. Thus it will be seen that although Great Britain did not resort to any forced loans in spite of the great strain of the war, unusual inducements were attached to many of the war loans. Moreover, in addition to the loans raised internally, considerable borrowing was effected in the United States. This borrowing took the form during the earlier years of the war of raising from American nationals, various amounts, ranging up to the equivalent of about £150,000,000. These loans were raised before America came into the World War. Following upon that event, the United States Government gave credit to the British Government for goods and services supplied, and this indebtedness subsequently resolved itself into a liability of over £900,000,000, which was finally funded on terms involving the ultimate repayment over a period of some sixty-two years, dating therefrom. In addition, Great Britain borrowed temporarily certain sums from some of her overseas dominions, and from some foreign countries, but with the exceptions about to be mentioned, all such debts have now been repaid. At the beginning of 1928–29 the British Government recognized loans from certain Allied Governments as outstanding, the total being £135,700,000. These totals, however, were offset by much greater indebtedness to Great Britain, the indebtedness of Russia to Great Britain being £887,335,000; that of France £705,588,000; Italy £270,000,000; Rumania £31,000,000; Portugal £24,000,000 and various other debtors about £60,000,000. In addition Great Britain was owed by her oversea dominions about £123,000,000. At the end of the fiscal year 1927–28 the amount of the British funded debt of £1,232,000,000, was made up as follows:—2½ per cent Consols, £276,296,164; 2¾ per cent's £2,399,679; 2½ per cent's £21,120,357; 3½ per cent Conversion Loan £739,935,758; 4 per cent Consols £166,384,125, Debt to Banks of England and Ireland £13,645,869; Terminable annuities £12,242,000. Of the total unfunded debt of £5,287,714,849, the largest item consisted of 5 per cent war stock for £2,088,173,683; Treasury bills for £599,175,000; 4 per cent funding stock and bonds £388,777,644 and national savings certificates £371,823,328.

Dates of Redemption.—A feature of British debt at the beginning of 1928–29 was the large amounts maturing within a comparatively short period. The outstanding item was that of the 5 per cent war loan for £2,172,000,000, the Government having the option to redeem after 1929 and being compelled to redeem by 1947. In spite of the magnitude of the amount, the possibility of early redemption prevented the loan from rising much above 100, although it carried the exceptional attraction of income tax not being deducted at the source, holders returning separately to the authorities particulars of income derived therefrom. Consequently the stock is largely held by small investors, who, if the tax were deducted at the source, would be put to the inconvenience of making special claims for recovery. An interesting development in the case of this loan and of the 4 per cent funding loan (on which no interest is charged to foreign holders) occurred in 1928 when American investors became interested in them and large blocks were purchased on New York account, indeed the buying was so pronounced as to occasion a considerable rise in the stocks on the London stock exchange and to occasion sympathetic movement in other descriptions. Apart from the 5 per cent war loan, other maturing debts to be dealt with between the years 1930 and 1946 amount in the aggregate to a little over £800,000,000.

Dates of Maturing Debt.—In addition, however, to the debt maturing at fixed dates, Treasury bills outstanding at the beginning of the fiscal year 1928–9 amounted to £527,000,000 and the national savings certificates to £362,375,000. Accompanying his budget for 1928–9, the Chancellor of the Exchequer published the statement on page 141 with regard to the debt position on that date.

Debt Redemption and Conversions.—Reference has been made to the famous Goschen conversion scheme of the British debt in 1890, when existing 3%'s were gradually converted, first into 2¾%'s, then into 2½%'s. All British debt conversions, however, fade into insignificance compared with the post-war problem of converting the debt arising out of the World War. That problem too was enormously increased not only by the great sums borrowed, but by the high rates of interest paid. At the beginning of the war, the British Government was paying interest on consols at the rate of 2½%, while much of the debt incurred during the war was on a 4%–5% basis. Previous to 1914, the total amount involved in the consolidated fund service yearly was £24,500,000. In his annual budget for 1928–9, the Chancellor of the Exchequer fixed £355,000,000 as the amount to be applied annually to the consolidated debt service, that total including the sinking fund. For some few years previous, the new sinking fund (the new sinking fund as applied to British debt, means the amount set aside at the beginning of each year towards debt service and redemption; what is known as the old sinking fund is the realized surplus at the end of the year, which goes automatically to debt redemption) had been separated and fixed at amounts varying between £40,000,000–£65,000,000 annually, and the change effected in the 1928–9 budget meant the restoration of the old Sir Stafford Northcote sinking fund. Thus with a fixed amount of £355,000,000 applied consistently to the debt service, the amount available each year for actual debt redemption should increase in cumulative fashion owing to debt redemption in the previous year. Indeed, the Chancellor of the Exchequer in restoring this system, which had been in abeyance since the World War, estimated that in the absence of any further addition to the British debt, the system should provide for its complete extinction in fifty years' time, including the indebtedness to the United States. Past experience has shown, however, that these fixed allocations are not always inviolate, Chancellors of the Exchequer having on more than one occasion appropriated realized surpluses for the year and applied them to purposes other than debt redemption. Moreover, the effectiveness of the fixed fund in the case of a State possessing a heavy floating debt, such as that represented by the £500,000,000 of British Treasury bills, is very much at the mercy of the course of money rates in calculating the amount required each year for interest charges. A difference of 1% either way in the value of money affects the interest charged on Treasury bills alone to the extent of £5,000,000. Consequently, there is the possibility of the operative force of the sinking fund being materially weakened should money rates be particularly high in the course of any one year. Moreover, such conversions as were effected in British debt during the years following the war were not sufficiently favourable to the State to occasion very much lightening of the annual interest charge, while owing to the number of conversions which were effected on the basis of loans issued at a discount the actual diminution in deadweight debt was trifling, when compared with the amount of sinking fund money used. The chief conversion operations have consisted in the conversion of Treasury bills into short-dated bonds, and of bills and bonds into the 4% funding loan, the 3½% conversion loan, and the 4% consolidated loan, the amounts of which are set out in the foregoing table. The explanation of the growth in the 5% war loan from the original total mentioned earlier is explained not by further borrowing, but by various short-term bonds having been given the right of conversion into the 5% war loan. The problem of conversions of the British debt is a vital one for the taxpayer, as constituting the chief hope of relief from oppressive taxation. Whether as a result of failure to economize, or of conditions beyond the power of the State, such as unfavourable money markets, the inability of Great Britain to convert its debt more readily, and more profitably, has contrasted sharply with the United States, where as a combined result of economy and prosperity, debt redemption and conversion has been on a greater scale. During the post-war period, however, Great Britain has had the difficult task of combining her problem of improving national finance with that of restoring the gold standard. This

Debt Maturing Year by Year (Approximate Totals)

N.B.—The amounts shown for National War Bonds are the Nominal Totals, and do not include premiums. National Savings Certificates are shown at issue price, exclusive of accrued interest. External debt is shown at par of exchange. Loans marked * are being repaid by specific statutory Sinking Funds, included in the provision for New Sinking Fund.

Year	Security	Internal	External	Total
		£	£	£
1928–29	5% National War Bonds	163,062,000	..	269,679,000
	4% National War Bonds	30,442,000	..	
	4½% Treasury Bonds	72,834,000	..	
	5½% Straits Settlements Dollar Loan	..	3,341,000	
1929–30	5½% Treasury Bonds	30,637,000	..	52,411,000
	3% Exchequer Bonds	15,040,000	..	
	5½% 10-year Bonds, $8,853,000	..	1,819,000	
	5% Straits Settlements Dollar Loan	..	4,315,000	
1930–31	5½% Treasury Bonds	134,741,000	..	134,741,000
1932–33	4½% Treasury Bonds	121,266,000	..	121,266,000
1933–34	4% and 4½% Treasury Bonds	156,358,000	..	156,358,000
1934–35	5% Straits Settlements Sterling Loan	1,753,000	..	161,288,000
	5% Treasury Bonds	159,535,000	..	
1936–37	5½% 20-year Bonds, $143,584,000	..	29,504,000	29,504,000
1940–41	Anglo-French Loan 4½% Bonds $13,850	..	3,000	3,000
1942–43	4% War Loan, 1929–42	80,334,000	..	80,334,000
1944–45	4½% Conversion Loan	221,122,000	..	221,122,000
1945–46	4½% War Loan, 1925–45	12,804,000	..	12,804,000
1947–48	5% War Loan, 1929–47	2,172,273,000	..	2,172,273,000
	4% Victory Bonds*	342,969,000	..	342,969,000
	4% Funding Loan*	385,388,000	..	385,388,000
	3½% Conversion Loan*	832,258,000	..	832,258,000
	4% Consolidated Loan*	204,207,000	..	204,207,000
	Consols, etc.	313,409,000	..	313,409,000
	Terminable Annuities	12,551,000	..	12,551,000
	Treasury Bills	526,040,000	..	526,040,000
	Ways and Means Advances	161,850,000	..	161,850,000
	National Savings Certificates	362,375,000	..	362,375,000
	4% National Savings Bonds	614,000	..	614,000
	Loans from certain Allied Governments	..	135,700,000	135,700,000
	U.S.A. Government Loan—*$4,480,000,000	..	920,548,000	920,548,000
	Total outstanding on 31 March, 1928	6,515,452,000	1,095,230,000	7,610,682,000
	Deduct: Victory Bonds, etc., purchased by National Debt Commissioners, but not yet cancelled	83,112,000	..	83,112,000
	Totals	6,432,340,000	1,095,230,000	7,527,570,000

latter task successfully accomplished, while adding to the credit of the country, probably involved higher money rates than might otherwise have been necessary, and that in its turn increased the expenditure represented by the annual interest on the national debt, and was also unfavourable to debt conversions.

Committee on British Debt.—In 1923 a committee was appointed on national debt and taxation, presided over by Lord Colwyn, and its report was published in 1927. The majority of that committee recommended that steps should be taken to increase the sinking fund to £75,000,000 a year. They hoped that with the aid of additional repayments of loans by the Governments of Great Britain's Allies, reductions in the interest charge from conversions and redemptions, and possibly expanding revenue, such an amount should be quite practicable within a brief period. The committee was also strong in its recommendations that Government conversion loans should not be issued at a discount, but the advice was disregarded. The Colwyn committee also deprecated any other system than that of definitely revealed and fixed sinking funds. They stated that in their opinion "there was no possible device which could absolutely ensure the continuance of debt redemption, if the Government of the day decided on a contrary policy." Their recommendations as regards the enlargement of the sinking fund as a whole were strengthened by the fact that the sinking fund provisions, ear-marked for specific loans, themselves encroached very considerably upon the total amount available for debt redemption as a whole.

Contingent Liabilities.—Arising out of post-war conditions in Great Britain, a new form of liability was incorporated by the State in connection with various undertakings mostly of a local character, where money although not raised directly by the State, carried with it State guarantees. The circumstances responsible were generally those connected with the dearness of money, which made it difficult for industrial concerns to raise new capital on terms calculated to make the undertaking a paying proposition. Accordingly, and for a short period, when it was shown that the capital required was for the purpose of providing employment, which would not otherwise be provided, the State gave certain guarantees. The total amount involved was not large, being probably within the limit of about £100,000,000 but the point is one to be regarded as coming within the sphere, if not of British debt, of British liabilities, and moreover constituting a special feature arising out of the financial and social problems following upon the World War.

Debt of British Dominions.—Although the debts of the United Kingdom are self-contained, and there is no kind of liability with regard to the indebtedness of oversea dominions, the sentimental connection between them is close and especially so in recent years, when there is an increasing tendency in Great Britain to speak of empire as well as of the national finances. If, therefore, the British debt were to be added to debts of the various oversea dominions, the position at the beginning of 1928 comes out approximately as follows:—

United Kingdom	£7,527,000,000
Irish Free State	£ 17,300,000
Canada	£ 562,000,000
Australia (Commonwealth)	£ 461,000,000

New Zealand	£ 246,000,000
India	£ 721,000,000
South Africa	£ 221,956,000

These figures show that the total increase in the debt of the British Empire for the past quarter of a century is about £8,560,000,000, the growth being as remarkable in the case of the overseas dominions as in the case of Great Britain itself. For the most part, the growth in the Canadian and Australian indebtedness may be connected with the World War, but expenditure on the development of the resources of new countries has also added a considerable part, especially in the case of Australia.

A reference to the table of debts will show that the growth of debt per head in the Australian dominions has been remarkable and has occasioned considerable concern to the chief lending country—Great Britain. Moreover, while largely connected with development of the country's resources, the borrowing has also been stimulated by somewhat extravagant expenditure and Australia might be quoted as a classic instance of the problem of how far extensive borrowing, even for productive purposes, may tend to go ahead of the capacity of the population to bear the strain of the increased debt charge. Not the least interesting feature of the external debt of British dominions during the post-war period has been the tendency to borrow fairly large amounts in the United States, both Canada and Australia having raised large loans there. (A. W. K.)

Statistics of National Debts in Great Britain, British Dominions, and the United States

Country	Population (in thousands)	Total debt (in thousands)	Per capita debt	Total annual charge (in thousands)	Per capita charge
United Kingdom	44,738	(1) £7,587,000	£168	£355,000* (1928–9)	£7·9
Irish Free State	2,073	(22) £17,100	£ 5.8	£1,606	5.4
Canada	9,500 (1927 estimate)	(8) $2,734,973 (£562,000) (31.3.27)	£59.1	£26,620† (1926–7)	£2·74
Australia	6,170	(10) £461,068‡ (30.6.27)	£75	£23,416	£3.79
New Zealand	1,437	(12) £245,851§ (31.3.27)	£171	£0,300	£6.5
India	318,042	(6) £721,000 (31.3.26)	£ 2.3	£10,500*	6s 7d
South Africa	6,027 (1,672 white)	(14) £221,056 (31.3.26)	£32	£9,209†	£1·3
United States of America	105,711 (1920 census) or 118,028 (1927 estimate)	(2) $17,486,605,507 (£3,610,110) (30.6.28)	£36 £32	£163,200† (1927) £130,000† (1929 est.) £108,000‖ (1927) £112,500‖ (1929 est.)	£1.54 or £1.38 £1.32 or £1.17 £1.02 or £0.91 £1.06 or £0.95

*All charges.
†Interest only.
‡Dominion Govt. only, but includes loans raised on behalf of States, amounting to £94,456,237.
§In bonds and stocks.
‖Amortisation only.

THE UNITED STATES

When Alexander Hamilton (*q.v.*) became the first secretary of the U.S. Treasury in 1789, one of the major problems confronting him was the preparation of a statement of the National debt, and a plan for its settlement. This was the subject of his *Report on Public Credit* submitted on Jan. 9, 1790. The foreign debt, almost all French, incurred during the Revolution, including principal and accumulated interest, was placed at $11,710,000. It had been contracted under certain precise conditions which allowed of no disagreement in the way it was to be paid. The domestic debt was more difficult to determine since it consisted of a variety of credit obligations issued at different times under varying terms of contract. Hamilton estimated the principal at $27,383,000 and accrued interest at $13,030,000. These credit obligations had passed current in the country as monetary medium and had depreciated in value. The question arose as how they should be repaid, and Hamilton reached the conclusion that the present holders should be paid full value. Against much popular ill feeling Hamilton's plan was adopted. The third question, concerning the matter of State debts which totalled $18,271,786, was whether the Federal Government should assume these debts or not. Hamilton favoured assumption on the theory that it would contribute to a more orderly, stable and satisfactory arrangement of national finances and also contribute to national unity. The Southern States, whose debts were low, objected to the plan, and Hamilton was able to carry it through only by a political bargain which granted to the Southern States the removal of the national capital from Philadelphia to a territory to be set off from Virginia and Maryland, the District of Columbia. The Funding Act of Aug. 4, 1790, which provided for three loans to take up the three different classes of indebtedness, at once stabilized the finances of the new nation.

If the debt was not reduced so much as it was hoped in the following decade, it was not the fault of the administration so much as it was due to unexpected events. In 1801 the total debt stood at $83,000,000, a slight increase. However, during the able administration of Gallatin, the debt was cut to $45,200,000 (1812), in spite of the added Louisiana Purchase debt, which was paid off in five years. The last of the foreign debt was paid in 1809. The excellent record was halted by the War of 1812, the expenses of which raised the debt to a new height in 1816 of $127,334,000. Much was paid off during the years 1816–17, but bad years following greatly entangled the finances. Disadvantageous long-term loans were resorted to, which could not be taken up by the surplus accruing in the better years following 1822. So favourable were the finances after 1825, however, that in spite of the handicap of inelastic loans, the entire debt was paid off by 1835, and the Treasury began to accumulate a surplus which proved almost more embarrassing than a debt.

The Mexican War created a net indebtedness of $49,000,000. All of the bonds were easily placed at par and some at a premium, which may be contrasted with the financing of the War of 1812, when loans in stock were sold with difficulty even at a discount. Also the loan was subscribed to in specie for the first time since the foundation of the Government.

When Salmon P. Chase was appointed secretary of the Treasury by President Lincoln at the beginning of the Civil War, the national debt was $74,985,000, of which $18,000,000 had been incurred since the beginning of the secession movement. The demands of the Civil War called for financial operations on a scale which made all former Treasury records seem insignificant. Unceasing drain on credit and reverses in the field made the fiscal year of 1862–63 the darkest in the nation's history. Bonds did not sell at home even at a discount and found no market abroad. Temporary loans and the issue of notes were resorted to. After the battles of Gettysburg and Vicksburg in 1863 matters took a brighter turn and Chase's third report in 1864 was optimistic. The public debt on Sept. 1, 1865 at the end of the war, stood at $2,758,000,000, the highest in the nation's history until the World War. Less than one-half of this was funded. For the first few years after the war a portion of the available revenue was devoted to a partial contraction of the currency by retiring greenbacks, but in 1870 and 1871 funding acts were passed which authorized the issuing of $1,800,000,000 worth of bonds at 4%, 4½% and 5%, redeemable in from 10–30 years, to care for the major part of the debt. The funding acts shaped the character of the debt for the next quarter century. By saying that the bonds were redeemable in "coin" and not in gold, a troublesome silver controversy was later raised. An attempt was made to place some of the bonds abroad, but the Franco-Prussian War and other con-

ditions prevented much success. In general there has always been much opposition in the United States to borrowing abroad by the National Government, and it was never seriously attempted except under the stress of the Civil War. The 30 year period for the major share of the bonds under the Funding Act was too long. A surplus appeared in the Treasury in 1882 which could otherwise have been applied to their retirement. Long before the bonds were due the Government could borrow money at 2½%. Despite the fact that the bonds were selling at a premium and that the effect was naturally to raise their quotations, different secretaries of the Treasury bought in the open market all that could be purchased. Thus the indebtedness was reduced from $1,996,000,000 in 1879 to $891,000,000 in 1890, a remarkable achievement at that time.

The Spanish-American War again raised the debt, but the Funding Act of 1900 arranged for it together with other old loans to be refunded into 30 year 2% gold bonds. A small cash premium was paid to induce holders to make the exchange. From 1902 to 1913 there was little change in the debt total, retirements being balanced by increases due to the construction of the Panama canal. In 1913 the debt stood at $1,028,600,000, nearly three-fourths of which bore interest at the rate of 2%.

During the World War years the national debt reached a new peak. For the fiscal years ending June 30, 1917, 1918 and 1919, the respective additions to the debt were $902,353,000, $9,015,646,000 and $13,555,021,000. On June 30, 1919, the grand total stood at $25,482,034,000. Practically all the war-time indebtedness was in the form of bonds held by U.S. citizens. The Treasury Department immediately after the war began the reduction of the total. Its success was such that the annual decrease averaged almost $900,000,000. By June 30, 1928, the national debt had been lowered to $17,526,219,000. Concerning this matter, the report issued by Secretary of the Treasury Mellon dated Nov. 19, 1927, is particularly interesting. (For details of the recent period *see* UNITED STATES: *Finance.*) (X.)

OTHER NATIONAL DEBTS

Although the increase in the national debts of the world during the last quarter of a century has been mainly due to the great World War, and therefore affects primarily the debts of the belligerent countries, there has nevertheless been a rise in the indebtedness of almost every country throughout the world. This, of course, to some extent is normal, and usually proceeds *pari passu* with the growth of population. Some idea, however, of the manner in which the costs of the war hit the belligerent countries may be gathered from the great change which has taken place in the debts *per capita* of the various nations compared with the beginning of the present century. In 1920 the French debt was easily the largest, but in the liability per head France came fourth in the list, while the United Kingdom occupied the third position in a list of 25 countries as regards total debt, and the eleventh as regards liability per head. In 1928, however, Great Britain easily led the way with the largest debt in the world of £7,527,000,000, representing a *per capita* liability of £168, while the total annual charges give a *per capita* charge of nearly £7.10s. This compares with a total debt at the beginning of this century of £628,979,000, representing only £15.7s.6d. per head and an annual charge per head of only 11s.4d. In noting, however, the fact that the French debt now falls greatly below the British debt, allowance has to be made for the fact that the franc has been devaluated. At the beginning of 1928 the French franc was not definitely stabilized, but it had stood for a long period at the rate of 124 francs to the £, and it is on that basis that francs in the table have been converted into sterling. It will be seen, therefore, that but for this process of conversion, the French debt would have stood at more like £13,000,000,000, or considerably ahead of all the other debts of the world, including that of Great Britain.

Even more striking, of course, is the enormous increase in the *per capita* liability of some of the British dominions with small populations, their indebtedness having been heavily increased as the result of the share taken by them during the World War and the subsequent resumption of expenditure on development. Thus, the *per capita* debt of New Zealand works out to the extraordinarily heavy amount of £171, and even in Canada the debt *per capita* is nearly £60.

STATISTICS OF NATIONAL DEBTS

Country	Population (in thousands)	Total debt in thousands of pounds sterling. £1 = $4.865	Per capita debt	Total annual charge (in thousands)	Per capita charge
France	40,744	(3) £2,680,000 (30.8.27)	£65.5	£163,800* (1926)	£4.02
Germany	62,411	(4) £1,460,000† (31.8.27)	£23.4	£121,600 (1927-8)*§	£1.95
Italy	42,116	(5) £900,000‖ (30.6.27)	£21.4	£44,300 (1926-7)‖	£1.05
China	440,000	(13) £238,660,000	10s	£16,000	0s 9d
Japan	83,454	(9) £500,000 (30.9.27)	£ 0	£38,100¶	9s 2d
Holland	7,416	(11) £253,000 (1927)	£34.2	£16,200*	£2.18
Belgium	7,875	(17) £161,200‖ (31.12.26)	£20.5	£14,500*	£1.84
Spain	21,066	(7) £621,000 (1927)	£28.3	£28,700 (1927)	£1.31
Austria	6,535	(21) £63,500 (31.12.25)	£ 9.74	£4,500 (1926)*	14s 9d
Czecho-Slovakia	13,613	(15) £213,000 (1927)	£15.6	£13,050 (1927)*	19s 2d
Sweden	6,074	(18) £95,600 (1.1.27)	£15.75	£4,730 (1927-8)†	15s 7d
Norway	2,772	(19) £88,000 (exchange at par) £73,000 (at exchange at date) (30.6.26)	£32.0	£6,390 (at par)*	£2.3
Denmark	3,435	(20) £64,000 (at par) (1.4.27)	£18.65	£1,200† £805‡ (1927-8)	7s 0d 4s 8d
Argentina	10,300 (estimated)	(16) £102,400 (31.12.26)	£18.7	£15,350	£1.49

Dates in table refer to dates to which statistics apply.
*All charges.
†Interest only.
‡Amortisation only.
§Includes mks. 25,000,000,000, capital value of reparations liabilities, also mks. 2,000,000,000, annual charge for 1927-8.
¶Includes all "Treasury" expenditure.
‖Internal debt only.

In the case of many of the foreign countries, and notably in the case of Russia, post-war conditions are still so chaotic that only a bare estimate of debt can be given, and in the case of Germany and some other countries, comparison with the beginning of the century is almost impossible by reason of the fact that, while on the one hand new debt has been increased by borrowings, the old debt has been practically wiped out or greatly reduced owing to depreciated currencies. As regards Germany, there has also to be added to the ordinary debt vast liabilities under the head of reparations (*see* REPARATIONS). Comparison of the debts of countries like Austria and Czechoslovakia with the figures at the beginning of the century is impossible owing to the territorial changes resulting from the Treaty of Versailles.

Asiatic Countries.—As regards the Asiatic countries, there has been a heavy increase in the debts both of China and Japan. At the beginning of the century, the *per capita* debt of China was about 3/- and the *per capita* annual charge only about 2d. At the beginning of 1928, both politics and finance in China were in a chaotic state, while the very fact of the great variation in the estimates of population makes it impossible to give really reliable figures with regard to proportion of debt to population. There was no doubt, however, as to the very large expansion of the debt

and, so far as may be judged, the *per capita* debt had risen to about 10/- and the *per capita* charge of the annual service to about 9d. The Japanese debt too, which at the beginning of 1900 amounted to the equivalent of only £53,000,000, had risen in 1928 to about £500,000,000 and the *per capita* charge of the annual service to about 9/2d. against 1/5d. In the case both of China and Japan the growth into debt has been largely the result of wars.

South America.—In the South American countries, an interesting feature to note is the fact that although the Argentina debt has grown since the beginning of this century from £103,000,000 to £182,400,000, the actual debt per head has fallen from £23.12.0. to just under £18,—the reason, of course, being the great increase in the population. In fact, Argentina furnishes a striking instance of a country where growth in the debt has been accompanied by a more than proportionate increase in the total wealth.

(*See* also DEBT CONVERSION, INTER-ALLIED DEBTS, WAR FINANCE, FINANCE, SINKING FUND, FLOATING DEBT, and the details given under the headings of the chief countries.)

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(A. W. K.)

NATIONAL DEPOSIT FRIENDLY SOCIETY: *see* FRIENDLY SOCIETIES.

NATIONAL DIVIDEND. National Income has been defined as "the aggregate money expression of those goods produced, and services performed, by the inhabitants of a country, which are, as a fact, generally exchanged for money." The terms National Income and National Dividend are convertible, only the latter is more significant "when we are looking at the national income in the character of the new sources of enjoyment that are available for distribution" (Marshall), *i.e.*, the flow or fund, before it is assigned to individuals. This may be looked at in two sharply contrasted ways: "the flow *produced* during a year, or, the flow *consumed*." Dr. Marshall said "The labour and capital of the country, acting on its natural resources, produce annually a certain net aggregate of commodities, material and immaterial, including services of all kinds. This is the true net annual income or revenue of the country, or the national dividend." (Of course, services rendered by people to themselves, that they might have received from others and paid for, are not counted, otherwise the money valuation so essential for practical purposes would become difficult and vague.) Some writers (*e.g.*, Professor Fisher) have excluded savings as not being income, unequivocally claiming to "identify the National Dividend with those services and those only, that enter directly into consumption." But it is best to distinguish this and avoid confusion, as the "national income of consumable goods." Various corrections of gross money income of individuals taken in the aggregate are necessary to prevent double counting, *e.g.*, War loan interest paid out of income tax on incomes which have not been reduced (by the amount of the tax) in aggregation. If this were not done, the greater the War loan indebtedness the greater would be the amount of the national income, *without any change in the physical and usable incomes of goods and services.* (*See* also WEALTH, NATIONAL.)

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(J. S.)

NATIONAL FINANCE: *see* FINANCE.

NATIONAL GEOGRAPHIC SOCIETY, an American scientific society founded in Washington in 1888, "for the increase and diffusion of geographic knowledge." Its membership in 1929 was 1,200,000, of whom 77,000 resided in 88 other countries. In the field of research it has sent expeditions to many parts of the world, some wholly financed by it, others in collaboration with other institutions and organizations. The expeditions it has sent out to study the processes of volcanism and seismology, including studies at Mont Pelée, Messina, Mt. Katmai and the Pavlof area brought new light on these earth processes and resulted in the discovery of the Valley of Ten Thousand Smokes in Alaska, the greatest pre-geyser land known, which has been established as a national monument by proclamation of the U.S. president. In tracing the ancient civilizations of the New World the society, in conjunction with Yale university, unearthed the ancient Inca retreat, Machu Picchu, in Peru, and in a series of eight expeditions unearthed the even more ancient community of Pueblo Bonito, N.M., and laid the foundations for the co-ordination of the tree-ring calendar with our own and the establishment therefrom of an American chronology antedating the discovery of America by many centuries. In supporting active polar research the society aided Admiral Peary in all his Arctic work, sent the MacMillan-Byrd expedition to the Arctic (1925) and helped to finance the Byrd Antarctic expedition of 1928–29. In aiding solar research the society made the grants that provided the observatory and maintenance of the Brukkaros station of the Smithsonian Institution. In the field of spreading geographic knowledge the society publishes the *National Geographic Magazine*, which every member receives, issues a bulletin service for the daily press of the world, furnishes the schools of the United States with material for current-event geography and pictorial geography text in loose-leaf form. It also issues scientific monographs and publishes a widely distributed series of maps. (G. GR.)

NATIONAL GUARD (United States), that part of the militia which is organized and trained as land troops (*a*) subject to the jurisdiction of the governors of the various States and territories for use in local emergencies and (*b*) when in the service of the United States, a part of the United States army under the chief command of the President.

History.—The Constitution of the United States, recognizing the need for a well regulated militia, set forth general principles for its organization and government. The Union was obliged to protect all States thereof against invasion and, under certain conditions, against domestic violence. Various acts of Congress from 1792 onwards were passed, but none provided an effective militia. In 1903 the "Dick Bill" was enacted. This law distinguished between the whole body of citizens capable of bearing arms and subject to military service but untrained, and the organized militia comprising the naval militia and the land militia, the latter to be known as the National Guard. It was to have the same organization, armament and discipline as the regular army and to be instructed and inspected by officers of the regular establishment. Although this compromise was a vast improvement, it failed to satisfy the demands of the Constitution or the needs of the nation. The supplementary Act of May 27, 1908, gave the President power to draft the National Guard into the service of the United States, either within or without the borders of the country, without the formality or delay of volunteering either by organizations or by individuals.

The National Defence Act.—The outbreak of war in Europe in 1914 led finally to a demand for preparedness which culminated in the National Defence Act of June 20, 1916. This was amended in the light of war experience by the Act of June 4, 1920. These laws provided for the first time a comprehensive and definite military system such as was contemplated by the founders of the American Union, and adapted to modern needs by such interpretations and Federal grants as to permit the establishment of uniformity throughout the country.

The National Guard is recruited by voluntary enlistment of men between the ages of 18 and 45 for a period of three years and subsequent re-enlistments for either one or three years. The

strength originally contemplated by law was 435,000, but in view of the national policies the War Department does not expect that it will exceed 250,000. The strength in 1927 was 181,142. The organization in time of war is that of the regular army, modified for peace time needs. The commanding general of a brigade or division and, in time of war, the chief of staff and one assistant chief of staff of a division may be regular army officers. Under these laws the only troops permitted to the States are National Guard troops and these can be organized only by consent of the United States. Units are allocated to the States by the President upon recommendations made by a board of the general staff composed in equal parts of regular officers and National Guard officers holding reserve commissions in the U.S. army. States which receive Federal aid are forbidden to disband units or to reduce them beyond a fixed strength, and this aid is given only when the units reach a prescribed degree of efficiency determined by inspections. Administration is conducted by the militia bureau of the War Department, the chief of which must be an active or a former member of the National Guard. The country is divided into nine corps areas each embracing several States and supporting, in addition to regular and reserve formations, two infantry divisions of the National Guard and such coast artillery, corps, army and G.H.Q. reserve troops as may be prescribed. On the staff of the commanding general of each corps area is an officer for National Guard affairs.

Within each State the governor is commander in chief of the National Guard thereof and administers it through an adjutant general and a State staff. Divisional boundaries overlap State lines. Despite the apparent complication of this arrangement it works smoothly because it is to the interest of both State and Federal Governments that it should. Arms and equipment are the same as for the regular army and, together with other stores, animals, forage and the expenses of Federal officers on duty with the National Guard, are provided by the Union. The States supply armouries and other facilities, sometimes including additional pay for allowances. The troops are paid by the Federal Government at the rate of $\frac{1}{30}$ the initial or base pay per month for every armoury drill up to a maximum of 60 drills per annum; and during field training (about 15 days per year), pay, subsistence and transportation are at the same rate as for the regular establishment. Courts-martial can sentence to forfeiture of pay and assess fines or levy other punishments, and their processes must be carried out by the civil authorities. They have the power to issue subpoenas and warrants of arrest and to compel the attendance of witnesses.

Personnel and Training.—The quality of the personnel is high, but the annual turnover is large. Among subaltern officers it reaches 26% per annum. Training is therefore limited to basic drill. Physical standards are maintained by annual examinations. All ranks take their duty seriously. About 50% of all officers in 1927 held commissions as reserve officers, and ultimately this will be required of all, as examinations for appointment and promotion in both are according to the same standard, which among senior officers is high. Subalterns come from the ranks, from the reserve officers' training corps in colleges and universities (conducted by officers of the regular army); and sometimes from the citizens' military training camps. In 1927 officers were distributed as follows:—

Major Generals of the line	14
Brigadier Generals of the line	53
Brigadier Generals, adjutants general	19
State staff corps and departments	461
Staffs of division	371
Staffs of brigades	267
Officers of units less than a brigade	10,828
Total	12,013

Encampments or manoeuvres may be held separately or in conjunction with regular troops. Officers and enlisted men may be attached to regular units for field training. Instructors from the regular establishment are detailed for duty with the National Guard on the basis of one to a battalion or equivalent unit, which requires a total of 476 officers in addition to 589 non-commissioned instructors. Special courses are given for both officers and enlisted men at service schools, and from 1920 to 1927 a total of 1,702 officers attended such courses at branch schools, the command and general staff school and the army war college. Such provisions have raised the standards of personnel and instruction. Training has improved rapidly in recent years and the National Guard is developing a strong *esprit de corps*.

Present State.—In 1927 no less than 17 States called out their National Guard in local emergencies, such as the Mississippi floods and the Florida hurricane, and these crises have proved these troops to be a reliable force, and have earned it the warm support of the States. Although proficiency varies with local conditions some National Guard units with a short period of combined training would make first class combat troops.

When drafted into the Federal service the National Guard becomes an integral part of the United States army, subject in all respects to the same rules and regulations. It serves for the duration of the emergency, after which it reverts to State control. As an indication of the increased reliance placed upon this force as an asset in the national defence, one may compare the appropriation of $1,000,000 for 1900 with the following:

Year	Appropriation	Strength
1919	$ 6,450,150	37,210
1920	13,194,791	56,090
1921	28,002,882	113,640
1927	30,879,252	181,142

In 1927 the Chief of the Militia Bureau reported: "It is evidently the intent of Congress, and all War Department plans and policies bear it out, that the National Guard is to be used as first line troops subject to call at the same time as the regular army."

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(J. M. Sc.)

NATIONAL INSURANCE: HEALTH. Any satisfactory scheme of national health insurance should have two main objects, (1) to secure for the insured any medical attendance that he may require at any time, and (2) to compensate him by money payments for the loss of wages when compelled to cease work through sickness. Until late in the 19th century there was little or no recognition in any country of any duty of the State to concern itself with the making of provision against sickness amongst its workers. In many countries some provision was made independently of the State by the workers themselves through mutual provident associations, but only part of the field was covered by this means, and the less thrifty section of the community, who were most in need of protection, were rarely included. The position in many working-class households was, therefore, that when sickness fell upon the breadwinner, involving ordinarily not only cessation of his wages, but also the extra cost of doctor's bills, as soon as any small savings had been exhausted there was no alternative but recourse to the poor law. In 1883 a compulsory scheme of insurance was introduced in Germany and this was extended in 1889 to cover permanent incapacity. The example of Germany was followed by Austria in 1888 and by Hungary in 1891. About the beginning of the 20th century public opinion in most European countries began to crystallize in favour of some organized provision to meet the contingency of sickness amongst the workers, and in one country after another schemes based on the German model of compulsory insurance were brought into operation.

I. GREAT BRITAIN

The scheme of national health insurance in Great Britain was founded on the National Insurance Act, 1911, which was brought into operation on July 15, 1912. The scheme is on a compulsory and contributory basis, the cost being shared between the workers, the employers and the State. The persons who are required to be

insured comprise roughly the whole wage-earning community over the age of 16, with the exception of non-manual workers remunerated at a rate exceeding £250 a year. There are, however, a few exceptions, of which the most important are persons employed under the Crown, a local authority or a statutory company who, by the terms of their employment, are entitled to provision during sickness at least equivalent to that provided under the act. In addition to these excepted persons who are completely outside the national scheme of health insurance, persons who would normally be compulsorily insured may claim exemption if they can prove that they have a pension or unearned income of at least £26 a year, or that they are mainly dependent for their livelihood on someone else or on some non-insurable occupation. The employers of these exempt persons are, however, required to pay the employer's share of the contribution. Persons who are compulsorily insured by virtue of their employment are known as employed contributors. The scheme also allows any person (other than a married woman) who has been insured for at least two years as an employed contributor and has paid at least 104 weekly contributions to continue in insurance as a voluntary contributor, if he so elects, on ceasing to be employed. A married woman may not herself be insured as a voluntary contributor but where an uninsured man marries an insured woman who has paid at least 104 contributions he is allowed to become a voluntary contributor. The total number of insured persons at the end of 1927 was about 16,000,000.

Contributions.—The weekly rate of contribution has, from the year 1926, been 9d. for men and 8½d. for women, of which 4½d. is payable by the employer. The employer is required to pay the whole contribution in the first instance, but may recover the portion for which he is not himself liable by deduction from the wages of the worker. In the case of a voluntary contributor the whole contribution is payable by the contributor himself. The contribution of the State towards the cost of the scheme takes the form of the payment of a definite proportion of the cost of all benefits and of their administration. Since 1926 the proportion payable by the State has been one-seventh in the case of men and one-fifth in the case of women insured persons.

The weekly contributions are at a flat rate irrespective of the age at which persons first become insured. The rates are fixed so as to cover the actuarial cost of the benefits in the case of persons entering insurance at the age of 16. For persons first becoming insured at higher ages the contributions at the flat rate would not in themselves be sufficient to cover the actuarial cost of the benefits and the shortage is made good by the creation of book credits called reserve values. These book credits are gradually converted into cash through the operation of a sinking fund derived from small deductions from all weekly contributions over a period of years. This system of reserve values, taken in conjunction with the payment by the State of a proportion of the cost of benefits and administration, is equivalent in its effect to the provision by the State of the reserves required to enable the benefits to be given to all insured persons at a flat rate of contribution irrespective of age at entry into insurance.

Benefits.—The benefits to which the insured persons become entitled in return for their contributions are—

(1) *Medical Benefit, i.e.,* free medical attendance and treatment and any necessary medicines. The medical attendance is limited to such as is within the competence of an average general practitioner. A person becomes entitled to medical benefit immediately on becoming insured and in general remains entitled throughout his insurance.

(2) *Sickness Benefit,* which consists of weekly cash payments to the insured person when rendered incapable of work by illness, the standard rates being 15s.od. a week for men and 12s.od. a week for women. Sickness benefit is payable from the fourth day of incapacity and may continue for a maximum period of 26 weeks. A person does not become entitled to sickness benefit until he has been insured for 26 weeks and has paid 26 weekly contributions. Benefit is then payable at the reduced rate of 9s.od. a week for men and 7s.6d. a week for women. When 104 weeks of insurance have been completed and 104 contributions paid, benefit becomes payable at the full standard rates.

(3) *Disablement Benefit, i.e.,* weekly payments at a reduced rate when, and so long as, incapacity continues after the title to sickness benefit has been exhausted. The normal rate of disablement benefit is 7s.6d. a week both for men and women. The qualifying conditions for the receipt of disablement benefit are 104 weeks of insurance and the payment of 104 weekly contributions.

(4) *Maternity Benefit, i.e.,* a money payment in the event of the confinement of an insured woman or the wife of an insured man. The standard rate of maternity benefit is £2, and in the case of a married woman who is herself insured, benefit is payable both in respect of her own and her husband's insurance. The qualification for maternity benefit is 42 weeks of insurance and the payment of 42 weekly contributions.

(5) *Additional Benefits,* which may take the form either of an increase in the standard rates of the cash benefits, or of payment towards the cost of various forms of treatment required by the insured persons, such as dental, ophthalmic or convalescent home treatment. These additional benefits differ from the ordinary benefits in that they are only payable by Approved Societies which are found on valuation to have a surplus available for the purpose.

Contributions are payable for every week during the whole or any part of which an insured person is employed. If there has been no employment during a week the insured person falls into arrears and unless these arrears are excused or redeemed by making the appropriate payment within the time allowed, penalties in the form of reduction or suspension of cash benefits will result. From the inception of the scheme arrears have been excused when due to incapacity for work through sickness of which notice has been given, and by the Act of 1928 arrears which can be shown to have been due to genuine unemployment also involve no penalty. In effect, therefore, the present position is that an insured person is credited with a contribution in respect of every week during which he is either employed, sick or genuinely out of work, but if, during any contribution year (July to June) there are any weeks in respect of which no contribution is credited, *e.g.,* weeks of voluntary abstention from work or weeks during which the insured person is engaged in some occupation which is not employment within the meaning of the Act, then unless the arrears for such weeks are redeemed within the period of grace the rates of sickness and disablement benefits are reduced throughout the ensuing calendar year in proportion to the number of arrears outstanding.

The title to sickness and disablement benefits and the liability for the payment of contributions cease on an insured person attaining the age of 65, at which age in the normal case the title to a contributory old age pension accrues.

Where an insured person is rendered incapable of work by an accident or industrial disease in respect of which he is entitled to compensation under the Workmen's Compensation Act or to damages, sickness and disablement benefits are not payable to him unless the weekly value of compensation or damages is less than that of the benefit which would ordinarily have been payable. In this case the difference only is payable by way of benefit.

An employed contributor does not cease to be insured and entitled to benefits immediately on ceasing employment but continues so entitled for a period between 1½ and 2 years at the full rates of benefit, and if he can show that throughout that period he was genuinely unemployed his insurance is continued for a further year, subject, however, to reduced rates of benefit. A person who has been insured for at least 10 years and who becomes unemployed after reaching the age of 60 is allowed to continue in insurance (so long as he remains genuinely unemployed) until he attains the age of 65, and thus his title to a contributory old age pension is safeguarded.

Payment and Collection of Contributions.—The contributions are paid by means of the purchase of special stamps at any post office. The health insurance contribution is paid jointly with the contribution payable under the State scheme of contributory widows', orphans' and old age pensions, by means of a single health insurance and pensions stamp to the amount of the joint contribution. One of these stamps has to be affixed to the

insured person's contribution card in respect of each week of employment, but special arrangements may be made in certain cases for stamping in bulk. It is the duty of every insured person to obtain a contribution card at the beginning of each contribution period and to present the card to his employer to be stamped at the proper times. The contribution period is a period of six months commencing on the first Monday in January and July of each year. If an insured person fails to produce a contribution card to his employer to be stamped at the proper time, the employer is required to stamp an emergency card, which can be obtained at any post office. The money for health insurance received at post offices from the sale of health insurance stamps is paid into a fund known as the National Health Insurance Fund, which (in England) is under the control of the Minister of Health and out of which all the moneys required for the payment of health insurance benefits and the cost of their administration is supplied.

Medical Benefit.—The arrangements for the administration of medical benefit are on a territorial basis and are made through special bodies, known as Insurance Committees, in every county and county borough. These committees are composed, as to a majority, of representatives of the insured persons in the area, the remaining members being representative of doctors or nominated by public authorities. It is the duty of the insurance committee to prepare a panel of all the doctors in the area of the committee who desire to treat insured persons, and any registered medical practitioner has the right to have his name placed upon the panel. The insured person has free choice of the insurance practitioner from whom he is to receive treatment. The insurance practitioner enters into an agreement with the insurance committee, by which he undertakes to provide to all insured persons on his list any medical treatment (within the competence of a general practitioner) which they may require at any time and to prescribe for them such medicines as may be necessary. In return for his services he is paid at the rate (since 1924) of 9s.0d. a year for every insured person on his list. In addition to this capitation payment doctors in rural areas receive a supplementary mileage allowance in respect of additional cost of travelling. The insured person can obtain the medicines prescribed for him by his doctor from any chemist taking part in the service. A further obligation of the insurance practitioner is to supply the insured persons on his list with such medical certificates of incapacity for work as they may require in order to make good their claims to sickness and disablement benefits. The total charge on insurance funds to meet the cost of medical benefit and its administration is limited by the Act to 13s.0d. per insured person per annum.

Cash Benefits.—The cash benefits, *i.e.*, sickness, disablement and maternity benefits, are administered by bodies known as Approved Societies. These bodies are independent self-governing groups of insured persons banded together for the purposes of the national health insurance scheme. They are not ordinarily on a territorial basis but the members generally have some community of interest which may be religious, occupational or social, or may arise out of private insurance with the same society. Any body of persons may make application to the Minister of Health for approval, the only statutory conditions attached being that the body should not be carried on for profit and that it should make rules to the satisfaction of the Minister for the administration of State insurance under which the affairs of the society must be subject to the absolute control of its members. On approval being granted the society becomes entitled to receive the contributions of all insured persons who become members and it undertakes to pay them the cash benefits to which they may become entitled. An insured person is free to select his own approved society and a society may accept or reject any applicant for membership in accordance with its rules. The number of approved societies in Great Britain is about 1,000, and the membership varies from less than 100 to more than 2,000,000. About thirty approved societies are divided into branches, each of which is a separate and autonomous financial unit. The total number of such branches is about 7,000. Approved societies are of many types, of which the principal are Friendly Societies (either with or without branches), Trade Unions, societies associated with industrial assurance companies, and employers, or works, societies. Every approved society has complete control of its own funds and the members stand to gain or lose as the result of their society's experience and standard of administration. The insured members of a society are required to surrender to the society their stamped contribution cards at the end of each contribution period and the society is credited in the National Health Insurance Fund with the total value of health insurance contributions represented by the stamps on the cards surrendered by all the members of the society. Out of its credit in this fund, with the relative State grant, the society obtains the necessary money for paying all benefits to which the members become entitled, as well as the cost of the society's administration. So far as the amount standing to the credit of a society in the National Health Insurance Fund is more than sufficient to meet the current expenses of the society, the balance becomes available for permanent investment and one-half is paid over to the society itself for investment by the trustees, the other half being transferred to the credit of the society in the investment account and invested by the national debt commissioners.

A small deduction is made from every weekly contribution paid in respect of each member of a society and is allocated to a contingencies fund which is available to meet any deficiency which may be disclosed on the valuation of the society. After each valuation the sum standing to the credit of the contingencies fund is transferred to the benefit fund of the society, and in so far as it is not required to make good any deficiency it becomes available for the provision of benefits. A further protective fund, similarly derived, but augmented by a contribution from the Exchequer, is the Central Fund, which is a single fund common to all societies and is available to meet the balance of any valuation deficiency which cannot be met out of a society's own contingencies fund. The granting of assistance from the central fund is conditional on the deficiency not being due to unsatisfactory administration on the part of the society.

In order to claim sickness or disablement benefit an insured person who has become incapable of work through sickness should at once obtain from his insurance doctor a certificate of incapacity and should forward it to his approved society. Further medical certificates should similarly be obtained and forwarded at intervals (normally weekly) as required. If the society is satisfied that the member is incapable of work and that the necessary qualifying conditions for benefit are satisfied, payment of benefit is made to the member weekly. Similarly a claim for maternity benefit is made by the insured person sending to the society the necessary certificate of confinement. Any dispute between an insured person and his society with reference to a claim for benefit has to be referred to arbitration in accordance with the rules of the society, and a final right of appeal lies to the Minister of Health, whose decision is binding on both parties.

A society which is in doubt as to the incapacity for work of a member claiming benefit, can obtain a second medical opinion on the point by referring the member for examination to one of a body of medical referees known as Regional Medical Officers, appointed by the Minister of Health.

Every approved society is required to keep accounts of its receipts and expenditure under the act and to submit these accounts to audit by auditors appointed by the Treasury. The amount which a society may expend on administration is limited to 4s.6d. per member per annum. Every approved society and branch is subject to a valuation of its assets and liabilities at intervals, usually of five years, by valuers appointed by the Treasury. If on valuation a surplus is disclosed, such part of the surplus as the valuer certifies to be disposable for the purpose is used by the society in providing additional benefits for its members in accordance with a scheme drawn up by the society and sanctioned by the Minister of Health. A scheme of additional benefits ordinarily covers a period of five years. If on valuation a society or branch is found to be in deficiency, recourse must be had first to the society's own contingencies fund, and if that is not sufficient

to make good the deficiency application may be made for a grant from the central fund.

The results of the valuations which have been made show that the finance of national health insurance is on a thoroughly sound basis. At the first valuation, which was made as at Dec. 31, 1918, the great majority of all societies and branches were found to have surpluses, the aggregate amount of which was about £17,000,000. On the second valuation, which was made as at Dec. 31, 1923 (or a year earlier in the case of certain societies) the membership of societies showing surpluses was about 15,000,000, while that of societies with deficiencies was less than 250,000. The aggregate amount of the surpluses exceeded £42,000,000, of which about £15,000,000 was kept in reserve, the balance being devoted to the provision of additional benefits. Many of the societies were thus enabled to make substantial additions to the standard rates of sickness, disablement and maternity benefits, and also to pay the whole or part of the cost of various forms of treatment required by their members and not provided as part of medical benefit. The most popular of these treatment benefits is dental benefit, which is provided for about 75 per cent of the whole insured population, and to which a sum of nearly £3,000,000 a year is devoted. The benefit ordinarily takes the form of the payment by the society of not less than 75 per cent of the cost of any dental treatment obtained by the member and not less than 50 per cent of the cost of any dentures supplied. A scale of charges has been agreed between the approved societies and the dental profession, and insured persons are given free choice amongst the dentists willing to provide treatment on the agreed scale.

Other widely adopted additional benefits are ophthalmic benefit (including the provision of spectacles), treatment in convalescent homes, and the provision of medical and surgical appliances.

Deposit Contributors.—Insured persons who do not join an approved society within a certain time after their entry into insurance fall automatically into a special class known as deposit contributors. Such persons are only entitled to benefits up to the limit of the amount standing to their own individual credit as the result of the contributions paid in respect of them, but the usual proportion of the cost of their benefits is paid by the State. The number of deposit contributors at the end of 1926 was 282,400. It is always open to a deposit contributor at any time to join any approved society which is prepared to admit him to membership. By the Act of 1928 a special insurance section was set up through which any deposit contributor who can prove that he is unable, by reason of the state of his health, to obtain admission to an approved society, is able to obtain the full normal benefits of the scheme on an insurance basis.

Central Administration.—The general supervision of the scheme of national health insurance on behalf of the central government is vested in the Minister of Health in England and Wales, and in the Scottish Board of Health in Scotland, and the cost of the central administration is borne by the Exchequer. It rests with the Minister to determine doubtful questions of insurability, to enforce the payment of the statutory contributions, and to satisfy himself that the scheme is properly administered by approved societies and insurance committees. The Minister is empowered to withdraw approval from a society which is found, after enquiry, to be administering the scheme in a manner prejudicial to the interests of its members.

Statistics.—The total number of insured persons at the end of 1926 was approximately 16 million, of whom more than 98 per cent were members of approved societies. The total income of the scheme for the year was about £37 million, of which £24½ million was derived from the contributions of insured persons and their employers; £7 million was paid by the Exchequer, and nearly £6 million was derived from interest on accumulated funds. The expenditure on benefits was about £32 million and the total cost of administration by approved societies, insurance committees and the central departments was approximately £5 million. The cost of administration was, therefore, about 13½ per cent of the total revenue of the scheme. The total accumulated funds at the end of 1926 amounted to £126 million.

Royal Commission on National Health Insurance.—A Royal Commission was appointed in 1924 to enquire into the scheme of national health insurance and to recommend any alterations or extensions which might be thought desirable. After hearing evidence from representatives of all bodies or persons participating in, or affected by, the scheme, the commission issued their report in 1926 and arrived at the conclusion that "national health insurance has established its position as a permanent feature of the social system in this country and should be continued on its present compulsory and contributory basis." The commission, however, made many recommendations for the improvement of the scheme in detail. Amongst the most important were that medical benefit should be extended to include a consultant and specialist service; that the insurance medical service should be properly co-ordinated with other health services, and that in order to promote this end the insurance committees should be abolished and their powers transferred to the county and county borough councils. A further important recommendation was that there should be a partial pooling of the surpluses of approved societies in order to provide the necessary funds for the proposed extension of medical benefit, and also to mitigate to some extent the inequalities between different approved societies arising out of favourable or unfavourable experience as revealed on valuation. A minority of the commission reported in favour of the abolition of the approved society system and the transfer of the administration of the cash benefits, as well as medical benefit, to the local health authorities.

Success of the Scheme.—There can be no doubt that the British scheme of national health insurance has thoroughly justified itself by its results. At the inception of the scheme considerable hostility and opposition were encountered. It did not meet with a favourable reception from the medical profession and was unpopular with large sections of employers and with some classes of insured workers. This opposition has now almost entirely disappeared. There can be no question that the benefits provided under the scheme are highly appreciated amongst the insured community and the contributions are paid with almost entire absence of friction. The financial success of the scheme has been demonstrated by the results of successive valuations, and the great majority of insured persons are receiving benefits substantially greater than the minimum provided under the act. The amount of distress amongst the working-classes occasioned by reason of sickness of the wage-earners has been materially reduced, with the result that expenditure on poor law relief is substantially less than it would have been in the absence of a scheme of national health insurance. As regards the effect of the scheme on the general health of the nation, it is difficult to produce any convincing statistics but the fact that all insured workers are entitled to free medical attendance immediately they have any need of it must obviously be conducive to prompt treatment of incipient illness, with a consequent lessening of more serious results. The general death rate has fallen materially since the scheme was introduced and it is reasonable to attribute this in some measure to the medical and other benefits provided under the scheme.

Northern Ireland.—The original National Insurance Act of 1911 applied to the whole of Ireland as well as to Great Britain, and as a consequence a scheme of national health insurance almost identical with that of Great Britain is still in operation in Northern Ireland. The most important variation is that medical benefit is not included in the Northern Irish scheme, but a benefit known as sanatorium benefit is provided. This benefit consists of the right of treatment in sanatoria or otherwise of insured persons suffering from tuberculosis. It is administered through the local insurance committees under arrangements made with the councils of the counties and county boroughs. The same benefit was originally provided in Great Britain but was discontinued in 1921 when the duty of making comprehensive arrangements for the treatment of tuberculosis amongst the whole population, insured and uninsured alike, was laid upon the county and county borough councils. Owing to the absence of medical benefit in Northern Ireland the rates of contributions are less than those in Great Britain by 2d. a week.

II. BRITISH DOMINIONS

In the Irish Free State similar provision is made to that in Northern Ireland, but up to 1928 no complete scheme of national health insurance had been brought into operation in any of the other self-governing dominions of the British Empire. In Australia a State scheme of non-contributory pensions for persons permanently incapacitated for work was introduced in 1908 in conjunction with the non-contributory old age pension scheme. Since 1912 there has also been a system of maternity allowances on a non-contributory basis. A Royal Commission was appointed in 1925 to investigate the subject of a complete scheme of national health insurance and it reported in 1927 in favour of the establishment of a general scheme on a compulsory and contributory basis. Up to 1928 no steps had been taken in Canada, South Africa or New Zealand towards the establishment of a State scheme of insurance against sickness but in each country public attention was being increasingly directed towards the desirability of such provision. (E. HA.)

III. UNITED STATES

In no other civilized country in the world has the principle of national health insurance, except as a subject of academic study, made less progress than in the United States. Owing to the newness of the country and its rich natural resources there has been opportunity for persons of ability in all groups. The incomes of the majority are higher than in other countries, and the development of private insurance and other private institutions to provide for emergencies is more extensive than in other countries. This has been augmented by the difficulties in enacting social legislation, due to the Federal form of government and the review of legislation by courts. Industrial workers are protected against incapacity due to accidents and in some States illness arising out of their employment, through compensation laws enacted by States and the Federal Government. The number of workers insured against sickness is about 25%; others are dependent upon savings. Though compulsory health insurance has been the subject of study and investigation at various times in certain States, no scheme has been actually brought into operation. A bill to set up a comprehensive scheme on a compulsory and contributory basis, following the German and British schemes in most respects, was introduced into the legislature of the State of New York in 1919 and was actually passed by the senate, but the strongest opposition was organized in various quarters and the measure did not succeed in becoming law. (X.)

IV. EUROPEAN COUNTRIES

Organized provision of some kind for the insurance of workers against sickness has been made in all European countries. Compulsory schemes are in operation in Austria, Bulgaria, Czechoslovakia, Germany, Hungary, Norway, Poland, Rumania, Russia and Yugoslavia, and in certain Cantons of Switzerland. In all these countries the schemes are on a contributory basis, the cost being shared between the employers and workers, except in Rumania, where the whole contribution is payable by the worker, and in Russia, where the whole cost falls on the employer. Some part of the cost of the scheme is borne by the State or other public funds in Bulgaria, Norway, Poland and Switzerland. Voluntary schemes, which receive assistance from public funds, and which cover a large proportion of all the wage-earners, are in operation in Belgium, Denmark, France, Sweden and Switzerland. In Holland a compulsory scheme of insurance against permanent invalidity was brought into force in 1919 but up to 1928 sickness insurance was still on a voluntary basis and received no assistance from the State. In Italy a scheme of compulsory maternity insurance for employed women was instituted in 1910, and compulsory insurance against invalidity in 1919, but although the question of the establishment of a general State scheme of compulsory sickness insurance had been under discussion, no provision other than through voluntary mutual benefit societies not aided by the State, had been made up to 1928.

There are three main differences between the schemes in force in European countries and the British scheme. In the first place, while in Great Britain the contributions and benefits are on a flat rate, in other countries they are graded in accordance with the wages of the insured workers. Again, in Great Britain the weekly payments to the insured while incapacitated for work through illness are continued in the form of disablement benefit without any time limit after the maximum period of sickness benefit has been exhausted, but in the continental schemes the payments cease after a period, usually of 26 weeks but shorter in some countries and longer in others, and the insured person, if still remaining incapable of work, is not entitled to any further payment under the sickness insurance scheme. He may, however, then become entitled to relief under the scheme of invalidity pensions, which is separately administered, either as an independent scheme or in conjunction with the State scheme of old age pensions. Finally, in contrast to the British system of approved societies as agencies for the administration of the cash benefits, the insurance institutions in continental countries are in general organized on either a territorial or an occupational basis, or both.

International Conference on Sickness Insurance.—An International Labour Conference on Sickness Insurance was held at Geneva in 1927 under the auspices of the League of Nations. Delegates from 43 countries were present and the arrangements for sickness insurance in each of these countries were passed under review. As a result the conference adopted a convention with regard to sickness insurance which was remitted for ratification to all the States members of the League. The scheme outlined in this convention was similar in all essentials to that in force in Great Britain. All countries which ratify the convention pledge themselves to set up a compulsory scheme of sickness insurance applicable both to manual and non-manual workers, deriving its income from contributions by workers and their employers, and providing medical attendance for the insured workers, together with cash payments in compensation for loss of wages through sickness. There is therefore reason to hope that provision substantially equivalent to that under the British scheme described above will before long exist in most European countries.

BIBLIOGRAPHY.—The whole of the statutory provisions with regard to national health insurance in Great Britain is to be found in the *Statutes, Regulations and Orders relating to National Health Insurance*, published by H.M. Stationery Office. The best critical review of the scheme is contained in the *Report of the Royal Commission on National Health Insurance*, Cmd. 2596 of 1926. Much interesting information with regard to the financial and actuarial aspects of the scheme is to be found in the *Report by the Government Actuary on the Second Valuation of Approved Societies*, Cmd. 2785 of 1927, and in *National Health Insurance, a Statistical Review*, Watson, J.R.S.S., Vol. 90, Part 3. For comparative statements of the schemes in different European countries, reference should be made to various publications of the International Labour Office, Geneva, and in particular to *General Problems of Social Insurance*, Studies and Reports, Series M. No. 1, 1925 and *Compulsory Sickness Insurance*, Studies and Reports, Series M. No. 6, 1927. Miller, *Social Insurance in the United States* (1918) and Morgan, *Public Relief of Sickness* (1923). (E. HA.)

NATIONAL INSURANCE: WIDOWS' AND ORPHANS' PENSIONS. The first quarter of the 20th century was remarkable for the rapid development of schemes of social insurance. The article that follows deals with developments in Europe. These do not exist in the United States except in the form of Mothers' pensions, an account of which will be found in the article PENSIONS: *The United States*. While at first the schemes were directed to the protection of the workman himself, the necessity of making provision for the family when death removes the breadwinner has increasingly claimed attention. In Great Britain the problem of the widow and fatherless children received special consideration in the Report of the Royal Commission on the Poor Laws, published in 1909. The subject was debated in the House of Commons for the first time in 1919, and afterwards in 1923, 1924 and 1925. There was general agreement as to the desirability of establishing a scheme of pensions for widows, but the debates showed divergence of opinion as to the method of financing the scheme. Within a month after the last debate Mr. Winston Churchill in introducing the Budget announced that the Government had decided to bring in a Bill establishing widows' and orphans' pensions and old age pensions at the age of 65. The Widows', Orphans' and Old Age

Contributory Pensions Bill, the second reading of which was moved by the Minister of Health, Mr. Neville Chamberlain, on May 18, 1925, proclaimed that the Government had adopted the contributory principle. It became law, and the provisions relating to widows and orphans came into operation on Jan. 4, 1926.

Scope of the Scheme.—The scheme is contributory and compulsory and is interlocked with the national health insurance scheme (*see* NATIONAL INSURANCE: HEALTH), all persons insured under the latter, whether as employed or as voluntary contributors, being within the scope of the widows' and orphans' scheme. Employed contributors are persons compulsorily insured and consist in the main of persons employed under a contract of service, with a remuneration limit of £250 per annum in the case of persons employed in a non-manual capacity. Two comparatively small classes who are not insured under the health insurance scheme are compulsorily insured for widows' and orphans' pensions. These classes consist of men who hold certificates exempting them from liability to be insured under the National Health Insurance Act and of persons employed in certain types of "excepted employment." Voluntary insurance under the National Health Insurance Act is limited to persons who, having previously been compulsorily insured for a minimum period, elect within a specified time to continue as voluntary contributors. On the same principle the right to continue as voluntary contributors is given on certain conditions to persons who were previously insured compulsorily for widows' and orphans' pensions only, *i.e.*, as exempt men or as persons in excepted employment.

The Pensions Act made a further addition to the classes of persons eligible for voluntary insurance. As a married woman is debarred from being a voluntary contributor under the Health Insurance Act, the Pensions Act provides that an uninsured man may become a voluntary contributor within a prescribed time after his marriage to an insured woman if certain conditions attaching to her previous insurance are satisfied, so that her insurance before marriage gives *inter alia* the opportunity of acquiring a title to a widow's pension.

Contributions.—The normal contribution, 9d. a week for a man and 4½d. for a woman, includes the contribution for old age pensions between 65 and 70. Exempt men, however, and the majority of persons in excepted employment are not insured for old age pensions and their contributions, for widows' and orphans' pensions only, are 7d. for men and 3½d. for women. It is to be observed that the woman's contribution, which in general is half the man's contribution, is not based solely on the value of the benefits which flow from her own insurance.

From the starting point that the contribution of the insured woman would be equal to half the contribution of the insured man, it was found that the appropriate contribution to provide all the benefits of the Act (including old age pensions between the ages of 65 and 70) in the case of a boy of 16, the age at which contributions begin, was 10d. a week. Certain savings, however, resulting to the Exchequer from adjustments in Unemployment Insurance consequent on the Pensions Act were taken into consideration and as a result the rate of contribution was fixed at 9d. per week, a uniform rate for all men without having regard to their age at the date that they became insured. As the contributions are based on the rates appropriate to those entering the scheme at the age of 16, they are insufficient to provide the benefits for entrants over that age. The residual liability is carried by the Exchequer. In the first two years the contributions were more than sufficient to meet the payments but thereafter there is a growing demand on the Exchequer. This liability, which includes the Exchequer's contribution to old age pensions between 65 and 70, was estimated to amount to a net total of £46,000,000 over the first ten years, and the Act provides for its liquidation by a uniform payment of £4,000,000 a year.

The contribution for men is divided between the employer and employee in equal shares except in the case of the exempt man, where the employer pays his normal contribution of 4½d. and the employee 2½d. In the case of women 2½d. (excepted women 2d) is paid by the employer and 2d (excepted women 1½d) by the employee. Although an exempt woman is not insured under the pensions scheme her employer is required to pay his normal contribution of 2½d a week.

Contributions begin at the age of 16 and, as regards the employee's portion, cease at 65 but the employer's liability to contribute terminates only on the termination of employment. The employer's contribution for an employee over 65 is 9d (for a woman 7d) but as his contribution for health insurance (4½d for man or woman) ceases on the employee attaining 65, his total liability under the two schemes is unaltered. The employer pays the weekly contributions for health and pensions by affixing a single stamp to the contribution card of the employee and he is entitled to recover the employee's share by deduction from wages. For persons in excepted employment, who are outside the health insurance scheme, contributions are paid periodically in cash. The contributions for voluntary contributors are the same as for employed contributors, viz. 9d and 4½d for men and women respectively, the whole amount being paid by the contributor.

The number of insured persons paying contributions during the first year of the scheme was approximately 16,300,000.

Benefits and Qualifications.—The benefits for widows and orphans—an orphan is defined as a child both of whose parents are dead—are:—

(1) Widow's pension—a payment of 10/– a week to the widow of an insured man until she reaches the age of 70 or marries, with an additional allowance for children under the age of 14 or under the age of 16 if still at school, at the rate of 5/– a week for the eldest and 3/– a week for each other child.

A widow who is in receipt of a widow's pension on reaching the age of 70 is entitled to an old age pension at the same rate. A widow on remarriage continues to receive the allowance for children under the specified age. The allowance for children is, on the death of the widow, transformed into orphans' pensions.

(2) Orphans' pensions—a payment of 7s. 6d. a week for each child, under the specified age, of an insured man, being a married man or a widower, or of an insured widow.

An orphan's pension is payable to the guardian or other person having the charge of the child.

The qualifying conditions are: (i.) the insured person must have been insured for not less than 104 weeks and not less than 104 contributions must have been paid: (ii.) over the three contribution years (running from July in one year to June in the next) preceding his death an average of 26 contributions a year must have been paid, but for this purpose weeks of incapacity for work due to sickness and weeks of genuine unemployment count as weeks for which contributions were paid: (iii.) he must have been resident in Great Britain for two years immediately prior to his death and his last employment (excluding temporary employment) must have been in Great Britain. The last condition does not apply to soldiers, sailors and airmen.

A pension or an additional allowance is not payable to or for any person (a) while an inmate of a poor law institution, unless admission was for the purpose of obtaining medical or surgical treatment, when there is no disqualification, up to a maximum of three months from date of admission, so long as treatment continues: (b) while detained in a lunatic asylum: (c) while being maintained in any place as a pauper-lunatic or criminal lunatic: (d) while undergoing a period of imprisonment given without the option of a fine. A widow is not entitled to her pension, but the additional allowance remains payable to her, while she is cohabiting with a man as his wife.

With certain exceptions, a person who is receiving a World War pension for the death of any person, other than a son, is not entitled to a pension under the Act, but if the pension which otherwise would have been payable under the Act is the greater, the excess is paid as an addition to the War Pension. A similar provision applies to a person who is receiving a pension for the death of any person whose death was attributable to service at any time with the naval, military or air force.

When compensation is received for a child under the Workmen's Compensation Act, the additional allowance or orphan's pension under the Act is payable only to the extent that it exceeds the weekly value of the compensation. The widow's pension of

10/– a week is unaffected by the receipt of compensation.

Non-contributory Classes.—Exceptional provision was made for the widows and children of men who, having died before Jan. 4, 1926, the date of the commencement of the Act, could not have participated in the contributory scheme. The rates of widows and orphans pensions are the same as under the contributory scheme, but a widow in this class is only entitled to a pension if there was a child under the age of 14 at the commencement of the Act, and she ceases to be entitled six months after her youngest child reaches the age of 14.

The capital value at the commencement of the Act of the total amount which the Exchequer would have to provide for these non-contributory classes was estimated at £42,000,000.

In the restricted provision made for the widow this non-contributory section of the scheme is closely in line with most of the non-contributory schemes of mothers' pensions which operate in several parts of the British Dominions and in many States of the U.S.A. The widow as widow was not the object of the benefit. The provision was designed entirely in the interests of the children.

Administration.—In England and Wales the scheme is administered by the Minister of Health and in Scotland by the Scottish Board of Health. Claims for pension are made on forms which are obtainable at all Post Offices. Successful applicants receive a notice from the Department for presentation at the Post Office which they nominated on their claim forms and are given in exchange a book containing a series of weekly orders. Bound up in every order book is a form which the pensioner completes shortly before the currency of the book expires, thereby requisitioning a new book.

Number of Pensions.—Up to March 31, 1928, 123,136 widows' pensions and 4,306 orphans' pensions had been awarded under the contributory part of the scheme, and 132,554 widows' pensions and 15,705 orphans' pensions under the non-contributory part. On the same date the numbers actually in receipt of pensions or allowances under the scheme were: contributory, 112,525 widows and 88,547 children: non-contributory, 94,172 widows and 180,294 children.

British Dominions and Northern Ireland.—None of the Dominions has a contributory scheme of widows' and orphans' pensions, but non-contributory schemes, which provide assistance to needy and worthy mothers for the care of their children in their own homes, have been established in Canada (Alberta, British Columbia, Manitoba, Ontario and Saskatchewan), Australia (New South Wales) and New Zealand.

The Widows', Orphans' and Old Age Contributory Pensions Act (Northern Ireland) was passed on Nov. 6, 1925. In all essential particulars its provisions are identical with those of the British Act. Reciprocal arrangements between Great Britain and Northern Ireland were at once made, with the result that contributions paid in Great Britain rank as valid contributions in connection with a claim for pension made in Northern Ireland and vice versa.

European Countries.—In several countries provision for the widow and children of a deceased insured person is made under contributory schemes providing invalidity and old age pensions. Pensions for the widow and children are usually based on the invalidity or old age pension to which the deceased was entitled, and the proportion varies considerably in different countries, from 20 to 50% for the widow and from 10 to 50% for the children. Pensions to widows and children are paid in Germany (salaried employees' scheme), Austria (salaried employees' scheme), Belgium and the Netherlands. Children's pensions are payable under the manual workers' scheme in Germany and under schemes in Czechoslovakia and Jugoslavia, but in these cases the provision made for the widow is limited: in Germany her pension is deferred until she is 65 unless she is unable to work, in Czechoslovakia she is entitled only if unable to work, and in Jugoslavia her pension ceases three years after her husband's death.

A non-contributory scheme exists in Denmark under which indigent widows have the right to a public contribution towards the support and education of children under 14.

BIBLIOGRAPHY.—*Report by the Government Actuary on the Financial Provisions of the Widows', Orphans' and Old Age Contributory Pensions Bill* (Cmd. 2406, H.M. Stationery Office), contains a detailed explanation of the financial basis, estimates of the future number of beneficiaries and future cost of the scheme in selected years up to 1965–66. *General Problems of Social Insurance* (Internat. Labour Office, League of Nations), contains a review of the position of social insurance in general. *Social Insurance* (the Report of League of Nations Union Conference, Nov. 1925), contains *inter alia* a report of a discussion on the scheme of the 1925 Act, in which the relative merits of contributory and non-contributory schemes are argued.

For old age pensions and unemployment insurances *see* OLD AGE PENSIONS and UNEMPLOYMENT INSURANCE. *See* also PENSIONS IN THE UNITED STATES. (J. M. H.)

NATIONALITY AND NATURALIZATION. Nationality may be defined as the quality of being a national of a given State. It may be pointed out by way of abundant caution that in the British empire the term nationality is used only in the political sense, since the empire having no common law, the personal law of a British subject is determined not by his nationality, but by his domicil. In those States where the national law prevails throughout their respective territories, the necessity for this distinction does not arise. Political and civil status are synonymous. The law of British nationality then now rests upon the common law and upon three statutes, viz., the British Nationality and Status of Aliens Act 1914 which came into operation on Jan. 1, 1915, which professed to be a consolidating and amending statute, and which repealed a number of former enactments; the Amending Act 1918; and the Amending Act 1922. These statutes are now officially printed as one statute and cited as the British Nationality and Status of Aliens Acts 1914–22.

At common law, with certain exceptions to be mentioned later, all persons born within the British dominions are natural-born British subjects. For instance the child of French parents born during their temporary residence in England is a British subject and liable to be convicted of high treason if he took part in hostile operations against Great Britain (see *Aeneas Macdonald's Case* 18 State Trials, 857).

By s. 1 (1) of the statute the following persons are deemed to be natural-born British subjects, viz.:—(a) "Any person born within His Majesty's dominions and allegiance." It was necessary to add the condition of birth *within the allegiance* of the king in order to prevent the acquisition of British nationality by a child born to an enemy father within the British dominions at the time in the occupation of the enemy or by a child born to a foreign sovereign or foreign ambassador or diplomatic agent. (b) "Any person born out of His Majesty's dominions whose father was at the time of that person's birth a British subject, and who fulfills any of the following conditions, that is to say, if either (i.) his father was born within His Majesty's allegiance; or (ii.) his father was a person to whom a certificate of naturalization had been granted; or (iii.) his father had become a British subject by reason of any annexation of territory; or (iv.) his father was at the time of that person's birth in the service of the Crown; or (v.) his birth was registered at a British consulate within one year or in special circumstances, with the consent of the secretary of State, two years after its occurrence, or in the case of a person born on or after the first day of Jan. 1915, who would have been a British subject, if born before that date, within 12 months after the first day of Aug. 1922." (c) "Any person born on board a British ship whether in foreign territorial waters or not: provided that the child of a British subject, whether that child was born before or after the passing of the act, shall be deemed to have been born within His Majesty's allegiance if born in a place where by treaty, capitulation, grant, usage, sufferance or other lawful means, His Majesty exercises jurisdiction over British subjects. Provided also that any person whose British nationality is conditional upon registration at a British consulate shall cease to be a British subject unless within one year after he attains the age of 21 or within such extended period as may be authorized in special cases by regulations made under this act (i.) he asserts British nationality by a declaration of retention of British nationality in such manner as may be prescribed by regulations made under the act; and (ii.) if he is a subject or citizen of a foreign country under the law of which he can, at the time of asserting his British nationality, divest himself

of the nationality of that foreign country by making a declaration of alienage or otherwise, he divests himself of such nationality accordingly."

By the act of 1772 a child born out of the British dominions whose father *or whose grandfather* was born within those dominions was deemed to be a natural-born British subject, provided that his father at the time of his death had not ceased to be a British subject. By the act of 1914, however, this privilege was taken away from grandchildren born after Jan. 1, 1915, outside the British dominions. Such children were not British subjects unless their father had been born within the British dominions, with the exception of those children born in a place where by treaty, capitulation, etc., His Majesty exercised jurisdiction over British subjects. But owing to the agitation by British subjects resident in foreign countries and particularly by those residing in the Argentine—the British colony in Buenos Aires numbered some 30,000—the act of 1922 was carried, which provides that a British subject who has a child born abroad after Jan. 1, 1915, may secure British nationality for such child by registering its birth at a British consulate in the manner above stated. Consequently British subjects, whether natural-born or not, living abroad can extend British nationality to their descendants in perpetuity.

In *Carlebach's Case*, 1915, 3 K.B. 716, it was held that under the act of 1870 a naturalized British subject could not transmit his nationality to his children born abroad, who consequently became aliens. Now by the act of 1914 such children born abroad after Jan. 1, 1915, are deemed to be natural-born subjects. And by iii. and iv. of para. (b) of subsect. (1) the provisions of the common law are enlarged and the children of a father wherever born who, at the time of their birth, had become a British subject by reason of any annexation of territory, or who was in the service of the Crown, are deemed to be natural-born British subjects.

(d) "Any person born on board a British ship whether on the high seas or in foreign territorial waters is a British subject." The term "British ship" includes vessels of the royal navy and of the navies of the dominions, and vessels as defined by s. 1 of the Merchant Shipping Act 1894, viz., vessels owned wholly by natural-born British subjects, by naturalized British subjects, by British denizens, and by corporations established under and subject to the laws of some parts of His Majesty's dominions and having their principal place of business in those dominions.

It should be noted that the act is not retrospective, except as otherwise expressly provided. Consequently the old law applies to those born prior to Jan. 1, 1915.

Naturalization is the act of investing an alien with the status of a national in a given State. Aliens may still acquire British nationality by a private act of parliament or may become denizens by grant of letters of denization by the Crown. The former process is extremely rare. When the late Lord Reay succeeded to a Scottish peerage in 1877 he was naturalized by act of parliament. The latter although preserved by s. 25 of the act of 1914 is likely to fall into disuse owing to the disqualifications which still attach to denizens. By s. 2 of the act an alien may obtain a certificate of naturalization from the secretary of State provided he has resided in His Majesty's dominions for not less than five years or been in the service of the Crown for not less than five years within the last eight years, is of good character and has an adequate knowledge of the English language and intends to reside in His Majesty's dominions or to continue in the service of the Crown. He must have resided in Great Britain for at least one year immediately preceding his application. The grant of such certificate lies in the absolute discretion of the secretary of State and the certificate does not take effect until the applicant has taken the oath of allegiance. A person to whom a certificate is granted is entitled to all political and other rights, powers and privileges and is subject to all obligations, duties and liabilities as a natural-born British subject and to all intents and purposes enjoys the status of a natural-born British subject (s. 3 [1]). By the Act of Settlement 1700, naturalized persons and denizens could not be privy councillors, or members of either House of Parliament, or enjoy any office or place of trust, civil or military, or take any grant of lands from the Crown. *Quoad* naturalized aliens these disqualifications were abolished (s. 3 [2]; see *Rex* v. *Speyer*, 1916, 2 K.B. 858). The secretary of State may also grant a special certificate of naturalization to any person with respect to whose nationality a doubt exists (s. 4); and may include in a certificate the name of any infant born before the date of such certificate and such child may within one year of obtaining his majority make a declaration of alienage and thereupon cease to be a British subject (s. 5). A certificate of naturalization may be revoked by the secretary of State if it has been obtained by false representation or fraud or by concealment of material circumstances, or if the person to whom the certificate is granted has shown himself to be disaffected or disloyal, or by reason of other specified grounds (s. 7). The wife and children may be included in this revocation, but if not they remain British subjects. The wife may, however, make a declaration of alienage for herself and her infants (s. 7, A).

British nationality is lost by foreign naturalization. Until the Naturalization Act 1870, the maxim *nemo potest exuere patriam* prevailed. By s. 6 of that statute a British subject by voluntary naturalization in a foreign State ceased to be a British subject. But it was subsequently held in *R.* v. *Lynch*, 1908, 1 K.B. 444 that this section did not enable a British subject to become naturalized in an enemy State during time of war. The section was substantially re-enacted by s. 13 of act of 1914. But it would appear from the decision in *Pedlar* v. *Johnson*, 1920, 2 I.R. 450 that a British subject may become naturalized in a neutral State during time of war and engage in acts of hostility against his State of origin without sacrificing his rights as a friendly alien.

(H. H. L. B.)

United States.—Nationality rests upon the fundamental law of the United States, its Constitution, or enactments of Congress and treaties made pursuant thereto, whether the individual be of native or of foreign birth. In art. I., s. 8, clause 4 of the Constitution, among the powers given to Congress is that to "establish an uniform rule of naturalization." The First Congress exercised this power in the enactment of the statute of March 26, 1790 (1 Stat. 103), by which a rule was established for the acquisition of citizenship in the United States by those of foreign birth. This Act was based upon the principle of the right of expatriation as inherent in the individual, which principle was declared in affirmative form in the Act of July 27, 1868 (15 Stat. 223), referred to hereinafter.

The statute of 1790 also asserted the doctrine of *jus sanguinis* (status by blood) in declaring as citizens the children of citizens of the United States though born beyond the sea or out of the limits of the United States. By this Act the Congress refused to recognize citizenship as descending through such foreign-born citizens as did not reside in the United States prior to the birth of children. *See* also Acts of April 14, 1802 (2 Stat. 155) and Feb. 10, 1855 (10 Stat. 604), the latter now appearing as s. 1993 of the Revised Statutes of the United States. These Acts of Congress declaring certain classes of persons to be citizens have been recognized by the Supreme Court of the United States as the exercise of a constitutional authority (*U.S.* v. *Wong Kim Ark*, 1898, 169 U.S. 649, 703, and *Weedin* v. *Chin Bow*, 1927, 274 U.S. 657).

The following words of s. 1 of Amendment XIV. of the Constitution of the United States, proclaimed July 28, 1868, give recognition to the doctrine of *jus soli* (status by country of birth): "All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside." Birth, therefore, confers citizenship notwithstanding there may be racial ineligibility of the parents for naturalization (*U.S.* v. *Wong Kim Ark*, 169 U.S. 649).

Congress has both conferred citizenship and fixed the national status of the inhabitants of certain territory through its treaty-making powers, and by statute pursuant thereto from time to time effected their collective naturalization either prior to or upon the admission of such acquired territory to statehood. Such action was taken in territory acquired under treaties concluded with Great Britain—Territory of Michigan (1794, 8 Stat. 116); France—Louisiana (1803, 8 Stat. 200); Spain—Florida (1819, 8 Stat.

252); Mexico—Guadelupe-Hidalgo (1848, 9 Stat. 922) and Gadsden (1853, 10 Stat. 1031); Russia—Alaska (1867, 15 Stat. 542); Denmark—Virgin islands (1916, 39 Stat. 1706).

In the absence of definite treaty stipulations, citizenship has been conferred upon inhabitants of acquired territory by legislative enactments prior to statehood. In this category may be included the Hawaiians (Act of April 30, 1900, 31 Stat. 141) and Porto Ricans (Act of March 2, 1917, 39 Stat. 953). United States citizenship was conferred collectively through the political incorporation of the original States into the United States also in the case of the State of Texas upon its annexation and direct admission into the Union as a State.

Congress formerly dealt with the Indian natives of the United States by treaty but afterwards by statute subsequent to the law of March 3, 1871 (16 Stat. 566). Certain of these acquired citizenship from time to time but all North American Indians born within the territorial limits of the United States were given citizenship by the Act of June 2, 1924 (43 Stat. 253).

The natives of the Philippine islands acquired the status of United States nationals under the treaty of peace with Spain, concluded Dec. 10, 1898 (30 Stat. 1759). The Philippine legislature, by enactment of March 26, 1920, provided for the naturalization of persons as Philippine citizens.

Citizenship is open to aliens who are free white persons and to aliens of African nativity or descent (s. 2169 R.S.U.S.). Aliens of the Japanese and Hindu races have been decided to be inadmissible by the Supreme Court (*Takao Ozawa* v. *U.S.*, 1922, 260 U.S. 178, and *U.S.* v. *Bhagat Singh Thind*, 1923, 260 U.S. 204). Chinese are excluded by the Act of May 6, 1882 (22 Stat. 61).

Naturalization Procedure.—On June 29, 1906, Congress repealed with but slight exception the then existing naturalization laws and enacted one major law or rule (34 Stat. 596). This law and the unrepealed laws are under the special supervision of a Federal commissioner of naturalization at Washington in the Bureau of Naturalization of the Department of Labor. This bureau has branch offices throughout the United States, strategically located in 27 cities.

On Sept. 22, 1922, by Act of Congress (42 Stat. 1021), women were required to become citizens independently of their husbands, with the repeal of s. 1994 of the Revised Statutes of the United States, by which a foreign-born woman acquired citizenship on marriage to an American citizen. By this Act of 1922 an American woman citizen who marries an alien racially ineligible to citizenship loses and cannot regain her citizenship during the continuance of the marital status.

Naturalization is a judicial proceeding, determinable by the district courts of the United States, and by the State courts of original jurisdiction in law or equity or law and equity in which the amount in controversy is unlimited. These State courts have been clothed by Congress with concurrent Federal authority for this purpose. In such a proceeding an alien, who has been admitted to the United States in conformity with the immigration laws for permanent residence, may declare his intention as soon as he desires before the clerk of the court within the jurisdiction of which he resides. Upon completion of five years of continuous residence within the United States he may petition the court of the jurisdiction where he then resides for admission to citizenship, if at that time his declaration of intention is two years old, or at such time as it shall become two years old. Two citizens of the United States as witnesses must be present so as appropriately to prove his allegations of residence and establish his good moral character and attachment to the principles of the Constitution. A woman who is the wife of an American citizen, or who lost her citizenship through marriage to an alien eligible for citizenship, is not required to make the preliminary declaration of intention and is required to have only one year of residence in the United States immediately preceding the time she petitions for naturalization. A period of 90 days must intervene after filing a petition before the court may hear it. Exceptions are allowed to certain aliens such as sailors and soldiers. The officers of the Naturalization Bureau examine the applicant and witnesses and appear in court on behalf of the Government at the hearing. Before many Federal courts they have a quasi-judicial authority in determining admissibility. A certificate of citizenship, furnished by the Bureau of Naturalization, is issued to the newly naturalized citizen by the clerk of the court. The costs are $1.00 for a declaration of intention, and $4.00 for the petition to the court and certificate of citizenship, if granted.

An alien born child derives citizenship through the acquisition of that status by the parent if the child take up permanent residence in the United States prior to its attainment of the age of 21 years (s. 2172 R.S.U.S.; s. 5, Act of March 2, 1907, 34 Stat. 1229; *Kaplan* v. *Tod*, 267 U.S. 229).

Protection Abroad.—All children born and residing outside of the United States who acquire citizenship through their fathers, are, in order to receive the protection of the United States Government, required upon reaching the age of 18 years to record their intention to become residents of the United States and to remain citizens thereof. They are further required to take the oath of allegiance to the United States on attaining the age of 21 years.

Citizenship acquired by naturalization is a conditional status. It shall be presumed to cease upon residence for two years in the State of former allegiance or for five years in any other foreign State. This presumption may be overcome upon the presentation of satisfactory evidence to a diplomatic or consular officer of the United States under rules of the Department of State. An oath of allegiance to or naturalization in any foreign State accomplishes expatriation of an American citizen, whether native or naturalized.

Recent Legislation.—Certificates of citizenship are obtainable by those who are citizens through the naturalization of the parent, and by women who acquired citizenship through the citizenship of their husbands during the time citizenship was acquired by marriage, if the citizen is in the United States.

Costs for a certificate showing the date, place and manner of lawful arrival of the alien in the United States are $5.00; for the declaration of intention, $5.00; for the petition to the court and the certificate of citizenship if granted, $10.00; for a certificate of citizenship issued by the commissioner of naturalization to a foreign-born person who has acquired citizenship through the parent or the husband, and for a special certificate of citizenship to be issued for the purpose of securing recognition as an American citizen by the former sovereignty, to be delivered through the Secretary of State to such sovereignty, $10.00; for a new declaration of intention or a new certificate of naturalization in lieu of one lost or destroyed, $10.00. (R. F. C.)

France.—French nationality attaches to (1) children born anywhere of a French father; (2) children born in France (a) of unknown parents or of parents of unknown nationality; (b) of foreign parents, one of whom was born in France; (c) of foreign parents not born in France (see *Code Civil* Liv., i. tit. i.). By the law of Aug. 10, 1927, every male born in France of a foreign father, and domiciled, becomes French on making the required declaration under the age of 18. At 21 he would become French, but has a year to disclaim. An alien of 18 may become naturalized after uninterrupted residence of three years. An alien woman marrying a Frenchman is thereby naturalized only if by her national law she loses her former nationality, or on her express demand. The whole subject is now governed by the law mentioned.

Germany.—By Art. 110 of the Constitution of 1919, nationality in the Federation and in the States is acquired and lost in accordance with the provisions of a federal law. Every subject of a State is a subject of the Federation. By s. 2 of the Law of Nationality and Naturalization 1870, citizenship of a State is acquired by (1) descent, (2) legitimation, (3) marriage, (4) admission, and (5) naturalization. Admission is confined to Germans and naturalization to aliens. Both are conferred by a certificate. S. 2 was re-enacted in the Law of Nationality of the empire of July 22, 1913, by which imperial nationality must be conferred upon similar terms. By s. 25 a German by obtaining the written consent of the competent authorities of his home State could retain his German nationality even though naturalized in a foreign country. Germany, however, was constrained by Art. 278 of the Versailles Treaty of June 28, 1919 to undertake to recognize any

new nationality which had or might be acquired by her nationals under the laws of the Allied and Associated Powers.

Other Countries.—For the nationality and naturalization laws of the following countries, viz., Afghanistan, Austria, Belgium, China, Danzig, Denmark, Ecuador, Egypt, Esthonia, Greece, Honduras, Italy, Japan, Latvia, Lebanon and Syria, Lithuania, Monaco, Norway, Peru, Poland, Rumania, Russia (Soviet Union), Spain, Sweden, Switzerland, Syria, Tunis, Turkey, United States and Venezuela, reference should be made to *Parliamentary Papers, Misc.* No. 7 (1922), *Misc.* No. 2 (1927), and *Misc.* No. 8 (1927). *See* also Clunet, *Journal du Droit International; Annuaire de législation étrangère,* of the Société de legislation comparée, Paris; *American Journal of International Law; Journal of Comparative Legislation and International Law.* For the Argentine Republic *see* Zeballos, *La Nationalité,* 1914–19; for Bulgaria see *British & Foreign State Papers* 1911, and *Annuaire* 1911 p. 765; for Costa Rica *see* Constitution, 1917, Arts. 40–44, 60, 99, and 105; *La Gaceta,* June 13, 1917; for the Dominican Republic *see* Constitution, 1924, Pan-American Union *Law & Treaty Series,* No. 1 (1925), 6, 8, 10, 19, 21, Arts. 8, 18, 21, 55, 63; Naturalization Law of Oct. 31, 1924, Clunet, 53 *Journal* 1926, p. 243; for Finland *see* Constitution 1919, Art. 4; *see* also McBain & Lindsay Rogers, *The New Constitutions of Europe* (1922); for Mexico *see* Constitution, 1917, Arts. 27 (1), 30, 37, 73 (16); 111 *British & Foreign State Papers,* 787, 792, 794, 804; for the Netherlands *see* Law of Feb. 10, 1910, law of July 15, 1910, law of Dec. 31, 1920 and Constitution of 1922; 103 *British and Foreign State Papers,* 600; *Annuaire* 1910, 321; *ibid.* 1920, 116; 116 *British and Foreign State Papers,* 863; for Nicaragua *see* Constitution of 1911, Arts. 7–11, 111 (17); 107 *British and Foreign State Papers* 1039, 1051–52; New Constitution of 1913; for Portugal *see* decree of Dec. 2, 1910; 103 *British and Foreign State Papers,* 619; decree of March 28, 1911; *Annuaire* 1911, 366; Constitution of 1911, Art. 74; 105 *British and Foreign State Papers,* 779; for San Marino *see* decree of Jan. 21, 1910; *Annuaire* 1910, 286; for Serbia *see* Constitution, Arts. 6, 29, 144 (9); 110 *British and Foreign State Papers,* 934, 936, 939–940; for Siam *see* Law of May 18, 1911; 105 *British and Foreign State Papers,* 793; decree of Aug. 7, 1911; *Annuaire* 1911, 718; law of April 10, 1913; 108 *British and Foreign State Papers,* 793; decree of Aug. 7, 1911; *Annuaire* 1911, 718; law of April 10, 1913; 108 *British and Foreign State Papers,* 585; Command Paper (1928), 3,221.

See Foote, *Private International Law* (5th ed., 1925); J. Westlake, *A Treatise on Private International Law* (7th ed., 1925); A. V. Dicey, *Conflict of Laws* (Edit. by A. B. Keith, 4th ed., 1927).

(H. H. L. B.)

NATIONALIZATION: *see* COLLECTIVISM, SOCIALISM.

NATIONAL OLD TRAILS ROAD, an American highway, the only one originally built by the U.S. Government. It was conceived by George Washington in Colonial days, financed by Congress on admitting Ohio into the Union in 1802, and extended by Congress in 1825 to Santa Fe, then in Mexico. In 1837 it passed under State control. It is variously known as the "National Pike," "Cumberland road" and "Santa Fe trail." It extends from Washington, D.C., to Los Angeles, Calif., a distance of 3,096 m., and it is the most northerly all year road from the Atlantic to the Pacific. It has more miles of pavement than any other highway in America, permits the fastest road transit from coast to coast, and carries more transcontinental travel than any other two highways. It traverses many scenic wonders, including the Grand Canyon of the Colorado and Petrified Forest and offers an unsurpassed view of Pikes Peak and the Spanish Peaks of the Rocky mountains. It is largely due to the initiative of Judge G. M. Lowe. It passes through Columbus, O., Indianapolis, Ind., St. Louis and Kansas City, Mo., Great Bend, Kan., La Junta, Col., Santa Fe and Socorro, N.M., St. Johns, Ariz., and San Bernardino, Calif.

NATIONAL PARKS AND MONUMENTS, THE, of the United States are reservations set aside by Congress for the benefit and enjoyment of the people. In 1929 there were 21 of these reservations administered by the national park service of the department of the interior, and 59 related reservations known as national monuments, of which 32 are administered by the national park service.

One of the main distinctions between these two classes of reservations is the method of establishment. National parks are areas of unusual scenic beauty or natural phenomena, set aside by Congress "to conserve the scenery and the natural and historic objects and the wild life therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations," to quote from the organic act of Aug. 25, 1916, establishing the national park service. The national monuments, on the other hand, are reservations established by presidential proclamation under authority granted the president of the United States in the act of June 8, 1906, known as the Antiquities Act, "to declare by public proclamation historic landmarks, historic and prehistoric structures and other objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States to be national monuments." Generally speaking the national monuments are small areas reserved to protect objects of historic, prehistoric or scientific value within their boundaries, while the national parks are larger areas containing scenery of the first order. Several of the existing national parks, however, were originally designated national monuments, to prevent their settlement or spoliation while awaiting the necessary legislation to give them park status. Among these were the Grand Canyon, Zion, Lassen Volcanic and Lafayette.

National Park Service.—For many years the various national parks and national monuments under the jurisdiction of the department of the interior were handled as an incidental item to the work of the miscellaneous division of the office of the secretary. In 1915 the secretary of the interior, the Hon. Franklin K. Lane, realizing the desirability of correlating and developing national park work, appointed an assistant in charge of national parks, pending the establishment of a separate bureau to handle this work. On Aug. 25, 1916, the president signed legislation entitled "An act to establish a national park service, and for other purposes." In the following April the bureau was established with headquarters in Washington, D.C.

The general administrative work of the national park service is carried on in the Washington office. Here are prepared detailed estimates of appropriations needed for park work and accurate cost records kept of Government money expended. Every matter of policy for the management of the parks is referred to the Washington office for final decision; every employé in the field is appointed through headquarters; and the general public relations work of the service, including the preparation and distribution of park literature, publicity and maps, is handled there.

Local Administration.—Each of the national parks is in charge of a local superintendent. In several of the smaller parks the superintendent has only two or three assistants, while in the more extensive, such as Yellowstone and Yosemite, a large force is necessary, both clerical and protective. The protective work is done by the ranger force, headed by a chief ranger who reports to the superintendent. The permanent ranger force is the all-year nucleus around which is built up the larger summer force.

The more important of the national monuments are in charge of local custodians. The group of south-western national monuments is in charge of a superintendent, through whom the custodians report. In addition to the field forces at the national parks and monuments, there are three field divisions at large promoting specialized lines of development. These are the educational, the civil engineering, and the landscape architectural divisions with headquarters in San Francisco, California.

Policy Governing National Park Creation and Administration.—The national park system is unequalled for scenic grandeur, and it is an established policy that additional areas chosen for park status must be worthy of the dignity and prestige of the existing parks. Park projects, to receive favourable recommendation from the department of the interior, must contain scenery of distinctive quality or some natural features so extraordinary or unique as to be of national interest and importance, such as typical forms of world architecture.

National parks and monuments in order of establishment	Location	Area	Special features
Hot Springs 1832	Arkansas	1½ sq.m.	Reserves for the use of all citizens of the nation its hot springs, believed to possess healing properties.
Yellowstone 1872	Wyoming, Montana and Idaho	3,348 sq.m.	Believed to contain more and greater geysers than all the rest of the world. Grand Canyon remarkable for its gorgeous colouring and waterfalls. As a wild bird and animal preserve unequalled in the United States, containing herd of approximately 1,000 head of buffalo, antelope herd and large numbers of deer, elk, bear, mountain sheep and many smaller animals.
Yosemite 1890	California	1,126 sq.m.	Yosemite valley world-famed for its beauty. Contains interesting section of the Sierra Nevada mountains, many waterfalls of extraordinary height and three groves of the rare *Sequoia gigantea* trees.
Sequoia 1890	California	604 sq.m.	Magnificent groves of big trees, or *Sequoia gigantea*. The largest, the General Sherman, is 37·3 ft. in diameter and 273·9 ft. high. Scores of sequoias 20 to 30 ft. in diameter and thousands over 10 feet. Includes Mt. Whitney, highest mountain in continental United States outside of Alaska, and other interesting high Sierra country.
General Grant 1890	California	4 sq.m.	Preserves the General Grant tree, 40·3 ft. in diameter and 266·6 ft. high.
Mount Rainier 1899	Washington	325 sq.m.	Contains largest accessible single-peak glacier system in the United States. From the summit and cirques of Mt. Rainier 28 named glaciers move slowly downward. There are 48 sq.m. of glaciers, ranging in width from 500 ft. to 1 m. and in thickness from 50 ft. to many hundreds, perhaps more than 1,000 feet. Famous for its subalpine wild flower fields.
Crater Lake 1902	Oregon	249 sq.m.	Large lake of extraordinary blueness located in the crater of an extinct volcano, 6 m. in diameter, with a maximum depth of 2,000 feet. It lies 1,000 ft. below the crater rim.
Platt 1902	Oklahoma	1⅓ sq.m.	Contains sulphur and other springs believed to possess medicinal qualities.
Wind Cave 1903	South Dakota	17 sq.m.	Cave contains several miles of galleries and numerous rooms.
Sullys Hill 1904	North Dakota	1⅕ sq.m.	Important wild-animal preserve.
Mesa Verde 1906	Colorado	77 sq.m.	Some of most notable and best preserved prehistoric cliff dwellings in the United States.
Glacier 1910	Montana	1,534 sq.m.	Its rugged colourful mountains contain 250 glacier-fed lakes of unusual beauty and 60 small glaciers, the remnants of the mighty ice sheets that ages ago covered this area.
Rocky Mountain 1915	Colorado	378 sq.m.	Typical section of the Rocky Mountains. Most of its mountains have an altitude of from 11,000 to 14,255 feet.
Hawaii 1916	Hawaiian Islands	248 sq.m.	Includes the summit of three famous volcanoes—extinct Haleakala on the Island of Maui and the active volcanoes of Mauna Loa and Kilauea on the Island of Hawaii.
Lassen Volcanic 1916	California	124 sq.m.	Contains only active volcano in continental United States, excluding Alaska, and interesting cinder cones, mud geysers and hot springs.
Mount McKinley 1917	Alaska	2,645 sq.m.	Affords protection to herds of caribou and mountain sheep. Mt. McKinley, its main scenic feature, altitude 20,300 ft., is highest mountain in North America and rises higher above the surrounding country than any other mountain in the world.
Grand Canyon 1919	Arizona	1,009 sq.m.	Contains most spectacular portion of Grand Canyon of Colorado river. This canyon, the world's greatest example of stream erosion, is nearly a mile deep and its widest portion within the park is 18 miles.
Acadia 1919	Maine	15 sq.m.	Only eastern national park, and only one combining sea-coast and mountain scenery.
Zion 1919	Utah	120 sq.m.	Magnificent gorge, Zion canyon, varies in depth from 1,500 to 2,500 feet. Precipitous walls eroded in unusual forms and gorgeously coloured.
Devil's Tower 1906	Wyoming	1,152 ac.	Remarkable natural rock tower 1,200 ft. high of volcanic origin.
Montezuma Castle 1906	Arizona	160 ac.	Protects interesting cliff-dweller ruins.
El Morro 1906	New Mexico	240 ac.	Enormous sandstone rock eroded in the form of a castle upon which inscriptions were carved by early Spanish explorers.
Petrified Forest 1906	Arizona	25,625 ac.	Abundance of petrified coniferous trees of many colours.
Chaco Canyon 1907	New Mexico	21,509·4 ac.	Contains the ruins of many large prehistoric pueblos.
Muir Woods 1908	California	426·43 ac.	Contains one of the most noted coast redwood groves in California.
Pinnacles 1908	California	2,980·26 ac.	Contains many spire-like rock formations 600 to 1,000 ft. high.
Natural Bridges 1908	Utah	2,740 ac.	Three natural bridges, among the largest examples of their kind. The largest is 222 ft. high, with a span of 261 feet.
Lewis and Clark Cavern 1908	Montana	160 ac.	Interesting limestone cavern.

National parks and monuments in order of establishment	Location	Area	Special features
Tumacacori 1908	Arizona	10 ac.	Protects a ruined Franciscan mission dating from the 17th century.
Navajo 1909	Arizona	360 ac.	Numerous well-preserved cliff-dweller ruins.
Shoshone Cavern 1909	Wyoming	210 ac.	Contains a cave of considerable extent.
Gran Quivira 1909	New Mexico	560 ac.	Protects one of most important of earliest Spanish mission ruins of the south-west. Also contains some prehistoric ruins.
Sitka 1910	Alaska	57 ac.	Scene of the massacre of Russians by native Indians in 1802. Contains 16 totem poles of best native workmanship.
Rainbow Bridge 1910	Utah	160 ac.	Unique natural bridge of unusual symmetry in shape of a rainbow, height 309 ft. above the water and span 278 feet.
Colorado 1911	Colorado	13,883 ac.	Contains lofty monoliths, the work of erosion.
Papago Saguaro 1914	Arizona	1,940·43 ac.	Preserves an interesting collection of characteristic desert flora.
Dinosaur 1915	Utah	80 ac.	Deposits of fossil remains of prehistoric animal life.
Capulin Mountain 1916	New Mexico	681 ac.	Huge cinder cone of geologically recent formation.
Verendrye 1917	North Dakota	253·04 ac.	From Crowhigh Butte, Verendrye first beheld territory beyond Missouri river.
Casa Grande 1918	Arizona	472·5 ac.	Some of the most noteworthy relics of a prehistoric people within the limits of the United States.
Katmai 1918	Alaska	1,087,990 ac.	Great scientific interest as an example of volcanism on a large scale, and includes the Valley of Ten Thousand Smokes.
Scotts Bluff 1919	Nebraska	1,893·83 ac.	Many famous old pioneer trails to the West passed over this area.
Yucca House 1919	Colorado	9·6 ac.	Prehistoric ruins.
Fossil Cycad 1922	South Dakota	320 ac.	Interesting deposits of plant fossils.
Aztec Ruins 1923	New Mexico	17·2 ac.	Protects its prehistoric ruins.
Hovenweep 1923	Utah-Colorado	285·8 ac.	Four groups of prehistoric ruins.
Pipe Spring 1923	Arizona	40 ac.	Old stone fort, a relic of pioneer days.
Carlsbad Cave 1923	New Mexico	719·22 ac.	Limestone cavern of extraordinary size and beauty.
Craters of the Moon 1924	Idaho	51,200 ac.	Remarkable fissure eruptions, volcanic cones, craters, lava flows, caves and other volcanic phenomena.
Wupatki 1924	Arizona	2,234·10 ac.	Prehistoric ruins.
Glacier Bay 1925	Alaska	1,164,800 ac.	Tidewater glaciers of the first rank.
Bryce Canyon 1928	Utah	22½ sq.m.	Extraordinary box canyon filled with fantastically eroded and vividly coloured formations.
Grand Teton 1929	Wyoming	150 sq. m.	Embraces the highly picturesque Teton mountains bordering on the Jackson Hole country.
National Military and Other Parks			
Chickamauga and Chattanooga 1890	Georgia and Tennessee	6,534 ac.	Historic significance as Civil War battle-fields.
Antietam Battle-field 1890	Maryland	40 ac.	Scene of one of greatest battles of Civil War.
Shiloh 1894	Tennessee	3,546 ac.	Embraces the battle-field of Shiloh.
Gettysburg 1895	Pennsylvania	2,530·32 ac.	Well-marked scene of famous Civil War battle.
Vicksburg 1899	Mississippi	1,322·63 ac.	Scene of the siege and surrender of Vicksburg in 1863.
Lincoln's Birthplace 1916	Kentucky		Log cabin and part of the farm.
Guilford Courthouse 1917	North Carolina	131 ac.	Scene of a battle of the American Revolution.

National parks and monuments in order of establishment	Location	Area	Special features
National Military and Other Parks			
Moores Creek 1926	North Carolina	30 ac.	Site of a memorable battle of the Civil War.
Petersburg 1926	Virginia	185 ac.	Scene of campaign and defence of Petersburg during Civil War.
Fredericksburg and Spotsylvania 1927	Virginia		Scene of Civil War battles.
Stone River 1927	Tennessee		Scene of Civil War battle.
National Monuments[1]			
Chalmette 1907	Louisiana	17·47 ac.	Memory of battle of New Orleans.
Big Hole Battle-field 1910	Montana	5 ac.	Historic interest as battle-field of Indian wars.
Cabrillo 1913	California	½ ac.	From this point California was first sighted by the explorer Juan Rodriguez Cabrillo in 1542.
Mound City Group 1923	Ohio	57 ac.	Prehistoric Indian mounds.
Fort Wood 1924	New York	2·5 ac.	Site of the Statue of Liberty.
Castle Pinckney 1924	South Carolina	3.5 ac.	Historic fortification.
Fort Pulaski 1924	Georgia	20 ac.	Contains historic fort.
Fort Marion 1924	Florida	18·09 ac.	Fort built by the Spaniards in 1656.
Fort Matanzas 1924	Florida	1 ac.	Relic of the Spanish invasion.
Meriwether Lewis 1925	Tennessee	50 ac.	Contains the grave of Capt. Lewis of the Lewis and Clark expedition.
Fort Niagara 1925	New York	·0074 ac.	Commemorates erection of cross by Father Millett in 1688.
Fort McHenry 1925	Maryland	46·75 ac.	Here the "Star Spangled Banner" was written.
National Monuments[2]			
Gila Cliff Dwellings 1907	New Mexico	160 ac.	Numerous cliff dwellings.
Tonto 1907	Arizona	640 ac.	Cliff-dweller ruins.
Jewel Cave 1908	South Dakota	1,280 ac.	Interesting limestone cavern.
Wheeler 1908	Colorado	300 ac.	Interesting examples of erosion and volcanic action.
Mount Olympus 1909	Washington	299,370 ac.	Summer range and breeding ground of the Olympic elk.
Oregon Caves 1909	Oregon	480 ac.	Extensive limestone caverns.
Devils Postpile 1911	California	800 ac.	Spectacular mass of hexagonal basaltic columns like an immense pile of posts.
Walnut Canyon 1915	Arizona	960 ac.	Cliff-dweller ruins.
Bandelier 1916	New Mexico	22,075 ac.	Great number of cliff-dweller ruins.
Old Kasaan 1916	Alaska	38·3 ac.	Covers abandoned Indian village containing totem poles and other historic objects.
Lehman Caves 1922	Nevada	593·03 ac.	Limestone caverns.
Timpanogos Cave 1922	Utah	250 ac.	Limestone caverns.
Bryce Canyon 1923	Utah	7,440 ac.	Box canyon filled with fantastically eroded and vividly coloured pinnacles. This area was given national park status in 1928.
Chiricahua 1924	Arizona	4,480 ac.	Interesting rock formations.
Lava Beds 1925	California	45,967 ac.	Interesting ice caves and the site of a battle of the Modoc Indian war in 1873.
White Plains Battle-field 1926	New York		Memorial Tablet to indicate position of Revolutionary Army under command of General Washington.

[1]Administered by War Department.
[2]Administered by Department of Agriculture.

Complete Conservation.—The national parks and national monuments are the only areas in the United States where the native fauna, flora and natural phenomena are given absolute protection, in an endeavour to preserve for future generations bits of American scenery and wild life as they were when the early pioneers first saw them. The introduction of exotic animals or plants is guarded against. The complete protection afforded game species within these reservations serves an important economic purpose in that, by providing a safe retreat, especially during the breeding season, these animals are given an opportunity to increase to the point of overflow to adjacent territory, where they may be hunted or trapped under State laws.

Recreational Uses of National Parks.—Between 1916 and 1928, travel to the parks and monuments administered by the national park service increased from 356,097 to 3,024,844, and recreational facilities were provided to care for these visitors. Hotel and comfortable lodge accommodations are available and free public camp grounds have been provided by the Government. In some of these camp grounds housekeeping cabins may be rented and cafeteria service is available. Water, electric lighting and sanitary conveniences are furnished, as well as firewood and in some places open fireplaces for cooking. Transport service is provided for those visiting the parks by train, and saddle horses and pack outfits for those wishing to explore and camp in outlying portions of the parks. Roads are provided for motorists and trails for horseback riders and walkers. Where winter sports can be enjoyed, toboggans, ski courses and skis, sleighs and snow-shoes are to be had. The streams and lakes are stocked with game fish, and camera supplies are obtainable. Pamphlets descriptive of the various parks, giving information regarding their recreational attractions and the facilities provided for visitors may be secured from the National Park Service.

Private Lands Within Park Boundaries.—A problem that has caused considerable difficulty in administering the national parks to the best advantage is the existence of private lands within their exterior boundaries. With the exception of the Yellowstone national park and Hot Springs, which were created before any of the lands desired for original inclusion had been settled, practically all of the national parks contain *bona fide* private lands, which are given the same protection accorded private lands elsewhere. During the past 13 years continued efforts have been made to secure such private holdings for donation to the United States. Private contributions amounting to $150,000 have been secured to purchase magnificent stands of *Sequoia gigantea* and other private holdings in Sequoia national park alone; they were turned over to the United States for addition to the park. The only appropriation made by Congress before 1927 to purchase lands for park purposes was in 1916, when $50,000 was appropriated to purchase an important stand of big trees in the giant forest of Sequoia park. This appropriation was supplemented by $20,000 contributed by the National Geographic Society. In 1927, however, Congress recognized the importance of eliminating private holdings, and appropriated $50,000 for the purchase of privately owned lands within the boundaries of any national park, to be expended only when matched by equal amounts of donations from other sources and which are available for the same purpose. A similar appropriation was made in 1928.

Although not reserved for economic reasons, and not open to commercial development, the national parks, and to a lesser extent the national monuments, have a very decided value to the United States and this value lies in their complete protection from commercialization. Their forests, left standing, are of immeasurable benefit to nearby communities through affording protection to the watersheds of important streams, thus often preventing floods and the droughts that may follow in their wake. From a strictly financial standpoint, they bring in large revenues each year. During 1928 the revenues derived from franchise fees, automobile licences and other sources amounted to $808,255.81, and these funds were turned into the treasury of the United States to be available for appropriation for the purposes of the Government. In 1916 park revenues amounted to only $177,470.69. Of still greater economic importance is the part the parks play in offering to American travellers objects of such general scenic interest as to lead them to "see America first," in this way keeping at home millions of dollars which would otherwise be spent abroad, and which spent in the United States in travel brings increased taxes into the Federal Treasury.

(S. T. M.; I. F. S.)

NATIONAL PARKS HIGHWAY (Northwest Trail), a highway from Chicago to Seattle, Wash. It is paved through Illinois, Wisconsin and most of Minnesota; the balance is mostly gravel with short graded stretches. It is 2,532 m. long and passes just north of the Yellowstone National Park and south of Glacier National Park. It serves, among others, the cities of Fargo, N.D., Billings and Helena, Mont., and Spokane and Seattle, Wash.

NATIONAL PARK TO PARK HIGHWAY, an American highway bringing into connection all of the national parks (*q.v.*) of western United States and about 4,500 m. long. It is a most wonderful scenic road, circling the Rocky mountains, Sierra Nevada and Pacific coast ranges. The roadway is partly paved, improved or graded. Among the cities touched by it are Seattle, Wash., Portland, Ore., Yreka, Redding, Sacramento, San Francisco and Los Angeles, Calif., Kingman and St. Johns, Ariz., Zuni and Liberty, N.M., Pueblo and Denver, Colo., Cheyenne, Casper and Cody, Wyo., Great Falls and Libby, Mont., and Spokane, Wash.

NATIONAL PROVINCIAL BANK LIMITED. This great British banking institution, one of the "Big Five" (*see* BANKS, HISTORY OF), has over 1,200 branches in London and the provinces. The amalgamation movement wrought great changes in the English banking system, and the National Provincial bank has been closely identified with it, particularly during the period from 1918 to 1924. The most important amalgamation effected by the bank took place in 1918, when it took over the Union of London and Smiths bank, Limited. In the same year, the business of the Bradford District bank Limited was acquired. The Sheffield Banking company Limited was absorbed in 1919, the Northamptonshire Union bank Limited in 1920 and the Guernsey Banking company Limited in 1924. A number of private banks also were absorbed; in 1920 and 1924 respectively Coutts and Co. and Grindlay and Co. Ltd. became affiliated, though both organizations continue business in their own names.

The parent bank was founded in 1833. At the time of its establishment, the creation of joint stock banks had but recently been legalized, and any such banks conducting business within 65 miles of London were denied the right of issuing notes, at that time a lucrative privilege. It was decided to confine the banking activities of the new company to the provinces, thereby securing the right of note issue, and to maintain control from an administrative office in London. The first office was opened at Gloucester on January 1, 1834, and by 1838 there were 60 offices open. After some years the directors decided that the advantages of conducting business in London would outweigh those of retaining their note issue. Accordingly, business commenced in 1866 in Bishopsgate, London. At that time the bank was given a seat in the London Bankers' clearing house, a privilege hitherto withheld owing to the antagonism of the private banks to their joint stock rivals. In 1880 the institution was registered as a limited liability company.

The growth of the National Provincial bank is shown in the following figures:—

	Paid up capital and reserves	Deposits	No. of offices
	£	£	
1870 . . .	1,513,373	15,734,999	133
1914 . . .	5,000,000	74,916,017	444
1927 . . .	18,958,832	273,597,202	1,217

On December 31, 1927, the accounts of the National Provincial bank disclosed a balance of current, deposit and other accounts amounting to over £273,000,000 and the manner in which these funds were utilized will be seen from the following summary of the balance sheet as at that date.

Liabilities	£	*Assets*	£
Capital, paid up	9,479,416	Cash in Hand and at Bank of England	32,078,961
Reserve Fund	9,479,416	Cheques in course of Collection, etc.	9,737,553
Deposits	273,597,202	Money at Call and Short Notice	21,817,455
Acceptances, Engagements, etc., as *per contra*	12,024,760	Bills Discounted	38,993,472
Profit and Loss A/C	863,476	Investments	38,640,115
		Advances	146,715,211
		Bank Premises	5,436,743
		Acceptances, Engagements, etc., as *per contra*	12,024,760
	£305,444,270		£305,444,270

Whilst the bulk of its resources is employed in various interest-earning capacities, the bank keeps available in the form of cash in hand and balance at the Bank of England the substantial sum of £32,000,000. The item, money at call and short notice, of over £21,000,000, represents advances to the bill brokers and discount houses, chiefly against deposit of treasury bills or first class bank bills. These advances, as their name indicates, are very liquid and are repayable at short notice. Bills discounted include a large proportion of treasury bills and the item investments includes over £30,000,000 of British Government securities.

A large portion of the bank's funds is employed in advances to customers. Very considerable sums are borrowed from banks by trading and industrial undertakings and by private individuals, the bank advance occupying an important place in the economic structure of the country. (L. C. M.)

NATIONAL RESERVE. A body of men, who having served in any of the British military forces, registered with County Associations for service in time of grave national emergency. The original title in 1910 was "Veteran Reserve" but this was changed in 1911 and the late Lord Roberts, V.C., was appointed "Colonel of the National Reserve." At the outbreak of the World War the whole of the reserve were accepted in various capacities.

NATIONAL ROOSEVELT MIDLAND TRAIL, an American highway connecting Newport News, Va., and Los Angeles, Calif., traversing about 3,550 miles. It passes over the Appalachian mountains on the eastern end, through the farming districts of the Mid-West, across the plains, through one of the most mountainous regions of the Rockies, and over Westgard Pass into California at the foot of the Sierra Nevadas. In this section, for 100 m. on either side of Mt. Whitney, the highest American peak, there is a view of saw-tooth, snow-capped ranges. From Newport News to Kansas City, Mo., the roadway is paved, hard and improved; beyond it is partly paved, hard, gravelled or graded. Other localities served by the route are Richmond, Va., Charleston, W.Va., Lexington, Ky., Vincennes, Ind., St. Louis, Mo., Topeka, Kan., Denver, Hot Sulphur Springs and Grand Junction, Colo., Salt Lake City, Utah, McGill, Nev., and Big Pine and Olancha, Calif.

NATIONAL SAVINGS. Estimates of aggregate national savings may proceed upon two quite distinct bases:

(a) That amount which is definitely saved out of the national income from current consumption for capital purposes.

(b) The net additions to national resources.

If a man spares out of his income £200 to build a garage, he has, in the first sense, clearly saved £200, irrespective of the fact that a greenhouse worth £100 has been burnt down by accident during the year. But in the second sense his total resources have only increased by £100. It is clear, therefore, that a nation may be making handsome savings from its current production, but if existing assets are falling into disuse or obsolescence and losing their productive power, the net addition to national resources is not as great as it might otherwise have been. It may be said that this is sufficiently covered if, before savings are reckoned, proper provision is made for the upkeep of existing assets, but, in fact, long-period obsolescence, except in going concerns, is not usually specifically provided for. If estimates of national wealth are made on the same principle, at two different dates, the difference between them represents roughly the addition to national resources, provided there has been no change in the purchasing power of money, or the rate of interest by which capitalization is computed, in the meantime. If either of these factors is present, the same assets may present a very different money valuation, or conversely the same money valuation may hide a real difference in physical assets. Thus between the years 1885 and 1895 the national capital, measured in the same way, increased by only 63 millions annually, whereas between 1895 and 1905 it increased by 237 millions annually.

Estimates of national savings are extremely difficult to compile, because they are necessarily partial blends of two distinct things —one the value of objective things and the other the value of titles to objective things. Thus it might be thought, when a new company is floated with a capital of £500,000 fully subscribed by the public, that this represents so much actual saving. If, however, the company acquired existing factories which originally cost £250,000, all that may have happened is that the subscribers have sold out £500,000 worth of securities to make the subscription, the owner of the factories gives up the property, receives the money and reinvests it indirectly in the securities so given up. There has been a change of values of existing wealth on its exchange, but no addition to the real wealth.

Estimates of savings made by way of deducting a large total, such as total consumption from total income, are open to a large risk of error for two reasons; first, because the totals are both large by contrast with the difference sought, and a very small percentage of error in either total (or both) will be a very large error, proportionally, in the difference sought. Secondly, there is a great difficulty in determining the value of consumption goods as distinguished from capital goods.

Past Estimates of British Savings.—In 1880 Mulhall estimated the savings of the United Kingdom as 40 millions per annum from 1820 to 1840; 80 millions from 1841 to 1860, and 120 millions from 1861 to 1880. Baxter had put the ten years' average 1855 to 1865 at 124 millions. In 1907 the official *Census of Production Reports* estimated from 170 to 190 millions sterling as the value of production available for new capital investment within the United Kingdom. It must not, however, be overlooked that the new investments do not constitute as a whole a net addition to capital values. Even in cases in which plant, machinery, buildings, etc., are maintained in good physical condition, their value may be reduced owing to the fact that changes in the requirements of the community are in progress, and that the methods of production are undergoing continuous modification, so that obsolescence destroys the value of capital, even though its physical condition be maintained. There is further some apparently new investment which does not, in reality, correspond to extensions of the capital of the community. The annual sum assigned for wear and tear and replacement is only in part dissipated in current repairs and renewals. The reserve funds of individual businesses, provided out of the total, are invested either outside of, or in the businesses themselves, and are to a large extent designed to provide for the ultimate substitution of fresh forms of capital for the capital now existing, rather than for the current maintenance of such capital. But, if a vessel is written off over 25 years at 4 per cent per annum, the fund ostensibly provides no increase in assets or saving.

Recent Estimates.—In their Analysis in *National Income 1924* (1926), Professor Bowley and Sir Josiah Stamp say:—

"In 1911 the total saving was estimated roughly as £330 millions, of which £230 millions were invested at home, £100 millions abroad; hence, since home-produced income was about £1,900 millions, savings for home use amounted to about 12 per cent. of that income. Total savings are even more difficult to estimate in 1924, but if we adopt the figures finding most acceptance, £450 millions is a minimum and £500 millions is a maximum. These totals include £135 millions for overseas investment, so that the amount allotted to home investment is about £350 millions, not quite 10 per cent. of home-produced social income (*i.e.*, aggregate income less transfers). Total savings expressed as a proportion of total social income was on the same estimates, 16 per cent. in 1911 and 12 or 13 per cent. in 1924."

The amount of British national savings has recently been investigated by the Colwyn Committee, who found as follows:

"Until very recently the tendency has been to put national savings during the post-war depression very low indeed, but more mature consideration has seemed to justify an estimate of something like £450 millions to £500 millions, and a figure in this range of magnitude has won some acceptance.

"We are disposed to think that a figure of £450 millions to £500 millions represents the best estimate that can be made with the data available."

The equivalent of pre-war savings of £350 millions to £400 millions would, at the mean, be some £650 millions, when account is taken of the higher prices and increased population. Thus, while nominal savings have increased, real savings exhibit a decline which may amount in present money values to something like £150 millions to £200 millions.

The only detailed estimate before the Colwyn Committee was given by Dr. W. H. Coates for 1924, as follows:—

	£ *millions*
Internal new issues for investment in the United Kingdom	89
Internal new issues for investment abroad	135
Addition to National Savings Certificates	3
Increase in Treasury holdings of Bonds tendered in payment of Death Duties	9
Investments sold by the banks	35
New Houses	35
Profits not distributed by companies and private traders but invested in own businesses; and miscellaneous	194
	500

Dealing with the character of British savings, W. T. Layton gave the following table analysing new issues of 1913 and of 1921 to 1923 as tending to confirm the "general expectation that the public is playing for safety."

New Home Issues for Industrial Purposes

	Ordinary	Preference	Debenture	Total
	(£ millions)	(£ millions)	(£ millions)	(£ millions)
1913	20·0	20·6	13·0	53·6
1921	17·9	14·4	56·8	89·1
1922	12·3	12·9	50·4	75·6
1923	14·0	15·2	37·8	67·0

Evidence was given that in the five years before the World War there were £482 millions of foreign investments and £381 millions of colonial investments; in the five years since the war there have been £145 millions of foreign investments, and £321 millions of colonial investments.

Working-class savings, in the view of the committee, form a small percentage of the total savings by individuals. There has evidently been a decline in saving in the income tax paying classes as a whole, but there is no clear evidence for its allocation.

Generally, they concluded that the falling off in the national savings, equal to £150 millions or £200 millions at the 1927 level of prices, gave "ground for anxiety but not for pessimism."

An estimate of British national savings more recent than that of the Colwyn Committee is given by the Liberal Industrial Enquiry, 1928, as follows:—

1. Under the influence of the Government (Central and Local), including repayment of Government external debt, the Road Fund, Telephones, and Local Loans Fund, and capital expenditure by Local Authorities	£ 90,000,000
2. Through the accumulation of reserves by the retention of profits within existing businesses	195,000,000
3. Dwelling houses and their equipment, otherwise than by Public Authorities or under other headings	65,000,000
4. Through increased Bank loans and advances, etc. (net)	25,000,000
5. Through the New Issue Market for new capital expenditure at home not covered by previous headings and excluding exchanges of existing capital through the machinery of the New Issue Market	25,000,000
6. Through the New Issue Market and the Stock Exchange for investment abroad (net)	100,000,000
	500,000,000

A comparison of the two estimates brings out the difficulties of formulating estimates of this kind.

The Main Springs of National Savings.—It will have been seen from the foregoing analysis that the aggregate accumulation is to a marked extent dependent upon the undistributed profits of industrial concerns. This has great importance having regard to the sensitiveness of personal motives for saving to the influences of taxation or other causes. These funds are far less influenced by high or low rates of tax or high or low rates of interest, than any other section of national savings. It is true that the *scope* for accumulations may be rather less with high taxation, but they do not immediately attract supertax or death duties and the average board of directors is entirely uninfluenced by such considerations. There is an increasing practice of building up a solid and sound position by secret reserves and a desire to establish a policy of stable dividends. Reserves can be made in the first instance with the ostensible object of equalization of dividends, but they often ultimately find themselves solidified in investments or extensions of the business.

The second great source of saving, paradoxically enough, is taxation. High taxation levied to maintain a large sinking fund for the repayment of an enormous national debt is a very direct contribution towards the accumulated fund. When debt is paid off in the form of redemption of war-loan it is almost certain that the funds so received are not spent as income by the holder of the redeemed war loan but are reinvested. There is thus a constant stream of money withdrawn as taxation going into new objective forms.

High taxation with a sinking fund is, therefore, a forcible contribution to the national savings. For example, the Liberal Industrial Enquiry reported:

"The proposal of the Colwyn Committee that the Sinking Fund should be increased to £100 millions per annum would, therefore, obviously—although apparently burdensome on taxation—greatly increase the national resources for investment purposes. If they merely have the effect of increasing the volume of British loans abroad, it is doubtful whether the game is worth the candle, but if they are really available for the development of home resources then the apparent extra burden might easily be offset by increased productivity."

The third source is the aggregate of the very numerous accumulations of small sums put aside by the working classes. The improved standard of life and the social provision made for special circumstances of distress and for pensions, etc., have given greater free margin than formerly existed for small accumulations by way of the Post Office, National Savings Certificates, Industrial Insurance and Building Societies. The situation created by the war in the scarcity of houses has brought about, almost compulsorily, a new practice of house-ownership.

Taxation and National Saving.—The chief cause, inimical to high accumulation of capital, is the heavy taxation on the higher grades of income and estates. Nothing is here said as to the justice, viewed merely as a taxation burden upon the individual, of such progressive scales. In the past a very large part of the total savings came from the unused wealth of the rich. It has been said that the 19th century tacitly acquiesced in the great disparity in the distribution of wealth, on the understanding that the very wealthy did not use their money but "turned it in" again for the benefit of the community. If very large sums are absorbed from the relatively few wealthy for distribution amongst the many as pensions and for other social purposes, then the duty of accumulation cannot be discharged to the same extent by the few, but devolves upon the many. Sir Josiah Stamp has said: "On grounds which can be well defended, very large sums are taken from the higher incomes. The effect upon the range of net incomes of the nation is that they are much more evenly distributed than they would otherwise be. But the top portion of a big income used to contribute materially towards saving. To-day you take away that top portion for taxes. The great mass of the people benefit by this system, for, if it did not exist, they would have to bear a greater proportion of the national expenditure and have a smaller net income."

The Liberal Industrial Enquiry agreed that the pressure of taxation had reduced the savings of the rich and well-to-do far more than it had increased the savings of wage-earners "so that the amount annually available for investment has decreased by something like 150 to 200 million £." Savings certificates reached some 475 millions, including accumulated interest, by 1926. Post Office Savings Bank deposits rose 116 million £ in six years; co-operative capital increased by 57 millions in 12 years; Friendly Societies 47 millions in 13 years; Industrial and Provident Societies by 135 millions, and Building Societies 84 millions in 14 years. These figures indicate a contribution of from 80 to 100 millions a year from small investors and it is notorious that the average holdings in big industrial concerns are very small, and that the working classes are extending their interests in industry.

National Savings in Germany.—Dr. Helfferich's computations for the years immediately before the war, 1908 to 1913, led to an estimate of 8 to 8½ milliards of gold marks (£400 to 425 millions) as the annual national saving. A variety of estimates have been made, some of them rather arbitrary. Prof. Prior (*Kreditpolitik-Aufsatze und Reden*) gives 3 to 4 milliard marks in 1924 and 1925; Prof. Hirsch (*Magazin der Wirtschaft*), 5 milliards for 1925; the *Frankforter Zeitung*, 7½ milliards for 1926 and 9 for 1927; the *Reichskreditgesellschaft*, 6·4 for 1925, 6·3 for 1926 and 7·6 milliards for 1927. The hypothetical character of these estimates must be emphasized.

See: Report of the Colwyn Committee on Taxation and the National Debt; Report of the Liberal Industrial Enquiry; A. L. Bowley and J. C. Stamp: *National Income 1924* (1926). (J. S.)

UNITED STATES

When the value of money remains constant, in other words when the price-level does not change, it is usually a simple matter to measure the savings of an individual during any given interval of time. All that is necessary is to subtract the net value of his wealth at the beginning of the period from the net value of his wealth at the end of the period. The difference represents his savings during the period.

There are two logical ways of defining the term national savings: (1) The sum of the individual savings of all the inhabitants of the nation. (2) The increase in the physical, institutional, and mental wealth of the nation plus the increase in the value of its claims against other nations.

The National Aggregate of Private Savings.—It is not statistically practicable to ascertain the savings of each individual or of each family in the United States and then add these sums together to obtain the aggregate of private savings for the nation. In fact, the only type of private savings for which any records are available is for the savings of corporations as shown by their respective accounting systems.

At present, every corporation in the United States is required to report annually to the Bureau of Internal Revenue both its net income and the amount of dividends which it has paid out during the year. Obviously, by subtraction, one can arrive at the amount of saving shown by its corporate accounts. The aggregate of savings for all corporations, as indicated by the reports for the various years, are as follows: 1922, $2,530,484,240; 1923, $3,465,145,765; 1924, $2,456,328,887; 1925, $4,126,908,269; 1926, $3,565,146,340.

Could we accept these figures as valid, we would have covered one important field of national savings. Unfortunately, however, since the validity of the reported savings depends upon the accuracy of the estimates of the values of property owned by the corporations at the beginning and at the end of the year, and since doubtless, in very many instances, the valuation placed by the corporate accountant upon the property of his corporation bears but little relation to the realities of the case, the above figures, indicating the total volume of corporate savings, must be taken with many grains of salt.

Were the data available, a simple method of measuring the total of individual savings would be to find the value of all the wealth belonging to individuals at the beginning of the year, do the same for the end of the year, convert these aggregates to dollars of equal purchasing power, and, finally, subtract the corrected figure for Jan. 1 from the corrected figure for Dec. 31. For many categories of individual wealth, the data at hand are, however, so scanty that estimates made in this manner are necessarily subject to large possible margins of error. The only field in which there appears to be hope of securing worth while results by this method of computation is in the calculation of the volume of corporate rather than of individual saving.

Each corporation reports to the U.S. Bureau of Internal Revenue annually the amount of its funded debt, and the "fair" market value of its stock. The total value of corporate wealth is roughly represented by the combined value of the corporate bonds and corporate stocks. If we assume that the bonds are, on the average, worth par (an assumption not wildly in error), we can readily arrive at the change during the year occurring in the value of all corporations. Since, during the period covered by these reports, the price-level has fluctuated but slightly, estimates of corporate savings made in this manner are not without value. Figures for corporate savings, obtained in the manner just described, follow:—

Increase in Millions of Dollars

Period	Face value of bonds	Face value of stocks	Value of stocks and bonds
	$	$	$
June 30, 1923 to June 30, 1926	9,096	17,512	26,608
Average annual increase for three-year period	3,032	5,837	8,869

From the figures just presented, it appears that the corporations of the United States have recently been increasing in value to their owners at the average rate of about $9,000,000,000 per annum. Of course, a considerable proportion of this growth in value may represent not any increase in the volume of tangible property held by corporations, but merely an undue degree of optimism concerning the future course of corporate earnings.

Such scanty evidence as is available indicates that nearly half of the total volume of saving in the United States is done by business enterprises. (See *The Journal of the American Statistical Association*, Dec. 1922, pp. 458–470.) As yet, however, most agricultural undertakings, much of the mercantile business and many of the smaller enterprises in other lines have not been taken over by corporations; hence the volume of corporate savings is probably not over one-third of the total national savings.

It is far from easy to estimate the total extent of individual saving. If one attempts to obtain the figure from estimated aggregates of individual wealth one quickly discovers that, for most types of wealth, data are very incomplete.

National Saving from the Social Standpoint.—From the social standpoint, a nation's savings during any period are comprised of increases in: (1) The stock of wealth in the form of material goods used either for production or consumption by the nation or its inhabitants. This type of saving evidently includes improvements in the land itself as well as additions to the stock of buildings and of movable goods. (These claims are equities in a stock of tangible goods located abroad which either have been produced or which it is expected will be produced in the future.) (2) Valuable claims against other nations or their inhabitants.

Social Savings during the 10-year Period 1909–1918

Calendar year	Millions of dollars having a value equivalent to that of 1913
	$
1909	5,231
1910	5,509
1911	4,289
1912	5,208
1913	4,880
1914	4,140
1915	7,381
1916	11,401
1917	7,162
1918	−1,196

Corresponding estimates for more recent years are not available.

A Roughly Estimated Index of the Fractional Increase During a Decade in the Actual Wealth of the People of the United States

Kinds of wealth	Beginning of period		End of period		Multiplier	Product in millions.	
	Year	Amount	Year	Amount		Beginning of period	End of period
						$	$
Acreage of important crops (millions) (*a*)	1917	331·1	1927	339·8	100	33,110	33,980
Horses, mules and cattle (thousands) (*b*)	1917	95·5	1927	77·7	50	4,773	3,886
Sheep and swine (millions) (*c*)	1917	93·4	1927	96·3	10	934	963
Gold coin and bullion in treasury (millions of $) (*d*)	1917	3,218	1927	4,587	1	3,218	4,587
Freight cars (thousands) (*e*)	1916	2,329	1926	2,404	5 (*g*)	11,645	12,020
Locomotive tractive power (millions of pounds) (*e*)	1916	2,066	1926	2,611	1 (*g*)	2,066	2,611
Railways (thousands of miles) (*f*)	1916	266·3	1926	261·5	30 (*g*)	7,989	7,845
Passenger cars in service on railways (thousands) (*e*)	1916	55·2	1926	56·9	50 (*g*)	2,760	2,845
Telegraph wire (thousands of miles) (*h*)	1917	1,889	1926	2,056	0·1	189	206
Ocean cables (thousands of miles) (*i*)	1912	67·7	1922	76·7	1	68	77
American Telephone Co., wire operated (thousands of miles) (*j*)	1917	22,610	1927	56,823	0·05	1,130	2,841
Electric railways (thousands of miles) (*k*)	1915	46·5	1925	46·7	80	3,716	3,740
Electric railway cars (thousands) (*k*)	1915	99·4	1925	104·7	20	1,988	2,094
Total elec. power production (millions of kw.hr.) (*n*)	1917	32,679 (*l*)	1927	80,208 (*m*)	0·1	3,268	8,021
Horse-power used in factories of U.S. (thousands) (*o*)	1914	22,548	1925	35,773	1	22,548	35,773
Number of motor cars registered (thousands) (*p*)	1917	4,983	1927	23,127	0·4	1,993	9,251
Tonnage of merchant marine (thousands) (*q*)	1917	2,441	1927	7,309	0·2	488	1,462
Navy tonnage in commission (thousands) (*r*)	1917	1,533	1927	1,522	0·8	1,226	1,218
Pupils in public schools (thousands) (*s*)	1916	20,352	1926	24,741	0·2	4,070	4,948
Mileage of improved roads (thousands) (*t*)	1916	277	1926	550	6	1,662	3,300
Property rights in foreign countries (millions of $) (*w*)	1918	2,900 (*u*)	1927	12,500 (*v*)	1	2,900	12,500
(*a*) Calculated estimates by U.S. Bureau of Agriculture Economics; (*b* and *c*) *U.S. Yearbook of Agriculture;* (*d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *p*, *q*, *r*, *s*, *t*) *Statistical Abstract of U. S.;* (*g*) largely on the basis of cars and locomotives; (*l*) U.S. census of electric light and power stations; (*m*) U.S. survey of current business; (*n*) production of electric power used as indicator; (*o*) U.S. census of manufactures; (*u*) *Journal of the American Statistical Association;* (*v*) U.S. Dept. of Com., balance of international payments in 1927; (*w*) a dubious figure as it is impossible to say how much is collectible.	..	..	..		Total Index (base, beginning of period)	111,741 1·0000	154,168 1·38

(3) The accumulated store of scientific knowledge and organization of productive forces. (4) The productive power of the inhabitants resulting from education, hygienic measures, etc.

A confessedly rough estimate made by the present writer in *The Journal of the American Statistical Association* for Dec. 1922, shows the social savings of the nation to have amounted to about one-seventh of the total income of the nation during the years 1909 to 1918 inclusive. When translated into terms of dollars of 1913 value the amounts estimated to have been saved annually are as in table on page 161.

In the same study, appears an estimate along this line, on the basis of sample data, of the increase in the value of the wealth of the United States during the nine or ten year period ending approximately in 1918. This estimate indicates that the nation's wealth increased by about one-third in that period of nine or ten years.

A corresponding estimate for the last decade appears in the accompanying table.

According to the indications cited in the table, the wealth of the people of the nation increased by approximately 38% during the decade ending in 1926 or 1927. Apparently the American people are still tending to save a very considerable fraction of their total annual income—a fraction amounting to at least a tenth and possibly as much as a seventh of the whole. This percentage is, of course, subject to a wide margin of error. Substantial gains in the individual items entering into the total are, however, so general as to convey the distinct impression that the proportional rate of increase in the aggregate during this decade has been at least as rapid as that characterizing the decade immediately preceding. (W. I. K.)

NATIONAL WORKSHOPS (in French, *Ateliers Nationaux*), the term applied to the workshops established to provide work for the unemployed by the French provisional government after the revolution of 1848. (The term is also incorrectly applied to the proposed *ateliers sociaux* of Louis Blanc [*q.v.*], state-supported co-operative productive societies.) The revolution was both preceded and followed by a severe financial and industrial crisis which rendered the problem of unemployment in Paris very acute. The provisional government under the influence of one of its members, Louis Blanc, and on the demand of a deputation of Parisian workers, passed a decree (Feb. 25, 1848) which contained bold promises assuring relief from the extreme conditions then prevailing. Moreover, this relief was to be immediate, effectual and universal. The following is an extract from the decree:—

"The provisional government of the French Republic undertakes to guarantee the existence of the workmen by work. It undertakes to guarantee work for every citizen."

For the carrying out of this decree, Louis Blanc wanted the formation of a ministry of labour, but this was shelved by his colleagues who, as a compromise, appointed the "Luxembourg" labour commission, under the presidency of Louis Blanc, with power of inquiry and consultation only. The carrying out of the decree of Feb. 25 was entrusted to the minister of public works, M. Marie, and various public works were immediately started. These included clearing the trench of Clamart and conveying the earth to Paris for the construction of a railway station on the chemin de fer de l'Ouest; construction of the Paris terminus of the Paris-Chartres railway; improvement of the navigation of the Oise; extension of the Sceaux railway to Orsay.

Those applying for work far exceeded in number the jobs available. There was no effective administrative service and no real desire on the part of the government to make the experiment a success. The disorder and waste were amazing.

Owing to the increase in the number of those claiming work or relief, disorganization set in, and both the bureaux and the maires became the centres of disturbances, those in charge of the offices being unable to control the crowds. As a consequence M. Marie commissioned Émile Thomas, a chemist, connected with the École Centrale, to reorganize the works. When Thomas took the work in hand on March 5, the number of unemployed had increased to 14,000 in addition to some 4,000 or 5,000 employed on public

works, and it was steadily on the increase. On March 16 the daily pay of the workmen who were not working was reduced to one franc; work was guaranteed for at least every other day, in which case the pay was to be two francs for the day.

The National Assembly had in the meanwhile been elected, and met on May 4. The Executive Commission was elected a few days later; Louis Blanc was excluded, but all the other members of the provisional government were on it. Blanc renewed his motion for a ministry of labour; this was rejected. The dispersal of the *emeute* of May 15 freed the Assembly from fear of the revolutionary clubs, and on May 15 Thomas received instructions to dismiss all unmarried men under 25 years of age who would not enlist in the army, all men who could not prove six months' residence in Paris, and all who refused offers of private employment. Piece-work was to be established instead of time-work, and men were to be prepared to be drafted into the provinces. The protests of Thomas held this plan up, but he was removed from office on May 26 and on June 20 the proposals were approved, and the sequel was the insurrection of June 23 and following days (*see* FRANCE: *History*).

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NATIONS, LAW OF: *see* INTERNATIONAL LAW.

NATROLITE, a mineral species belonging to the zeolite group. It is a hydrated sodium and aluminium silicate with the formula $Na_2Al_2Si_3O_{10}\cdot 2H_2O$, and containing sodium (Na_2O, 16·3%). "Needlestone" or "needle-zeolite" are other names, alluding to the common acicular habit of the crystals, which are often very slender and are aggregated in divergent tufts. Larger crystals have the form of a square prism terminated by a low pyramid: the prism angle being nearly a right angle (88° 45½′), the crystals are tetragonal in appearance, though actually orthorhombic. There are perfect cleavages parallel to the faces of the prism. The mineral also often occurs in compact fibrous aggregates, the fibres having a divergent or radial arrangement. Natrolite is usually white or colourless, but sometimes reddish or yellowish. The lustre is vitreous, or in finely fibrous specimens sometimes silky. The spec. grav. is 2·2, and the hardness 5½. The mineral is readily fusible. It is decomposed by hydrochloric acid with separation of gelatinous silica.

NATTIER, JEAN MARC (1685–1766), French painter, was born in Paris in 1685, the son of Marc Nattier, a portrait painter, and of Marie Courtois, a miniaturist. He received his first instruction from his father, and took the first prize at the Paris Academy at the age of fifteen. He refused to study at the French Academy in Rome, and in 1715 went to Amsterdam, where Peter the Great was then staying. There he painted portraits of the tsar and the empress Catherine, but declined an offer to go to Russia. Between 1715 and 1720 he painted the "Battle of Pultawa," for Peter the Great, and the "Petrification of Phineus and of his Companions," which led to his election to the Academy. The financial collapse of 1720 caused by the schemes of Law all but ruined Nattier, who was obliged to turn to portraiture. He became the painter of the artificial ladies of Louis XV.'s court. The most notable examples of his straightforward portraiture are the "Marie Leszczinska" at the Dijon Museum, and a group of the artist surrounded by his family, dated 1730. He died in Paris in 1766.

Among his pictures are the "Magdalen" at the Louvre; "La Camargo" and "A Lady of the Court of Louis XV." at Nantes; the "Head of a Young Girl" at Orléans and "Mme. de Pompadour" at Marseilles. The Versailles Museum owns an important group of two ladies, and the Dresden Gallery a portrait of the "Maréchal de Saxe." In the Wallace collection are "The Comtesse de Dillières," "The Bath (Mdlle de Clermont)," "Portrait of a Lady in Blue," "Marie Leszczinska" and "A Prince of the House of France." Nattier's works have been engraved by Leroy, Tardieu, Lépicié, Audran, and other noted craftsmen.

See "J. M. Nattier," by Paul Mantz, in the *Gazette des beaux-arts* (1904); *Life of Nattier*, by his daughter, Madame Tocqué; *Nattier*, by Pierre de Nolhac (1904, revised 1910); and *French Painters of the XVIIIth Century*, by Lady Dilke (London, 1899).

NATURAL BRIDGE, a small village of Rockbridge county, Va., in the western part of the State, 179 m. by rail W. of Richmond, and about 16 m. S.E. of Lexington, the county seat. It is served by the Chesapeake and Ohio and the Norfolk and Western railways. In the vicinity of the village, which is about 1,500 ft. above sea-level, is the great natural curiosity from which it derives its name—a bridge of natural rock 90 ft. long and from 50 to 150 ft. wide, which spans Cedar Creek at a height of 215 ft. above that stream. It consists of horizontal limestone strata, and is the remains of the roof of a cave or underground tunnel through which the creek once flowed. It is crossed by a public road. In the village are magnesia and lithia springs and a saltpetre cave.

NATURAL GAS, the name given to the inflammable gas occurring in petroliferous formations. The occurrence of natural gas is wide-spread, both geographically and geologically. Geographically, natural gas is produced in: (1) United States—Alaska, Arkansas, California, Colorado, Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Missouri, Montana, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, West Virginia and Wyoming; and (2) Canada—Alberta, New Brunswick, Ontario and Saskatchewan. The more important fields in which natural gas is produced in the United States are described as: (*a*) Appalachian; (*b*) Lima-Indiana; (*c*) Mid-continent; (*d*) Gulf coast; (*e*) Rocky mountain; and (*f*) California. Geologically, these deposits of natural gas are as follows: (*a*) Appalachian field, from the Carboniferous, Devonian, Silurian, Ordovician and Cambrian systems; (*b*) Lima-Indiana field, mostly from the Trenton formation of the Ordovician system; (*c*) Mid-continent field, mainly from the Carboniferous system; (*d*) Gulf coast, from the Tertiary and Cretaceous systems; (*e*) Rocky mountain, from Carboniferous, Tertiary, Cretaceous and Jurassic systems; and (*f*) California, throughout the entire Tertiary system including Eocene, Oligocene, Miocene and Pliocene formations.

Chemical Composition.—Natural gas is, for the most part, composed of the hydrocarbons of the paraffin series, carbon dioxide, nitrogen and helium. However, its composition varies considerably in the different fields. Natural gas of the eastern or Appalachian field is almost entirely made up of the hydrocarbons of the paraffin series. Natural gas of some parts of Kansas, Oklahoma and Texas is very high in nitrogen and relatively high in helium content. Some of the natural gas of the Pacific coast contains large percentages of carbon dioxide. Natural gas in a few districts contains hydrogen sulphide and organic sulphur compounds. The paraffin hydrocarbons found in natural gas are methane, ethane, propane, butane, pentane, hexane, heptane and octane. The first four named hydrocarbons are gaseous under ordinary conditions of temperature and pressure. The last four hydrocarbons are normally liquid at atmospheric temperature and pressure, and are the main components of natural petrol gas (gasolene).

The following is a tabulation of typical analyses of commercial natural gas:—

Cities	Methane	Ethane	Carbon dioxide	Nitrogen
Pittsburgh . . .	84·7	13·7	..	1·6
Cleveland . . .	80·5	18·2	..	1·3
Cincinnati . . .	79·8	19·5	..	0·7
Columbus . . .	80·4	18·1	..	1·5
Bartlesville . . .	92·4	3·1	1·4	3·1
Kansas City . . .	84·1	5·7	0·8	8·4
Fort Worth . . .	51·5	10·2	..	38·3
Los Angeles . . .	77·5	16·0	6·5	0·0
Little Rock . . .	96·7	..	1·0	2·3
Monroe, La. . . .	94·69	2·80	0·2	2·31

(The data contained in this tabulation, with the exception of those relative to Monroe gas, have been taken from *Technical Papers* No. 109 and 158 of the U.S. Bureau of Mines. The information regarding Monroe gas has been furnished by J. A. Bechtold, secretary, Standard Oil Company of Louisiana.)

"Dry" and "Wet" or "Casinghead" Natural Gas.—Natural gas gasolene, as vapour, does not exist in recoverable quantities

in all natural gas. Stable natural gas gasolene is made up of the hydrocarbons butane, pentane, hexane, heptane and octane. The notable instances of fields of natural gas production wherein gasolene vapours do not occur are: Ft. Smith, Ark.; Shallow Sand, Desoto parish, La.; Elm Grove, La.; east Texas; Murraysville Sand, Pa., and Upper Oriskany Sand, Pa. (6,822 ft.). Natural gas is commonly described as "dry" and "wet" or "casinghead" gas. These descriptions are relative. Dry gas is usually produced from gas wells containing natural gas gasolene vapours, recoverable as liquid, to the extent of 0·75 gal. or less per 1,000 cu.ft., while wet or casinghead gas is natural gas which is produced from oil wells and contains gasolene vapours, recoverable as liquid, to the extent of more than 0·75 gal. per 1,000 cubic feet. There are well known instances of gas coming from gas wells in which the gasolene content is more than 1 gal. per 1,000 cu.ft. and there are many instances of gas coming from oil wells wherein the gasolene content is less than 0·25 gal.[1] per 1,000 cubic feet.

Special types of natural gas containing the following substances are here arbitrarily classified: hydrogen sulphide and organic sulphur compounds; helium; nitrogen in excess of 10% by volume; carbon dioxide in excess of 10% by volume; vapours of carbon compounds, normally liquid, other than paraffin hydrocarbons. Natural gas which contains hydrogen sulphide, or organic sulphur compounds, is produced at: Glasgow, Ky.; Olney, Ill.; Findlay, O.; from some wells near Monroe, La.; Lower Oriskany Sand, Pa. (7,740 ft.); and Gulf coast and west Texas regions. Natural gas which contains helium has been found in Kansas, Oklahoma and Texas. Natural gas which contains nitrogen in excess of 10% by volume has been obtained in several counties in Kansas, and occurs in many wells in west Texas from the Panhandle on the north to Mitchell county on the south. The content of nitrogen is so high in some of the gas from the wells in west Texas that the gas in non-combustible.

Gasolene Recovery from Gas.—There are three processes of recovering gasolene from natural gas: The compression and cooling process; the oil absorption process; and the charcoal, or silica gel, adsorption process.

The *compression* process is practised under pressures varying from 90 to 300 lb. per square inch. Natural gas is used, whose gasolene content varies from 1 to 14 gal. per 1,000 cubic feet. The compressed gas is cooled generally by passing it through water-cooled pipes or intercoolers in which low temperatures are maintained by refrigeration.

The *absorption* process consists in absorbing the gasolene hydrocarbon vapours from the gas by means of a suitable oil. The gasolene is separated and recovered from the absorbent oil by a distillation process. The denuded oil is then cooled and reused in the absorbing cycle. The absorption process is practised at pressures as low as 1 lb. and as high as 350 lb., with natural gas containing as little as $\frac{1}{10}$ and as high as 3 gal. per 1,000 cu.ft.

The *adsorption* process consists in adsorbing the gasolene hydrocarbon vapours from the gas by the means of solid adsorbents, such as charcoal, silica gel and iron gel. The gasolene is separated and recovered from the adsorbent by a distillation process. The denuded adsorbent is cooled by means of residue gas and when cooled is used cyclically in the adsorbing operation. Charcoal plants are now in operation at pressures from 5 lb. to 350 lb. and on gas of a gasolene content varying from $\frac{2}{10}$ to 1 gal. per 1,000 cubic feet. There are no technical limitations in the practice of both the oil adsorption and charcoal adsorption processes. The compression process is limited to the recovery of gasolene from natural gas of 1 gal. or greater content per 1,000 cubic feet.

The deepest natural gas producing well in the world is located on Chestnut Ridge at Ligonier, Pa., on the acreage of the Peoples Natural Gas Company. This well is 7,756 ft. deep and is drilled to the geological stratum known as the Stormville, which is below the Oriskany. The total length of pipe or "casing" is 3,433 m. and weighs 247 tons; temperature at 7,640 ft., 177° F or 65·21 ft. per degree above 60° F. The composition of the gas produced from this well is hydrogen sulphide—0·8%; carbon dioxide—0·1%; methane—98·8%; ethane—0·3%. The gas contains no vapours of the gasolene hydrocarbons. (J. B. G.)

[1] *American gallons.*

NATURALIZATION: *see* NATIONALITY AND NATURALIZATION.

NATURALISM, in philosophy, is the view which maintains that all explanation should keep within the realm of what is natural, and avoid all recourse to the supernatural. Thinkers may be agreed about this even if they differ on many other points. Thus, for example, materialism, pantheism, positivism are all naturalistic; but it is absurd to equate them for that reason.

NATURAL LAW, in science, means the formulation of some uniform characters or connection of things or events; but it is frequently used for the uniformity itself as it exists in natural phenomena. Any such uniformity may be called a natural law (*e.g.*, all the laws formulated in Physics and Chemistry). On the other hand the term "Law of Nature" is sometimes restricted to irreducible or ultimate laws (like the Law of Gravitation), as distinguished from derivative laws (like Kepler's three laws of planetary motion). *See* LAW (in science, etc.); SCIENTIFIC METHOD; J. S. Mill, *System of Logic* (1875, etc.).

NATURAL RESOURCES, CONSERVATION OF. This term came into common use in the United States early in the present century and had public attention focused upon it by a conference of governors of the States, called by President Roosevelt on May 13–15, 1908. Before adjourning, the conference adopted a declaration of principles of conservation. Several States have since formed conservation commissions, and many countries (1929) have equivalent bodies. The general principles of wise and thrifty use of natural resources have come to be observed throughout the world.

Productive use of agricultural land, continuous production of forests, skilful development of waters coupled with the protection of their forests, economy in the use of mineral reserves, the building up of fisheries, the increase of the protection of wild life and the proper handling and safeguarding of recreation resources are instances of conservation. Use of natural resources without waste, economic development to secure from them the maximum service, continuous production of renewable resources and permanence of industries and of community life, lie as the basis of the conservation principle. In the article entitled PHYSICAL RESOURCES OF THE WORLD, a description is given of the known reserves through which the principle of conservation may become operative.

NATURE. In the history of philosophy the term "nature" has been used in various inconsistent senses, corresponding more or less to the different attitudes which thinkers adopted towards the material part of the world in relation to the rest. The early Greek thinkers known as the hylozoists were not conscious of any fundamental difference between mere matter, on the one hand, and life and consciousness on the other. For them, accordingly, "nature" (φύσις) included everything that is, or that ever came into being (Latin *natura* from *nasci*, to be born). Later on the Sophists contrasted the "natural" with the "conventional," or that which anything is originally and what it is as the result of human intervention. In this way they and others described as conventional not only law and custom, but even colours and other secondary qualities in contrast with matter and motion. Thus the "natural" came to be contrasted with the "human" and, of course, the superhuman. Then owing partly to the influence of Plato, and partly to the influence of Christianity, it became customary to set body and mind (to say nothing of Platonic "Ideas," the "Good," and God, etc.) sharply against one another, and to identify "nature," or "the world and the flesh," with the material part of the universe only. This is one of the reasons for the rather common tendency to identify "naturalism" with materialism. With the Renaissance there came a more friendly attitude towards the material world, and the older Greek conception of "nature" was revived. And so in due course we find in Bruno and Spinoza, among others, the term "nature" used in the all-comprehensive sense of the entire universe—a sense which, of course, excluded the possibility of anything "supernatural." Hence the other meaning of the term "naturalism," merely as the antithesis to "supernatural-

ism" in science and philosophy. For the conception of nature in recent science *see* A. N. Whitehead, *The Concept of Nature* (1920).

NATURE RESERVES. The name nature reserve has been applied rather vaguely to any area withdrawn from ordinary human interference so that the flora and fauna, as well as the physical changes of ground, may follow their natural course. Included among motives for reservation is the desire to preserve the remnants of unique vegetations, the breeding-grounds of particular species of birds, sanctuaries for birds and big game, or landscapes.

The movement in favour of nature reserves, which had its historic origin in 1832 when the Congress of the United States definitely set aside Hot Springs reservation (Arkansas), has grown in strength in recent times. An important landmark was the establishment of the Yellowstone National Park in 1872 (area, 3,348 sq.miles), followed in 1890 by Sequoia reservation, by which several groves of these ancient and world-famous trees (*Sequoia gigantea*) were definitely withdrawn from the danger of destruction. Whilst the United States, the undoubted pioneers in this field, held, in 1928, 20 National parks with a total area of 11,846 sq. miles, and 60 minor areas termed National monuments, the establishment of reserves has become world wide.

As yet no standardized classification of such areas can be given. Thus in Great Britain the authorities range from single individuals or groups, local societies and town and county councils (or the like), to the National Trust, a society founded in 1895 and incorporated in 1907 "for the preservation of Places of Historic Interest or Natural Beauty." By 1928 this body held about 150 separate stations of which, whilst many were of definite historic interest, others of scenic beauty (mountains, downs, coast lines), a definite minority, including Wicken fen (Cambs.), Blakeney point and Scolt head (Norfolk), Hawksmoor (Staffs.) and many other areas are nature reserves and are administered and are being used for study and research. In an old and settled country like England large areas of virgin territory, comparable to the Yellowstone park, are out of the question, but smaller parcels are continually being acquired.

In recent years attention has been paid to the protection of birds' breeding grounds, especially sea-birds, as in the case of the Farne islands, Blakeney point and Scolt head. Thus Blakeney point, presented to the National Trust in 1912 for its representative shingle, dune and salt-marsh vegetations, now possesses perhaps the finest ternery in the British Isles, where five species regularly breed, including large numbers of Sandwich terns.

In other parts of the British empire great efforts are in progress for the provision of worthy reservations. This applies to Canada, South Africa, with its Paul Kruger reserve (a sanctuary for big game), Australia, New Zealand, with its innumerable scenic reserves and the recently established Otari "open-air native plant museum"—a remnant of virgin forest near Wellington where a living collection of plants indigenous to New Zealand is being established.

Other countries show results equally inspiring, and the Scandinavian group, Poland, Germany (where Conwentz was a notable pioneer), Czechoslovakia and Japan, vie with one another; Holland is outstanding for its bird sanctuaries.

See also PROTECTION OF ANIMALS, BIRDS, PROTECTION OF, BIRD SANCTUARIES, GAME RESERVES. (F. W. O.)

NAUGATUCK, a borough of New Haven county, Connecticut, U.S.A., occupying 16·8 sq.m. on the Naugatuck river, 15 m. N. by W. of New Haven. It is served by the New York, New Haven and Hartford railroad, and there is an aviation field 6 m. from the business district. Pop. (1920) 15,051 (32% foreign-born white); 1928 local estimate 17,000. The principal public buildings, including a fine high school, are grouped around the central green. A mile to the north is the 18th century Porter tavern, and 2 m. south the Collins tavern (1810), a noted stopping-place on the stage-coach route between New Haven and Litchfield. The manufacture of rubber goods (including 25,000 pairs of shoes and boots daily) is the leading industry, and one of the largest rubber-regenerating plants in the world is situated here. Other important products are safety-pins (1,000,000 daily), candies, malleable iron castings, copper floats and airplanes. The aggregate factor output was valued at $15,548,056 in 1925. Naugatuck was th home of Charles Goodyear (*q.v.*) who in 1839 invented the proc ess of vulcanizing rubber. The name is an Algonkin word mear ing "one tree."

NAUHEIM or **BAD-NAUHEIM,** a watering-place c Germany, in the republic of Hesse, situated on the north-ea slope of the Taunus mountains, 24 m. by rail N. of Frankfort on-Main on the main line of railway to Cassel. Pop. (1925 9,193. Nauheim, which was bestowed by Napoleon upon Marsha Davout, became a town in 1854. From 1815 to 1866 it belonge to the electorate of Hesse-Cassel, but in 1866 it was ceded to th grand-duchy of Hesse-Darmstadt. Its thermal waters (84° to 95 F), although known for centuries, were, prior to 1835, onl employed for the extraction of salt. The waters, which are saline strongly impregnated with carbonic acid, and to a less exten with iron, are principally used for bathing, and are specific i cases of gout and rheumatism, but especially for heart affection Three smaller springs, situated outside the Kurpark, supply wate for drinking. In 1899–1900 a new spring (saline) was tapped a a depth of 682 ft. Another attraction of the place is the Johan nisberg, a hill 773 ft. high, overlooking the town.

NAUKRATIS, an ancient Greek settlement in Egypt. Th site was discovered by Professor W. M. Flinders Petrie in 188 on the eastern bank of a canal, about 10 m. W. of the presen Rosetta branch of the Nile. In ancient times it was approache by the Canopic mouth, which was farther to the west. Th identification of the site is placed beyond doubt by the discover of inscriptions, with the name of the town, and of great masse of early Greek pottery. The site was excavated in 1884–86 b the Egypt Exploration Fund, and a supplementary excavation wa made by the British School at Athens in 1899. A list of th temples of Naukratis is given by Herodotus (ii. 178); they wer the Hellenion, common to all the colonizing cities, and thos dedicated by the Aeginetans to Zeus, by the Samians to Hera, an by the Milesians to Apollo. A temple of Aphrodite is also men tioned by Athenaeus. Traces of all these temples, except that o Zeus, or at least dedications coming from them, have been foun in the excavations, and another has been added to them, th temple of the Dioscuri. In addition to these temples, there wa also found a great fortified enclosure, about 860 ft. by 750, in th south-eastern part of the town; within it was a square tower o fort. A portico of entrance and an avenue of rows of sphinxe was added in Ptolemaic times, as is shown by the foundation de posits found at the corners of the portico; these consisted o models of the tools and materials used in the buildings, model of instruments for sacrifice or ceremonies, and cartouches o King Ptolemy Philadelphus. Dr. Hogarth subsequently foun traces of another great walled enclosure to the north-east of th town, together with pottery dedicated τοῖς τῶν Ἑλλήνων θεοῖς and he claims with reason that this enclosure is more likely tha the other to be the Hellenion.

Apart from the historic interest of the site, as the only Greel colony in Egypt in early times, the chief importance of the ex cavations lies in the rich finds of early pottery and in the inscrip tions upon them, which throw light on the early history of th alphabet. There are clear traces of a settlement going back t the 7th century, including a scarab factory, and yielding fragment of early Greek pottery. It seems a fair inference that the maker of these were Greeks, and that they probably represent the earl Milesian colony, settled here in the time of Psammetichus I.

NAULETTE, a large cavern on the left bank of the Lesse which joins the Meuse above Dinant, Belgium. Here in 186 Edouard Dupont discovered an imperfect human lower jaw, nov in the Brussels Natural History Museum. It is of a very ape like type in its extreme projection and that of the teeth socket (teeth themselves lost), with canines very strong and large molar increasing in size backward. It was found associated with th remains of mammoth, rhinoceros and reindeer. The Naulette mar is now assigned to the Mousterian Epoch.

See G. de Mortillet, *Le Préhistorique* (1900); J. Dechelette, *Archéologie*, vol. i. p. 281 (1912).

NAUMACHIA, the Greek word denoting a naval battle (*ναῦς*, ship, and *μάχη*, battle), used by the Romans as a term for a mimic sea-fight. These entertainments took place in the amphitheatre, which was flooded with water, or in specially constructed basins (also called *naumachiae*). The first on record, representing an engagement between a Tyrian and an Egyptian fleet, was given by Julius Caesar (46 B.C.) on a lake which he constructed in the Campus Martius. In 2 B.C. Augustus, at the dedication of the temple of Mars Ultor, exhibited a naumachia between Athenians and Persians, in a basin probably in the *horti Caesaris*, where subsequently Titus gave a representation of a sea-fight between Corinth and Corcyra. In that given by Claudius (A.D. 52) on the *lacus Fucinus*, 19,000 men dressed as Rhodians and Sicilians manoeuvred and fought. The crews consisted of gladiators, condemned criminals, and in later times, volunteers.

See GAMES: *Classical;* ROME: *Ancient City;* PANATHENAEA.

NAUMBURG, a town in the province of Prussian Saxony, the seat of the provincial law courts and court of appeal for the province and the neighbouring districts. It is situated on the Saale, near its junction with the Unstrut, 29 m. S.W. from Halle, on the railway to Weimar and Erfurt. Pop. (1925) 29,339. In the 10th century Naumburg was a stronghold of the margraves of Meissen, who in 1029 transferred to it the bishopric of Zeitz. In 1564 the last bishop died, and the bishopric fell to the elector of Saxony. In 1631 the town was taken by Tilly, and in 1632 by Gustavus Adolphus. It became Prussian in 1814. The cathedral, a building in the Romanesque Transition style (1207–42), has a Gothic choir at each end, and contains some mediaeval sculptures. It is remarkable for its large crypt and its towers.

NAUNDORFF (or NAUNDORFF), **KARL WILHELM** (d. 1845), French pretender, claimed to be the dauphin, Louis Charles, son of Louis XVI. and Marie Antoinette, who was announced as having died in the Temple in 1795.

Naundorff, who had arrived from nowhere in Berlin in 1810, with papers giving the name Karl Wilhelm Naundorff, in order to escape the persecutions of which he declared himself the object, settled at Spandau in 1812 as a clockmaker, and married in 1818 Johanna Einert. In 1822 he removed to Brandenburg, and in 1828 to Crossen, near Frankfurt. He was imprisoned from 1825 to 1828 for coining, though apparently on insufficient evidence, and in 1833 came to push his claims in Paris, where he was recognized as the dauphin by many persons formerly connected with the court of Louis XVI. Expelled from France in 1836, the day after bringing a suit against the duchess of Angoulême for the restitution of the dauphin's private property, he lived in exile until his death at Delft on Aug. 10, 1845, and his tomb was inscribed "Louis XVII., roi de France et de Navarre (Charles Louis, duc de Normandie)."

BIBLIOGRAPHY.—For the case of Naündorff *see* his own narrative, *Abrégé de l'histoire des infortunes du Dauphin* (1836; Eng. trans., 1838); also Modeste Gruau de l'Barre, *Intrigues dévoilées ou Louis XVII* . . . (3 vols., Rotterdam, 1846–48); O. Friedrichs, *Correspondance intime et inédite de Louis XVII.* (Naundorff) 1834–38 (2 vols., 1904); *Plaidoirie de Jules Favre devant la cour d'appel de Paris pour les héritiers de feu Charles-Guillaume Naundorff* (1874); H. Provins, *Le Dernier roi légitime de France* (2 vols., the first of which consists of destructive criticism of Beauchesne and his followers, 1889); A. Lanne, "Louis XVII., et le secret de la Révolution," *Bulletin Mensuel* (1893, *et seq.*) of the Société des études sur la question Louis XVII., also *La Légitimité* (Bordeaux, Toulouse, 1883–98). *See* further, the article "Naundorff" in M. Tourneux, *Bibl. de la ville de Paris pendant la Révolution*, vol. iv. (1906).

NAUNTON, SIR ROBERT (1563–1635), English politician, was educated at Trinity college, Cambridge, of which he became a fellow in 1585. He entered parliament in 1606 for Helston, and sat in five successive parliaments. Through Buckingham's influence he became secretary of State in 1618; his strong Protestant opinions and enforcement of the laws against the Catholics brought complaints from the Spanish ambassador Gondomar and censure from the king. Naunton then resigned. He died at Letheringham, Suffolk, on March 27, 1635. He wrote *Fragmenta Regalia* (1641, 2nd ed. 1653; Arber reprint, 1870), a valuable account of Elizabeth's reign.

See *Memoirs of Sir Robert Naunton* (1814).

NAUPLIA, a town in the Peloponnesus, at the head of the Argolic Gulf, the seaport of the plain in which Argos and Mycenae are situated, with several tombs of the Mycenaean age. A hero Nauplius took part in the Argonautic expedition; another was king of Euboea. In classical times it was of no importance, and Pausanias, about A.D. 150, found it deserted. The mythic importance of the town revived in the middle ages, when it became chief city of the Morea. It was captured in 1211 by Godfrey Villehardouin with the help of Venetian ships; a French dynasty ruled in it for some time, and established feudalism. In 1388 the Venetians bought Argos and Nauplia. In the wars between Venice and the Turks it often changed masters: given to the Turks in 1540, it was recaptured by Venice in 1686, and the Palamidhi hill overhanging the town was fortified. In 1715 it was taken by the Turks; in 1770 the Russians occupied it for a short time. The Greeks captured it during the War of Independence on the 12th of December 1822, and it was the seat of the Greek administration till 1833, when Athens became the capital of the country. It is the chief town of the department of Argolis. Pop. (1923) 7,300.

NAURU: *see* PACIFIC ISLANDS.

NAUSEA, sea-sickness, or generally any disposition to vomit; also used figuratively to denote feelings of strong aversion or dislike.

NAUSICAA, in Greek legend, daughter of Alcinous, king of the Phaeacians in the island of Scheria (*Odyssey*, vi. 15–315, viii. 457). When Odysseus (*q.v.*) swam ashore to Scheria, he was found by Nausicaa, who supplied him with clothes and took him to her father's palace, where he was hospitably entertained.

NAUTCH, an Indian ballet-dance (Hindostani *nach*). The nautch is performed by nautch-girls, who scarcely move their feet, and the dance consists of swaying and posturing with the arms.

NAUTILUS, the name given by the ancient Greeks to a cephalopod mollusc, *Argonauta argo* (the paper nautilus). Linné, however, applied it as a scientific designation to another cephalopod, the pearly nautilus of eastern seas, and named the "nautilus" of the Greeks, *Argonauta*. The structure and zoological position of the pearly nautilus are discussed in the article CEPHALOPODA. It is represented at the present time by four species, which are restricted to the area between the Fiji and the Philippine islands. It usually lives near the sea bottom at considerable depths, though at night it comes into shallow water where it is caught for food by the natives.

The paper nautilus (*Argonauta*) is found in practically all sub-tropical and tropical seas. Although it has been taken from depths over 500 fathoms it is characteristically found at the surface. It is placed along with a few other genera in a separate family of the Octopoda or eight-armed cephalopods. The genus is characterized by several very peculiar features. In the first place the male *Argonauta* is very much smaller than the female, the latter in certain cases being as much as 15 times the size of the male. Like the rest of the Octopoda the male *Argonauta* lacks an external shell, but the two dorsal arms of the female secrete a calcareous shell which is unique in the mollusc phylum. Its origin from the arms is unlike that of the shell of other molluscs which is developed from the mantle. Moreover this shell is used as a receptacle for the eggs and in it they are incubated until the young are hatched out.

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NAUVOO, a city of Hancock county, Illinois, U.S.A., on the Mississippi river at the head of the lower rapids and about 50 m. above Quincy. Pop. (1920) 972. On the opposite bank of the river is Montrose, Iowa, pop. (1920), 549, served by the Chicago, Burlington and Quincy railway. "Commerce City" was laid out here in 1834 by Connecticut speculators; but the first settlement of importance was made by the Mormons (*q.v.*) in 1839–40; they named it Nauvoo, in obedience to a "revelation" made to Joseph Smith, and secured a city charter in 1840. The Mormons said the name was of Hebrew origin and meant "beautiful place"; Hebrew "naveh" means "pleasant." In 1844 its population was

about 15,000, and a large Mormon temple had been built, but internal dissensions arose, "gentile" hostility was aroused, the charter of Nauvoo was revoked in 1845, two of the leaders, Joseph Smith and his brother Hyrum, were killed at Carthage, the county-seat, by a mob, and in 1846 the sect was driven from the State. Traces of Mormonism, however, still remain in the ruins of the temple and the names of several of the streets. Three years after the expulsion of the Mormons, Nauvoo was occupied by the remnant (some 250) of a colony of French communists, the Icarians, who had come out under the leadership of Étienne Cabet (*q.v.*). For a few years the colony prospered, and by 1855 its membership had doubled. Each family occupied its own home, but property was held in common, all ate at the common table, and the children were taught in the community school. A proposal to revise the constitution resulted in rending the colony into two irreconcilable factions, and in Oct. 1856 Cabet with the minority (172) withdrew to St. Louis, Mo. Soon after the schism of 1856 those who had rebelled against Cabet began to prepare a permanent home in Adams county, Iowa. There too in 1879 the community split into two factions, the Young Party and the Old Party. Most of the members of the Young Party removed to Sonoma county, Calif., and here early in 1884, formed the Icaria-Speranza Community. All branches of the society ceased to exist after 1895.

See Albert Shaw, *Icaria: A Chapter in the History of Communism* (1884); Jules Prudhommeaux, *Icaria et son fondateur Étienne Cabet* (1907).

NAVAHO, an Athabascan people in northern Arizona and New Mexico, situated between the various Pueblo Indians. They are first mentioned about 1630; they may have been met by the Spaniards before this without being distinguished from the Apache. They are probably an Apache division in origin, specialized through contact with the Pueblos. Their territory comprises the heart of the prehistoric Pueblo area about Chaco canyon and other affluents of the San Juan river; but they have never adopted the masonry houses, sedentary life, or, except to limited extent, agriculture of the Pueblos. For several centuries they raided these people and the Spanish-Mexican colonists, drove off their stock, and gradually acquired herds of horses, cattle, goats and especially sheep, from which their living is still largely derived. They are noted for their blankets and silver work. Their great ceremonies last nine days. The Navaho are matrilineal, their 50–60 clans bearing the names of localities but being exogamous. Their houses are of stick and earth covered on a foundation of logs; they make very little pottery and basketry. The original population was probably only a few thousand; it is thought to have reached 9,000 in 1869, and since 1900 has been variously reported from 20–28,000.

NAVAL AND MILITARY SCIENTIFIC SOCIETIES. The *Royal United Service Institution*, first known as the *Naval and Military Library and Museum* (1831), took the name of the *United Service Institution* in 1839, and was incorporated in 1860; its professional museum is housed in the banqueting hall at Whitehall; it publishes a *Journal* (1857, etc.). The *Institution of Naval Architects* (1860) publishes *Transactions* (4to, 1860, etc.). The *Royal Artillery Institution* (1838), which issues the *Royal Artillery Journal*, is at Woolwich, and the *Institution of Royal Engineers* (1875), which issues the *R. E. Journal*, at Chatham. The *Navy Records Soc.* (1893) publishes works connected with the history of the British Navy. CANADA: Toronto, *Military Inst.* INDIA: Simla, *United Service Institution.*

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NAVAL ARTICLES. The subject of navies generally is dealt with in the article NAVY AND NAVIES.

The navies of the various nations are dealt with under the name of each nation, but separate articles have been allotted to the various types of warships, *e.g.*, AIRCRAFT CARRIER, BATTLESHIP, CRUISER, DESTROYER, FLEET AUXILIARY VESSELS, SUBMARINE.

Historical aspects are dealt with under NAVY: GREAT BRITAIN, UNITED STATES, WORLD WAR: NAVAL, while important operations or engagements, such as ARMADA, BELGIAN COAST (including Zeebrugge), COPENHAGEN, CORONEL, DARDANELLES, DOGGER BANK, DUTCH WARS, FALKLAND ISLANDS, FIRST OF JUNE, FRENCH REVOLUTIONARY WARS, JUTLAND, NAPOLEONIC CAMPAIGN, NAVARINO, NILE, QUIBERON, SAINTS, SEVEN YEARS' WAR, ST. VINCENT, TOULON, TRAFALGAR, are found under their appropriate headings.

Biographies of distinguished naval commanders will be found under their names.

For a more general study of naval warfare, see articles on BLOCKADE, COAST DEFENCE, CONVOY, FUELLING STATIONS, NAVAL BASES, NAVAL STRATEGY AND TACTICS, SEA POWER.

Technical articles in addition to those dealing with each type of ship include ANCHOR, ARMOUR PLATES, BUOY, CAMOUFLAGE, CABLE, CAPSTAN, CHRONOMETER, DEPTH CHARGE, FIRESHIP, FLEET, FRIGATE, GALLEY, GUNNERY, LOG, MINES, MINELAYING AND MINESWEEPING, ORDNANCE, PARAVANE, PILOTAGE, PILOTAGE LAWS, RANGE FINDERS, RULE OF THE ROAD AT SEA, SEAMANSHIP, SHIP, SHIPBUILDING, SHIPS' FIGUREHEADS, TORPEDOES, WASHINGTON TREATY.

Administration and personnel will be found dealt with under ADMIRAL, ADMIRALTY, CAPTAIN, COURT MARTIAL, CREW, MARINES, MEDICAL SERVICE, MIDSHIPMAN, NAVY DEPARTMENT, PRESS GANG, STAFF, UNIFORM.

NAVAL STORES, a trade name for the products derived from the oleoresin (gum or pitch) of the pine tree. As originally used the term included all raw materials used in building and maintaining sailing vessels as for instance, tar, pitch, rosin, flax, cordage, masts and timber. The possibility of obtaining a source of supply for these materials independent of Russia and the Dutch traders had considerable influence upon the British in establishing the colonies in Virginia. Flax, cordage and lumber are no longer classed as naval stores. The term embraces turpentine, rosin, pine oil, pine tar, pine tar oil, pitch and rosin oil. Charcoal from the destructive distillation of "lightwood" and pine needle oil are sometimes included but are not generally considered to be true naval stores products. The former is made from the wood and not from the oleoresin of the tree and the latter is an essential oil usually classed under drugs and chemicals.

From 65% to 70% of the world's production of naval stores comes from the United States, half the rest from France, with Spain, Greece, Portugal, Mexico and India following in order and small amounts coming from Austria, Russia, Finland, Scandinavia, Philippines and Japan. The total value of the naval stores crop to the producers of the United States is about $50,000,000. It is all produced in the southern pine belt and includes North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana and a small part of Texas. American naval stores come from the long-leaved pine (*Pinus palustris* or *Pinus australis*) and the slash or Cuban pine (*Pinus Caribaea*). The French source of naval stores is the maritime pine (*Pinus Pinaster*) in the Landes.

There are three distinct methods of manufacture, and the products therefrom vary widely in their characteristics. By far the greatest amount of naval stores is produced by the gum method. The trees are "chipped" and the oleoresin which exudes from the wood in order to heal the wound is caught in cups, collected each week and transported to a still. The volatile material is distilled off with steam and condensed as gum turpentine. The residue is gum rosin and is run out of the bottom of the still, strained through cotton batting into troughs and dipped into barrels. The rosin is graded according to colour and freedom from dirt—the lightest grades being *X, WW, WG, N, M;* the medium grades being *K, I, H, G* and *F;* and the dark grades *B* and *D.*

DD turpentine, *DD* pine oil, pine tar, pine tar oil and charcoal

are produced by the destructive distillation of the dead wood and stumps left on the ground after the lumbering industry has taken off the timber. Long-leaved pine wood contains only 5% resinous material, but the dead wood and stumps may contain as high as 40% and wood can be obtained in commercial quantities with more than 20% resinous material. Destructive distillation was originally carried out in the woods by covering a pile of dead wood with sod, clay, etc., and burning the pile with an insufficient amount of air to form complete combustion. The process is now carried out in well designed retorts where all volatile materials can be recovered.

The third method of manufacture is the so-called steam-distillation, solvent-extraction process, wherein the dead wood and stumps from cut-over land are ground up, loaded into steel retorts, steamed with live steam to obtain turpentine and pine oil and then extracted with boiling gasolene to obtain rosin. The production of steam distilled wood turpentine, and wood rosin is equal to 20% of America's output of gum turpentine and gum rosin.

Turpentine and rosin in the United States are consumed in the following industries: paint and varnish; soap; rosin oil, greases and printing inks; shoe polish and leather dressing; motor cars, buggies, wagons; sealing wax and insulation; oils and greases; linoleum, oil cloth and roofing; foundries and foundry supplies; shipyards; pharmaceuticals and chemicals; matches and wooden ware; and various other fields.

See Gamble's *Naval Stores Year Book* (Savannah, Ga.).

(V. R. C.)

NAVAL STRATEGY AND TACTICS. Naval strategy in its broad sense does not differ in principle from any other war strategy. It may be defined as the disposition of forces *vis-à-vis* those of the enemy outside the actual battle arena. The term must not be confused with tactics, which relate to the disposition and employment of forces in battle. Whereas certain well-defined principles governing sound strategy can be culled from history and adapted to present-day conditions, tactics must be studied chiefly in relation to weapons and mobility, factors which have changed repeatedly in the past and which must continue to change with the march of science and the development of material.

It is a defect in not a few works on naval warfare that the writers do not differentiate clearly between strategy and tactics in appraising the value of historical examples; but history, modern as well as ancient, establishes certain immutable strategical principles governing the use and disposition of forces in war. As applied to naval warfare these may be summarised as follows:— (1) Naval efforts, like military operations, must always be subordinate to government policy; but although political aims may tend to influence war plans, they should never be allowed by ministers and their professional advisers to dictate a course of action which is at variance with sound strategy. (2) The primary mission of a navy in war is to deny the use of the sea to the enemy, while preserving it for friendly interests. (3) Concentration of effort must always be aimed at, because with it goes the conservation of energy and economy of force.

History provides a number of examples where political aims have conflicted with the correct military objective in war, and where the subordination of the latter to the former has imperilled the issue. This condition of affairs has almost invariably arisen from a lack of community in thought and in counsel between political leaders and the heads of the fighting Services. On occasion the latter have been deliberately excluded from councils where the most momentous decisions regarding the conduct of war have been taken. On others, although present, they have, through a false sense of diffidence or through being personally inarticulate, failed to give the Government the benefit of their professional knowledge and experience. This defect in the machine of State has been remedied to a great extent of late by the British Government, who have now charged the three professional heads of the navy, army and air force with the duty of presenting collective advice on all defence matters to the committee of Imperial Defence, of which these three high officers are permanent members, while the Prime Minister or his deputy is chairman. In other respects the composition of this committee varies with the problem under review, so that it always possesses a truly representative character. On the outbreak of hostilities it would doubtless be transformed into a War Cabinet which would enunciate the war policy governing the strategic disposition and employment of the fighting forces. Fundamentally that policy must be directed towards the attainment of the one clear purpose for which a nation takes up arms, namely to impose its will so effectively on the enemy that he will sue for peace on that nation's own terms.

In the past it has frequently occurred that effort has been dispersed and wasted by engaging in attractive, but subsidiary, projects whereby the main object was lost sight of and the war unduly protracted. As an example may be quoted the misuse of a large proportion of the British fleet during the years 1793–5 in operations directed to acquire French and Dutch possessions in the West Indies. The assumption was that this course would add to British resources and reduce those of the enemy, but in effect it jeopardised sea security to an extent which might have proved disastrous. By dispersal of strength, the British fleet in the Mediterranean was at one time five sail of the line below the number of the French fleet at Toulon. As the First Sea Lord of that day, Sir Charles Middleton, wrote: "It is this system of unlimited conquest that cripples us everywhere and diverts the fleet from its natural uses. . . . But for this system, half the number of ships now employed in the West Indies and in army convoys would have been sufficient and the French be prevented from sending a single ship to sea." Here was the case of a political aim, the capture of possessions, being allowed to outweigh the sound military object of bringing to action or neutralising the enemy's principle naval forces. With the enemy main fleet defeated or closely blockaded, England would have secured the unchallenged use of the seas, while they would have been denied to her enemy. Even if this did not of itself end the war, it would have greatly facilitated any subsequent project for territorial conquest.

With regard to the primary mission of a navy in war, it was for long maintained that the chief object of the fleet should be to engage that of the enemy. To such an extent did this doctrine obsess certain minds that as lately as the year 1914 it was asserted by a distinguished British naval authority that the Admiralty ought not to be responsible for the passage of the British Expeditionary Force to France until the German High Seas Fleet had been defeated.

There can be no doubt that, as a means of fulfilling its true mission, the destruction of the enemy's main fleet is of very great importance, because it is the most drastic and probably the most effective action which can be taken to deprive him of the use of the sea. But under modern conditions it is extremely improbable that an adversary would risk an obviously inferior fleet in an encounter which is likely to end in disaster. Moreover, nowadays, an inferior fleet can safeguard itself against being forced into an unequal contest by outer defences, such as mines and submarines, which enable it to lie in secure retreat, where at least it exerts the influence of a "fleet in being"; a potential danger and therefore a drain on the opponent's warlike resources. The old days when it was possible to invade an enemy harbour and destroy his fleet at anchor, as Nelson did at Aboukir Bay and Codrington at the battle of Navarino, are no more, although in the not too distant future the development of air power may recreate the possibilities of attacking an enemy fleet, in its base. To argue that the principal duty of a navy is to defeat the main fleet of the enemy is, however, to confuse the object with the means of its attainment. It is nevertheless a first essential in the strategical disposition of naval forces that the main fleet should be so based *vis-à-vis* the enemy's main fleet that any and every opportunity of bringing the latter to action can be seized. The importance of this is self-evident when it is realised that all other naval dispositions must depend for their security and efficiency on the main fleet being able to counter effectively any attempt by the enemy to take the offensive with superior forces.

No more striking example of this statement can be found than that given by British naval strategy in the World War. At the

mere threat of hostilities the Grand Fleet, as it was afterwards called, went to its war base at Scapa Flow. Later the Firth of Forth was developed sufficiently to allow it to move south to this more convenient anchorage. But throughout the War this predominant force, far up in the North Sea, contained the German High Sea Fleet so effectively that the latter was unable to prevent the complete eviction of German cruisers from the seas and the passage of armies and war materials to do battle against the German army and its allies in whatever part of the world their enemies desired. Such was the balance and interdependence of naval and military strategy throughout the war that the security and maintenance of the British and allied armies in every theatre of war was directly dependent on the British main fleet in the North of Scotland. (*See* also BATTLESHIP and BELGIAN COAST OPERATIONS.)

Although British naval strategy in the World War proved to be sound enough in the main, some serious blunders were made, notably in the case of the Dardanelles campaign. Owing to the lack of a properly constituted naval staff at the Admiralty at that time, there was no clear appreciation of the influence and limitations of warships when used in conjunction with military forces on a sea coast or of the support they could give to an opposed landing. These limitations hinge largely on two tactical principles which may be stated in general terms to be: (1) Ships' gun-fire cannot dominate territory threatened by hostile land forces, save for a very limited period. (2) Ships' gun-fire cannot be relied upon to destroy enemy guns mounted on shore; or in other words ships' gun-fire may be able to keep down the fire of land batteries for a limited period, but it will probably break out again as soon as the ships withdraw or cease firing owing to expenditure of their ammunition.

The strategy which governed the employment of naval forces at the Dardanelles was not co-ordinated with military effort as it would have been had there been proper co-operation between a fully developed naval staff at the Admiralty and the General Staff at the War Office. The ultimate object necessitated occupying and holding both banks of this narrow waterway; the initial conception of ships blasting their way through it in the face of land defences and mined channels and eventually threatening Constantinople at the point of their guns was proved to have been fundamentally unsound. The employment of ships to bombard the shore defences before military forces were available in sufficient strength to ensure a successful landing and advance on both sides to the straits was a strategical error of judgment which prejudiced the campaign at the very outset. The best that can be said of the Dardanelles expedition as it was actually carried out is that it acted as a diversion on a large scale, holding up forces and distracting the attention of the enemy to an extent which assisted operations in other theatres of war. But there can be no question that, as a diversion, the huge expenditure of life and war material was not justified, while as a major operation it failed, owing to lack of proper strategical co-ordination. As such it must remain an historical example of the dire results of attacking prematurely with insufficient force, of failure to appreciate the interdependence of sea and land warfare in coastal operations and, lastly, of the vital necessity for clearly defining the object of a campaign and then for proper staff work to formulate the strategy to be employed before forces are put into motion.

DEVELOPMENT OF NAVAL TACTICS

It is quite conceivable that the most elementary tactics were those employed by the earliest antagonists afloat in their endeavours to board each other's craft and obtain victory by a hand to hand conflict. This primitive form of sea warfare held a recognised place in the tactical handling of fleets even up to the Trafalgar Era. Moreover we see instances of its unpremeditated revival even in the World War, notably in the hand to hand encounters which ensued when the flotilla leader "Broke" under Commander E. R. G. R. Evans charged into a German destroyer flotilla in the Straits of Dover on the night of April 20, 1917. "Boarding," as it came to be called, was an operation calling for considerable skill, whether in the ancient days of war canoes and rowing galleys, or in later years when great sailing ships of the line grappled with each other yard-arm to yard-arm.

Contemporary with these boarding tactics was another early form of attack, namely that of using the ship itself as a ram. The ancient triremes, although they used sails for making a passage from place to place, found this method of propulsion was not sufficiently handy for fighting and ramming, and, before going into battle, oars were reverted to. We find similar methods adopted by Phormio, the Athenian Admiral of the 5th century B.C., by the Norse King Olaf Tryggveson of the 10th century A.D. and by the chiefs of the Christian and Turkish fleets at the Battle of Lepanto in A.D. 1571. In fact, for centuries naval tactics seem to have been moulded into a more or less common form. The vessels usually aimed at attacking in line abreast (*see* FLEET) the object being that action should be joined by all units simultaneously and that they should ram and subsequently board the enemy in a united effort. It was necessary to attack head on for boarding no less than for ramming, because the oars projected so far outside the opposing craft that they could not otherwise be brought close enough for the crew to jump the intervening space. It may be noted that this same difficulty prevailed in the case of sailing ships in later times, as they were built with "tumble home" sides, that is to say, with sides sloping inwards from the water line.

Success either in ramming or boarding depended, of course, on the skill with which each vessel was handled. The highly trained Athenian crews of the early Peloponnesian wars relied mainly on the ram. They usually endeavoured to sheer off the oars from one side of an opponent, and when he was at their mercy, turn and ram him in the stern. But ramming, whether by the rowing galley or the steel-shod battleship of much more recent times, has always proved an uncertain form of attack, for a very slight error of judgment may convert the rammer into the rammee, while the impact may so seriously damage the bows of the ship ramming that she is left in considerable straits herself, even though she may have seriously damaged her adversary. Nevertheless we see the idea of ramming influencing warship design up to as late a period as 1911, when the last British battleships, the "Lord Nelson" and "Agamemnon," were built with ram bows.

Tactics on a more elaborate scale have developed with the increasing range of weapons. Such primitive armaments as bolts fired from heavy cross bows fixed on the bulwarks, bows and arrows, weights dropped from a yard or pole rigged over the side, and various incendiary projectiles, like burning tow attached to arrows or "Greek fire" blown through tubes, all necessitated close action. Even the introduction of guns did not at first produce much in the way of tactical manoeuvring, save with the object of getting the weather gauge, so long as their limitations necessitated fighting at almost point blank range. But tactical manoeuvring as we understand it to-day may however, be said to have been employed by the British fleet in its encounter with the Spanish Armada. In this historic conflict the Spanish ships suffered from first to last by being out-manoeuvred and outranged by their opponents. They towered out of the water like great high fortresses; but they depended for victory largely on the lines of infantrymen armed with pikes and muskets, which stood in serried ranks, awaiting the opportunity to board. But this the elusive English failed to give them. At the outset Drake, with his ships in single line ahead, sailed round the great fleet of Medina Sidonia, and while seeming at first to refuse battle, he obtained the exact position that he desired. Then each English ship in turn, using her longer ranging guns, opened an overwhelming and unanswerable fire on her adversary, mowing down the defenceless lines of infantry. Having discharged her broadside, each, in turn, swung round to take station astern, while her guns were reloaded. The result was to throw the Spanish fleet into a state of confusion and demoralisation, from which it never recovered and from which it suffered more and more during its unhappy passage up-channel and final dispersion when what ships remained fled into the open waters of the North sea.

In the first half of the 18th century the tactics of the British

Navy were severely restricted by flag officers in command of fleets being commanded by the official Fighting Instructions to adhere strictly to the ordered line of battle. Moreover they were not permitted to attack an enemy until that line had been correctly formed and until they were in a position for each ship to bear down like one of a row of infantry soldiers charging in line on their opposite numbers of the enemy's fleet. To such an extent had this become a fetish that Admiral Mathews, after his encounter with the Franco-Spanish fleet in 1744, was relieved of his command and tried by Court Martial, one of the two counts being that he engaged without having ordered and dressed his line.

But already there were to be found flag officers who refused to be tied by these academical restrictions. Chief amongst these was Admiral Vernon, who initiated and put into effect a number of reforms which broke away from the rigidity enforced by the official restrictions. Nelson was nothing if not enterprising in his tactics, and he seldom failed to seize the golden opportunity because it called for unconventional action. Trafalgar, the culmination of his great career and pinnacle of his fame, was fought in accordance with his intentions. The British fleet bore down in two lines on the approaching Franco-Spanish fleets, which were in a crescent formation. As an old naval authority puts it: "This novel mode of coming into action kept the enemy completely in suspense. It threatened every part of their line. If our two columns had turned the same way, they would have been able to do infinite damage in that quarter before the other wing of the enemy could come up to succour their overpowered fleets: if the two columns should cut through the centre, they must destroy it and effectively separate the two wings so as to leave them ignorant of each other's fate. Such was the fact: the enemy, though superior in numbers, lost no less than nineteen sail of the line."

But the tactics of the sailing navies must not be taken as suitable for guidance in naval tactics of the present day. Many new influences have arisen in sea warfare which have not merely extended the range at which battles must be fought, but have altered their whole character and conduct. Chief amongst these influences has been the introduction of steam, whereby a fleet can now disregard the direction of the wind so far as the actual propulsion of the ships themselves is concerned.

Next in order of importance is the introduction of underwater weapons, notably the self-propelled torpedo (*q.v.*). The increased power of the gun and the danger of torpedo attack have combined to rule out ramming and boarding as deliberate methods of attack. But the great tactical principle of seeking to concentrate the maximum available force on some part of the enemy's fleet in such a way that the rest of it cannot retaliate, or assist their hard-pressed companions, remains today just as much as in the past. But such an ideal tactical advantage can, generally speaking, only be secured by a fleet with greatly superior speed. Nevertheless it was achieved by masterly manoeuvring aided by conditions of low visibility when Admiral Jellicoe deployed the Grand Fleet across the head of the German High Sea Fleet in the opening stage of the main action at Jutland (*q.v.*). Even so, a skilful enemy may be able to extricate himself from what would otherwise be a disastrous position, and this the German Admiral, Scheer, succeeded in doing on two occasions during that battle. True, his method was merely to execute a precipitate right-about-turn, and the result clearly showed that although, diagrammatically, he was, at one moment, somewhat in the position of Nelson at Trafalgar, in that his fleet was heading for the centre of his opponents' battle line, yet both his subsequent manoeuvres and the results of the tactical situation, were as difficult as it is possible to conceive. Nelson deliberately designed such an approach; he charged on, and thereby achieved a great victory; Scheer accidentally found himself in a position where he was threatened with annihilation by the concentrated fire of the British battle fleet. He withdrew just in time, but sorely damaged, under cover of a heavy smoke screen and torpedo attack by his destroyer flotillas.

The tactical requirements of a modern fleet necessitate various types of warships. The battleship remains as the predominant surface fighting unit. The battle cruiser claims certain tactical qualities, due to her greatly superior speed and power armament. But the limitation of capital ship tonnage by the Washington Treaty (*q.v.*) will probably see this type merged into that of the battleship. It is very questionable whether the lightly armoured British type of battle cruiser justified its existence as a fleet unit, however useful they may have proved in the World War when on detached service. The fleet type cruiser or light cruiser, as it used to be called, must remain in order to provide the outposts of the battle fleet. Their duties are, essentially, to reconnoitre and to keep the commander-in-chief informed as to its position and formation until battle is joined, after which they would close in and, acting as semi-independent squadrons, seize every opportunity to counter attacks by enemy light craft and to harry his aircraft carriers. These latter are a new fleet unit which may produce a novel and powerful influence on fleet tactics of the future. In suitable weather conditions, aircraft can take over a great deal, if not all, of the reconnaissance work of cruisers. Observation from the air may be the means of effecting a junction between rival fleets, or of enabling a weaker fleet to evade action altogether. It may be the means whereby an admiral may attain an overwhelming tactical advantage over a less well-served adversary. It may assist him to waylay and bring to action an evasive enemy, like the German fleet at Jutland. It may enable gunfire to be directed efficiently at a range so great that it would be impossible accurately to observe the fall of shot from the control tops of the ships, themselves. In addition, aircraft have enhanced the torpedo menace by introducing it in a new form. Flying from the deck of a carrier, out of sight of the hostile fleet, a torpedo-carrying squadron may appear out of the mist or from behind a smoke screen with but little warning, dive down and release their torpedoes at almost point blank range. This is a form of torpedo attack against which a sure means of defence is not very easily devised.

On the other hand the aircraft carrier constitutes a new weakness, as well as a new menace. Huge vulnerable vessels, they must suit their course to the wind when flying off their aircraft. This may lead them away from the cover of their battle fleet and expose them to the attack of enemy light forces or bombing and torpedo aeroplanes. The protection of his aircraft carriers must add appreciably to the anxieties of the commander-in-chief in battle, and the tendency of this new factor in naval war seems likely to be to complicate tactics more than ever. The destroyer, like the cruiser, is likely to hold her own as a necessary type of unit until the time arrives, if it ever does, when aircraft can function as surely as surface craft under all conditions of weather and light. Then, and only then, are we likely to see that tremendous metamorphosis in naval tactics and in naval construction which imaginative writers on air matters are wont to prophesy.

Two aspects of naval tactics have given rise to considerable controversy: the amount of freedom of action to be allowed to individual squadrons and units, and the extent to which a fleet should be divided in order to round up a retreating enemy or to concentrate on his van, rear or flank. The matter is one which has decreased in importance with the reduction in number of units in the battle fleet rendered obligatory by the Washington agreement. But in case of a long war when this agreement would no longer operate and additional battleships might be built, it is conceivable that the problem might assume something of the proportions which it did at Jutland.

There can be very little question but that officers commanding squadrons of light cruisers or flotillas of destroyers should be given very considerable latitude in order that they may make the most of opportunities which present themselves. The same may be said with regard to battle cruisers which have greatly superior speed to an enemy's battle fleet. But in the case of the battle fleet itself, experience has shown that, except where a division has very marked superiority of speed, it is exceedingly dangerous for part of the battle line to break away and indulge in independent tactics, as this involves grave risk of the enemy being able to concentrate on one part or the other with his whole

force. In principle the same arguments apply to individual ships, but circumstances may arise, particularly in the case of light craft at night, where the individual encounter may demand independent action. Nevertheless, whatever degree of licence is given to or assumed by subordinate commanders, they must at all times be guided by the main tactical plan or strategical aim of the commander-in-chief. For instance, at Jutland (*q.v.*) it was Admiral Jellicoe's object to manoeuvre the Grand Fleet into a position between the enemy fleet and its line of retreat to their base. With the able co-operation of the flag officers and captains under his command this object was finely attained. But if part of the battle fleet had launched out on an independent course of action with a view to harrying the enemy on the opposite side, under the conditions of low visibility which prevailed, it would have been out of touch with the main fleet, and this might have caused the commander-in-chief serious embarrassment. The only exception that can be made to this statement is the case of the fast division of "Barhams" (reduced to three ships soon after the main action was joined) whose speed was sufficient to enable them to draw away from the enemy's battle fleet at any time, while they were so powerful that they had nothing to fear from the faster enemy battle cruisers. It is not possible to dogmatise on the subject of naval tactics; so much must depend on circumstances, but it can be said confidently that the keynote of success in a fleet action will be in the future, as it has been throughout the ages, that co-operation between all commands which springs from complete mutual understanding and inspiring leadership.

(E. A.)

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NAVAN, a market town of co. Meath, Ireland, situated at the confluence of the Blackwater with the Boyne. Pop. (1926) 3,649. Here the Clonsilla and Kingscourt branch of the Great Southern railway crosses the Drogheda and Oldcastle branch of the Great Northern. By the former it is 30 m. N.W. of Dublin. Navan has considerable trade in corn and flour, some manufacture of woollens and of agricultural implements, and a tannery. It was a barony of the palatinate of Meath, was walled and fortified, and was incorporated by charter of Edward IV. It suffered in the civil wars of 1641. It is a favourite centre for rod-fishing.

NAVARINO, BATTLE OF, fought on Oct. 20, 1827. By the treaty signed in London on July 6, 1827 (*see* GREECE, *History*), England, France and Russia agreed to demand an armistice, as preliminary to a settlement. Sir Edward Codrington, then British commander-in-chief in the Mediterranean, received the treaty on the night of Aug. 10 at Smyrna, together with instructions to demand an armistice, and to intercept all supplies coming to the Turkish forces in the Morea. He at once proceeded to Nauplia to communicate with the Greeks, accompanied by his French colleague, Rear-admiral de Rigny. The Greek Government agreed to accept the armistice. Admiral de Rigny left for a cruise in the Levant, and Sir Edward Codrington, hearing that an Egyptian armament was on its way from Alexandria, found it, together with a Turkish squadron, at anchor at Navarino on Sept. 12. The Turkish Government refused to accept the armistice, but on the 25th an interview took place between Codrington, de Rigny, who had just arrived, and Ibrahim Pasha on behalf of the sultan, at which Ibrahim gave a verbal engagement not to act against the Greeks pending further orders. The allies, who were in want of stores, now separated again, Codrington going to Zante and de Rigny to Cervi, frigates being left to watch Navarino. The British admiral had barely anchored at Zante before he was informed that the sultan's forces were putting to sea. From Oct. 3 to 5 Codrington, who had with him only his flagship the "Asia" (84) and some smaller vessels, was engaged in turning back the Egyptian and Turkish vessels, a task in which he was aided by a violent gale. He resumed his watch off Navarino, and on the 13th was joined by de Rigny and the Russian squadron under Rear-admiral Heiden. By agreement among the Powers the command was entrusted to Codrington. The allied force consisted of three British, four French and four Russian sail of the line, and a total of 15 frigates, brigs and schooners. The Egyptians and Turks had three ships of the line and 15 large frigates, together with a swarm of small craft making a total of over 80. Ibrahim Pasha, though unable to operate at sea, considered himself at liberty to carry on the war by land, and his men were employed in burning the Greek villages. On Oct. 17 a joint letter of expostulation was sent to Ibrahim, but was returned with the manifestly false answer that he had left Navarino. The admirals, therefore, decided to stand into the bay. A French officer in the Egyptian service, named Letellier, had anchored the vessels of Ibrahim and the Turkish admiral in a horseshoe formation, of which the points touched the entrance to the bay, and there were forts on the lands at both sides of the entry. The allies entered in two lines and began to anchor in the midst of Ibrahim's fleet. Captain Fellowes, commanding the British frigate "Dartmouth," seeing a Turkish fireship close to windward of him, sent a boat to demand that she should be removed. The Turks opened fire on the boat, and the action at once became general. The result was obtained by heavier broadsides and better gunnery. Three-fourths of the Turkish and Egyptian vessels were sunk or fired by their own crews. The allied casualties were 177 killed and 519 wounded. The loss of the Turks and Egyptians was never accurately reported.

See Lady Jane Bourchier, *Memoir of the Life of Admiral Sir E. Codrington* (1873). (G. A. R. C.; W. C. B. T.)

NAVARRE, a province of northern Spain, and formerly a kingdom which included part of France. The province is bounded on the north by France (Basses Pyrénées) and Guipúzcoa, east by Huesca and Saragossa, south by Saragossa and Logroño and west by Alava. It is traversed from east to west by the Pyrenees and the Cantabrian Mountains. Pop. (1920) 329,875. From Navarre there are only three practicable roads for carriages into France—those by the Puerta de Vera, the Puerta de Maya and Roncesvalles. The highest summit is the Monte Adi (4,931 feet). The chief river flowing towards the Atlantic is the Bidasoa, which rises near the Puerta de Maya. After flowing southwards through the valley of Baztán it takes a north-easterly course, and for a short distance above its outfall at Fuenterrabia constitutes the frontier between France and Spain (Guipúzcoa); by far the larger portion of Navarre is drained to the Mediterranean through the Ebro, which flows along the western frontier and crosses the extreme south of the province. The hilly districts consist almost entirely of forest and pasture, the most common trees being the pine, beech, oak and chestnut. Much of the lower ground yields grain; the principal fruit is the apple, from which cider is made in some districts; hemp, flax and oil are also produced, and mulberries are cultivated for silkworms. Navarre is one of the richest provinces of Spain in live stock. Game is plentiful.

The Ebro Valley railway traverses southern Navarre and skirts the western frontier. It has several branch lines. Besides Pamplona (*q.v.*), the capital, the only towns with more than 5,000

inhabitants are Baztán (9,676), Corella (6,830), Estella (5,603) and Tafalla (5,829).

HISTORY

The kingdom of Navarre was formed out of a part of the territory occupied by the Vascones, *i.e.*, the Basques and Gascons, who occupied the southern slope of the western Pyrenees and part of the shore of the Bay of Biscay. In the course of the 6th century there was a considerable emigration of Basques to the north of the Pyrenees. The cause is supposed to have been the pressure put upon them by the attacks of the Visigoth kings in Spain. The name of Navarre is derived by etymologists from "nava" a flat valley surrounded by hills and "erri" a region or country. It began to appear as the name of part of Vasconia towards the end of the Visigoth epoch in Spain in the 7th century. Its early history is more than obscure. The first historic king of Navarre was Sancho Garcia, who ruled at Pamplona in the early years of the 10th century. Under him and his immediate successors Navarre reached the height of its power and its extension (*see* SPAIN: *History,* for the reign of Sancho el Mayor, and the establishment of the Navarrese line as kings of Castile and Leon, and of Aragon). When the kingdom was at its height it included all the modern province of the name; the northern slope of the western Pyrenees called by the Spaniards the "Ultrapuertos" or country beyond the passes, and now known as French Navarre; the Basque provinces; the Bureba, the valley between the Basque Mountains and the Montes de Oca to the north of Burgos; the Rioja and Tarazona in the upper valley of the Ebro. In the 12th century the kings of Castile gradually annexed the Rioja and Álava. While Navarre was reunited to Aragon—1076–1134—(*see* SPAIN: *History*) it was saved from aggression on the east, but did not recover the territory taken by Castile. About the year 1200 Alfonso VIII. of Castile annexed the other two Basque provinces, Biscay (Vizcaya) and Guipúzcoa. Tarazona remained in possession of Aragon. After 1234 Navarre, though the crown was claimed by the kings of Aragon, passed by marriage to a succession of French rulers. In 1516 Spanish Navarre was finally annexed by Ferdinand the Catholic. French Navarre survived as an independent little kingdom till it was united to the crown of France by Henry IV., founder of the Bourbon dynasty. From 1510 until 1833, when it was fully incorporated with Spain, Navarre was a viceroyalty.

See Don J. M. Yanguas, *Historia Compendiada de Navarra* (San Sebastian, 1832); J. F. Bladé, *Les comtes carolingiens de Bigorre et les premiers rois de Navarre* (1895–97).

NAVARRETE, JUAN FERNANDEZ (1526–1579), surnamed El Mudo (The Mute), Spanish painter of the Madrid school, was born at Logroño in 1526. An illness in infancy deprived him of his hearing, but at a very early age he began to express his wants by sketching objects with a piece of charcoal. He received his first instructions in art from Fray Vicente de Santo Domingo, a Hieronymite monk at Estella, and afterwards he visited Naples, Rome, Florence and Milan. According to the ordinary account he was for a considerable time the pupil of Titian at Venice. In 1568 Philip II. summoned him to Madrid with the title of king's painter and a salary, and employed him to execute pictures for the Escorial. The most celebrated of these are a "Nativity" (in which, as in the well-known work on the same subject by Correggio, the light emanates from the infant Saviour), a "Baptism of Christ" (now in the Madrid Picture Gallery), and "Abraham Receiving the Three Angels" (one of his last works dated 1576). He died at Toledo in February 1579.

NAVARRO, PEDRO (*c.* 1460–1528), Spanish military engineer and general. Beginning as a sailor, he became *mozo de espuela,* or running footman, to the cardinal Juan de Aragon. In 1485 he enlisted as a mercenary in a war between Florence and Genoa, and took part in the warfare between the Genoese corsairs and the Mohammedans of northern Africa. He enlisted under Gonzalo de Córdoba when he sailed to Sicily, to take part with the French in the partition of Naples, and in 1500 he laid mines to breach the walls at Cephalonia without much success. He distinguished himself in the campaigns of 1502–03, by the defence of Canosa and of Taranto and by his share in the victory at Cerinola. His mining operation against the castles of Naples, held by French garrisons, in 1503, won him fame as the first military engineer of his age. At the expulsion of the French from Naples, he received from Gonzalo a grant of land and the title of count of Olivetto. In 1508 he took Velez de Gomera, largely by means of a species of floating battery which he invented. He did excellent service in the conquest of Oran (1509), and took Bougie and Tripoli in 1510. At Ravenna he covered the orderly retreat of the Spanish foot, was taken prisoner by the French and imprisoned in the Castle of Loches. Ferdinand, "the Aragonese skinflint," refused to pay his ransom, and after three years of imprisonment, Navarro entered the service of Francis I. in a pique. He distinguished himself in the passage of the Alps, at Marignano, at Milan, and in the siege of Brescia. He was at the battle of Pavia, and in 1522 was taken prisoner at Genoa by the Spaniards. He was confined at Naples till the peace of 1526 and his Olivetto estate was confiscated. His last service was in the disastrous expedition of Lautrec to Naples (1527).

See *Documentos inéditos para la Historia de España,* vol. xxv. (Madrid, 1854).

NAVASOTA, a city of Grimes county, Texas, U.S.A., in the south-eastern part of the state, 72 m. N.W. of Houston, near the Brazos river. It is served by the Gulf, Colorado and Santa Fe, the Missouri Pacific and the Southern Pacific railways. Pop. (1920) 5,060 (49% negroes), estimated locally at 6,000 in 1928. It has cotton gins and cottonseed-oil mills, and is a shipping point for cotton, grain, pecans and other agricultural products. The city was settled about 1820, and incorporated in 1866.

NAVE, ecclesiastically considered, that part of a church appropriated to the laity as distinguished from the chancel, the choir or the presbytery, reserved for the clergy. In a 14th century letter (quoted in Gasquet's *Parish Life in Medieval England,* 1906, p. 45) from a bishop of Coventry and Lichfield to one of his clergy, the reason for this appropriation is given. "Not only the decrees of the holy fathers but the approved existing customs of the Church order that the place in which the clerks sing and serve God according to their offices be divided by screens from that in which the laity devoutly pray. In this way the nave of the church . . . is alone to be open to lay people, in order that, in the time of divine service, clerics be not mixed up with lay people, and more especially with women, nor have communication with them, for in this way devotion may be easily diminished." The word "nave" has been generally derived from Lat. *navis,* ship. Salmasius in his commentary on Solinus (1629) finds the origin in the resemblance of the vaulted roof to the keel of a ship. The use of the word *navis* may, however, be due to the early adoption of the "ship" as a symbol of the church (*see* Skeat's note on *Piers Plowman,* xl. 32). The Greek *ναός,* Attic *νεώς* (*ναίειν,* to dwell), the inner shrine of a Greek temple, the *cella,* has also been suggested as the real origin of the word. This derivative must presume a latinized corruption into *navis,* for the early application of the word for ship to this part of a church building is undoubted.

Architecturally considered the nave is the central and principal part of a church, extending from the main front to the transepts, or to the choir or chancel in the absence of transepts. When the nave is flanked by aisles light is admitted to the church through clerestory windows. (*See* BYZANTINE AND ROMANESQUE ARCHITECTURE.) At times, however, a gallery was carried above the side aisles.

NAVEL, in anatomy, the umbilicus, the depression in the abdomen which indicates the point through which the embryo mammal obtained nourishment from its mother. (*See* ANATOMY: *Superficial* and *Artistic.*)

NAVIGATION. The science or art of conducting a ship across the sea. The term is also popularly used in connection with boats on rivers and lakes and with flying-machines, although in this latter case the science is often and correctly termed air-navigation. Navigation is technically limited to the art of conducting a ship from one port to another across, and on the surface of, the open sea, and it is in this technical sense that the subject is dealt with below.

Historical.—Before the introduction of the mariners' compass

in the 14th century, the only practical means, among western nations, of navigating ships was to keep within sight of land; or to steer for short distances out of sight of land by reference to the sun or stars, more particularly the pole star. In eastern waters, long voyages out of sight of land were possible owing to the steadiness in direction of the monsoons, which enabled vessels in these localities to keep their course by running directly before the wind. The act of fixing positions by astronomical methods progressed far more rapidly on shore than at sea. The few rude appliances available to the navigator were limited, until the 18th century, to finding only the latitude of the ship at sea. No means of finding the longitude was devised, except the very rough method of estimating the run of the ship—known as dead reckoning—until the introduction, for practical purposes, of the lunar problem early in the 18th century. This complicated calculation made the finding of longitude one of considerable difficulty, even after the introduction of the sextant; because the moon passes the stars lying in her course through the heavens at a mean rate of only 33″ in one minute of time, and her motion in regard to the sun being less than this, it is obvious that a very small error in measuring the distance produces a correspondingly large error in the resulting longitude. The rise of what may be termed modern methods of astronomical navigation may be fairly dated from the invention of the chronometer in 1735, although it was not until some 40 years later that extensive trials of Harrison's chronometer proved to navigators the value of this instrument. The method of finding the apparent, or sun, time at the ship's position was well-known; but until the chronometer came into use afloat, and enabled the navigator to carry Greenwich mean time with him on board, it was not possible to find the longitude by simple calculation. (*See* CHRONOMETER.)

Rapid strides were made in the 19th century in the improvement of instruments and the publication of text-books useful to the navigator; also in the production of tables of logarithms compiled to facilitate the solution of trigonometrical problems associated with navigation. The *Nautical Almanac*, first published under authority for the use of seamen in 1767, came into general use. Machines for taking soundings were introduced and various methods were invented whereby the errors of the magnetic compass, due to the permanent and induced magnetism in the iron of the ship, could be very largely eliminated. Methods were applied whereby that important factor in obtaining an accurate position, the speed of the ship through the water, could be serviceably ascertained. The introduction of steam vessels went far to simplify the problems of navigation as the dead reckoning could be calculated with greater accuracy than was the case with sailing vessels. The progress of the art of navigation was, and is, of course, still inseparably connected with chart drawing. The steady and continuous improvement in the number and accuracy of charts is due to the marine hydrographic and coast survey service conducted by the principal maritime nations.

Modern Navigation.—With the above brief summary of the progress of navigation, the methods in use at the present time will be described, referring the reader for a more detailed and technical description to the text-books available on the subject. When making a passage from port to port situated at no great distance apart, the navigator ordinarily selects a course on a Rhumb line, which, on a Mercator's chart, the chart normally used, is a straight line. Between ports situated at great distances from one another, and differing widely in longitude, the course followed should be on the Great Circle, which, on a Mercator's chart is a curve, the shortest distance between any two places on the surface of the earth.

Time at Sea.—To avoid confusion a system of time zones for time-keeping at sea is in force in the navies of most countries. This system has been adopted so that vessels at sea, within certain defined limits of longitude, shall keep the same time as that used on land. The world is longitudinally divided into 24 zones of 15° each, the centre of the system being the meridian of Greenwich. This centre division lies between the meridians of the 7½° E. and 7½° W. and is known as the zero zone, or zone 0; the zones lying to the eastward being numbered in sequence with a minus (−) prefix; those to the westward being similarly numbered with a plus (+) prefix. The limits of the zones on land are modified somewhat according to the geographical configuration of the country concerned. By this system the same time is kept whether on land or sea throughout each zone except during the periods of summer time. The term Greenwich mean time (G.M.T.) is considered to be the standard time of the meridian of Greenwich, commencing at midnight and reckoned throughout the 24 hours. Both civil and astronomical times are, therefore, reckoned from midnight instead of from midnight and noon respectively. In the *Nautical Almanac* (abridged for the use of seamen) for 1925, and following years, the elements which prior to 1925 were given for every two hours of the astronomical day, which then began at noon, are given for every two hours of G.M.T. commencing at midnight.

Astronomical Navigation.—When considering the various methods of fixing the position of a ship at sea by observations of heavenly bodies, it is assumed that the errors of the chronometers are accurately known. Although chronometers have reached a high standard of efficiency they are nevertheless subject to very slight variations in respect to the true Greenwich time. The introduction of wireless time signals enables navigators in ships fitted with wireless telegraphy to obtain accurate time daily in most parts of the world. There are over 50 stations, working on various wavelengths and situated in different countries, for transmitting these signals. It is desirable to refer to the relevant publications for details of the form of transmission, and procedure.

Assuming then, that the true Greenwich time is calculated; that the observer is competent and the instrumental errors are known, the accuracy of a sea position, obtained by the observation of heavenly bodies, depends mainly on the accuracy of the sea horizon. On account of abnormal refraction occasioned by special conditions in the atmosphere, the sea horizon, as seen by an observer, is often displaced from the position which the tables of normal dip of the horizon would assign to it. This refraction is most common in localities where the temperature of the air and water differ widely. By combining the results obtained from observation of bodies situated in opposite quarters of the horizon, the errors in finding the true position of the horizon are largely counteracted. The conditions at dawn and twilight, when the horizon is visible and suitably placed stars can be selected, lend themselves to this purpose. And, moreover, it is in these periods that opportunities are present for another important purpose, that is, the selection, for simultaneous observation, of bodies whose relative bearings are such that the lines of position determined from the observations shall afford a well defined intersection, and thus serve to accurately find the latitude and longitude at approximately the same instant.

The only information that is obtained from one observation of a heavenly body is that the ship is somewhere on the circumference of a small circle, on the earth's surface, the centre of which is the geographical position of the body and the radius of which has the same arc-measure as the zenith distance at the instant of observation. At this instant the heavenly body observed must be vertically over some one point on the surface of the earth. The latitude of this point is equal to the declination of the body and the longitude is equal to the hour angle of the body from the meridian of Greenwich.

Owing to the size of the globe which would be required, it is, of course, not practicable to plot this small circle on a globe, and plotting it on a chart is inconvenient unless the radius is very short and the ship in low latitude. A small circle becomes very greatly distorted when plotted on a Mercator's chart, unless near the Equator. The usual method of plotting, on a chart, is to represent a portion of the small circle as a straight line, a tangent to the circumference; that is, a straight line drawn at right angles to the bearing of the body observed. But, as a straight line represents accurately only a very small portion of the circumference of a circle, it is necessary to select some point through which to draw this line, as near the actual position of the ship as possible. This straight line is the "line of position" somewhere on which the ship must be. If another heavenly body, suitably placed, is now observed or, after a reasonable interval, to allow of a change of

bearing, a second observation of the same body is made, a second line of position is obtained. The intersection of these two lines of position gives the actual position, provided the first line of position has been moved parallel to itself to allow for any run of the ship in the interval. The line of position, being a tangent to the small circle, is at right angles to the radius or bearing of the body observed; it follows, therefore, that the angles at which the several lines of position will intersect one another must be the same as the angles at which the bearings intersect. Bodies should, therefore, be selected which will give a good "cut." Each line of position has precisely the same value, provided the altitude has been observed with equal accuracy. An error of 1′ in the observed altitude, and thence in the zenith distance, produces an error of one mile in the line of position.

Now as to the manner of obtaining the point through which to draw the line of position. Whatever method is used, provided the method is a correct one, the point found will be somewhere on the line of position. There can be only one line of position derived from the observation of one body. Different methods of calculation do not give different lines of position, but give different points through which *the* line of position can be drawn. A point can be found by assuming the latitude and calculating the resulting longitude, which is a procedure applicable to observations of heavenly bodies which have a large azimuth; or by assuming the longitude and calculating the resulting latitude, which is applicable to observations of bodies with a small azimuth. The best method, however, is to assume both latitude and longitude and, therefrom, to calculate the zenith distance of the body observed, or in other words, the radius of the circle of position. Having, at the same instant, observed the actual altitude, and thence the zenith distance, it is at once ascertained whether the ship is on a line which is directly nearer to or directly farther from, the geographical position of the body than the assumed or dead reckoning position.

MODERN AIDS TO NAVIGATION

Directional Wireless.—Determining the position of a ship at sea by means of directional wireless telegraphy (*see* WIRELESS) is of inestimable value to ships in thick weather, when approaching the land. The bearing of the shore station from the ship can be obtained either by means of a directional receiving apparatus carried in the ship, or by the system whereby the bearing of the ship is determined by one or more directional receiving sets on shore and the result being communicated to the ship.

The method of receiving bearings from ashore has the advantage that no additional equipment outside of the ship's ordinary wireless equipment is needed. However, it is subject to the disadvantage that the navigator himself cannot take and check the bearings. Furthermore, the shore stations can give a bearing to only one ship at a time which prevents a constant, repeated check of the ship's position. On the other hand the method of carrying the directional receiving set in the ship, once considered an interesting novelty, has been widely accepted as a necessary aid to navigation. The advantages of this method can be readily appreciated. For the navigator can repeatedly check his bearings upon the shore station with no wait except for the momentary pause in the code signals characteristic of that particular shore station. A knowledge of telegraphy is not required to receive the code signals, and the operation of the ship's wireless direction finding equipment is practically simple.

Either method of course is dependent upon the establishment of wireless direction finding (D/F) stations at points of importance to navigators.

The accuracy of the bearings is affected somewhat when the direction runs approximately parallel to the coast-line. Also bearings sometimes have been found to be unreliable at night. Wireless waves travel along the arc of a great circle as the shortest distance between any two points on the surface of the earth. It follows, therefore, that the true bearing of the ship from the station, or vice-versa, must be corrected for convergency to obtain the mean mercatorial bearing which is required if a chart on Mercator's projection is in use. A simple formula given in text-books enables this to be done. On a chart constructed on the gnomonic projection D/F bearings can be laid down without any correction for convergency, since great circles appear as straight lines on this projection. If, however, a compass "rose" is used it is necessary to have one on the chart for each D/F station, to compensate for the angular alteration of the projection at that station.

Sound Ranging.—Sound ranging (*see* also SOUNDING) also enables the position of a ship to be determined with accuracy at a considerable distance from the land.

Echo Sounding.—(*See* SOUNDING), by which the depth of water is obtained by the acoustic method, is of value in cases where the depth of water, or the speed of the ship, makes sounding by direct measurement unreliable. To obtain an accurate sounding by this method, a complete and sensitive apparatus is required. The apparatus consists of two microphones, one of which registers the emission of a sonic signal and the other the arrival of the echo reflected by the bottom of the sea. A specially constructed time recorder capable of reading to one-thousandth part of a second is connected to the microphones and enables the depth to be deduced. Sound travels through sea water at an average velocity of 4,800ft. per second. Consequently, by the acoustic method, very great depths can be reached in a brief space of time and the depths nominally required for navigational purposes will be reached in a small fraction of a second.

The highest practical development of the echo sounding principle is a device named the *Fathometer*. (*See* FATHOMETER.)

The Leader System.—The Leader system assists vessels to enter or leave harbour or to pass through narrow channels in thick weather. A submarine electric cable is laid along the channel, the shore end being connected to a station producing an alternating current. A simple and inexpensive receiving apparatus on board the ship enables the signals to be heard in telephones, or other form of amplifier, placed at or near the position from which the ship is usually conned. Two sets of coils are fitted, one on either side of the ship and so arranged that they can each be connected up to the receiving telephones. By connecting first one set of coils and then the other, to the receiving telephones, it is an easy matter, when within range, to determine whether the cable is to port or starboard. With practice, the distance of the cable can be estimated with comparative accuracy, because the signals become stronger as the cable is approached, the maximum intensity of the signals occurring when the ship is close to, but not vertically over, the cable. The same cable enables one ship to enter and one to leave harbour at the same time, provided, of course, the navigable channel is of sufficient width; it is a simple matter for each ship to steer to keep the cable a reasonable distance away on her port side, so that the two ships pass safely port to port. If space permits, it is possible to lay two cables, one for entering and one for leaving, the signals produced in each cable being distinctive by their note and character. This system has not come into general use owing presumably to the somewhat heavy cost.

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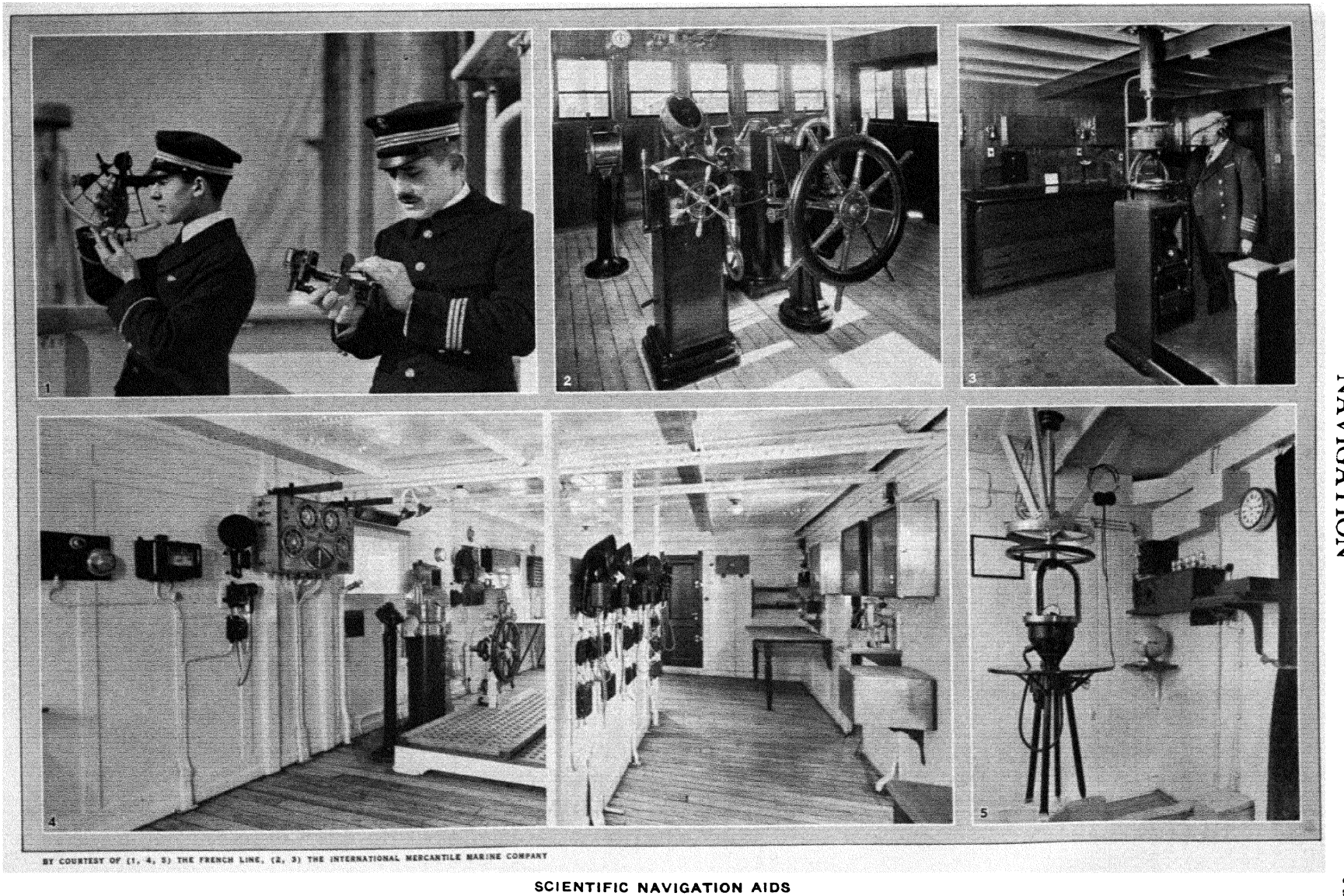
NAVIGATION LAWS. Historically this expression refers to laws passed at various times and places to restrict commerce to ships of a particular nationality, but, in another sense, navigation laws are those which lay down rules of the road and in other ways regulate the actual navigation of ships. With these latter all ships are as a rule required to comply, whatever their nationality. The two classes will here be dealt with separately.

Restriction of Navigation.—In England the first Navigation act was passed in 1381, during the reign of Richard II. Policy varied from time to time until the 17th century. Then, in 1651, during the period while Oliver Cromwell was in power, the Navi-



BY COURTESY OF (1, 4, 5) THE FRENCH LINE, (2, 3) THE INTERNATIONAL MERCANTILE MARINE COMPANY

SCIENTIFIC NAVIGATION AIDS

1. Officers on the bridge of the S.S. "De Grasse," determining the ship's position by means of sextants, through which the sun is sighted. 2. Wheelhouse of the S.S. "California," showing, to the left, the gyro-pilot which controls the rudder wheel on the right, automatically holding the ship on a predetermined course. The gyro-compass is visible above the small handwheel at the left of the photograph. 3. Radio position finder on the S.S. "California." The bearing of a shore station, from which wireless signals are being sent, is accurately determined on board ship by means of the directional receiving apparatus shown. 4. Navigating room of the S.S. "Ile de France." The loud-speakers, on vertical position, are used in establishing rapid communication between the bridge and other portions of the ship, serving as great aids to navigation. The hand-controlled steering wheel, shown in centre, was later supplemented by gyro-pilot control. 5. Radio position finder on the S.S. "Ile de France." As in the type of fig. 3, the direction from which the land signals are being sent is ascertained by determining from what point of the compass signals are received with maximum intensity

gation act was passed in order to strike a blow at the maritime supremacy of the Netherlands. The system set up of requiring the national trade by sea to be carried in ships under the national flag was maintained in force (as varied and amended by a number of further statutes) for a period of two centuries. By the Navigation acts ships under the national flag were required to be owned by British subjects, and shipmasters, and a proportion of the seamen were also required to be British.

"Under the form the Navigation acts had assumed in 1847 no produce of Asia, Africa or America could be imported for consumption into the United Kingdom from Europe in any ships, the object being that the trade should be direct and in British bottoms. The whole of the coasting trade of the United Kingdom was restricted to British ships, and the colonial trade was prohibited to all foreign ships unless under the sanction of a special Order in Council. Various restrictions were imposed on imports except in British ships. Differential dues and restrictions on importations could be imposed by Order in Council on the ships of any foreign country which imposed similar restrictions on British trade. It is to be observed that, with the exception of restrictions on exportation from this country to certain British possessions, the prohibitions of the Navigation acts were entirely restricted to imports. This necessarily followed from certain important trading powers having anticipated Great Britain in the enactment of navigation laws, their refusal to receive our goods except in their own ships preventing the possibility of the British parliament effectually restricting exportation in this direction." (Pulling.)

By an act passed in 1849 (12 & 13 Vict. C. 29) the Navigation laws were repealed, subject to a reservation of the coasting trade, and to a provision, intended to secure reciprocity, whereby, if British ships were subjected in other countries to prohibitions or restrictions, the privilege of the ships of those countries in British ports might be restricted.

Foreign ships were admitted to the coasting trade of the United Kingdom by an act passed in 1854 (17 & 18 Vict. C. 5) the provisions of which have been re-enacted in the Customs Consolidation act 1876, section 141.

While the laws restricting trade to national ships have thus long ceased to operate, British Law still provides that a ship shall not be deemed to be a British ship unless owned wholly by British subjects, or by a body corporate established in some part of the King's Dominions. British ships are required to be registered as such (Merchant Shipping acts). Further, by the British Nationality and Status of Aliens act 1914, an alien cannot be the owner of a British ship, and, by the Aliens Restriction (Amendment) act 1919, no alien may act as the master or as one of the principal officers of a British ship.

In the United States a system of duties discriminating against foreign ships was adopted in 1789. Under various statutes provision was made for relief by way of reciprocity, and consequently, after 1849, British ships were admitted to United States ports on the same terms as American ships were admitted into British trade, but coastwise trade has continued to be limited to ships of the United States.

The treaties of peace entered into at the conclusion of the World War laid down that steps should be taken to secure and maintain freedom of communications and of transit and equitable treatment for the commerce of all members of the League of Nations. At conferences convened by the League several international conventions on these lines were adopted. These included the Maritime Ports convention under which each of the contracting parties undertook, subject to the principle of reciprocity "to grant the vessels of every other contracting State equality of treatment with its own vessels, or those of any other State whatsoever, in the maritime ports situated under its sovereignty or authority, as regards freedom of access to the port, the use of the port, and the full enjoyment of the benefits as regards navigation and commercial operations which it affords to vessels, their cargoes and passengers. The equality of treatment thus established shall cover facilities of all kinds, such as allocation of berths, loading and unloading facilities; as well as dues and charges of all kinds levied in the name or for the account of the Government, public authorities, concessionaries or undertakings of any kind."

This Maritime Ports convention, however, does not apply to maritime coasting trade. The conference at which the convention was adopted passed a resolution recommending that all States should refrain from inequitable economic measures, such as in particular an abusive extension of the scope of the maritime coasting trade. The representatives of nearly 40 countries took part in this conference and the representatives of the United States attended as observers.

Regulation of Navigation.—The other class of navigation laws laying down rules of the road and in other ways regulating the actual navigation of ships may apply (1) on the high seas, or (2) within territorial waters, ports, harbours, docks and inland navigable waters. (As to territorial jurisdiction in general *see* WATERS, TERRITORIAL.)

Customary rules of seamanship applicable to navigation on the high seas were gradually developed. In England the Trinity Masters advised the judges as to the rules by which those in charge of a ship should be guided. In 1846 some Trinity House rules of navigation were made statutory. In 1889 an international maritime conference took place at Washington, the ultimate outcome of which was the drawing up of the international regulations for preventing collisions at sea. These have been adopted by all maritime nations, and are thus of universal application. They are operative in respect of British ships everywhere and in respect of foreign ships when within British jurisdiction in the following way. The British Merchant Shipping acts empower the King, by Order in Council, to make regulations of this kind. This was done in 1896. Several further orders were made, and in 1910 the regulations were consolidated and reissued in the form in which they are now in force.

The collision regulations apply in general everywhere but they are subject in certain harbours and inland waters to qualifications introduced by local rules to adapt them to special local circumstances. These were made either in the same way as other national laws or by local authorities under powers given to them by the national legislature having jurisdiction over the place in question. Thus local rules are in force in many British and Irish ports and waterways, in the Danube and port of Sulina, in the Scheldt, at Gibraltar, in the Suez Canal, in United States inland waters and in the Great Lakes, both United States and Canadian.

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NAVY AND NAVIES. Originally the navy of a country meant the whole of its shipping, whether used for war, the carrying of merchandise or fishing. In modern parlance, however, the word is generally taken to mean a nation's warships and craft of every kind maintained for fighting on, under or over the sea and the personnel which mans them, *e.g.*, the British Navy consists of the surface warships,—battleships, cruisers, aircraft carriers, destroyers, mine-layers, mine-sweepers, gun-boats and other auxiliary craft; the submarines; and the fleet air arm. Behind the actual fighting units there is, necessarily, a vast organization for their administration and upkeep. *See* the sections "Defence" of the articles UNITED STATES, FRANCE, GERMANY and other countries; also such articles as ADMIRALTY, STAFF, NAVAL AND DOCK YARDS and NAVAL BASES.

History of Navies.—In early history we find navies in the form of the armed men of a tribe or town putting to sea in such large boats or ships as might be available to give battle to enemies similarly equipped or to raid territory from the sea. The craft themselves were for the most part those used for commerce, fishing or, when occasion served, for war or piracy. It was the exception that they were built especially for fighting purposes. But later we see special types of war craft designed as such beginning to assume a recognized place in the armory of peoples and their sovereigns. Some of the earliest of what we should, to-day, term sea powers were the Phoenicians, Athenians, Carthaginians, Romans, Norsemen, Venetians, French and early English, but navies

in legendary form are to be found 2,000 years before they materialised in accredited records and the adventures of the Argonauts and of Ulysses would seem poetic forecasts of the age of the Vikings. In regard to the vessels themselves, there are definite indications of long ships built for speed as distinguished from round ships for burden from the time of the ancient Greeks and Romans. The Athenian navy was a state force and in 483 B.C. the threat of Persian attack caused Athens to increase her fleet from 50 to 100 long ships which were paid for out of the proceeds of the mines of Laureium (*see* THEMISTOCLES). The effect of this was to make Athens the predominating partner in the league formed by the Greeks for their common naval defence. By the end of the 5th century B.C. the fleet had increased to 300 long ships and later to as many as 360. In peace these war vessels were kept on slips and under cover in sheds; in war a *strategos* was appointed in command and he chose the trierarchs who were deputed to commission the vessels, partly at their own expense, under the supervision of State Inspectors.

In general the organization of the Athenian navy resembled closely that of the British navy in the 16th and 17th centuries. The trierarch, who was either one of a group of citizens assisting to finance one or more war vessels, or someone paid to discharge the duty, answered to the captain; there was a sailing master; a number of petty officers; seamen and oarsmen; while soldiers or marines formed the fighting personnel. The most ancient warships were many-oared galleys (*q.v.*), each requiring a very large number of rowers. The result was that the personnel provided to man a fleet of those times had to be a considerable one. For instance, the Roman and Carthaginian forces in the first Punic War numbered approximately 150,000 men on each side. These great rowing galleys relied for their offensive powers on boarding or ramming, and we see them in great numbers in the Mediterranean as the war fleets of the succession of Alexander, of Carthage, of Rome, of Byzantium, of the Italian Republics, of the Arabs and of Aragon. (*See* also SHIP.)

In the naval organization of ancient Rome we see the beginning of the idea of an Admiralty in the navy commissioners appointed in 311 B.C. It is interesting to note, too, that the Roman Empire was faced, on a small scale, with maritime problems which have assumed such vast importance to the British Empire of to-day. Not only had Rome to maintain a fleet to neutralize the threat arising from rival sea powers, but sea-borne trade was of such importance as to compel her to provide a navy capable of dealing with prevalent piracy and the needful safeguarding of routes. This organization, which was very complete, included two main fleets which guarded the coasts of Italy at Ravenna and Misenum. These were known as the Praetorian. Other squadrons were allocated to Forum Julii, to the mouth of the Orontes, to Alexandria, to Carpathus (between Crete and Rhodes), to Aquileia (at the head of the Adriatic), to the Black Sea and to Britain. River flotillas were stationed on the Rhine and Danube and, later, on the Euphrates. All these squadrons did not exist at the same time, but there was always a highly organized navy with a body of soldiers, the *classici*, specially assigned for service afloat.

The navy of the Eastern Empire may be said to have originated with the foundation of Constantine's New Rome on the site of Byzantium. The threat of attack from the Vandal kingdom of Carthage (from A.D. 428 to 524) compelled the Emperors to attend to their fleet, but with the fall of that kingdom the navy was neglected until the rise of Mohammedan power at the end of the 7th century produced a new menace. The Byzantine navy reached a high state of efficiency under the sovereigns of the Macedonian dynasty (867–1056). It consisted of an Imperial fleet commanded by the Great Drungarios, the first recorded Lord High Admiral, and of provincial squadrons under their *strategoi*. The Imperial Fleet was essentially a war organization, while the provincial or thematic squadrons were smaller but more permanent forces maintained for police purposes. It is interesting to note that this navy included a corps corresponding to the gunnery experts of a modern fleet. These were the *siphonarioi*, who worked the *siphons* used for discharging the "Greek fire."

After the disorganization of the Eastern Empire by Turkish invasions in the 12th century, the Byzantine navy withered. In the middle ages the Italian republics and monarchial states bordering on the Mediterranean possessed appreciable fleets, and their seamen, especially those of Genoa, were regarded as some of the first in the world, so much so that their services were sought by the powers of Western Europe and even by England. Edward III. and the kings of France employed Genoese to assist them in nautical matters.

The Mediterranean navies made their last great appearance in history at the Battle of Lepanto, 1571 (*q.v.*). From thence onwards the scene of naval activity changed and the ships and fleets took upon themselves a new form, and one to fit them for ocean sailing and fighting. The history of the growth of modern great navies will be found under their respective countries. (E. A.)

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Mediaeval.—As regards the mediaeval navies the first place may be allowed to the Italians. A general bibliography of Italian nautical literature *Saggio de una bibliografia marittima italiana*, occupying fifty-eight pages, drawn up by E. Celani, will be found in the *Revista marittima*, supplement for 1894. The histories of the different Republics of the middle ages record their maritime enterprises. An excellent book, which gives far more than its title promises, is the *Storia della marina pontificia* of A. Guglielmotti, O.P., in 10 volumes published at different times, and in two editions, at Florence 1856, etc. The general maritime history of the Mediterranean in the middle ages is well illustrated in the *Memorias sobre la marina comercio y artes de Barcelona* (1779–1792) by A. Capmany. The naval enterprises of the Norsemen are dealt with in a scholarly fashion by G. B. Depping, *Histoire des expéditions maritimes des Normands* (1826); and with newer knowledge by C. F. Keary, *The Vikings of Western Christendom* (1891).

Great Britain.—*The History of the Royal Navy to the French Revolution*, by Sir N. Harris Nicolas (1847), is unfortunately incomplete. It ends at the year 1422, but is the work of a most laborious and exact antiquary, who had been a naval officer in his youth. The administrative history of the British navy until 1660 is the subject of the *History of the Administration of the Navy and of Merchant Shipping in relation to the Navy* (1896) by M. Oppenheim—a most valuable collection of materials. *The Naval History of England* (1735) by T. Lediard, is copious and useful. The *Naval Chronology, or an Historical Summary of Naval and Maritime Events from the Time of the Romans to the Treaty of Peace 1802*, by Captain I. Schomberg (1802), contains a mass of valuable information, lists of ships, dates of construction, etc., and some administrative details. A good book is *The Naval and Military Memoirs of Great Britain 1727 to 1783* (1804) by R. Beatson, a very careful and well-informed writer who had seen some service as a marine officer. The *Naval History of Great Britain*, from 1793 to the accession of George IV., by W. James (1827), republished with a continuation by Chamier in 1837, is a standard authority. The *History of the British Navy from the Earliest Period to the Present Time* (1863) by C. D. Yonge, contains some original matter for the naval transactions of the 19th century. *The Royal Navy*, 7 vols. (1897–1903), edited and partly written by Sir W. L. Clowes, is a compilation of unequal value. Some of Sir W. L. Clowes's coadjutors, notably Captain Mahan and Sir C. R. Markham, are of high standing and authority. *The Naval Chronicle*, 1799–1818, a magazine, contains useful matter, for the Revolutionary and Napoleonic Wars. *The Naval Biographical Dictionary; life and services of every living officer* (1846), by W. R. O'Bryne, is a solid book of reference. The publications of the Navy Record Society (1894 and subsequent years) contain large and valuable publications of original matter, with some reprints of old authorities, such as Sir W. Monson's *Tracts*, which were difficult of access. *See* also *A Short History of the Royal Navy*, by D. Hannay; *Official History of the War:* "Naval Operations" (1920, etc.); G. Callender, *The Naval Side of British History* (1924); G. F. S. Bowles, *The Strength of England* (1926).

France.—Léon Guérin, *Histoire maritime de la France* (1844). The *Histoire de la marine française* of Le Comte de Bonfils Lablénie (1845), a naval officer, is of value. *La Marine de guerre, ses institutions militaires depuis son origine jusqu'à nos jours*, by Capne Gougeard (1877); the *Essai sur l'histoire de l'administration de la marine française* of Lambert de Sainte Croix (1892); and the excellent little book of M. Loir on *La Marine royale, 1789* (n.d.), may be consulted with pleasure and profit. The three books of A. Jal, *Archéologie navale* (1840), *Glossaire nautique* (1848) and *Abraham du Quesne et la marine de son temps* (1872) are all of high value. *Les Batailles navales de la France* of O. Troude (1867), is a carefully written account of naval actions.

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NAVY DEPARTMENT: *see* GOVERNMENT DEPARTMENTS.

NAWABGANJ, the name of three towns of British India. (1) The most important is the headquarters of Bara Banki district in the United Provinces, 17 m. E. of Lucknow; pop. (1921) 12,369. It has a considerable trade in sugar and cotton goods. It was the scene of a victory by Sir Hope Grant during the Mutiny. (2) A town in Malda district of Bengal, on the Mahananda near its junction with the Ganges, a centre of river trade; pop. (1921) 12,833. (3) A town in Gonda district, United Provinces, pop. (1921) 5,305.

NAWANAGAR or JAMNAGAR, a native State of India, in the Western India States Agency, Bombay, situated on the south of the Gulf of Cutch. Area, 3,791 sq.m. Pop. (1921) 345,353. Tribute, £7,000, to the British Government, the Gaekwar of Baroda and the Nawab of Junagarh. The chief, whose title is Jam, is a Jareja Rajput of the same clan as the rao of Cutch. Prince Ranjitsinjhi (b. 1872), well known in England as a cricketer, came to the throne in 1907. There is a State railway from Rajkot to Tamnagar town. Grain, cotton and oilseeds are exported. Marble and copper are found, and there is a pearl fishery in the Gulf of Cutch. The town of Jamnagar is about 5 m. from the seaport of Bedi. Pop. (1921) 42,495. Founded by Jam Rawal in 1540, it is built of stone, has manufactures of silk and gold embroidery and locomotive works and is well-known for its dyeing. Its water is supplied from a reservoir covering 600 acres and an aqueduct 8 m. long.

NAXOS, the largest of the Cyclades (about 22 m. by 16 m.), east of Paros, with which, and adjacent smaller islands, it forms an *eparchia*. In early times it was also called Dia or Strongyle. Rich in vines and famous for its wine, it was a centre of the worship of Bacchus. The god found Ariadne asleep on its shore, when she was deserted by Theseus. The sculptors of Naxos were important in early Greek art; unfinished statues are still to be seen in the quarries, notably the colossal one in Apollona Bay, to the N.E. During the 6th century B.C. a tyrant Lygdamis ruled Naxos in alliance with Peisistratus of Athens. In 501 a Persian fleet attacked it unsuccessfully, but in 490 it was captured and treated with severity. Four Naxian ships joined the expedition of Xerxes, but deserted to the Greek side at Salamis in 480. Naxos was a member of the Delian League (*q.v.*); but, revolting in 471, was captured by Athens, and remained in her possession till her fall. In later times after its capture, in A.D. 1207, by the Venetian, Marco Sanudo, the duchy of Naxos flourished till the Turks took the island in 1566. Since the War of Independence it has belonged to the Greek kingdom. The ancient remains of a temple (*Palati*), supposed to be that of Dionysus, are on an island just off the town. Naxos is rich in fruit trees, and exports corn, wine and oil, but its most important product is emery. The population is about 17,000.

NAXOS, the earliest Greek colony in Sicily, was founded by Theocles from Chalcis in 735 B.C., on the east coast, south of Tauromenium (mod. Taormina), just north of the mouth of the river Alcantara, where the castle of Schiso now stands. As there were already Sicels at Tauromenium, they cannot have offered any opposition. The adoption of the name of Naxos, the island in the Aegean Sea, may show that there were Naxians among its founders. It soon founded Leontini and Catana. Naxos was the warmest ally of Athens in the Sicilian expedition. In 403 B.C. it was destroyed by Dionysius and its territory given to the Sicels. Its exiles at last found refuge in 358 at Tauromenium. Scanty traces of its walls are to be seen.

NAYAR (NAIR), the dominant lay caste in Malabar, on the west coast of southern India. The Nairs were originally a militia, the name being a form of Sanskr. *nāyaka*, "leader," as is Tamil *nāyadu, naidu;* but many Nairs now enter civil professions. The caste is split up into numerous groups of varying status, but all are or were curiously submissive to the Nambūtiri Brahmans. To the Nair, as a soldier or marine, marriage was forbidden, and a Nair woman was therefore ritually married to anyone, even a stranger, merely as a form. After that she could be united to a Nambūtiri or a Nair, not below her in group-status, by the *sambandham* ceremony. It would seem that once she was permitted to have several such "husbands," not necessarily brothers, at a time. But, strictly speaking, polyandry did not exist, and it is now probably as extinct in fact as in theory. The *sambandham* became monogamous and usually permanent. From the custom, however, descent in the female line naturally ensued, and it involved also inheritance in that line, a man's heir-at-law being his (uterine) sister's son. But a woman's property was managed by the senior male of her own kin. To remedy the evils of this system the Malabar Marriage Act of 1896 enabled *sambandhams* to be registered as binding and permanent marriages, but little advantage has been taken of the statute, as it merely legalised the prevailing custom.

E. Thurston, *Castes and Tribes of Southern India*, vol. v. (1905), is exhaustive; Moore, *Malabar Law and Custom* (1905).

NAYARIT, a State of Mexico, until 1917 the territory of Tepic, facing on the Pacific ocean and bounded N., E. and S. by Sinaloa, Durango and Jalisco. Area 10,445 sq. miles. Pop. (1900) 150,098; (1910) 171,173; (1921) 162,499. The active volcano of Ceboruco rises in the western part of the territory. The slopes and valleys are densely wooded, the lower regions being very fertile and adapted to tropical agriculture. The rainfall is abundant, and the climate hot, damp and malarial. The Río Grande de Lerma, or Santiago, is the principal river, whose sources are to be found on the high plateau in the State of Mexico. The next largest river is the Mezquital, which has its sources in the State of Durango, not far from the city of the same name. Among the products of the coast lands are sugar, cotton, beans, tobacco, maize, palm oil, coffee, fine woods and medicinal plants. Mining attracts much attention in the sierras, and its mineral deposits are rich. There are cotton and cigarette factories at the city of Tepic, besides sugar works and distilleries on the plantations. The capital of the State is Tepic. Pop. (1910) 16,778, in 1921, 13,766; attractively situated on a small plateau 3,000 ft. above sea-level, 26 m. E. by S. of its port, San Blas, with which it is not yet connected by rail. The city now is reached by the Southern Pacific of Mexico railway running between Nogales and Guadalajara.

NAYLER or **NAYLOR, JAMES** (1618–1660), English Puritan, was born at Andersloe or Ardsley, in Yorkshire, in 1618. In 1642 he joined the parliamentary army, and served as quartermaster in John Lambert's horse. In 1651 he became a Quaker. He gradually arrived at the conviction that he was a new incarnation of Christ. He gathered round him a small band of disciples, who followed him from place to place. At Appleby in 1653 and again at Exeter in 1655 he suffered terms of imprisonment. In Oct. 1655, in imitation of Christ's procession into Jerusalem, he entered Bristol on horseback riding single—"a rawboned rude figure, with lank hair reaching below his cheeks" —attended by seven followers, some on horseback, some on foot, he in silence and they singing "Hosanna! Holy, holy! Lord God

of Sabaoth!" At the High Cross he and his followers were arrested. His trial occupied the second parliament of Cromwell for several days, and on Dec. 16, 1656, he was convicted of blasphemy and sentenced to be whipped from the Palace Yard to the Old Exchange, to be branded in the forehead with "B" (for blasphemer), to have his tongue bored with a red-hot iron, to be whipped through the streets of Bristol, and to suffer imprisonment with hard labour for two years. On his release he was readmitted into the communion of the Quakers, and spent some time in Westmorland with George Whitehead (1636?–1723).

A collected edition of the *Tracts* of Nayler appeared in 1716. See *A Relation of the Life, Conversion, Examination, Confession, and Sentence of James Nayler* (1657); a *Memoir of the Life, Ministry, Trial, and Sufferings of James Nayler* (1719); and a *Refutation of some of the more Modern Misrepresentations of the Society of Friends commonly called Quakers, with a Life of James Nayler*, by Joseph Gurney Bevan (1800).

NAZARENES, an obscure Jewish-Christian sect, existing at the time of Epiphanius (*fl.* A.D. 370) in Coele-Syria, Decapolis, (Pella) and Basanitis (Cocabe). According to him (*Panarion*, xxix. 7) they dated their settlement in Pella from the time of the flight of the Jewish Christians from Jerusalem, immediately before the siege in A.D. 70; he characterizes them as neither more nor less than Jews pure and simple, but adds that they recognized the new covenant as well as the old, and believed in the resurrection, and in the one God and His Son Jesus Christ. Recent investigation leads to the conclusion that the Nazarenes of the 4th century are, in spite of Epiphanius's distinction, to be identified with the Ebionites (*q.v.*).

NAZARETH, a town of Lower Galilee, on the northern border of the plain of Esdraelon, 1,600 ft. above sea-level. The population in 1923 was 7,424 (2,486 Muslims, 4,885 Christians). There are numerous places of worship and charitable institutions in the town. The industries are lace-knitting, and the manufacture of mementoes for sale to tourists.

Nazareth is not mentioned in the Old Testament. It first became known as the place where Jesus spent his youth. The village was the home of Joseph and Mary, and to it they returned after the flight to Egypt. In its synagogue Jesus preached the sermon that led to his rejection by his fellow-townsmen. A mass of legends and precarious identifications has grown up with the ages. A sample of the soil in which they took root and flourished may be here given. Antoninus Martyr, who visited Palestine in A.D. 570, tells us: "In the synagogue there is still the book from which our Lord was set to learn A.B.C. In the synagogue, too, is the bench upon which our Lord sat with the other children. This bench can be moved and lifted up by Christians; but Jews cannot at all stir it, nor does it permit itself to be carried out of doors." To-day visitors are shown the church of the Annunciation, the workshop of Joseph, St. Mary's well, Christ's table, the place of precipitation, etc. Only for the well can authenticity be assured.

The Crusaders captured Nazareth in 1100 and transferred there the bishopric of Scythopolis (Beisān). It was taken by Saladin (1187) and re-taken by Frederick II. (1229). On its capture by Beibars (1263), the Christian inhabitants were massacred. In 1517 it came into the possession of the Turks. In the final phase of the World War operations in Palestine, Nazareth was the headquarters of the commander-in-chief of the Turco-German army. It was surprised and captured by a brigade of British cavalry on Sept. 20, 1918. (E. Ro.)

NAZARETH, a borough of Northampton county, Pennsylvania, U.S.A., 7 m. N.W. of Easton; served by the Lackawanna and the Lehigh and New England railways. Pop. (1920) 4,288 (92% native white). It has cement works and a variety of factories. Nazareth was founded by the Moravians in 1740 and was incorporated as a borough in 1858.

NAZARITE or, better, **NAZIRITE,** the name given by the Hebrews to a peculiar kind of devotee. The characteristic marks of a Nazarite were unshorn locks and abstinence from wine (Judges xiii. 5; 1 Sam. i. 11; Amos ii. 11 *seq.*); but full regulations for the legal observance of the Nazarite vow are given in Num. vi., where every product of the grape-vine is forbidden, and the Nazarite is enjoined not to approach a dead body. The law contemplates the assumption of the vow for a limited period only, and gives particular details as to the atoning ceremonies at the sanctuary by which the vow must be recommenced if broken by accidental defilement. On the expiry of his vow the Nazarite cuts off his hair and burns it on the altar, thus returning to ordinary life. In the earliest historical case, that of Samson, and in the similar case of Samuel (who, however, is not called a Nazarite), the head remains unshorn throughout life, and in these times the ceremonial observances as to uncleanness must have been less precise: *e.g.*, Samson touches the carcass of a lion and is often in contact with the slain.

In the cases of Samuel and Samson the unshorn locks are a mark of consecration to God (Judges xiii. 5) for a particular service. Since, moreover, the Hebrew root *n-z-r* is only dialectically different from *n-d-r*, "to vow," both corresponding to the same original Semitic root (Arab. *n-dh-r*), it would seem that the peculiar marks of the Nazarite are primarily no more than the usual sign that a man is under a vow of some kind. To leave the locks unshorn during an arduous undertaking in which the divine aid was specially implored, and to consecrate the hair after success, was a practice among various ancient nations. The spirit of warlike patriotism that characterized the old religion of Israel could scarcely fail to encourage such vows (*cf.* 2 Sam. xi. 11), and from the allusion in Amos we are led to suppose that at one time the Nazarites had an importance parallel to that of the prophets.

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NDEBELE or **MATABELE,** also called Abaka-Zulu. This important member of the Eastern or Zulu-Xosa group, carried large oval shields, and short hand-bladed stabbing assegais, with which they charged at close quarters. They overran the areas occupied by Bushmen (*q.v.*), and conducted successful wars during the earlier part of the 19th century against Barolong, Bastaards and Koranas under the leadership of Moselekatze. Their herds of cattle were of great size and were carefully tended. They devastated the lands of the Bangwa, Ketse and Bakubia, and have given their name to Matabeleland. *See* RHODESIA and SOUTH AFRICA: *Ethnology*.

See G. W. Stow, *Native Races of South Africa* (1895).

NEAGH, LOUGH, the largest lake (Irish, "lough") in the British isles, situated in the north-east of Ireland, in the province of Ulster, its waters being divided between counties Antrim (north and east), Down (south-east), Armagh (south), Tyrone and Londonderry (west). Its shape is an irregular oblong, its extreme measurements being 18 m. from north-east to south-west, 16 from north to south, and 11 from east to west. Its circumference, without including minor indentations, is about 64 m., and its area 98,255 ac. or about 153 sq. miles. The shores are generally flat and marshy, or very gently sloping, but flat-topped hills rise near the northern shore, where the lake reaches its extreme depth of 102 feet. The mean height above sea-level is 48 feet. The river Bann, flowing northward, is the only outlet. The principal feeders are the Main on the north, the Crumlin (whose waters have petrifying powers) on the east, the Bann and Blackwater on the south, and the Ballinderry and Moyola on the west. Antrim and Toome, at the north-east and north-west respectively, are the only towns immediately on the shores. The islands are few and near the shores; namely, Skady Tower on the north, Ram's island (with a ruined round tower) on the east, Ready and Coney islands on the south-west. The lough abounds in fish, including gillaroo trout, char and pullen or fresh-water herring. There is a tradition that the lough rose suddenly from a fountain, inundating a populous district, and that remains of buildings may be seen in it.

NEALE, EDWARD VANSITTART (1810–1892), English co-operator and Christian Socialist, was born at Bath on April 2, 1810, the son of a Buckinghamshire clergyman. He studied at Oriel college, Oxford, was called to the bar at Lincoln's Inn in 1837, became a member of the Christian Socialists in 1850 and also joined the council of the Society for Promoting Working

Men's Associations. He founded the first co-operative store in London, and advanced the capital for two builders' associations, both of which failed. In 1851, though strongly opposed by other members of the promoting "Council," he started on his own initiative the Central Co-operative Agency, similar in many respects to the Co-operative Wholesale Society of a later day. The failure of this scheme, together with that of the operatives' cause in the engineering lock-out of 1852 is said to have cost him £40,000. He was closely associated with the movement which resulted in the Industrial and Provident Societies Act of 1876, and the passing of the Consolidation Act of 1862 was almost entirely due to his efforts. Besides publishing pamphlets on co-operation he served on the executive committee which afterwards developed into the Central Co-operative Board, and took an active part in the formation of the North of England Co-operative Wholesale Society in 1863. One of the founders of the Cobden mills in 1866, and the Agricultural and Horticultural Association in 1867, he also promoted the annual co-operative congress, afterwards becoming general secretary of the central board. He was also a director of the Co-operative Insurance Company and a member of the Co-operative Newspaper Society for many years. He visited America in 1875 with a deputation whose object was to open up a direct trade between the farmers of the western States and the English co-operative stores. He died on Sept. 16, 1892.

NEALE, JOHN MASON (1818–1866), English divine and scholar, was born in London on Jan. 24, 1818, and was educated at Trinity college, Cambridge. He occupies a high place as a hymnologist, but principally as a translator of ancient and mediaeval hymns, the best known being probably "Brief life is here our portion," "To thee, O dear, dear country," and "Jerusalem, the golden," which are included in the poem of Bernard of Cluny, *De Contemptu Mundi,* translated by him in full. He also published *An Introduction to the History of the Holy Eastern Church* (1850, 2 vols.); and other works. His *Collected Hymns* were published in 1914.

See *Letters of John Mason Neale* (1910), selected and edited by his daughter Mrs. C. Towle, who in addition wrote a *Life* (1907) of her father.

NEANDER, JOHANN AUGUST WILHELM (1789–1850), German theologian and Church historian, was born at Göttingen on Jan. 17, 1789, of poor Jewish parents named Mendel. He graecized his name into Neander on his baptism in 1806. Educated under Schleiermacher, he became professor at Heidelberg in 1812 and removed to Berlin in 1813. His great learning, his wide sympathies, and a very lovable personality attracted many students, and he did perhaps more than any other teacher to bring a new and less formal spirit into Lutheran teaching. He died on July 14, 1850.

Among the English versions of his works may be mentioned *General History of the Christian Religion and Church,* trans. by J. Torrey (1850–58); *History of the Planting and Training of the Church by the Apostle,* by J. E. Ryland (1851); *Julian and his Generation,* by G. V. Cox (1850); *Life of Jesus,* by J. M'Clintock and C. E. Blumenthal (1848), and *Memorials of Christian Life in the Early and Middle Ages,* by J. E. Ryland (1852).

See A. Harnack, *Rede auf August Neander* (1889), reprinted in vol. i. of Harnack's *Reden und Aufsätze;* A. F. J. Wiegand, *Neanders Leben* (1889); L. T. Schulze, *August Neander* (1890); and K. T. Schneider, *August Neander* (1894). *Cf.* Herzog-Hauck, *Realencyklopädie;* and P. Schaff, *Germany: its Universities and Theology* (1857).

NEANDERTHAL MAN. The cave in which the Neanderthal bones were discovered, in 1857, is situated in the valley of the Düssel, a tributary of the Rhine. The fragments then found, the vault of the skull, right and left thigh bones, and portions of the shoulder blade, pelvis and ribs, belonged to a separate species —which is represented by remains found in Jersey, in France, Belgium, Spain (Gibraltar), Czechoslovakia and Palestine. The normal skull of this race was long, wide, and, though low, was capacious. The flattening affected the back part of the skull, so that the head must have appeared as set on a thick bull neck. The brow ridges were massive. The chin was lacking. The teeth and palate were specialized in form and point to a rough vegetable diet. The thigh bones are more simian in character than those of modern man. In sum, the differences between Neanderthal man and modern man are greater than between modern races.

See Sir A. Keith, *The Antiquity of Man,* 2nd ed. (1925); *Journal of the Royal Anthropological Institute* (1928), vol. lviii., pt. i.

NEAP, a word only used of tides in which the high-water mark is at its lowest, as opposed to "spring tides" (*see* TIDE). The word is obscure in origin; it may possibly be connected with "nip," in the sense of "pinched," "scanty."

NEARCHUS, one of the officers in the army of Alexander the Great. A native of Crete, he settled at Amphipolis in Macedonia. In 325, when Alexander descended the Indus to the sea, he ordered Nearchus to conduct the fleet to the head of the Persian Gulf. Nearchus was then entrusted with the more difficult task of circumnavigating Arabia from the mouth of the Euphrates to the Isthmus of Suez, a project cut short by the death of the king (323). In the troubles that followed Nearchus attached himself to Antigonus, under whom he held the government of his old provinces of Lycia and Pamphylia, and probably therefore shared in the downfall (301) of that monarch.

He wrote a detailed narrative of his expedition, of which a full abstract was embodied by Arrian in his *Indica.*

The text, with copious geographical notes, is published in C. Müller's *Geographi Graeci Minores,* i. (1856); on the topography *see* W. Tomaschek, "Topographische Erläuterung der Küstenfahrt Nearchs vom Indus bis zum Euphrat" in *Sitzungsberichte der K. K. Acad. der Wissenschaften,* cxxi. (Vienna, 1890). *See* also E. H. Bunbury, *Ancient Geography,* i. ch. 13; and ALEXANDER THE GREAT. Ancient authorities.—Arrian, *Anab.,* vi. 19, 21; vii. 4, 19, 20, 25; Plutarch, *Alexander,* 10, 68, 75; Strabo, xv. pp. 721, 725; Diod. Sic., xvii. 104; Justin, xiii. 4.

NEATH (Welsh, *Castell-Nêdd*), a municipal borough and market-town of Glamorganshire, South Wales, situated near the mouth of the Neath or Nêdd, on the G.W.R., 7½ m. E.N.E. of Swansea. Pop. (1921) 18,928.

The town perhaps occupies the site of the Roman Nidum on the Julia Maritima from which a vicinal road branched off here for Brecon. At the Norman conquest of Glamorgan, Fitzhamon gave the district between the Neath and the Tawe to Richard de Granaville, who built on the west banks of the Neath first a castle and then in 1129 a Cistercian abbey, to whose monks he later gave all his possessions in the district. All traces of this castle have disappeared. Another castle, built in the same century, on the east bank, was held direct by the lords of Glamorgan, as the westernmost outpost of their lordship. It was frequently attacked by the Welsh, notably in 1231 when it was taken, and the town demolished by Llewelyn ab Iorwerth. The portcullis gate and a tower are all that remain of it; of the abbey there still exist the external walls, with parts of the chapel, vaulted chapter-house, refectory and abbot's house. Neath is a borough by prescription and received its first charter in the 12th century from William, earl of Gloucester, who granted its burgesses the same customs as those of Cardiff. Other charters were granted to it by successive lords of Glamorgan in 1290, 1340, 1359, 1397, 1421 and 1423. By the first of these (1290) the town was granted a fair on St. Margaret's Day (July 20) and as the abbey had extensive sheep walks the trade in wool was considerable. In 1685 James II. granted a further charter. At the Dissolution the abbey and the manor of Cadoxton (part of its possessions) were sold to Sir Richard Williams or Cromwell. Copper smelting has been carried on in or near the town since 1584 when the Mines Royal Society set up works at Neath Abbey; the industry attained huge proportions a century later under Sir Humphrey Mackworth, who from 1695 carried on copper and lead smelting at Melincrythan. With the development of the South Wales coalfield Neath continued its metallurgical associations and concentrated on the by-product industries, thus locally diminishing to some extent the marked depression that has characterized this coalfield since the collapse of the post-war boom in 1921–22. Besides the copper works the town possesses tinplate, steel and galvanized sheet works, foundries and engineering works. In the neighbourhood there are numerous collieries. The Neath Canal, from the upper part of the Vale of Neath to Briton Ferry (13 m.), passes through the town, which is also connected with Swansea by another canal.

One time independent railway lines now form important branches of the G.W.R. to the Rhondda, Aberdare and Brecon respectively.

NEBO or NABU ("the proclaimer"), the Accadian translation of various Sumerian ideograms for the god of wisdom and writing, the main seat of whose worship was at Borsippa—south-west of Babylon. It is due to the close association of Borsippa with Babylon after the period when Babylon became the centre of the Babylonian empire that the cult of Nebo retained a prominence only some degrees less than that of Marduk. The amicable relationship between the two was expressed by making Nebo the son of Marduk. In this case the expression of the relationship in this form was intended to symbolize the superiority of Marduk, different, therefore, from the view involved in making Marduk the son of Ea (*q.v.*), which meant that the prerogatives of Ea were transferred to Marduk by the priests of Babylon.

Nebo was the "god of wisdom" to whom more particularly the introduction of writing was ascribed. He takes his place, therefore, by the side of Ea as a cultural deity. The wisdom associated with him had largely to do with the interpretation of the movements in the heavens, and the priests of Nebo at an early age must have acquired widespread fame as astrologers. Assuming now, for which there is a reasonable amount of confirmatory evidence, that the priestly school of Nebo had acquired a commanding position before Babylon rose to political importance we can understand why the worshippers of Marduk persisted in paying homage to Nebo, and found a means of doing so without lowering the dignity and standing of their own god. If Assur-bani-pal, the king of Assyria (668–626 B.C.), in the subscripts to the copies of Babylonian literary tablets invokes as he invariably does Nebo and his consort Tashmit as the gods of writing to whom all wisdom is traced, it is fair to assume that in so doing he was following ancient tradition and that the priests of Marduk likewise were dependent upon the school at Borsippa for their knowledge and wisdom.

The temple school at Borsippa continued to flourish until the end of the neo-Babylonian empire, and school texts of various contents, dated in the reigns of Artaxerxes, Cambyses and Darius, furnish the evidence that the school survived even the conquest of Babylonia by Cyrus. (538 B.C.). Originally this Sumerian deity seems to have been connected with Dilmun and was often identified with the philosophic principle *mummu;* creative word, form. As such he is the son of the water God Enki (Ea), god of the first principle "water." As the god of writing, Nebo has charge of the tables of fate on which he inscribes the names of men and decides what their lot is to be. If in the systematized religious system, Marduk appears as the arbiter of human fates, the conclusion is warranted that Marduk is here imbued with the authority which originally was in the hands of his son. A reconciliation between the rival claims was effected by continuing Nebo in the rôle of scribe, but as writing at the dictation of the gods, thus recording what the divine assembly, gathered in the "chamber of fates" (known as ubshukinna) within the precincts of E-Saggila—Marduk's temple at Babylon—under the presidency of Marduk, had decided.

Nebo also does homage to his father by paying him an annual visit during the New Year celebration, when the god was solemnly carried across to Babylon, and in return Marduk accompanied his son part way back to his shrine at Borsippa. Within E-Saggila, Nebo had a sanctuary known, as was his chief temple at Borsippa, as E-Zida, "the legitimate (or 'firm') house." The kings, and more particularly those of the neo-Babylonian dynasty, devote themselves assiduously to the worship and embellishment of both E-Saggila and E-Zida. In their inscriptions Marduk and Nebo are invoked together and the names of the two temples constantly placed side by side. The symbols of the two gods are similarly combined. On boundary stones and cylinders, when Marduk's symbol—the lance—is depicted, Nebo's symbol—the stylus—is generally found adjacent. In astronomy he was identified with the planet Mercury, and with the principal star of Taurus, Aldebaran. In the official reports of astrologers and in official letters, Nebo is even mentioned before Marduk without fear of thereby offending the pride of the priests of Marduk.

His consort, known as Tashmit, plays no independent part, and is rarely invoked except in connection with Nebo.

See also BABYLON, BORSIPPA, BABYLONIAN AND ASSYRIAN RELIGION.

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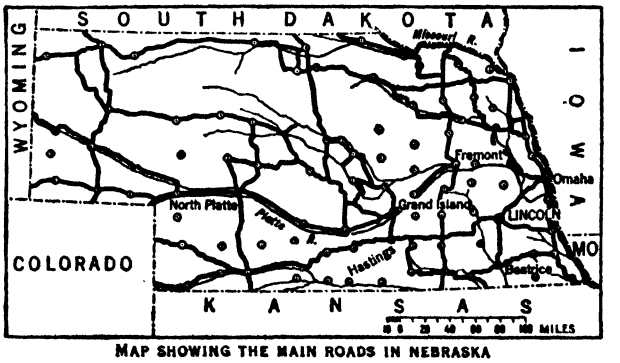
NEBRASKA, styled "The Tree Planters' State" by act of legislature on April 4, 1895, is near the centre of the United States of America, lying approximately between 40° and 43° N. lat. and between 95° and 104° long. W. from Greenwich. It is bounded on the north by South Dakota, on the east by Iowa and a corner of Missouri, on the south by Kansas, on the south and west by a corner of Colorado and on the west by Wyoming. The Missouri river flows along the eastern and north-eastern border. The extreme length of the State is about 430 m. and the extreme breadth about 210 m. The area is 77,520 sq.m., of which 712 are water surface. Nebraska was named "Tree Planters' State" because Arbor Day originated there and forestry has been given great emphasis by its early pioneers and their successors.

Physical Features.—The main feature of Nebraska topography is a great undulating plain, sloping gradually from the north-west to the south-east, at an average of 10 ft. per mile. This plain is broken along its northern and eastern borders by hilly regions of varied character. The highest point, 5,350 ft. is in Banner county. The point of lowest elevation is 825 ft. in Richardson county, at the south-eastern corner. The mean elevation is about 2,500 ft. The United States and State topographical surveys classify Nebraska into four regions: the loess, the sand-hills, the high plains and what hitherto has been called the Bad Lands, but is now named the Pierre Shale hills or Gumbo plains.

The loess region includes about 43,000 sq.m. of the best farming region in the eastern, central and southern parts of the State. In the loess plains the landscapes flow in a series of long gentle waves toward the south-east. Along the Missouri, the Republican, and at some points elsewhere, the waves converge into moderate hills. The sand-hill region lies west and north-west of the loess plains, like an open fan with the handle toward the north-east. The main region includes about 18,000 sq.m. with outlying areas dotting



MAP SHOWING THE MAIN ROADS IN NEBRASKA

other parts of the State. Scattered through the sand-hills are rich valleys, lakes and fertile table-lands. The sand-hills themselves are for the most part, a series of sloping hills, rising sometimes into pinnacles, at other times stretching in gentle plains. Their present contours are chiefly the result of wind action. Save in rare instances they have long ceased to be shifting dunes; for, with the cessation of prairie fires and the increase of settlement, they have become well grassed over and stable. Their general height is from 25 to 100 ft. above the valleys between.

West and north-west of the sand-hills lie the high plains, mostly

level stretches of table-land, broken occasionally by deep canyons. In this region are about 12,000 sq. miles. Included in this region are two areas of evergreen wooded mountains, the Wild Cat range, in Scotts Bluff and Banner counties and the Pine Ridge in Sheridan, Dawes and Sioux counties. A conspicuous feature of these high plains is the buttes, isolated rugged hills, nearly destitute of vegetation, rising hundreds of feet above the surrounding plain. The entire plain-region rises to an average height of from 3,000 to 4,000 ft. with large areas of level rich soil. The North Platte river, with its valley, 10 to 12 m. in width, cuts through the heart of the high plains and is joined near the edge of the sand-hills by the South Platte river entering from Colorado. The Pierre Shale region (or Bad Lands) occupies an area of about 1,000 sq.m. chiefly in Sioux county, with minor sections in Dawes and Sheridan counties. Their weathered slopes and valleys furnish fine grazing and, with water, grow abundant crops. In connection with the Pine Ridge and Wild Cat mountains this section furnishes a region of rare scenic beauty and a sheltered range for stocks.

Rivers and Drainage Basins.—All the drainage of the State reaches the Missouri river, which skirts the eastern border for approximately 450 miles. Present navigation is limited to ferry and excursion boats. Chief tributaries of the Missouri in Nebraska are the Platte, with its branches; the Niobrara; the Republican; the Big and Little Blue; the Big and Little Nemaha. The Platte river is the dominant and characteristic Nebraska river. Its wide terraced valley, extending across the entire State and leading to mountain passes, has made it the chief highway across the continent from the beginning. Its channel varies from ½ m. to 1 m. in width, and is filled with islands of varying size and shape. Its waters are shallow with a fall of about 6 to 8 ft. per mile. In the spring its depth varies from 1 to 6 feet. In the late summer use of water for irrigation leaves its middle course in the State entirely dry. The Loup and Elkhorn rivers, principal tributaries of the Platte, head in the sand-hills and are nearly 200 m. long each, with an abundant flow of water through beautiful valleys. Of Nebraska's 77,000 sq.m. about 40,000 are in the drainage basin of the Platte and its tributaries. The Niobrara is a very swift stream over 400 m. in length, running for about half that distance through canyons and hills wooded with pine and cedar. Beautiful waterfalls exist upon the Loup, Niobrara and their tributaries, some of them 70 ft. in height, and the entire region, with its hundreds of lakes scattered over the sand-hills, makes an attractive tourist camping ground. The Republican river is the principal stream along the southern border, as the Niobrara is in the north. The Big Blue and the Little Blue, about 200 m. in length, with their tributaries, drain the south-central part of the State. Their flow is more sluggish, the grade gently sloping back to the surrounding prairie. The Big and Little Nemaha, about 150 m. long, drain the south-east section.

The lake region in Nebraska is chiefly in the sand-hills, on the headwaters of the Elkhorn and Loup, making an area about 200 m. long by 50 m. wide. Several hundred lakes in this district furnish ideal fishing and hunting grounds. The lakes vary greatly in size and in water, from fresh spring-fed bodies to strongly alkaline. Artesian water exists in at least ten different counties with over 1,500 flowing wells.

Climate.—The climate of Nebraska is inland or continental. The prevailing wind of the year is north-west; but in the spring, summer and much of the autumn, its predominance is greatly reduced by south and south-west winds from the Gulf of Mexico. Wet and dry years run in irregular cycles with no sufficient data to formulate a rule for them. A curve covering the past 70 years would show dry cycles in 1860–63, 1890–95, 1910–13.

The normal mean annual temperature (compiled from records 1876–1927) is 48·7°. There is a considerable difference in the averages for different months, the normal means of January and July through 50 years being 21·9° and 74·6°. The actual growing season between frosts varies from 165 days in the south-east to 135 in the north-west. The normal mean annual precipitation for the whole State is about 23·54 in. in rain and melted snow, the actual yearly average varying through 50 years from 13·30 to 35·60 inches.

Soil.—A soil of remarkable fertility is Nebraska's fundamental asset. Silt is the most common and most fertile physical element in the State soils. It is the dominant element in the richest areas and, supplemented by fine sand, forms a combination easily worked by farm implements and responding with quick and sustained growth in the cultivation of the world's staple food crops which are the chief product of Nebraska. The top soils over most of the State are from 1 to 8 ft. in depth, a rich brownish-black vegetable humus. Below this top soil over the largest area is found the loess subsoil, varying from 10 ft. to over 200 ft. in depth. The soil in the sand-hills region is largely very fine sand mixed with silt. It never bakes, it holds moisture and, under favourable treatment, covers itself with vegetation. Fertile valleys and slopes in the sand hills grow exceptional crops. The soils of the high plains and the butte region are chiefly a mingling of silt and fine sand, rich in lime, derived from the decomposing Arickaree strata. These soils produce splendid crops with a minimum of rainfall under modern soil culture methods. The Pierre Shale soils contain elements of great fertility.

Flora.—Grasses are the outstanding feature, 200 species growing within the State, a greater variety of native forage species than any other State. Between 3,000 and 4,000 floral species have been identified within the State, including 64 trees and 77 shrubs growing native. About 1,000,000 ac. out of 49,000,000 are in forest trees.

Government.—A constitution adopted in 1875 forms the basis of the State Government. Eleven amendments were made during the period 1875–1918. A fourth Constitutional convention assembled in 1919 and submitted 41 additional amendments, which were adopted by the voters in 1920, making the Constitution as it exists to-day.

The general election, State and local, is in even-numbered years on the first Tuesday after the first Monday in November, but municipal and school district elections may be held at other times. In 1909 the State enacted a law providing for the non-partisan nomination of all judges, of all superintendents of public instruction and of regents of the State university.

The governor is the chief executive officer of the State, and one of the 11 executive State officers chosen by direct vote of the people. The other ten executive officers are: lieutenant-governor, secretary of State, auditor, treasurer, superintendent of public instruction, attorney-general, commissioner of public lands and buildings and three railway commissioners. All, governor included, are elected for a term of two years, except the superintendent of public instruction, who is elected for four years and the railway commissioners for six years. The governor appoints, with the approval of the senate, secretaries of the code departments, members of the board of control and a few other officers. He fills vacancies in State offices arising from death, resignation or removal. The governor may remove any officer appointed by him for incompetency, neglect of duty or malfeasance. The legislature consists of a senate of 33 members and a house of representatives of 100 members, and meets in regular session at Lincoln on the first Tuesday of January each odd-numbered year. Except at the governor's request, no bill or joint resolution may be introduced at a regular session after its 20th day. Special legislation of various kinds is expressly prohibited, and in the bill of rights it is declared that "all powers not herein delegated, remain with the people."

Administration of justice is vested in a supreme court, 18 district courts, county courts, municipal courts, justices of the peace, police magistrates and certain State administrative officers. The supreme court consists of six associate justices, elected one from each congressional district, and one chief justice elected from the State at large, all being chosen for a six-year term. Each district court consists of from one to nine judges, total number 35, elected for a term of four years. County courts have one judge, elected by the voters of the county. Municipal courts have from one to five judges each, elected by voters in the city. Lincoln and Omaha were the only cities with municipal courts until 1927, when the legislature enacted that cities having a population of 9,000 to 25,000 could, by initiative petition and referendum, create munic-

ipal courts. Police magistrates are elected from the municipality at large, justices of the peace from each rural precinct. Police judges and justices of the peace are the only judges paid by fees, all others receiving salaries. The district court is the court of general, original, legal and equity jurisdiction. It is a court of record, and its jurisdiction is unlimited in amount, and almost unlimited as to subject matter. Its appellate jurisdiction extends to all appeals from inferior courts. The inferior courts—county, municipal, police magistrates and justices of the peace—all have a limited jurisdiction, both in amount and in subject matter. The supreme court is the court of last resort. Under the Constitution, appeal to this court may not be denied in any case.

Voters in each county may choose the district-commissioner system or the township-supervisor system of government. Out of 93 counties, 24 had township supervisor government in 1928. There are about 600 incorporated cities and villages in the State. Under the Constitution and the State law there are three possible forms of city government: The mayor and council plan; the commission plan, which may be adopted only by cities of over 2,000 population; the city-manager plan, which may be adopted by any city, except Omaha, having over 1,000 population. Since 1912 any city with a population of more than 5,000 may frame a home-rule charter. Omaha and Lincoln have adopted the home-rule charter plan of government, freeing themselves to a large extent from the control of the legislature.

Population.—In 1920 the population of the State was 1,296,372, and in 1928 (United States census estimate) 1,408,000. Of the 1920 population, 1,279,219 were white; of these 149,652 were foreign-born, chiefly from Germany (40,969), Sweden (18,821), Czechoslovakia (15,758) and Ireland (5,422). The density of population was 16·9 per sq.m. in 1920. The five cities having, in 1925 (United States census estimate) a population over 10,000 are given in the table below:

	1925	1920	1910	Increase 1910–20
				%
Omaha	211,768	191,601	124,096	54·4
Lincoln*	70,000	54,948	43,973	25·0
Grand Island	15,602	13,947	10,326	35·1
Hastings	12,954	11,647	9,338	24·7
North Platte	13,670	10,466	4,793	118·4

*For 1927. Suburbs, University Place and Bethany, annexed in that year.

The shift of population from farms to cities began before 1920. In the decade 1910–20, 33 out of 93 counties showed a decrease in total population, and 43 (chiefly the older counties) showed a decrease in rural population. Indian population of Nebraska at the time of the first white settlement totalled about 30,000. There remain now in Nebraska, of the original tribes, about 3,000. All are now full citizens, holding land in severalty and voting.

Finance and Taxation.—The general property tax, established in the year 1867, was supplemented by a corporation licence tax in 1909, and by other State licences and fees and special taxes, and by contributions from the United States Treasury, to provide for the growing expenses of government. In the biennium (1925–27), out of a total State budget of $32,000,000, the general property tax supplied about $14,000,000; fees and licence taxes, $12,000,000; miscellaneous $2,000,000; U.S. contributions $4,000,000. In 1927 the assessed valuation was $3,141,146,000, upon which the State general property tax was $11,862,473, the county tax $11,017,262, the high-school tax $1,400,036, the school tax $28,951,782, the city and village tax $9,061,253, the township tax $1,622,138, making a total general property tax for all purposes of $63,914,947. The State has had no bonded debt since 1900. The legislature, in 1909, passed an act establishing a State guaranty fund "for the protection of the depositors in State banks." The act provides for a levy not to exceed $\frac{6}{10}$ of 1% annually on the average deposits of each State bank. This yields a maximum of $1,500,000 per year which is used for the payment of depositors when a bank fails. There were in 1928 789 State banks, with deposits of approximately $254,000,000 and capital stock of about $22,264,000; and about 168 national banks with deposits of $202,735,000, and capital stock of $16,215,000.

Education.—The United States endowment of public education embraced about 3,000,000 ac. of land for common schools, 90,000 ac. for the College of Agriculture and 46,080 ac. for the University of Nebraska. Under the present law enacted in 1897, this land can be leased but not sold. The present endowment of the common schools includes 1,600,000 ac. of land, and $12,000,000 proceeds of former land sales invested in securities; for the university and agricultural college about 12,000 ac. and $900,000 invested in securities. In addition the State endowed Peru Normal college with 12,000 ac. of State land. The annual income from these school endowments is about $1,000,000. The percentage of illiterate population above ten years of age was 1·4% in 1920, a percentage lower than that of any other State except Iowa (1·1%). Since 1891 a Free Text-book law has been in force. In the common school system in 1926 there were 7,653 school-houses with 327,472 enrolment, and 14,571 teachers. The total investment in school property was $64,000,000 and the annual expenditure $33,000,000.

There are four State normal teachers colleges, with a total attendance, in 1926, of 4,906 students and 162 faculty members; one at Peru (opened 1867), one at Kearney (1905), one at Wayne (originally private; purchased by the State in 1909) and one in Chadron (established by an act of 1909). The University of Nebraska at Lincoln was established in 1869 by an act of the State legislature and was opened in 1871. Connected with it and governed by the same regents are the College of Agriculture at Curtis and the agricultural experiment stations at North Platte, Valentine and Scottsbluff. The university in 1928 consisted of ten colleges and three schools, as follows: colleges of agriculture, arts and sciences, business administration, dentistry, engineering, graduate, law, medicine (at Omaha), pharmacy and teachers; and schools of fine arts, journalism and nursing. The total enrolment for the school year 1926–27 was 11,848 students and about 400 faculty. Nearly all educational institutions in the State are co-educational. Among the private educational institutions are: Nebraska Wesleyan university, at Lincoln; Union college, at College View, a suburb of Lincoln; York college, at York; Cotner university, at Lincoln; Grand Island college, at Grand Island; Doane college, at Crete; Hastings college, at Hastings; University of Omaha, at Omaha; Dana college, at Blair; Nebraska Central college, at Central City; and Midland college, at Fremont.

The State board of control and the State department of public welfare exercise a general supervision over charitable and penal institutions. The State institutions maintained in 1928 included: Girls' Training school, at Geneva; Industrial school for Boys, at Kearney; Womens' Industrial Home, at Milford; Orthopaedic hospital, at Lincoln; soldiers' and sailors' homes, at Grand Island and Milford. These institutions in 1927 had 6,377 inmates, 917 employees and their cost for the biennium 1925–27 was $4,713,300, about one-eighth of the State's total expenses.

Agriculture and Live Stock.—Of a total of 49,170,777 ac. there were, in 1925, 17,904,000 ac. in actual cultivation, 3,056,000 ac. in wild hay, and 26,728,000 ac. devoted to range and pasture purposes. The total crop values, exclusive of fruit, were $371,682,000 in 1927. The total number of farms had increased from 124,411 in 1920 to 127,734 in 1925. Of the total farms in 1925, 70,889 were operated by owners and 56,838, or 44·58%, by tenants. The value of farm-land and buildings was $2,794,807,717 in 1927 as compared with $2,712,107,760 in 1920; the average acreage per farm in 1927 was 377, as compared with 339 in 1920 and 297 in 1910. Improved machinery is the chief cause of the increase in larger farms. Production of principal crops for the year 1927 is shown in the following table:

Nebraska Field Crops, 1927

Maize	8,805,000 ac.	291,446,000 bu.
Wheat	3,630,000 „	73,826,000 „
Oats	2,441,000 „	69,814,000 „
Barley	246,000 „	7,577,000 „
Rye	274,000 „	4,110,000 „
Hay	4,783,000 „	7,201,000 tons
Sugar-beets	82,000 „	1,048,000 „

The value of live stock sold in 1927 was about $281,360,000, including dairy and poultry products. The total value of live stock and its products sold in 1926 was $344,598,858. The heavy sales of cattle during that year is largely responsible for the greatly increased value of gross sales. Domestic animals on farms in 1927 and 1920 were respectively: horses, 782,000, 961,000; mules, 116,000, 99,847; cattle, 2,875,000, 3,154,265; swine, 4,546,000, 3,435,000; sheep, 995,000, 750,000. The dairy industry has grown from 535,000 head of milch cows in 1920 to 613,000 head in 1927, and the total value of dairy cows in 1927 was $45,362,000 as against $36,780,000 in 1926. The number of poultry increased from 11,932,243 in 1920 to 13,517,021 in 1927. In 1926 the total value of poultry and eggs marketed was $25,587,468. Nebraska ships annually 16,000,000 lb. of dressed poultry, and about 2,000 cars of live poultry.

Irrigation and dry-farming have made remarkable increase in the western part of the State. Improved farming methods and favourable rainfall have brought large acreage and crops of winter-wheat over the entire high plains region. Motorized machines and "combines" which harvest and thresh in one operation have increased. Tractor ploughs which run day and night without an operator are used in the fields. In 1927 there were approximately 500,000 ac. under irrigation. The irrigation projects are mostly in the western or central counties of Scotts Bluff, Morrill, Garden, Keith, Dawson and Lincoln. The Platte is the chief source of water for all the irrigation projects so far developed. The sugar-beet industry in the irrigated regions has developed from 554,646 tons in 1919, to 1,048,000 tons and seven factories in 1928. The total value of the 1927–28 crop was $8,216,000, as against $7,274,000 for 1926–27, $5,823,786 for 1919, and the five-year average is $6,302,000. Sheep and cattle-feeding accompany the beet sugar industry, over 300,000 head of sheep and 50,000 of cattle being fattened in the North Platte valley in 1927.

Industries and Transport.—Manufacturing has grown, chiefly in the conversion of raw products of agriculture into commodities for market. The United States census of manufactures for 1925, showed 1,306 manufacturing establishments in the State, employing 27,200 wage earners. Nebraska's rank among the States in 1925, according to the amount of raw material manufactured ($348,397,110), was 23rd; according to total factory output ($443,308,700), it was twenty-eighth. The chief industries in 1925, ranked according to the value of their products, were: slaughtering and meat packing, $198,020,335; the manufacture of butter, cheese and evaporated milk, $38,873,667; flour and grain mills, $29,155,490; steam railway construction and repairs, $15,408,651; bakeries, $12,673,656; printing and publishing, newspapers and periodicals, $10,823,482.

Metallic minerals are almost absent from the State. The total value of the mineral output in 1925 was $3,358,585 or ·07% of the total production for the United States. The chief products in the order of their importance were cement, sand and gravel, clay products and stone.

Missouri river navigation was a leading method of transportation until the construction of the railways in the '70s. As a result of railway competition it declined to almost nothing. Railway mileage amounted to 6,454 m. in 1926. The principal railway construction since 1920 has been branch railways for transportation of sugar-beets in the North Platte valley. In 1927, all but four counties had railway outlets. Ten trunk railways radiate from Omaha, five of them with a network of feeders over the State. The Union Pacific was the first railway, beginning construction on July 13, 1865, at Omaha. There were in 1928 approximately 206 m. of electric railway operating in the State, chiefly as city street transportation systems. Motor truck transportation has greatly increased.

The most important development in Nebraska in the years 1920–28 has been the great extension of improved highways directed from the State engineer's office. An era of road-building and road maintenance began in 1917 which has been greatly promoted by the rapid increase of motor vehicles. The total mileage in the State highway system on Jan. 1, 1927 was 6,256. Of this total 2,660 m. were gravelled, 104 m. paved and 3,492 graded roads. The total number of motor vehicles registered in 1927 was 373,917, of which 31,555 were motor trucks and buses. Nebraska is traversed by two great trunk highways, or tourist lines, the Lincoln highway and the Detroit-Lincoln-Denver, each gravelled almost the entire distance across the State. North and south gravelled trunk lines include the Kansas City-Omaha, the Cornhusker highway and the Meridian highway. The Yellowstone Park and Oregon Trail highways traverse the North Platte valley.

History.—Francisco Vásquez Coronado, with 30 Spanish horsemen and two Indian guides, crossed the great plains northeast from the Rio Grande valley in the summer of 1541, seeking the kingdom of Quivira, which they found to be nothing more than Indian villages not far from 40° N. lat. From Coronado's account most historical writers believe that he was the first white man to reach Nebraska and that view has been incorporated into the literature and pageantry of the State. In 1720, a Spanish and Indian command under Col. Pedro de Villasur, marched from Santa Fe to the valley of the Platte for the purpose of conquering and colonizing the Nebraska region. His command was massacred by the Otoe and Pawnee Indian tribes, probably near the present city of Columbus, on Aug. 10. French explorers came up the Missouri river to Nebraska shores in 1700. In 1739–40, the Mallet brothers (French) crossed the region from east to west naming the Platte river in their report. Nebraska was claimed by France, Spain and England. From about 1700 until 1763 France was the leader in trade and exploration. From 1763 until 1803 Spain exercised authority, but the white population and language of the vast Louisiana province, including Nebraska, remained French. Nebraska passed to the United States in 1803 as part of the Louisiana Purchase. American exploration by Lewis and Clark (1804–06); Lieut. Z. M. Pike (1806); Manuel Lisa (1807–20); Major Stephen H. Long (1819–20); Col. Henry Dodge (1835); Lieut. John C. Fremont (1824–44); and Lieut. G. K. Warren (1855–57) made known to the public important facts regarding the region. Major Long's map designated the country as a "great desert," and his report stated that the country was "entirely unfit for agriculture."

Records show the existence of trading posts in 1795, 1802, 1807, 1812, the last two near the present towns of Ft. Calhoun, 16 m. north of Omaha, and Bellevue. Manuel Lisa, of Spanish descent, was the leading fur trader and first white settler (1807). The most important early white settlement was Ft. Atkinson on the present site of Ft. Calhoun, a military post of 1,000 men, and the centre of the first white industry and agriculture (1819–27). Bellevue (1823), was the first permanent white settlement, and in 1849 the first United States post-office in Nebraska. In 1825 the Government acquired the first Indian lands and in 1833 the first white missionaries began work among Nebraska tribes. Ft. Kearny was established in 1847 where Nebraska City now stands, and in 1848 it was relocated on the south bank of the Platte about 6 m. south-east of the present city of Kearney.

The overland trail era was the next important period in Nebraska history. Beginning in 1832 with the Oregon trail which followed the Little Blue and the south bank of the Platte across the State, followed by the Mormon or California trail in 1847 up the north bank of the Platte, and the subsequent Nebraska City cut-off (established 1858–60), Nebraska furnished the principal routes from the Missouri river to the Rocky mountains and Pacific coast. In a single year 50,000 people with nearly as many live stock and 8,000 wagons crossed the region by these highways.

The movement to organize Nebraska Territory arose directly from the conflict between the United States and Great Britain for the possession of the Oregon country. The name "Nebraska" derived from the Otoe name, "Ne-brath-ka," or Shallow Water, for the Platte river, was first suggested by Lieut. Fremont in 1843, recommended by Secretary-of-War Wilkins in 1844 and adopted by Stephen A. Douglas who introduced bills for the organization of the territory in 1844, 1848 and 1852. In 1852–53, a provisional Territorial Government was formed by Wyandot Indians and licenced white residents on Indian lands. A delegate was elected to Congress, but not seated. The final Kansas-Nebraska bill, providing for two territories, became the centre

of an intense struggle in Congress between the North and South, involving the extension of slavery, the removal of Indians and rival routes for the proposed Pacific railway. The bill, signed on May 30, 1854, by President Franklin Pierce, repealed the Missouri Compromise of 1820, provided that the new territories should be slave or free as voted by citizens in each, and reopened the fierce sectional conflict between the North and South. The conflict split the Democratic Party, destroyed the Whig Party, led to the organization of the new Republican Party and to the series of events leading to the Civil War.

Nebraska Territory, as organized in 1854, included the vast region from the 40° N. lat. to British America, and from the Missouri and White Earth rivers to the summit of the Rocky mountains. In 1861 and 1863 it was reduced by the creation of other territories to nearly its present boundaries, the only important change since then being the annexation in 1890 of what is now Boyd county. White settlers in the territorial period (1854–67) were chiefly in a narrow strip along the Missouri river, with isolated ranches westward along the Platte valley and the Oregon trail. The enactment by Congress in 1862 of the Union Pacific Railroad Act and the Free Homestead Act aided white settlement, the first claim under the Free Homestead Act being located in Nebraska, on Jan. 1, 1863. In 1861 there were probably 30,000 inhabitants in the territory and 3,300 men from Nebraska were enlisted for the Union army in the Civil War. The great industry in this period was transport by the overland trail. Rival routes from Kansas City, St. Joseph, Leavenworth, Atchison, Nebraska City and Omaha, converged at Ft. Kearny on the Platte. Freight carried over these trails amounted to 200,000 tons in 1865. Over them ran the overland stage coaches, carrying passengers, and in 1860–61, the famous "Pony Express," whose service ended with the completion of the overland telegraph in the latter year. This trail transportation business terminated in Nebraska with the construction of the Union Pacific railway in 1865–69.

The legislature first met in Omaha on Jan. 16, 1855, and annually thereafter, during the territorial period. Important early legislation related to land claims, bank charters, schools, prohibition and woman suffrage. A fight for the location of the capital between rival towns of the Missouri river front, Bellevue, Brownville, Nebraska City, Plattsmouth, Omaha and Florence resulted in Omaha holding the capital, but in the creation of a violent feud between the North and South Platte sections which continued for many years. An episode of this fight was the "Florence secession" of 1858, when a majority of the legislature deserted Omaha and adjourned their sessions to Florence. In 1858–59 the South Platte region held a convention, sent delegates and sought annexation to Kansas. Great speculation in town sites and lands culminated in 1857 in general distress and in the failure of all territorial banks but one, $400,000 of bank notes becoming worthless.

Statehood.—A proposition to form a State in 1860 was defeated at the polls. Congress passed an Enabling Act on April 19, 1864, but a convention elected in that year to frame a State Constitution adjourned without action. A Constitution was adopted by the legislature in 1866, submitted to the voters on June 2, 1866 and carried by a majority of 100 in a total vote of 7,766. The Republicans favoured statehood in order to help the Republican majority in Congress in its struggle with President Andrew Johnson; the Democrats opposed it. The Constitution, as adopted, limited suffrage to free white males. Congress refused to admit Nebraska until the territorial legislature passed an act pledging that negroes would not be barred from the ballot. These terms of admission were accepted by Nebraska and carried in spite of President Johnson's veto, and Nebraska was proclaimed a State on March 1, 1867.

The South Platte region had a majority in the first State legislature of 1867 and passed an act providing for the relocation of the capital in that section. Opponents of removal offered an amendment naming the capital "Lincoln," in order to make it distasteful to Democratic members from the South Platte region. The latter accepted the amendment and the capital commission on July 29, 1867, located and named the capital site at the little hamlet of Lancaster, on Salt creek.

The Democratic Party was the sole political party in Nebraska from 1854 to 1858. The only political divisions were factions of that party. The Republican Party was first organized in the campaign of 1858. Slavery domination of the national administration and especially President Buchanan's veto of the Free Homestead Act changed territorial politics, giving the Republicans control in 1860, which was firmly held by them until 1890. In that year the Farmers' Alliance organized the Peoples' Independent or Populist Party. A three-cornered fight resulted in the Democrats getting the governor, and the Farmers' movement a majority of the legislature. The Populists elected the governor in 1894 and in 1896, by fusion with the Bryan Democrats and Silver Republicans, swept the State. Defalcations disclosed of Republican State officials amounting to over $700,000 assisted the fusion party in controlling the State until 1900 when the Republicans again came into power. The Populist Party disintegrated and disappeared as a political factor after 1904, and political control has fluctuated between the Democrats and Republicans since then. The legislature in 1919 passed what is called "The Civil Administrative Code Act," consolidating about 25 State administrative organizations into six departments: finance, agriculture, labour, trade and commerce, public works, public welfare. The legislatures from 1919 to 1927 granted $9,000,000 for the construction of a new State capitol. This building, designed by Bertrand Goodhue, is one of the noted artistic structures in America.

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NEBRASKA CITY, a city of south-eastern Nebraska, U.S.A., on the high bank of the Missouri river, 40 m. below Omaha; the county seat of Otoe county. It is on Federal highways 73 and 75, and is served by the Burlington Route and the Missouri Pacific railway systems. The population was 6,279 in 1920 (91% native white) and was estimated locally at 8,000 in 1928. It is the seat of the State Institute for the Blind, and the trading and shipping point for a fine agricultural region. "Arbor Lodge" (formerly the home of J. Sterling Morton, a member of Cleveland's cabinet and the originator of Arbor Day) with its fine arboretum, is now a State park. Nebraska City is one of the oldest settlements in the State, and for some years at the height of the migration westward it was the largest city. A fort was established on the site in 1847, but was abandoned the following year for a location farther west. In 1858 several settlements in the vicinity were consolidated and incorporated as Nebraska City, and it was made the headquarters of a great freighting firm which distributed supplies to the army posts between the Missouri and the Rockies (amounting to 2,782,258 pounds in 7 months in 1859).

NEBUCHADREZZAR or NEBUCHADNEZZAR, king of Babylon, the *Ναβουκοδρόσορος* of the Greeks. The first and last are nearer to the original name as it is found on the cuneiform monuments, viz., Nabu-kudurri-uṣur, "Nebo, defend the land-

mark." Nebuchadrezzar seems to have been of Chaldean origin. He married Amuhia, daughter of the Median king, according to Abydenus, and in 605 B.C. defeated Necho at Carchemish, driving the Egyptians out of Asia and annexing Syria to the Babylonian empire. In the following year he succeeded his father Nabopolassar on the Babylonian throne, and continued the restoration of Babylon, which he made one of the wonders of the world. His "new palace" there was built in fifteen days; temples were erected to the gods, the great walls of the city were constructed with a moat surrounding them, the Euphrates was lined with brick and a strong fortress erected. Canals were dug throughout the country and a great reservoir excavated near the capital. Only a fragment of his annals has been preserved, recording his campaign against Amasis (Aḥmosi) of Egypt in his thirty-seventh year (567 B.C.) when he defeated the soldiers of "Phut of the Ionians." Tyre revolted in the seventh year of his reign, and was besieged for 13 years; a contract-tablet dated in his fortieth year shows that at that time it was under Babylonian officials.

After the investment of Tyre Nebuchadrezzar marched against Jerusalem, put Jehoiakim to death and placed Jehoiachin on the throne. Three months later Jehoiachin was deposed and Zedekiah made king in his place. Zedekiah's revolt in 588 B.C. led to another siege of Jerusalem, which was taken and destroyed in 586 B.C. (*See* JEWS and JERUSALEM.) From his inscriptions we gather that Nebuchadrezzar was a man of peculiarly religious character.

See Josephus, *Cont. Apion*, i. 19; Eusebius, *Praep. Evangel.* x.

NEBULA, in astronomy, the name given to certain luminous patches in the sky. (Latin for "mist," Greek *νεφελη*). Dark nebulae are also known. The smaller luminous nebulae resemble distant comets when seen in a telescope of moderate power but can be easily distinguished from them, because the latter, being within the confines of the solar system, appear to move among the stars, while the nebulae, being at stellar distances, have no such motion. They are almost without exception invisible to the unaided eye, and, while a few hundred of them can be seen with a small telescope, it requires the combined aid of a very large instrument and the photographic plate to study these faint objects at all adequately. The two largest and brightest are the spiral nebula in Andromeda and the irregular nebula in Orion.

The nebulae are very numerous, their number being reckoned in hundreds of thousands, but only a comparatively few of these appear large enough to show much structure even on photographs taken with our most powerful telescopes. As the nebulae present to us luminous *surfaces*, as opposed to the point-image of a star, even the largest telescope, though it makes them appear larger, does not make them any brighter than they are to the unaided eye. But the photographic plate has the advantage over the human eye of being able to accumulate the effect of exposure to a faint source of light, and thus by means of long exposures, sometimes extending over many hours, it is possible to photograph nebular detail far too faint to be observed visually in any telescope.

Historical.—Before the days of photography the nebulae were observed by Charles Messier in Paris in 1771; he recorded 103 of them; by Sir William Herschel at Slough, and by Sir John Herschel both there and at the Cape of Good Hope, who raised the number of known nebulae to 4,000; and in the middle of the 19th century by the third Earl of Rosse, with his giant reflecting telescope at Parsonstown. They were first observed with the spectroscope in 1864 by Sir William Huggins, whose discovery that some of them had a gaseous spectrum dispelled the idea then becoming current that all nebulae were aggregations of stars, and that it was merely a matter of obtaining more powerful telescopes to show them as such. The catalogues formed by J. L. E. Dreyer contain about 10,000 nebulae discovered visually. They have not yet been superseded by any general catalogue based upon photographic observations.

Amongst the pioneers of photography as applied to the study of the nebulae were A. A. Common and Isaac Roberts in England, and later E. E. Barnard and J. E. Keeler in America. During the present century the nebulae have been extensively photographed at the Lick, Mount Wilson, and Lowell observatories in America, at Heidelberg by Max Wolf, and at Helwan in Egypt.

Classification.—The nebulae fall naturally into two groups, which have been called the galactic and the extra-galactic, the former class comprising those nebulae which lie in or near the plane of the Milky Way, and the latter those which are found outside this plane. This is not merely a spatial classification, as the two classes of objects differ fundamentally in their nature, and they will consequently be discussed separately.

THE GALACTIC NEBULAE

These nebulae, which are only found in or near the Milky Way, are of three kinds: (a) *Dark Nebulae*, which do not shine, and can only be detected because they obscure the light coming from the stars that lie behind them; they are irregular in shape; (b) *Diffuse Nebulae*, also irregular in shape; they are often of very intricate structure; (c) *Planetary Nebulae*, which are round, or nearly so, and have sharply defined edges.

Dark Nebulae.—There are in the Milky Way a great number of dark patches, some of them entirely devoid of stars. A few of these were discovered by Sir John Herschel, who thought them to be holes through which we looked into empty space beyond; and Barnard, whose studies of these dark nebulae finally showed that they were caused by the presence of clouds of non-luminous matter, was at first loth to believe they were other than holes or spaces actually containing no stars. They vary in size from small patches only a minute of arc in diameter to the large lanes in Ophiuchus and Scorpius. Even the huge rift, 120° long, which divides the Milky Way from Cygnus to Centaurus, must be considered to be of a similar nature. It stretches right through the region where most of the globular clusters are found, and yet there is not a single one of these clusters within its boundaries.

When stars appear in these dark spaces, it seems likely that in general they lie between us and the obscuring cloud, though there are undoubtedly cases where the stars are actually involved in it. In fact the dark nebulae are commonly found associated with bright stars and luminous nebulosity (diffuse nebulae), in such a way as to suggest irresistibly that they are physically connected and therefore at the same distance from us. The distances of some of these bright stars are known and are of the order of 400 light-years (a light-year is the distance that light travels in a year, about six million million miles). The dark nebulae connected with them must therefore be equally distant and their actual dimensions consequently very great, the dark lane in Ophiuchus being for example about 60 light-years long by 5 light-years wide. The region just south of the star ζ Orionis (Pl. I., fig. 2) is a typical example of the association of dark nebula, diffuse nebula, and stars. The left hand part of the field is covered by an obscuring cloud, and there are relatively few stars to be found in it. This cloud is edged with luminous nebulosity, of which there are also patches round the brighter stars. Beyond its boundary on the right the normal number of stars for a Milky Way region can be seen.

These clouds may be composed of particles of all sizes from mere molecules to bodies of almost stellar mass, but it seems clear from their obscuring power that they must contain a large amount of fine dust. For a given mass of matter the maximum obscuration is obtained when it is in the form of particles the circumferences of which are of the order of a wave-length of light (about one two-thousandth of a millimetre), and the whole of the obscuration of the large cloud in Ophiuchus could be produced by matter equal in mass to about 12 stars like our sun if it were in the form of minute particles of this optimum size.

Diffuse Nebulae.—These are similar to the dark nebulae, except that they are luminous, which fact enables us to learn a good deal more about them. Almost without exception they are found to have bright stars involved in them, and in many cases they are fringed with dark nebulosity. This suggests that the bright and dark nebulosities are parts of the same cloud, which the bright stars involved in it render luminous in their immediate vicinity. That this is at any rate sometimes the case was first suggested by the discovery by V. M. Slipher that the stars of the Pleiades and the nebulosity surrounding them had similar spectra.

More recently a systematic study of the diffuse nebulae by E. Hubble has brought to light a well-marked connection between the size of the luminous patch and the brightness of the star involved in it, the stars being found to illuminate the clouds around them to a distance proportional to their brightness. The method by which the clouds are made to shine cannot be always that of simple reflection of the star's light, because in many cases the nebulae shine with a different kind of light from that of the stars. Diffuse nebulae exist with both the continuous spectrum characteristic of the stars and with the bright-line spectrum which we have learned to associate with a rarified gas.

Only when the star involved in the nebula is an extremely hot one (spectral type B1 or earlier), does the nebula have a bright-line spectrum. When the star responsible for its light is of a cooler type the spectrum of the nebula is continuous and, in general, of the same type as that of the star. In this case the nebula may shine by reflection of the star's light. But the light of those nebulae which have gaseous spectra cannot be explained by simple reflection; it is necessary to postulate excitation of the dark cloud to luminosity in some other way (*see* the Gaseous Spectrum of Nebulae below). It appears then that a diffuse nebula is in general just a part of a dark cloud which is made luminous by the action of a star.

It is possible to determine with considerable accuracy the radial velocities (velocity in the line of sight) of those diffuse nebulae which show a gaseous spectrum, because their light though faint is concentrated in a few bright spectral lines; and it is found to be low, the average being about 11kilom. a second. Owing, however, to the general absence in them of sharply defined points suitable for accurate measurement, it is a far more difficult matter to determine the motions, either of the nebula as a whole or of its constituent parts, across the line of sight. In fact, with the possible exception of the "Crab" nebula in Taurus, no change has been detected in the structure of a nebula. On looking for the first time at a photograph of such a nebula as the great one in the sword of Orion (Pl. I., fig. 1) one might well suppose that the internal motions of its parts would cause changes that would soon make a conspicuous alteration in its appearance. But when one considers its great distance (about 600 light-years), it is evident that sensible change of form could not be caused by motion at any reasonable velocities during the comparatively few years that the nebula has been studied by photography.

The same is true of all the diffuse nebulae, except the rare *variable nebulae*, of which the most remarkable are those in Monoceros and Corona Austrina (Nos. 2261 and 6729 in Dreyer's New General Catalogue). These two nebulae vary rapidly in both form and brightness, distinct differences being discernible in a few days. They are both fan-shaped, and each has a variable star at the apex of the fan. It is almost certain that the variations are caused, not by motion of the matter forming the nebulae, but by changes in the illumination of stationary nebulous matter emanating from the variable stars with which they are connected.

The density of the diffuse nebulae must be extremely low. Dynamical considerations suggest that in the case of the Orion nebula it cannot be greater than 1/1,000,000,000,000,000 of the density of ordinary air; it may be much less. It is certainly a much more perfect vacuum than anything we can yet produce in our laboratories, yet so great is its size that it may contain enough matter to form thousands of stars as large as the sun.

Planetary Nebulae.—The planetary nebulae form quite a small class, there being less than 150 of them known; and, owing to the ease with which they can be recognised from their gaseous spectra, it is probable that we know of most that exist, and that they are therefore a comparatively rare form. A few of them are several minutes of arc in diameter, but the majority are so small that when viewed in the telescope they are indistinguishable from stars, except under a high power. They have the appearance of discs, round or nearly so in shape, with sharply defined edges and a faint star as nucleus. In many cases the disc is more luminous at its edge than in the centre, and the nebula has the appearance of a ring (Pl. I., figs. 3 and 4); whence they are sometimes called "annular nebulae." If they were actually discs, it is extremely unlikely that we should see them all as circles. Their planes would naturally be inclined at various angles to our line of sight, and thus the discs would appear to us as ellipses of various degrees of elongation. Their real form is clearly spherical or nearly so; what appear to us as rings must be spherical shells, and the beautiful structure of ring within ring seen in some of these nebulae must be in reality a series of shell within shell.

The central stars of these nebulae are the bluest and hottest known (spectral class O), and there can be but little doubt that they are responsible for the light emitted by their nebulous envelopes, in a way similar to the excitation of luminosity in the diffuse gaseous nebulae by the hot stars involved in them. The planetary nebulae have as a class high radial velocities, averaging over 30kilom. a second, higher than those of the Class O stars, which are not connected with nebulae, and consequently higher than stars of any spectral class; a few have radial velocities exceeding 100kilom. a second. Exact determination of their motions across the line of sight is not easy, but it is clear that they are small, and that the average distance of these nebulae must be at least several hundred light-years. They are thus large bodies, several hundred times as large as the solar system.

The spectroscope has revealed that those which appear slightly flattened in form are rotating, and this is probably true in general. The periods of rotation must be reckoned in thousands of years. In some of them internal motions more complicated than a simple rotation have been detected by the spectroscope. Their densities seem to be very low, though perhaps not quite so low as those of the diffuse nebulae. Notwithstanding this their masses must be as large as those of the brightest stars.

The question as to what place, if any, the planetary nebulae take in the scheme of stellar evolution is a difficult one, to which at present there is no certain answer. Being so few in number, they cannot be regarded as forming a regular link in any evolutionary chain. It is possible that they are a later stage in the life history of the new stars (novae), which as they decline in brightness develop spectra of the same type as have the nuclei of planetary nebulae, and are also then usually surrounded by faint nebulous envelopes.

The Gaseous Spectrum of Nebulae.—The spectra of all gaseous nebulae are very similar, the differences consisting chiefly in the relative intensities of the bright lines. The lines in the spectrum are sharp, indicating that it is due to a gas of low density. The lines of hydrogen are prominent, and those of helium are usually present; but there are several lines, and among them are the strongest in the spectrum, which are so far unknown to us in our laboratories. These strong lines form a pair in the green region of the spectrum ($\lambda\lambda$ 5007, 4959) and a close pair in the ultra-violet ($\lambda\lambda$ 3726, 3729). The unidentified lines were originally ascribed to an element, unknown on earth, to which the name "Nebulium" was given, but it now seems clear that they are due to known elements in a state which has not yet been produced in the laboratory. This unfamiliar state may well be the extremely low density existing in these nebulae, far beyond anything we can produce in our vacuum tubes. Whereas in the latter the mean interval between atomic collisions is never more than one thousandth of a second, in the nebulae it may be as much as several minutes or even hours. I. S. Bowen has recently from theoretical considerations accounted for all the chief lines of "nebulium" in this way, the two strongest pairs being ascribed to ionised and doubly ionised oxygen in a "metastable" state.

All the lines of the nebular spectrum are characteristic of a form of radiation which requires a great amount of energy for its excitation. The source of this energy cannot be in the nebulae themselves, for that would postulate for them an impossibly high temperature. A possible source is the bombardment of the atoms of the nebula by electrons emitted by very hot bodies, and such bodies are to be found in all gaseous nebulae—the stars of spectral classes O and B, the hottest bodies known to us.

THE EXTRA-GALACTIC NEBULAE

General Characteristics.—The extra-galactic nebulae are found scattered all over the sky except in the Milky Way itself,

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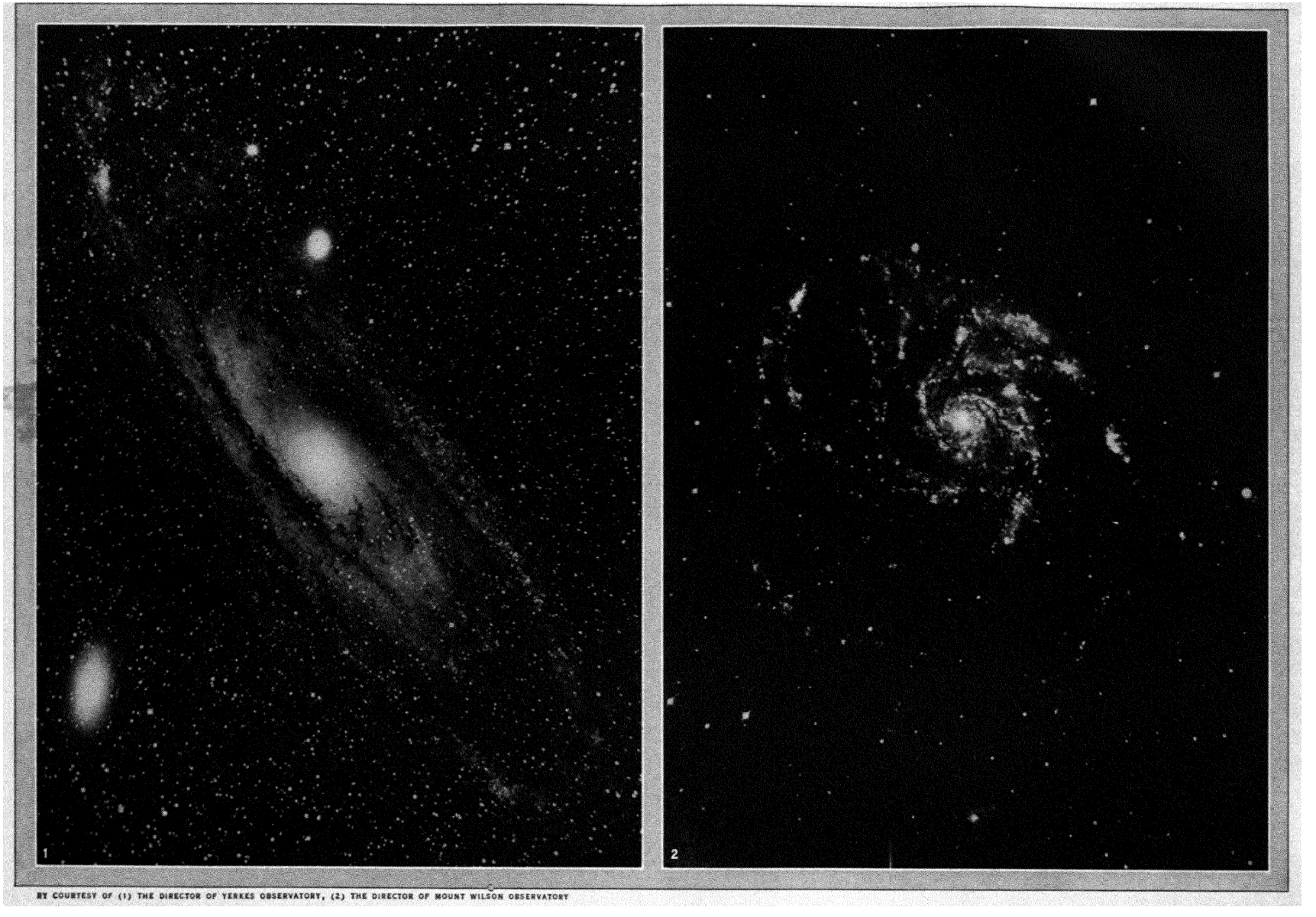
PHOTOGRAPHS OF DIFFUSE, DARK AND PLANETARY NEBULAE

1. Great Nebula in Orion (N.G.C. 1976), one of the largest of the diffuse nebulae
2. Nebulosity south of the star Zeta Orionis (N.G.C. 2023) an example of a dark nebula
3. Planetary nebula in Lyra (N.G.C. 6720); a luminous surface, hollow in the centre; in the Milky Way
4. Planetary nebula in Ursa Major (N.G.C. 3587). A nearly circular form and a sharp outline are characteristic of this type of nebula



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SPIRAL NEBULAE OR "ISLAND UNIVERSES"

1. Spiral Nebula in Andromeda (M. 31, N.G.C. No. 224) 2. Spiral Nebula in Ursa Major (M. 101, N.G.C. 5457)

which they rigidly avoid. This characteristic is, however, by no means the only thing that differentiates them from the galactic nebulae, and the most casual study soon shows them to be objects of quite a different nature. They vary in apparent size from the great spiral nebula in Andromeda, which is more than 2° long, to objects so small that only in the largest telescopes can they be distinguished from stars. Of these small nebulae there are several hundred thousand within our reach. They are too minute to show any structure, but of the larger objects a few are irregular in shape and bear some resemblance to the Magellanic Clouds, but in general the extra-galactic nebulae are remarkable for their symmetry of form. They appear as circular or elliptical objects and form a progressive sequence, from the *globular* or *elliptical nebulae*, which are quite structureless, to the *spiral nebulae*, which show spiral structure in various degrees of development.

The globular nebulae show no signs of resolution into separate stars even in the most powerful telescopes. They get gradually brighter towards the centre and have no well defined edge, as have the planetary nebulae. They are found with all degrees of elongation from circular to spindle shapes, but it seems from the frequency of the circular form that many of them must be actually spherical or nearly so, though the majority may be lenticular in form. An example of a globular nebula can be seen in the lower left hand corner of the plate of the spiral nebula in Andromeda.

The chief characteristic of the typical spiral nebula is the emergence from opposite sides of its central nucleus of two spiral arms which wind themselves round it. Their forms are many and varied, some being very complicated and all very beautiful; but most of them can be graded into a sequence, with objects at one end differing but little from the structureless globular nebulae, and at the other end nebulae with highly developed spiral arms. At the beginning of this sequence the nucleus has all the characteristics of a globular nebula, but as progress is made along the sequence the nucleus becomes smaller and sharper in outline until at the other end it is almost stellar. The spiral arms, however, develop; unwinding themselves further and becoming more and more studded with condensations, which at the far end of the sequence can be resolved with the most powerful telescopes into separate stars.

It is tempting to suppose that this sequence gives us a picture of an evolutionary process, and that the spiral nebula actually develops from the structureless globular nebula to a final state of clusters of stars by the formation of spiral arms and the continued projection of the matter originally forming the globular nebula, or nucleus, along them. That such is a possible process in the case of a lenticular revolving mass, such as the globular nebula may be supposed to be, has been shown by J. H. Jeans, who by mathematical reasoning has traced out the whole sequence; how the nearly spherical and slowly rotating globular nebula spins faster as it contracts, and thus becomes more flattened; how the tides raised in it on opposite sides of its equator by some neighbouring nebula form protuberances, which are impelled forth as spiral arms; and how these arms as they emerge wind round the central mass and are disintegrated into groups of condensations which ultimately become stars. The process must be an extremely slow one as we reckon time, involving millions of millions of years, and we must not therefore expect to see in a lifetime much change in the form of a particular nebula. However, the spectroscope has shown that they are in rapid rotation, and, provided that they are not more distant from us than the galactic nebulae, it should be possible by comparing photographs taken only a few years apart to detect movements of the condensations in those nebulae which are turned so as to give us an open view of them.

The plates accompanying this article show two spiral nebulae, the great nebula in Andromeda, with its plane considerably tilted to us, coming comparatively early in the evolutionary sequence. Here the nucleus is large and the centre of the nebula structureless, and only in the outer parts are condensations beginning to form. The other plate shows an open view of a more developed spiral in Ursa Major. It has a much smaller nucleus and the spiral arms are full of condensations throughout their length, the outermost of them becoming stellar in character. Dark markings will be seen in the Andromeda nebula, and these are found in many of the spirals. They suggest irresistibly the presence of obscuring clouds similar to those seen in the Milky Way. Many of the extra-galactic nebulae which are seen edge-on are found to be crossed by dark bands, clearly caused by surrounding rings of dark matter hiding some of the luminous nebulosity nearer their nuclei. A typical example is N.C.G. 4594 for an illustration of which, and of several other spiral nebulae, *see* COSMOGONY.

Spectroscopic observation of the extra-galactic nebulae is difficult on account of their faintness, but the central parts of those that are sufficiently bright have all been found to show continuous spectra, crossed by absorption lines, similar in nature to those of stars like our sun. A few also show bright lines in their spectra; but these come from individual condensations, and not from the nebula as a whole. Thus these nebulae must be formed either of bodies similar to the stars or of matter that derives its light from stars involved in it, in a way similar to that postulated for those of the diffuse nebulae that show similar spectra.

The "Island Universe" Theory.—The question of the nature of the extra-galactic nebulae is intimately bound up with that of their distance, on which, of course, that of their actual dimensions depends. Are they members of our system of stars forming the Milky Way, or do they lie outside it, as globular clusters are believed to do?

The evidence available is preponderantly in favour of the extra-galactic nebulae lying outside our stellar system and even beyond the globular clusters. This means that they must be at immense distances, for we have reason to believe that the distance of some of the star clouds of the Milky Way is of the order of tens of thousands of light-years, and that the most distant of the globular clusters are 200,000 light-years away.

The velocities of these nebulae in the line of sight, revealed by the spectroscope, come out very large, the average being over 500 kilom. a second, many times that of any of the bodies within our galactic system. They also appear almost without exception to be receding from us. No entirely satisfactory explanation of this is yet forthcoming, but it seems possible that these observations do not represent real velocities of the nebulae. There are reasons, derived from the general theory of relativity, for supposing that extremely distant bodies might *appear* to be receding rapidly from us. Whatever is the final interpretation of these observations, they differentiate the extra-galactic nebulae from any bodies in our stellar system.

During recent years several examples of two types of variable star, which otherwise are only found closely confined to the plane of the Milky Way, have been discovered in some of the larger spirals. As there are none of these stars in the regions around, it seems certain that they lie actually in the nebulae and are not merely seen projected on them. These variables are of the kind known as Cepheids, or are novae (new stars). The Cepheid variables in the Galaxy have the peculiarity that their periods of variation are closely correlated with their actual luminosities, whence from a knowledge of the period and the apparent brightness of such a star, both easily observable quantities, its distance can be inferred. Assuming that the Cepheids found in the spirals are of the same nature as those in the Galaxy, and that consequently this law holds for them also, Hubble has determined the distances of the great spiral in Andromeda and of that in Triangulum to be each of the order of 900,000 light-years. These distances are confirmed by the brightness, when at their maximum luminosity, of the novae in them, if we may assume that this will be on the average the same as it is with those in the Galaxy. And these are the two largest and most conspicuous of the spiral nebulae, and therefore may be among the nearest to us.

The evidence then points unmistakably to the extra-galactic nebulae being bodies at truly immense distances, reckoned in millions of light-years, and in some cases perhaps in tens of millions; for, though on this point we have as yet no certain knowledge, it is possible that all these bodies are of much the same size, the minute apparent size of so many of them being only the effect of immense distance. They must then be of vast actual dimensions, comparable to, though apparently not quite so large

as, our own stellar system, which they resemble in so many ways; in their lenticular shape; in their colour, their spectra being similar to the integrated spectrum of the Milky Way; in the presence in them of dark clouds of obscuring matter; and in the resolvability of the more advanced of them into separate stars, which seem similar in character to those in our stellar system. The absence of a nucleus in our own system shows, however, that it is not a typical spiral nebula, as does the much greater brightness of the central parts of even the advanced type of spirals.

Thus the problem of the nature of the extra-galactic nebulae seems definitely settled in favour of the "island universe" theory, as the supposition that they are bodies external to our own stellar universe has been called. But as H. Shapley, who has made a special study of the structure of the universe, has said "If we call them islands, the galaxy is a continent." There is no sign of the nebulae thinning out as far as we can penetrate space, and we must picture the whole of known space as an ocean filled with these island universes, and our own stellar system among them but of sufficiently greater size to deserve the more dignified appellation of continent. It is a stupendous thought that the light which now reaches us from the outermost parts of this cosmos started on its journey millions of years ago, and that our photographs of these distant universes give us pictures of them, not as they are now, but as they were before the dawn of the human race on this small earth of ours. But then in the ages occupied by stellar evolution a million years is but a day.

BIBLIOGRAPHY.—Numerous photographs of nebulae will be found in Isaac Roberts, *Photographs of Stars, Star Clusters, & Nebulae* (1893–99); *Publications of the Lick Observatory*, vol. viii. 1908, and vol. xiii. 1918. The best and most up-to-date general account of them is in Russell, Dugan & Stewart, *Astronomy*, vol. ii. 1926. Numerous papers by E. Hubble in recent volumes of the *Astrophysical Journal*.

(H. K.-S.)

NEBULAR THEORY: *see* COSMOGONY.

NECESSITY: *see* FREEWILL.

NECK, that part of the body which connects the head with the trunk (*see* ANATOMY: *Superficial* and *Artistic*). The word is transferred to many objects resembling this part of the body in shape or function; it is thus applied to an isthmus, or to the narrowest portion of a promontory, to the narrow part of a musical stringed instrument connecting the head and body, as in the violin, or to a narrow pass between mountains, which in the Dutch form *nek*, appears in place-names in South Africa. In architecture, the "neck" is that part of the capital just above the "astragal," and the term "necking" is applied to the annulet or round, or series of horizontal mouldings, which separates the capital of a column from the plain part or shaft. In Romanesque work this is sometimes corded.

In Geology, the term "neck" is given to the denuded stump of an extinct volcano. Beneath every volcano there are passages or conduits up which the volcanic materials were forced, and after the mass has been levelled by denudation there is always a more or less circular pipe which marks the site of the crater. This pipe, filled with ashes or lava, is the characteristic of a volcanic neck. Many instances are furnished by the geological history of the British Isles. In Derbyshire, Fife, the Lothians and the Glasgow district the remains of Carboniferous volcanoes occur in every state of preservation. Some have the conical hills of lavas and ashes well preserved (*e.g.*, Largo Law in Fifeshire); others retain only a small part of the original volcanic pile (*e.g.*, Arthur's Seat, Edinburgh; the Binn of Burntisland) and of the larger number nothing remains but the "neck" which shows where once the crater was situated.

In regions of former volcanic activity necks are the most persistent of all volcanic structures, because the active volcanic magma is located deep within the earth's crust, and the pipe by which it rises to the surface is of great length and traverses a great thickness of strata. This extensive pipe was usually vertical, and nearly uniform in diameter for great depths; when exposed by denudation, it has a circular ground plan, or if shown in vertical section (or elevation) in a cliff is a pillar-shaped mass crossing the bedding planes of the strata nearly at right angles. It terminates upwards, in the remains of the volcanic cone and communicates below with the reservoir from which the lavas were emitted, represented in most cases, where it has been exposed, by a large irregular mass (a batholith or boss) of coarsely crystalline igneous rock. The site of such a neck is generally indicated by a low conical hill consisting of volcanic rock, surrounded by sedimentary or igneous strata of a different kind. The low cone is due to the greater hardness and strength of the volcanic materials and is not connected with the original shape of the volcano. Two splendid sugar-loaf cones known as the Pitons of St. Lucia in the West Indies, rising from the sea with almost vertical sides to a height of nearly 3,000ft., are old volcanic necks. In Texas, New Mexico, Arizona, California and many of the western states of North America, geologists have observed conical volcanic hills having all the features which belong to necks.

Where the volcanic rocks are soft and easily disintegrated the position of a neck may be indicated by a cup-shaped hollow; this is the case with some of the diamond-bearing basic pipes of South Africa. Examples are the Kimberley diamond mines. The blue-ground (or serpentine breccia) occupies great pipes or funnels, circular in outline with nearly vertical sides, extending downwards to unknown depths; these are the necks of the old volcanoes.

The size of necks varies considerably; the smallest may be only 20 or 30yd. in diameter, the largest are several miles. In this respect they resemble active craters, but no necks have been met with on the earth's surface with dimensions approaching those of the so-called "craters" of the moon.

Occasionally a whole neck is composed of solid crystalline rock representing the last part of the magma which ascended from the underground focus and congealed within the crater. In Mont Pelée, for instance, the last stage of the eruptions of 1902 to 1905 was the protrusion of a great column of solidified lava which rose at one time to a height of 900ft. above the lip of the crater, but has since crumbled down. The Castle Rock of Edinburgh is a neck occupied by a plug of crystalline basalt. Necks of this kind weather down very slowly and tend to form prominent hills.

After the eruptions terminate gases or hot solutions given out by deep-lying masses of molten rock may find a passage upward through the materials occupying the crater, greatly modifying their mineral nature and laying down fresh deposits. A good example of secondary deposits within a volcanic neck is provided by the Cripple Creek mining district of Colorado. The ore-bearing veins are connected with volcanic rocks and part of these occupy a vertical circular pipe which is a typical volcanic neck. A phonolitic breccia, greatly altered, is the principal rock, and is cut by dikes of phonolite, dolerite, etc. The country rock is mostly granite and gneiss, and blocks of these are common in the breccia. A large volcano was built up in Tertiary times on the granite plateau, and has since been almost entirely removed by denudation. The gold ores were carried upwards by currents of hot water derived from the volcanic magma and were deposited along cracks and fissures in the materials which occupied the crater, and also in the surrounding rocks (*see* VOLCANO). (J. S. F.)

NECKAM, ALEXANDER (1157–1217), English schoolman and man of science, was born at St. Albans in September 1157, on the same night as King Richard I. Neckam's mother nursed the prince with her own son, who thus became Richard's foster-brother. He was educated at St. Albans Abbey school, and became schoolmaster of Dunstable, dependent on St. Albans Abbey. Later he went to Paris, where by 1180 he had become a distinguished lecturer of the university. By 1186 he was back in England, where he again held the place of schoolmaster at Dunstable. The assertion that he was ever prior of St. Nicolas, Exeter, seems a mistake, but he was certainly much at court during some part of his life. Having become an Augustinian canon, he was appointed abbot of Cirencester in 1213. He died at Kempsey in Worcestershire in 1217, and was buried at Worcester. Besides theology he studied grammar and natural history, but his name is chiefly associated with nautical science. For in his *De naturis rerum* and *De utensilibus* (the former of which, at any rate, had become well known at the end of the 12th century, and was probably written about 1180) Neckam has preserved to us the earliest European notices of the magnet as a guide to seamen—outside China, indeed,

these seem to be the earliest notices that have survived in any country or civilization. It was probably in Paris that Neckam heard how a ship, among its other stores, must have a needle placed above a magnet (the *De utensilibus* assumes a needle mounted on a pivot), which needle would revolve until its point looked north, and thus guide sailors in murky weather or on starless nights. Neckam has no air of imparting a startling novelty: he merely records what had apparently become the regular practice of many seamen of the Catholic world.

See Thomas Wright's edition of Neckam's *De naturis rerum* and *De laudibus divinae sapientiae* in the Rolls Series (1863), and of the *De utensilibus* in his *Volume of Vocabularies*. Neckam also wrote *Corrogationes Promethei*, a scriptural commentary prefaced by a treatise on grammatical criticism; a translation of Aesop into Latin elegiacs (six fables from this version, as given in a Paris ms., are printed in Robert's *Fables inédites*); commentaries, still unprinted, on portions of Aristotle, Martianus Capella and Ovid's *Metamorphoses*, and other works. Of all these the *De nat. rer.*, a sort of manual of the scientific knowledge of the 12th century, is much the most important: the magnet passage herein is in book ii. chap. xcviii. (*De vi attractiva*), p. 183 of Wright's edition. The corresponding section in the *De utensil.*, is on p. 114 of the *Vol. of Vocabs.* Roger Bacon's reference to Neckam as a grammatical writer (*in multis vera et utilia scripsit: sed . . . inter auctores non potest . . . numerari*) may be found in Brewer's (Rolls Series) edition of Bacon's *Opera inedita*, p. 457. *See* also Thomas Wright, *Biographia Britannica literaria, Anglo-Norman Period*, pp. 449–459 (1846: some points in this are modified in the 1863 edition of *De nat. rer.*); C. Raymond Beazley, *Dawn of Modern Geography*, iii. 508–509. (C. R. B.; X.)

NECKAR, a river of Germany, 247 m. long, and a right-bank tributary of the Rhine, rises in the Hercynian gneisses of the Black forest, near Schwenningen and close to the headwaters of the Danube. It flows north and then north-east along the foot of the Jurassic scarp of the Swabian Jura, passing Rottweil, Rottenburg, and Tübingen. At Plochingen it changes its course flowing away from the scarp edge to Cannstatt near Stuttgart. The valley is very picturesque, becomes broader and deeper, is now navigable and lies between vine-clad hills being cut into the middle Trias sandstones. Continuing north past hills crowned by feudal castles, it runs by Heilbronn and Wimpfen to Eberbach. It now takes a tortuous westerly course, and the scenery on its bank becomes more romantic. Winding by Neckarsteinach and Neckargemünd between wooded heights, it sweeps beneath the Königsstuhl (1,900 ft.) washes the walls of Heidelberg, and quitting the valley enters the Rhine-trough from the right at Mannheim. (*See* RHINE.)

NECKER, JACQUES (1732–1804), French statesman, finance minister of Louis XVI., was born at Geneva in Switzerland. His father was a native of Cüstrin in Pomerania, and became a citizen of Geneva. Jacques Necker had been sent to Paris in 1747 to become a clerk in the bank of M. Vernet. He soon afterwards established the famous bank of Thellusson and Necker. Thellusson superintended the bank in London, and Necker the Paris branch. Both became extremely rich by loans to the treasury and speculations in grain. In 1763 Necker fell in love with Madame de Verménou, the widow of a French officer. But while on a visit to Geneva, Madame de Verménou met Suzanne Curchod, the daughter of a pastor near Lausanne, to whom Gibbon had been engaged, and brought her to Paris in 1764. Necker married Suzanne before the end of the year. She encouraged her husband to make himself a public position. He accordingly became an able director of the French East India Company, and defended it against the attacks of A. Morellet in 1769. Meanwhile he had made interest with the French government by lending it money, and was appointed resident at Paris by the republic of Geneva. Madame Necker entertained the chief leaders of the political, financial and literary worlds of Paris. In 1773 Necker won the prize of the Académie Française for an *éloge* on Colbert, and in 1775 published his *Essai sur la législation et le commerce des grains*, in which he attacked the free-trade policy of Turgot. His wife believed he could get into office as a great financier, and made him transfer his share in the bank to his brother Louis.

In October 1776 Necker was made finance minister of France, with the title of director of the treasury, which he changed in 1777 to director-general of the finances. He regulated the finances by attempting to divide the taille or poll tax more equally, by abolishing the "vingtième d'industrie," and establishing *monts de piété* (establishments for loaning money on security). But his greatest financial measures were his attempt to fund the French debt and his establishment of annuities under the guarantee of the state. In the operation of funding Necker rather pointed out the line to be followed than completed the operation. He treated French finance rather as a banker than as a political economist, and thus fell far short of Turgot, the greatest economist of his day. His establishment of provincial assemblies was only a timid application of Turgot's great scheme for the administrative reorganization of France. In 1781 he published his famous *Compte rendu*, in which he drew up the balance sheet of France. His dismissal in the same year was not really due to his book, but to the influence of Marie Antoinette, whose schemes for benefiting the duc de Guines he had thwarted.

In 1787 Necker was banished by "lettre de cachet" 40 leagues from Paris for attacking Calonne. In 1788 the country, which had at the bidding of the literary guests of Madame Necker come to believe that Necker was the only minister who could "stop the deficit," as they said, demanded Necker's recall, and in September 1788 he became once more director-general of the finances. Throughout the momentous months which followed the biography of Necker is part of the history of the French Revolution (*q.v.*). Necker put a stop to the rebellion in Dauphiné by legalizing its assembly, and then arranged for the summons of the states general. Throughout the early months of 1789 he was regarded as the saviour of France, but he regarded the states general as an assembly which should grant money, not organize reforms. But as he had advised the calling of the states general, and the double representation of the third estate, and then permitted the orders to deliberate and vote in common, he was regarded as the cause of the Revolution by the court, and on July 11 was ordered to leave France at once.

Necker's dismissal brought about the taking of the Bastille, which induced the king to recall him. He was received with joy in every city he traversed, but in Paris he proved himself unequal to the crisis. After his resignation (Sept. 1790) he lived at Coppet, near Geneva. Madame Necker died in 1794, and he lived with his daughter Madame de Staël (*q.v.*), and his niece, Madame Necker de Saussure. He died in 1804.

AUTHORITIES.—*Mémoires sur la vie privée de M. Necker* (Paris and London, 1818), by his daughter, Madame de Staël-Holstein, and the *Notice sur la vie de M. Necker* (Paris, 1820), by Auguste de Staël-Holstein, his grandson, published in the collection of his works edited by the latter in 1820–1821 (Paris, 15 vols.). The bibliography of his works is as follows:—*Réponse au mémoire de M. l'Abbé Morellet* (1769); *Éloge de J. B. Colbert* (1773); *Essai sur la législation et le commerce des grains* (1775); *Compte rendu au roi* (1781); *De l'administration des finances de la France* (3 vols., 1784); *Mémoire en réponse au discours prononcé par M. de Calonne* (1787); *De l'importance des opinions religieuses* (1788); *Sur l'administration de M. Necker, par lui-même* (1791); *Du pouvoir exécutif dans les grands états* (2 vols., 1792); *Réflexions sur le procès de Louis XVI.* (1792); *De la révolution française*, several editions, the last in 4 vols. (1797); *Cours de la morale religieuse* (1800); *Dernières vues de politique et de finance* (1802); *Manuscrits de M. Necker*, published by his daughter (1804); *Suites funestes d'une seule faute*, published after his death. *See* also *Le Salon de Madame Necker*, by the Vicomte d'Haussonville (2 vols., 1882), compiled from the papers at Coppet; Ch. Gomel, *Les Causes financières de la révolution française* (1892); and for contemporary tracts and pamphlets M. Tourneux, *Bibl. de l'histoire de Paris pendant la révolution* (vol. iv., 1906), also (for the earlier ones) *Collection complète de tous les ouvrages pour et contre M. Necker, avec des notes critiques . . .* (3 vols., Utrecht, 1781); Gambier Parry, *Mme. Necker, her Family and her Friends* (1913).

NECKING, in architecture, a narrow, horizontal band around a pier, pilaster, column or similar vertical form; especially the band which circles a Doric capital below the echinus or projecting portion, and above the astragal, or projecting moulding, which marks the junction of shaft and capital.

NECROPOLIS, a cemetery (*q.v.*) or burying-place (Gr. *νεκρός*, corpse, and *πόλις*, city).

NECROSIS, a term restricted in surgery to death of the whole or a portion of a bone. A severe inflammation, caused by

a violent blow, by the action of pyogenic microbes as in osteomyelitis or by the absorption of various poisons, as mercury and phosphorus, is the general precursor of necrosis. The dead part analogous to the slough in the soft tissues, is called a sequestrum or exfoliation. At first it is firmly attached to the living bone around; gradually, however, the dead portion is separated from the living tissue. The process of separation is a slow one. New bone is formed around the sequestrum, which often renders its removal difficult. As a rule the surgeon waits until the dead part is loose, and then cuts down through the new case and removes the sequestrum. The cavity in which it lay gradually closes, and a useful limb is the result. In pathology the term is given a wider meaning and is used for local death of a portion of any tissue; when the death is of individual cells, and therefore is microscopic, it is often termed molecular necrosis or necrobiosis.

NECTAR and **AMBROSIA** (*q.v.*), the nourishment of the gods in Homer and in Greek literature generally. Probably the two terms were not originally distinguished; but usually, both in Homer and in later writers, nectar is the drink and ambrosia the food. On the other hand, in Alcman nectar is the food, and in Sappho and Anaxandrides ambrosia the drink. Each is used in Homer as a fragrant unguent (as *Iliad*, xiv. 170; xix. 38).

NECTARINE, a smooth-skinned peach (*q.v.*). Besides lacking the fuzz found on peaches, the fruits of nectarines are usually smaller, have firmer flesh, more aroma and a richer flavour. There are cling-stone and free-stone nectarines; like peaches they may have red, yellow or white flesh; the stones and kernels of the two fruits are indistinguishable, nor do nectarine trees differ from peach trees in any character. They are adapted to the same soil and climatic conditions and require the same care in the orchard.

The nectarine, which has been known for 2,000 years, is the classical example of bud and seed variation.

NEED-FIRE or **WILD-FIRE,** a term of folk-lore to denote a superstition which survived in the Highlands of Scotland until a recent date and had its origin in the early ideas of the purifying nature of flame. The need- or wild-fire is made by the friction of one piece of wood on another, or of a rope upon a stake. It is a practice of shepherd peoples to ward off disease from their herds and flocks; it is kindled on occasions of special distress, and the cattle are driven through it. Its efficacy is believed to depend on all other fires being extinguished (Pröhle, *Harz-Bilder*, Leipzig, 1855; Kelly, *Curiosities of Indo-European Tradition and Folklore*, p. 53 *seq.*).

See also Grimm, *Deutsche Mythologie*, i. 501 *sqq.*; Kelly, *Curiosities of Indo-European Tradition and Folklore*, p. 48 *sqq.*; Elton, *Origins of English History*, p. 293, *sqq.*; J. G. Frazer, *The Golden Bough*, iii. 301.

NEEDHAM, town of Norfolk county, Massachusetts, U.S.A., 12 m. S.W. of Boston, on the Charles river, and served by the New York, New Haven and Hartford railroad. Pop. (1925) 8,977 (State census). It is a residential suburb and has large factories making knit goods and surgical instruments. The town was set off from Dedham and incorporated in 1711.

NEEDLE. An instrument adapted for passing a thread through fabrics in sewing, consisting of a thin rod of steel, having a pointed end and pierced with a hole or "eye" to carry the thread.

The modern high quality needle is made from Sheffield crucible cast steel. The type of steel varies according to the purpose of the needle, thus hosiery needles are milder, *i.e.*, softer than sewing needles. In addition to grading the initial hardness of the steel to the particular type of needle there has also been a forward movement in the use of alloy steels for specific purposes. Thus with gramophone needles tungsten alloy steels have proved successful, and the high chromium or non-rustless steels have a very evident value in the case of surgical and hypodermic needles. The steel is hot rolled down into rod and the rod subsequently cold drawn into wire of the required diameter. The finished drawn wire is fed through straightening machines which also automatically cut the wire into pre-determined lengths. In hand sewing needles the length cut is always that required to form two needles. The cut lengths are packed in packets of a standard weight, according to diameter of wire, for delivery to the needle maker.

The first stage in the making of the needle is to secure absolute straightness and uniformity of physical condition. This is achieved by a method technically termed "rubbing." A number of blanks are heated to a uniform dull red heat, placed within two steel rings, and rubbed to and fro over a flat steel plate. The rotation of the wires within the containing rings results in perfect straightness and the gradual cooling from a dull red heat gives uniformity of physical condition.

The lengths are then automatically pointed by feeding from a container and being rotated over a revolving grindstone by a wheel running at right angles to the stone. The curvature of the face of the grindstone and the inclination of the traversing wheel are adjusted to the requisite contour of point. The lengths are reversed and the process repeated—thus giving a blank with two pointed ends. This automatic grinding applies to all hand sewing needles; it should be noted that machine needle points are swaged, *i.e.*, the points are formed by cold hammering between dies. The double length hand needle is fed into an automatic press which stamps the grooves at the head of each needle and in a second operation pierces the eyes of each needle and nearly separates the two. Complete separation and dressing of the head and eye are now effected mechanically.

The needle thus formed is in its soft state and as with steel cutting tools it requires hardening to bring it into service condition. Hardening is effected by quenching in oil from a red heat and in practice the operation has become nearly automatic. The hardened needles are then tempered by heating to a blue heat in order to give resilience or springiness. As with hardening, tempering in bulk is now an automatic process. The tempered needles are to some extent discoloured by the heating and the final stages are found in scouring to remove this discolouration, and polishing to obtain the silver bright finish. Scouring is effected by packing the needles in flexible containers with various mixtures all having a fine emery base and mechanically rolling the container up and down an iron roller path. Polishing is done in a similar manner with polishing reagents replacing the scouring mixtures. The polished needles are rolled down an inclined plane to bring the heads all in one direction; examined; graded, and made up into packets for sale. (P. Lo.)

NEEDLE-GUN, a military breech-loading rifle (Zündnadelgewehr), famous as the arm of the Prussians in 1866 and of the Germans in 1870–71. It was the invention of the gunsmith Johann Nicholas von Dreyse (1787–1867), who, beginning in 1824, had made many experiments, and in 1836 produced the complete needle-gun. From 1841 onwards the new arm was gradually introduced into the Prussian service, and later into the military forces of many other German states. Dreyse was ennobled in 1864. In practice the needle-gun proved to have numerous defects; its effective range was very short compared to that of the muzzle-loading rifles of the day, and conspicuously so as against the chassepot; the escape of gas at the breech was, moreover, very great. A paper cartridge was used. An improved model, giving greater muzzle velocity and increased speed in loading, was introduced later, but this was soon replaced by the Mauser rifle.

NEEDLEWORK. This subject may be considered under the two headings: (1) plain needlework, for purely utilitarian purposes; (2) art needlework, for decorative purposes. Plain needlework requires no such further explanation as may be given in the case of art needlework, under which title are included embroidery and other methods of decorative needlework, such as applied or appliqué work, ornamental quilting, patchwork and couching. In these last-mentioned methods the needlework is subservient to the decorative effect, which depends almost wholly upon the materials selected for the purpose; whereas in embroidery the needlework itself constitutes and is the visible decoration. The aim of this article is to indicate briefly different stitches of plain needlework and to show that these stitches are also used in art needlework.

The more necessary stitches in plain needlework for making clothes are tacking, running, hemming, feather-stitching or herring-boning (all of which are practically of the same type), and button-holing in which the thread is looped as each stitch is

made. Button-holing is allied to another looped stitch, namely chain-stitching, which though frequently used in embroidery is rarely if ever used in plain needlework. For repairs of clothes and household linen, etc., the principal stitch is darning; grafting, however, is a substitute for it, and varies with the character of the stuff to be repaired, *e.g.*, knitted stockings, damask linen, cloth, etc. Darning is allied to running, and grafting to patchwork. Patchwork as a form of decorative needlework is exemplified in sumptuous canopies and seat covers made several centuries B.C. by Egyptians, and rich hangings made by Italian and French workers in the 16th century.

Long and short stitches, kindred in principle to the running stitch in plain needlework, are perhaps the more frequent of any stitches used in embroidery, and are especially appropriate when the blending of tints with a flat even surface is the effect to be aimed at. Much mediaeval work of this character, as well as that done with chain stitch and its allied split stitch, is regarded as typical of *opus anglicanum*. Chain stitch produces a comparatively broken surface in decided contrast with the smooth one of long and short stitch, split stitch and satin stitch embroidery. Satin stitch is well adapted to express, with even flat surface in designs for colour effects, each mass which is to be of one tint. In this respect, therefore, satin stitch serves a purpose in contrast to that of long and short stitch. A characteristic of satin-stitching is the sheeny effect produced, on both sides of the material embroidered, by parallel stitches taken closely together. Buttonhole stitch in relation to art needlework prevails to a great extent in cut linen and drawn-thread work (often called Greek lace), and predominates in the making of needlepoint lace. In much of the Persian drawn-thread work, however, it is superseded by whipping or tightly and closely twisting a thread round the undrawn threads of the linen. Whipping has been put to another use in certain 16th century art needlework for ecclesiastical purposes, where round the gold threads employed as the ground of a design coloured silks are dexterously whipped, closely and openly, producing gradations of tint suffused with a corresponding variation of golden shimmer.

Another important branch of art needlework with gold and silver threads is couching. When the metallic threads, arranged so as to lie closely together, are simply stitched flatly to the foundation material, the work is called flat couching or laying, a kind of treatment more frequent in Chinese and Japanese than in European art needlework. Flat couching is also carried out with floss silks. When a design for couching includes effects in relief, stout strings or cords as required by the design are first fastened to the foundation materials, and over them the metallic threads or in some cases coloured gimps are laid, and so stitched as to appear in miniature like varieties of willow-twisting or basket work.

Appliqué or applied work belongs as much as patchwork to the mediaeval category of *opus consutum*, or stitching stuffs together according to a decorative design, the greater part of which was cut out of material different in colour, and generally in texture, from that of the ground to which it was applied and stitched. Irish art needlework, called Carrickmacross lace, is for the most part of cambric applied or appliqué to net.

Quilting is also a branch of art needlework rather than embroidery. Indians and Persians using a short running stitch have excelled in it in past times. Some good quilting was done in England in the 18th century with chain-stitching which lay on the inner side of the stuff, the outer displaying the design in short stitches. In the account of his voyage to the East Indies, published in 1655, Edward Terry (1590–1665) writes of the Indians "making excellent quilts of satin lined with taffeta betwixt which they put cotton wool and worked them together with silk." In many of the rural sections of the United States, especially those of the South, great interest has been maintained in making patch quilts for bed covering. Quilting parties are still extant, and the different designs accumulated by the family are the source of much pride. (*See* also LACE; HOME SEWING; TEXTILES AND EMBROIDERIES.)

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NEEMUCH or NIMACH, a town of Central India, with a British military cantonment, within the state of Gwalior, on the border of Rajputana. The pop. of the cantonment in 1921 was 10,490. In 1857 it was the most southerly place to which the Mutiny extended. The brigade of Indian troops of the Bengal army, which was stationed there, mutinied and marched to Delhi, the European officers taking refuge in the fort, until relieved by the Malwa field force. Since 1895 it has been the headquarters of the political agent in Malwa.

NEENAH, a city of Winnebago county, Wisconsin, U.S.A., 85 m. N. by W. of Milwaukee, on Lake Winnebago at its outlet into the (canalized) Fox river. It is on Federal highway 41, and is served by the Chicago and North Western, the Chicago, Milwaukee, St. Paul and Pacific, and the Soo Line railways, and by river steamers. Pop. (1920) 7,171 (84% native white). Neenah and Menasha, across the river, are practically one community. It is the centre of a large cheese industry. The city was chartered in 1873. Its name means "running water" or "rapids."

NEER, VAN DER, the name of two Dutch painters.

1. AERNOUT VAN DER NEER (1603–1677), commonly called Aert or Artus, was born at Gorkum in 1603. Houbraken states that he had been steward to a Dutch nobleman, and only took up painting seriously when he settled in Amsterdam. From 1658 to 1662 he kept a wine shop, but this venture ended in bankruptcy. Though Van der Neer seems to have made Amsterdam his home, he was evidently familiar with the canals and woods about Haarlem and Leyden and the reaches of the Maes and the Rhine. Occasionally, too, he painted in the neighbourhood of Dort, the home of Albert Cuyp, with whom he drifted into a curious partnership. Cuyp is said to have painted the foreground and cows of Van der Neer's sunset landscape in the Louvre and his signature is seen on the milkmaid's pail near the edge of the Van der Neer in the National Gallery, London. At the Staedel Institute in Frankfurt there is also a landscape in which the figures, a fisherman with a dog and a sportsman, are probably by Cuyp. Van der Neer may be said to have reached maturity with his "Moonlit landscape with a ruined castle" (1646), now in the Max Flersheim collection in Paris. His favourite subjects were the Dutch waterways at sunset; moonlight scenes; daylight icescapes with frozen water, sleighers and fishermen; and paintings of fires after dark.

2. EGLON VAN DER NEER (1634–1703), son of the above, was born at Amsterdam in 1634. He was first taught by his father and afterwards by Jacob van Loo, whom he accompanied or followed to Paris in 1663. In 1666 he went to Rotterdam, from there to Brussels and finally to Düsseldorf, where he entered the service of the elector-palatine Johann Wilhelm. Later, a portrait of the princess of Neuberg led to his appointment as painter to the king of Spain. He painted landscapes in the style of Adam Elsheimer and was one of three painters employed to put figures into the town views of Jan van der Heyden. His portraits are reminiscent of Netscher and his genre pictures come near to those of Ter Borch and Metsu in delicacy of touch. The "Lady with the Book" (1665) was sold together with the Bredel collection in 1875. A young woman in white and red satin at Rotterdam (1669) recalls Mieris, whose style also reappears in Eglon's "Cleopatra" at Buckingham Palace. Two landscapes with "Tobit and the Angel," dated 1685 and 1694, in the museums of Berlin and Amsterdam, illustrate his fashion of setting Scripture scenes in Dutch backgrounds. His most important sacred composition is the "Esther and Ahasuerus" (1696), in the Uffizi at Florence. But Eglon varied his practice also with arrangements of hunting and hawking parties, pastures and fords. The latest of his panels is a mountain landscape of 1702 in the gallery of Augsburg. He died at Düsseldorf on May 3, 1703.

(J. A. C.; X.)

NEERWINDEN, a village of Belgium in the province of Liége, a few miles E. by S. of Tirlemont, which gives its name to two great battles, the first fought in 1693 between the Anglo-Allied army under William III. of England and the French under the duke of Luxemburg (*see* GRAND ALLIANCE, WAR OF THE) and

the second in 1793 between the Austrians under Prince Josias of Coburg and the French under General Dumouriez.

NEES VON ESENBECK, CHRISTIAN GOTTFRIED (1776–1858), German botanist and entomologist, was born at Erbach on Feb. 14, 1776, and was educated at Darmstadt and at Jena, where he took the degree of M.D. After practising as a doctor, he was appointed professor of botany in Erlangen in 1816. Three years later he became professor of natural history in Bonn, and in 1831 he was appointed to the chair of botany in the university of Breslau. For his political activities in 1848, he was deprived of his professorship in 1851, and after spending the rest of his life in poverty, he died in Breslau on March 16, 1858.

For some years he edited the *Nova acta* of the "Acad. Leopold-Carolina," in which several of his own papers were published. His best-known works are those that deal with the *Fungi*, the *Hepaticae* and the *Glumiferae*, in all which groups he made valuable additions to knowledge.

NEGAPATAM, a seaport of British India, in the Tanjore district of Madras, forming one municipality with Nagore, a port 3 m. N. at the mouth of the Vettar river. Pop. (1921) 54,016. It carries on a brisk trade with the Straits Settlements and coast ports, steamers running fortnightly to the Straits. Ground nuts, cotton goods, tobacco and vegetables are exported. Vessels lie 2 m. off shore. Negapatam is the terminus of a branch of the South Indian railway, with large railway workshops, and has two technical institutes. It is also a depot for coolie emigration. Negapatam was one of the earliest settlements of the Portuguese on the Coromandel coast. It was taken by the Dutch in 1660, becoming their chief possession in India, and by the English in 1781. From 1799 to 1845 it was the headquarters of Tanjore district.

NEGAUNEE (nę-gaw'nę), a city of Marquette county, Michigan, U.S.A., 12 m. W. by S. of Marquette, near Lake Superior, at an altitude of 1,564 ft. It is on federal highway 41, and is served by the Chicago and North Western, the Duluth, South Shore and Atlantic and the Lake Superior and Ishpeming railways. The population was 7,419 in 1920 (33% foreign-born white). It is one of the important mining centres of the Upper Peninsula, surrounded by iron mines of both the deep-shaft and the open-pit type. A monument marks the spot where iron ore was first found (1844) in the Lake Superior region. Settlement here began about 1870 and the city was chartered in 1873. The name is a Chippewa word meaning "first" or "he goes before," chosen by the Pioneer Iron company as meaning "pioneer."

NEGLIGENCE, a ground of civil law liability, and in criminal law an element in several offences, the most conspicuous of which is manslaughter by negligence. In order to establish civil liability on the ground of negligence, three things must be proved —a duty to take care of, the absence of due care, and actual damage caused directly by the absence of due care. The duty may be to the public in general, on the ground that any person who does anything which may involve risk to the public is bound to take due care to avoid the risk. For instance, in the words of Lord Blackburn, "those who go personally or bring property where they know that they or it may come into collision with the persons or property of others have by law a duty cast upon them to use reasonable care and skill to avoid such a collision." Where a special duty to an individual is alleged, the duty must rest on a contract or undertaking or some similar specific ground. Thus, where a surveyor has carelessly given incorrect progress certificates, and a mortgagee who has had no contractual relation with the surveyor has advanced money on the faith of the certificate, the surveyor is not liable to the mortgagee in an action of negligence; because he owed no duty to the mortgagee to be careful. When a duty to take care is established, the degree of care required is now determined by a well-ascertained standard. This standard is the amount of care which would be exercised in the circumstances by an "average reasonable man."

Ordinarily a man is responsible only for his own negligence and for that of his servants and agents acting within the scope of their authority. For the acts or defaults of the servants of an independent contractor he is not liable. But in certain cases a stricter obligation is imposed on him by law. Thus, while the occupier of premises is under no duty whatsoever to trespassers, who must take the premises as they find them, and while he is under no duty to mere licensees other than the duty of seeing that there are no concealed dangers in the nature of traps, he is under a duty to invitees and to all persons entering as of right to see that the premises are in a reasonably safe condition so far as reasonable care and skill can make them so; and from such duties he cannot release himself by employing an independent contractor to maintain or repair the premises. The effect of this doctrine is that the occupier may be liable if it can be shown that the independent contractor or his servant has been guilty of a want of due care. A similar obligation has been enforced in the case of a wreck stranded in a navigable river, and the owner was held liable for damage caused by the carelessness of the servant of an independent contractor who had undertaken to light the wreck. So too any person who undertakes a work likely to cause danger if due care is not taken is liable for damage caused by the carelessness of the servant of an independent contractor, so long as the carelessness is not casual or collateral to the servant's employment.

In an action of negligence a familiar defence is "contributory negligence." This is a rather misleading expression. It is not a sufficient defence to show that the plaintiff was negligent, and that his negligence contributed to the harm complained of. The plaintiff's negligence will not disentitle him to recover unless it is such that without it the misfortune would not have happened, nor if the defendant might by the exercise of reasonable care on his part have avoided the consequences of the plaintiff's negligence. The shortest and plainest way of expressing this rule is, that the plaintiff's negligence is no defence unless it was the approximate or decisive cause of the injury. There was an attempt in recent times to extend this doctrine so as to make the contributory negligence of a third person a defence, in cases where the plaintiff, though not negligent himself, was travelling in a vehicle or vessel managed by the negligent third person, or was otherwise under his control. In such circumstances it was said that the plaintiff was "identified" with the third person. But the case of the "Bernina," decided in 1888, where a passenger and an engineer on board the "Bushire" were killed in a collision between the "Bernina" and the "Bushire" caused by fault in both ships, but without fault on the part of the deceased, exploded this supposed doctrine, and made it clear that the defence of contributory negligence holds good only when the defendant contends and proves that the plaintiff was injured by his own carelessness.

The American law of negligence is founded on the English common law; but the decisions in different States have occasionally contradicted English decisions, and also one another.

See T. G. Shearman and A. A. Redfield, *The Law of Negligence* (3rd ed., 1874); S. D. Thompson, *Commentaries on Negligence* (7 vols., Indianapolis, 1901–07); T. Beven, *Negligence in Law* (4th ed., 1928). (A. Ll. D.)

NEGOTIABLE INSTRUMENT, in law, a document or other instrument purporting to represent an obligation involving so much money, and the property in which passes, like money, by mere delivery or by endorsement and delivery. Negotiable instruments arise in either of two ways: (1) by statute, (2) by custom of merchants. The most commonly recognized negotiable instruments are bills of exchange, promissory notes, bills of lading, foreign bonds, debentures payable to bearer, and endorsed share certificates, such as are issued in Canada and the United States. Negotiable instruments constitute an exception to the general rule that a man cannot give a better title than he has himself. (*See* BILL OF EXCHANGE.)

NEGRITOS (Span. for "little negroes"), the name originally given by the Spaniards to the aborigines of the Philippine Islands. They are physical weaklings, of low, almost dwarf, stature, with very dark skin, closely curling hair, flat noses, thick lips and large clumsy feet. The term is now applied to one of the elements of the population of S.E. Asia, Indonesia and Oceania. The true negritos are always of little stature (the majority under 5 ft.), have rounded forms and their skull is relatively short and broad and of little height. Their skin is dark brown or black.

sometimes somewhat yellowish, their hair woolly (scanty on face and body), and they have the flat nose and thick everted lips and other physical features of the negro. Among negrito peoples are the Andamanese (*q.v.*), the Semang, Malay Peninsula and E. Sumatra (*q.v.*), the best types being the Tapiro (New Guinea) and Aetas (Philippines). There is evidence, physical, cultural and traditional, of a negrito substratum in the population of Assam (*Man in India*, VII. 4. 1927), while traces have been found by Hüsing along the Persian gulf. It is therefore an old element which survives in purity only among the Andamanese.

See A. de Quatrefages, *Les Pygmées* (Paris, 1887; Eng. trans. 1895); A. R. Broman, *The Andaman Islanders* (1922); *Album von Philippinen-Typen* (Dresden, 1885); Blumentritt, *Ethnographie der Philippinen* (Gotha, 1892); A. B. Meyer, *Die Negritos* (Dresden, 1899); A. H. Keane, *Ethnology;* A. C. Haddon, *The Races of Man* (1924); Roland B. Dixon, *Racial History of Mankind* (1923).



BY COURTESY OF THE HERLING NEW GUINEA EXPEDITION

NOGULLA NEGRITO OF NEW GUINEA WITH HIS CLUB

NEGRO, the designation of the distinctly dark-skinned, as opposed to the fair, yellow and brown races of mankind (from Lat. *niger*, black). In this sense it embraces the dark races, of the intertropical and sub-tropical regions of the eastern hemisphere, from Senegambia, West Africa, to the Fijian islands in the Pacific. It is convenient, however, to refer to the dark-skinned inhabitants of this zone by the collective term of *Negroids*, and to reserve the word *Negro* for the tribes found in Africa south of the Sahara and north of a not very well-defined line running roughly from the gulf of Biafra with a south-easterly trend across the equator to the mouth of the Tana. The Bantu Negroids are south of this line. The yellowish-brown Bushman and Hottentot (*qq.v.*) peoples of South Africa possess certain Negroid characters, the tightly curled hair, the broad nose, the tendency towards prognathism; but the relation is not close. The Negroids of Africa, Melanesia and Australasia have in common a number of characteristics such as:—A dark skin, varying from dark brown, reddish-brown or chocolate to nearly black; dark tightly curled hair, flat in transverse section, of the "woolly" or the "frizzly" type; a greater or less tendency to prognathism; eyes dark brown with yellowish cornea; nose more or less broad and flat; and large teeth. The Negro hair is flat, issues from the epidermis at a right angle, is spirally twisted or crisped, has no central duct, the colouring matter being disseminated through the cortex and intermediate fibres, while the cortex itself is covered with numerous rough, pointed filaments, adhering loosely to the shaft; lastly, the Negro pile will felt, like wool, whereas true hair cannot be felted. The true Negro (western Sudan type) is of tall stature, burly, short-legged, usually long-headed, with bulging forehead. A broad headed element of obscure origin extends across the continent. (For the Negro in the United States *see* NEGRO, THE AMERICAN.)

In Africa three races have intermingled to a certain extent with the Negro; the Libyans (Berbers, *q.v.*) in the Western Sudan; and the Hamitic races (*q.v.*) and Arabs (*q.v.*) in the east. The Bantu-speaking peoples in the southern portion of the continent approach the Hamites in those characteristics in which they differ from the true Negroes, and probably have a proportion of Hamitic blood.

The colour of the skin, which is also distinguished by a velvety surface and a characteristic odour, is due to the greater abundance of the colouring matter in the mucous membrane between the inner or true skin and the epidermis. This colouring matter is not distributed equally over the body, and does not reach its fullest development until some weeks after birth. The dark colour seems to depend neither on geographical position, the isothermals of greatest heat, nor even altogether on racial purity. The extremes of the chromatic scale are found in juxtaposition throughout the whole Negro domain, in Senegambia, the Gabun, upper Nile basin, lower Congo, Shari valley, Mozambique, ranging from dusky or yellow brown to sooty black. Some of the mixed races, such as many Abyssinians, Galla, Jolof and Mandingo, are quite as black as the darkest full-blood Negro. The development of pigment in the dark-skinned races as a natural protection against the ultra-violet rays in which tropical light is so rich must be viewed as merely a part of a many sided modification of the skin under torrid conditions.

In certain of these characteristics the Negro stands on a lower evolutionary plane than the white man, and is closely related to the highest anthropoids. The characteristics are length of arm, prognathism, a heavy massive cranium with large zygomatic arches, flat nose depressed at base and the tendency of the frontal bones to fuse together and form an eminence of peculiar shape. But in respect to the character of the hair, the white man stands in closer relation to the higher apes than does the Negro.

Mental Qualities.—In reviewing the comparative studies of the differences between the Negro and the modern European, Carr-Sanders concludes that "there seems to be no marked difference in innate intellectual power. The differences are rather differences in disposition and temperament. . . . The apparent arrest of development may not be so much an inevitable result of the kind of mental faculties which are inherited as the coming into play of a peculiar tradition." (*Population Problem*, 1922, p. 397.)

It is not fair to judge of the Negro's mental capacity by tests taken directly from the environment of the white man, as for instance tests in mental arithmetic; skill in reckoning is necessary to the white race, and it has cultivated this faculty; but it is not necessary to the Negroes, who often surpass white men in acuteness of vision, hearing, sense of direction and topography. Given suitable training, the Negro is capable of becoming a craftsman of considerable skill, particularly in metal work, carpentry and carving. The bronze castings by the *cire perdue* process, and the cups and horns of ivory elaborately carved, which were produced by the natives of Guinea after their intercourse with the Portuguese of the 16th century, bear ample witness to this.

Social Conditions.—Generally speaking the Negro is first and foremost an agriculturist. Next in importance to agriculture come hunting and fishing and, locally, cattle-keeping. The last is not strictly typical of Negro culture at all; nearly all the tribes by whom it is practised are of mixed origin, except perhaps the Dinka of the upper Nile, the whole of whose existence centres round the cattle pen. The social conditions are usually primitive, especially among the Negroes proper, being based on the village community ruled by a chief. Where the country is open, or where the forest presents no great obstacle to communication, a chief has often extended his rule over several villages and has ultimately built up a kingdom administered by sub-chiefs of various grades, and has even established a court with a regular hierarchy of officials. This "empire-building" has reached its greatest proportions in the south of the forest belt in the territory of the Bantu Negroids, where arose the states of Lunda, Cazembe, etc.

The domestic life of the Negro is based upon polygyny, so vital an element of the native social system that attempts to abolish plurality of wives would result in the most serious social disorder. Descent in the Negro world is often reckoned through the female, though many tribes with a patriarchal system are found. Traces of totemism are found sporadically. Secret societies are found in their highest development among the Negroes of the west coast.

The Negro is principally a vegetarian. Meat is everywhere regarded as a great delicacy. The cattle-keeping tribes rarely slaughter for food, because cattle are a form of currency. Fish is also an important article of diet in the neighbourhood of large rivers, especially the Nile and Congo. The two cultivated plants which form the mainstay of native life, manioc in the west and centre and mealies in the south and east, are neither of African origin. Cannibalism (*q.v.*) is found in its simplest form in Africa, where the majority of cannibal tribes eat human flesh because they like it. Among the true Negroes it is confined mainly to the

Welle and Ubangi districts, though found sporadically (and due to magical motives) on the west coast, and among the Bantu Negroids in the south-western part of Belgian Congo and the Gabun.

The most important craft is that of iron smelting and working. A good deal of aptitude is shown in the forging of iron, despite the primitive tools. Considerable skill in carving is also found in the west and among the Bantu Negroids, especially of Belgian Congo south of the Congo. Weaving is practised to a large extent in the west; the true native material being palm-leaf fibre. The cultivation of cotton has become important in West Africa. Among the Bantu of the Kasai district the art of weaving palm-cloth reaches its highest level, and in the east cotton-weaving is again found. Pottery-making is almost universal, though nowhere very advanced; the wheel is unknown, though an appliance used on the lower Congo displays the principle in rudimentary form. The production of fire by friction was universal, the method known as "twirling" being in vogue, *i.e.*, the rapid rotation between the palms of a piece of hard wood upon a piece of soft wood.

Trading is practised either by direct barter or by rude forms of currency which vary according to locality. Value is reckoned among the tribes with pastoral tendencies in cattle and goats; among the eastern Negroes by hoe- and spear-blades and salt blocks; in the west by cowries, brass rods and bronze armlets (manilas); in Belgian Congo variously by *olivella* shells, brass rods, salt, goats and fowls, copper ingots and iron spear-blades, etc.

Religion.—In the western forests where communities are small the Negro is a fetishist, combined more or less with nature worship. Where communication is easier worship becomes more systematic, and definite supernatural agencies are recognized, presiding over definite spheres of human life. Ancestor-worship appears and often assumes paramount importance, and is typical of all the eastern and southern portions of the continent. Malignant powers receive attention from man, with a view to propitiation or coercion. Beneficent agencies require no attention, since, from their very nature, they must continue to do good. In the western culture area, among both Negro and Bantu Negroid tribes, is the belief that any form of death except by violence must be due to evil magic exercised by, or through the agency of, some human individual; to discover the guilty party the poison ordeal is freely used. Similar ordeals are used in British Central Africa to discover magicians, and the wholesale "smelling-out" of "witches," was well-known among the Zulu-Xosa tribes. Everywhere magic, both sympathetic and imitative, is practised, both by the ordinary individual and by professional magicians, and most medical treatment is based on this, although the magician is usually a herbalist of some skill. Where the rainfall is uncertain, the production of rain by magical means is one of the chief duties of the magician, a duty which becomes paramount in the eastern plains among Negroes and Bantu Negroids alike.

Negroes and Negroids have been considerably influenced by Mohammedanism along the whole extent of country bordering the Sahara and in the east. Islam is simple, categorical and easily comprehended; it does not upset the native social system, especially in the matter of polygyny, and discourages indulgence in drink. Moreover, the number of native missionaries is considerable, and they are nearer to the people than strangers.

The Bantu Negroids all speak dialects of one tongue (*see* BANTU LANGUAGES). The Sudanic family of languages is spoken in the area recognized as the habitat of the Negro, but Hamitic speech (Nilotic group) is also used by Negroes.

See the excellent bibliography in *Africa I.* 3, p. 240 *sqq.* (1928) by Henri Labruret for the most important modern works, and A. B. Ellis, *The Tshi-speaking Peoples* (1887); *The Ewe-speaking Peoples* (1890); *The Yoruba-speaking Peoples* (1894).

NEGRO, THE AMERICAN. The migration of the European fair-skinned races in large numbers to other parts of the earth occupied by people of darker colour created a whole series of problems in the adjustment of racial relations which were almost unknown to the ancient world or to the life of modern Europe. These problems have been and are perhaps more acute in the United States than elsewhere, because there the lightest and the darkest races have commingled, because of the theory on which the government of the country nominally rests, that each freeman should be given an equal chance to improve his industrial position and an equal voice in deciding political questions, and because of the long-time almost irreconcilable differences in the public opinion of the two great sections of America. They were not solved by the Civil War and emancipation, but their nature was radically altered.

During the colonial period, and down to the changes initiated by the invention of the cotton gin, Negroes were distributed with some evenness along the Atlantic coast. Between the date of that invention and the Civil War, and largely as a result of the changes the cotton gin set in motion, the tendency was towards a concentration of the Negroes in the great cotton-growing area of the country. In 1700, for example, one-ninth of the population of the colony of New York was Negro; in 1900 only one-seventieth of the population of the Empire State belonged to that race. In the States north of Mason and Dixon's line, in all of which but Missouri Negro slavery either never existed or else was abolished before the Civil War, the white population increased tenfold and the Negro population only fourfold between 1790 and 1860. In the States south of that line, on the contrary, the southern States, the Negro population in the same period increased sixfold and the white population not so fast. It was a widespread opinion shortly after the Civil War that the emancipated slaves would speedily disperse through the country, and that this process would greatly simplify the problems arising from the contact of the two races. This expectation has not been entirely falsified by the result. Between 1860 and 1900 the Negroes in the northern States increased somewhat more rapidly than the northern whites, and those in the southern States much less rapidly than the southern whites. The five States with the greatest amount of Negro increase between 1900 and 1910 were all southern States. The increase in them was nearly one-half (49%) of that of the whole country. The five States which occupied a similar position between 1910 and 1920 were Pennsylvania, Ohio, Illinois, North Carolina and New York, four of them northern States, and the increase in them was nearly three-fifths (58%) of the whole. These four northern States are highly urbanised. The facts suggest a migration to industrial centres. The conjecture may be tested by computing the percentage of increase of urban population both Negro and white. From 1900 to 1910 the whites in cities having 2,500 inhabitants or more increased 39·1% and the Negroes 34·2%; from 1910 to 1920 the percentage of increase decreased for each race, but among the whites it fell 10·5% to 28·6%, and among Negroes it fell 1·6% to 32·6%, so that between 1910 and 1920 Negroes in cities increased at a higher rate than the whites.

The large amount of Negro migration to northern cities between 1910 and 1920 and the comparatively slight migration in 1900–10 appear from the following table:—

City	Negro population in 1900	Increase of Negroes	
		1900–10	1910–20
Chicago	30,150	13,953	65,355
New York	60,666	31,043	60,758
Philadelphia	62,616	21,846	49,770
Detroit	4,111	1,630	35,097
Cleveland	5,988	2,460	26,003
St. Louis	35,516	8,444	25,894
Total	199,047	79,376	262,877

The preceding figures are for the cities in which the Negro population increased by 25,000 or more between 1910 and 1920. All lie outside of the southern States. The Negro population of these six cities increased between 1900 and 1910 by 39%, and between 1910 and 1920 by 95%. As the increase of Negroes in all northern States between 1910 and 1920 was 444,635, nearly three-fifths (59%) of that increase was in these six cities.

The question "Have the American Negroes progressed, ma-

terially and morally, since emancipation?" is generally answered in the affirmative. But even on this question entire unanimity is lacking. Probably all competent students would admit, however, that the race has differentiated since 1865.

Evidence with regard to the progress of the American Negro is set forth under the following heads: numbers, showing ratio of Negro per cent of increase to White population; births and deaths, showing natural increase or decrease of Negroes by States; health, morals, and citizenship.

Numbers.—The Negro population of the United States as enumerated in 1920 was 10,463,131, an increase of 635,368, or 6·5% over 1910. The rate of increase was less than in any preceding decade and less than three-fifths of that between 1900 and 1910, the smallest up to that time. As in the white population the rate of increase between 1910 and 1920 was less than in any preceding decade. It might be thought that the fall in the increase among Negroes conformed to the trend of population change, but this would be an error. The rate of increase of Negroes in 1900–10 was about ·5 and in 1910–20 about ·4 of that of the whites. That this deviation in the rates of increase had been maintained for a long period appears from the following figures:—

Period	Increase				Ratio of Negro per cent of increase to White (100)
	Amount in thousands		Per cent		
	Negro	White	Negro	White	
1800–20	770	3,560	76·8	82·7	93
1820–40	1,102	6,329	62·2	80·5	77
1840–60	1,568	12,727	54·6	80·7	61
1860–80	2,139	16,481	48·2	61·2	79
1880–1900	2,253	23,289	34·2	53·9	64
1900–20	1,629	28,012	18·4	41·9	44

The numerical increase of Negroes was larger in the later periods, rising to a maximum in the last 20 years of the 19th century. The rate of increase, on the contrary, diminished steadily. At each period the rate of Negro increase was less than that of the white. Apparently the immediate result of the Civil War and emancipation was to raise the relative rate of Negro increase between 1860 and 1880 from ·6 to nearly ·8 of that of the whites. But since 1880 the rate of Negro increase has fallen rapidly, and Negroes, who in 1800 were 18·9% of the country's population, in 1920 were only 9·9%. If each race should increase through the present century as it did between 1900 and 1920, the population of the country in A.D. 2000 would be over 400,000,000, of which about 20,000,000, or one-twentieth, would be Negro. The rate of increase of each race is likely to fall, but the difference in favour of the white race is not likely to diminish.

Births and Deaths.—The remarkable fall in the rate of Negro increase and the rapid distribution of Negroes to other parts of the country than the South, especially to certain northern cities, are the striking changes revealed by the fourteenth census. How is the fall in the rate of increase to be explained? Has it any connection with the growth of interstate migration? These questions are elucidated by turning from the census figures of living population to the registration figures of births and deaths. The following tables show the registered births and deaths of Negroes in each of 30 States arranged in the order of increasing proportion of deaths to births.

If Negro deaths had exceeded births in the 17 states of the last table between 1910 and 1920, and if there had been no immigration of Negroes to this group of states, the number of resident Negroes would have been less in 1920 than in 1910. In fact, it increased from 352,120 to 1,113,940 or 30·7%. The total immigration to these States for the decade was probably not less than 300,000.

There are seven southern States for which we have births and deaths reported, and all but Kentucky had an excess of births over deaths. The Negro population of these States increased between 1910 and 1920 about 1%. On the basis of the figures for 1919 and 1920 there was a natural increase of about 35,600 annually,

States with a Natural Increase of Negroes

State	Period covered by registration	Negro births	Negro deaths	Deaths to 100 births
North Carolina	1917–22	143,367	77,758	54
Mississippi	1921–22	44,940	24,574	55
South Carolina	1919–22	95,110	53,372	56
Virginia	1917–22	119,435	77,775	65
New Jersey	1921–22	6,779	4,771	70
Maryland	1916–22	45,871	40,245	87
Massachusetts	1915–22	8,846	7,870	89
Wisconsin	1917–22	657	597	91
New York	1915–22	34,502	32,126	93
Delaware	1921–22	1,248	1,200	96
Michigan	1915–22	7,003	7,453	98
Connecticut	1915–22	3,890	3,868	99
New Hampshire	1915–22	86	85	99
Total		512,334	331,694	65

States with a Natural Decrease of Negroes

State	Period covered by registration	Negro births	Negro deaths	Deaths to 100 births
Illinois	1922	3,704	3,786	102
Pennsylvania	1915–22	45,311	48,207	106
Ohio	1917–22	21,710	23,940	110
Rhode Island	1915–19 and 1921–22	1,522	1,684	111
California	1919–22	2,688	3,054	114
Indiana	1917–22	8,758	10,377	119
Nebraska	1920–22	564	685	122
Kansas	1917–22	5,956	7,286	122
Utah	1917–22	128	158	123
Kentucky	1917–22	24,180	30,343	125
Vermont	1915–22	29	38	131
Oregon	1919–22	100	154	150
Minnesota	1915–22	913	1,388	152
Washington	1917–22	424	738	174
Montana	1922	20	40	200
Wyoming	1922	17	39	229
Maine	1915–22	84	194	231
Total		116,117	132,111	114

or 356,000 for the decade. As the decennial increase of Negroes was about 40,000, these States must have lost by emigration more than 300,000.

The bureau of the census has supplied figures of Negro births and deaths between 1915 and 1923 in the urban and rural districts. They are as follows:—

	Births	Deaths	Deaths to 100 births
Urban	206,380	209,631	102
Rural	517,945	309,243	60

These show that during these eight years in the cities of the United States for which the facts are known there were 3,251 more Negro deaths than births, but that in the country districts there were 208,702 more births than deaths. The figures of each class are given separately below for North and South.

	Births	Deaths	Deaths to 100 births
Northern urban	155,972	151,118	97
Northern rural	33,245	40,294	121
Northern total	189,217	191,412	101
Southern urban	110,408	118,513	107
Southern rural	484,700	268,949	55
Southern total	595,108	387,462	68

These figures show that the rural districts of the North are least suitable for Negro increase, that the urban districts of the South are almost as unfavourable, that the cities of the North show a slight excess of Negro births, and that the great reservoir for Negro increase is the rural districts of the South. The cause for the low rate of increase between 1910 and 1920 is found in the

migration from the country districts of the South both to the North and to southern cities, and to their exposure to conditions climatic or economic which raised the death-rate and lowered the birth-rate.

Health.—The prosperity and progress of a population group are indicated, not merely by growth in numbers but also by the longevity of its members. This vitality is roughly measured by the death-rate. Other things being equal, a low and sinking death-rate is evidence of a high and increasing average duration of life. In the United States vital statistics are in charge of the several States and cities, and are often defective or entirely lacking. In 1890 and 1900 the Federal government compiled such as were of importance, and in 1864 an official compilation was made of death-rates of Negroes before the war. The 1910 and 1924 figures are based on population in the 1910 and 1924 registration areas, respectively. Southern States have been the slowest to perfect their registry sufficiently to gain admission to the registered area and in 1910 but 19·7% of the Negroes lived in the registration area. In 1924 all southern States but West Virginia, Alabama, Arkansas, Oklahoma and Texas were included in the area so that the figures are much more complete. Part of the rapid decrease in Negro mortality may be due to the fact that the registration area is extending over more and more of southern rural territory where the Negro death rate is much lower.

Date	Negro deaths	Negro death-rate	White death-rate
Mainly between 1818-63 . .	106,217	35·0	27·0
1890 . . .	28,579	29·9	19·1
1900 . . .	37,029	29·6	17·3
1910 . . .	49,499	25·5	14·6
1924 . . .	147,852	17·6	11·2

These figures indicate that the death-rate of each race decreased during a half century, but that the decrease among Negroes was less rapid than among whites.

Morals.—Though its shortcomings are immediately apparent, obedience to law is the only practical index available for judging the comparative moral health of the Negro race in the United States. Reliance on statistics of prisoners instead of true judicial statistics offers plenty of opportunity for further qualifications. The Negroes are rarely able to employ expert defense, and many of the classes which come to trial are too ignorant to understand intelligently their own cases and situations. That prison punishment is more severe for Negroes than for whites, seems apparent from the fact that the 1910 census showed the average sentence of the Negro to be 17·4 months while that of the white was 5·2 months. It is doubtful if the wide difference between the two can be due entirely to the degree of the Negro's crime. In 1910 and 1923 prison statistics included prisoners awaiting trial and those imprisoned for failing to pay a fine. The Negro forms a large proportion of these classes for he does not often have the amount necessary to cover the bail or fine. This fact must be taken into consideration in comparing the number of prisoners in the table given below:

Date	Negro prisoners		White prisoners per 100,000 pop.
	Number	Per 100,000 pop.	
1880 . . .	16,089	244	96
1890 . . .	19,804	264	84
1904 . . .	20,087	278	77
1910 . . .	38,701	384	89
1923 . . .	34,178	327	77

Whether the sharp increase between 1904 and 1910 was due entirely to the factors mentioned above or partially to increased crime it is impossible to say. In any case there was a marked decrease between 1910 and 1923. The proportion of Negro prisoners among all prisoners in the United States declined in this period from 34·0% to 31·3% despite the increase in Negro population. Some factors accounting for the higher percentage of crime among Negroes are (1) a greater degree of illiteracy, (2) crowded, unhealthy and even vicious living conditions in many cities, (3) poverty in both cities and rural districts, and (4) inadequate provision for the segregation of feeble-minded and mentally unbalanced Negroes in many communities. Whether in the final analysis there is, in addition, a greater tendency toward crime inherent in the Negro race is a question upon which there is great difference of opinion and little scientific data.

In considering the offenses for which prison terms were imposed in 1923 Negroes formed exceptionally high percentages of the totals convicted of gambling (64%), carrying concealed weapons (51·4%), assault (43·9%), fornication and prostitution (43·7%) and homicide (41·5%). For rape, despite a wide belief that the Negro is particularly prone to this crime, Negro commitments were but 17·8% of the total for this cause, which was considerably below the proportion for either native or foreign-born whites.

The proportion of commitments of Negroes to their population was much lower in the southern States than in either the northern or western States, which condition is probably due chiefly to the fact that in the South greater numbers of the Negroes live in rural districts while in the North or West they are congregated in cities and towns where higher commitment rates are to be expected. Such figures also suggest lack of adjustment to their surroundings resulting from their migrations of recent years.

Citizenship.—When the Fourteenth and Fifteenth Amendments to the Federal Constitution were adopted, the former conferring United States citizenship on all native Negroes and the latter providing that the right of such citizens to vote should not be abridged by any State on account of race, colour or previous condition of servitude, it was not the practice in northern States to allow Negroes to vote. Proposals to grant them the suffrage were submitted to the voters in 1865 in Connecticut, Wisconsin, Minnesota and Colorado, and in each State they were rejected. In all States containing a large proportion of Negroes, the results of the Federal policy of reconstruction were disastrous. Since the withdrawal of Federal troops in 1877 the prevailing and persistent judgment of southern whites regarding the laws and the policy to be adopted upon this subject has been accorded more and more weight in determining the action of the States and the Federal Government. The number of Negroes voting or entitled to vote has been reduced latterly by legislation or provisions of the State Constitutions. If such enactments are nominally directed not against any race but against certain characteristics which may appear mainly in the race, such as illiteracy, inability or unwillingness to pay an annual poll tax or to register each year, they have been and are likely to be held within the constitutional authority of the State. On the part of the overwhelming majority of Negroes this practical disfranchisement has aroused little protest, while it has tended to improve the government and to open the way for the gradual development and expression in word and vote of differences within the ranks of white voters regarding questions of public policy.

Along with this decrease of pressure from without the southern States and the development of economic competition between the races within them, there has gone an increased demand on the part of the whites for a complete social separation between the races in school, in church, in public conveyances and hotels, all founded upon a fear that any disregard of such separateness will make intermarriage or fruitful illegal unions between the races more frequent. In short, these developments are towards a more and more rigid caste system.

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NEGRO ECONOMIC LIFE

Following emancipation, in 1865, the large majority of Negroes gainfully employed were in agriculture. In 1890 there were 1,362,713 Negro agricultural labourers; in 1920, 1,192,504. In 1910 more than one-fourth of the Negro female population ten years of age and over were employed in agriculture. By thrift and hard labour the land-owning Negro farmer has arisen. Of 746,717 Negro farmers in 1900, 25·1% were owners, 0·2% managers and 74·6% tenants; in 1920, of 925,708 Negro farmers, 23·5% were owners, 0·2% managers and 76·3% tenants. The value of land and buildings owned by Negro farmers in the Southern States was $69,634,420 in 1900, and $552,178,137 in 1920.

Industrial Workers and Artisans.—Between 1850–60 there were cases of slaves manning cotton factories and working successfully in iron mines, furnaces and tobacco factories. The post-war development of the southern cotton mills, however, turned to white labour. The slave artisan became an important factor in the *ante-bellum* economic organization of the South. Even before the Revolutionary War Negro slaves were employed in New Jersey as iron workers, sawmill hands, wheelwrights, tanners, coopers, shoemakers, etc., and as early as 1708 white mechanics felt the competition of slaves in Pennsylvania. Employment in the North was mainly in semi-skilled and unskilled occupations, Negroes following the prevailing occupations of the locality; barbers, bakers, carpenters, clothiers, domestics, hairdressers, labourers, seamen, and waiters. There were a few physicians, clergymen, merchants and traders and saloon and restaurant keepers. As late as 1908–10, a study of Negroes at work in New York city found over 70% of the men and 89% of the women gainfully employed in domestic and personal service.

In 1900, there were in the United States 275,149 Negroes in manufacturing and mechanical pursuits, or 6·9% of those gainfully employed, and 209,154 in trade and transportation (5·2%); by 1920 there were 960,039 in manufacturing and mechanical pursuits (19·9%) and 540,451 in trade and transportation (11·2%).

In 1920 about 73·4% of the Negro population of the northern States was living in ten industrial districts where immigrant labour had largely supplied the surplus of workers prior to 1914.

In the South wages paid Negroes are generally somewhat less than those paid whites in the same occupations. In the North industrial wages are about the same for occupations to which Negroes are admitted. Negro workers are handicapped in both sections, however, by restrictions on promotion to higher jobs, by greater difficulty in obtaining employment by exclusion from unions and by less security of tenure. In the building trades and some other fields increasing numbers of Negroes have been admitted to unions and are thus overcoming these barriers.

The Professional Class.—In 1920 there were 19,571 Negro clergymen. Before the Civil War there were Negro teachers who conducted private schools in the North and in the South for children of free Negroes. Law and custom forbade teaching slaves. With freedom, the greatest outreach of Negroes was for education, and teachers increased accordingly. There were 29,727 Negro teachers, professors and college presidents in 1910 and 36,626 in 1920.

In 1860 there were 14 physicians and a Negro dentist in Massachusetts; five dentists in Philadelphia and one physician in St. Louis. The number of Negro physicians, surgeons and dentists had increased to 3,555 in 1910 and to 4,819 in 1920. There were 41,324 Negroes in professional service in 1900, and 80,183 in 1920. The proportion in professional service of all Negroes gainfully employed, however, remained the same, 3·7%.

Trade and Commerce.—*The Negro Year Book* estimates that there were 4,000 Negroes in business in 1866. These were usually small enterprises such as those of blacksmiths, shoemakers, barbers, tailors, caterers and hotel keepers. Here and there Negroes of marked ability developed enterprises of proportions before 1860. There were a few foundries, rope and cordage factories, drygoods and grocery stores and similar establishments. The intervening decades show slow but substantial growth. There were over 50,000 Negro business establishments in 1920 and about 70,000 in 1926.

Life insurance among Negroes has grown rapidly in 20 years and is now the largest business owned and operated by them. The first old line, legal reserve Negro life insurance company was organized in 1912. There were already several industrial life companies, and several white companies were carrying Negro risks. In 1926, there were 28 Negro companies, with business in force amounting to $243,534,500, of which $96,064,700 was old line, legal reserve, $97,018,263 industrial and $50,451,537 sick and accident insurance; and employing 9,100 Negroes as officers, agents and clerical force; their net income for the year of $1,509,467 and their gross assets of $11,170,191 represent financial resources within the Group. Fire insurance has been of recent development. The first stock company was organized in Georgia in 1919 and was merged in 1922 with the only Negro fire insurance company now existing. In 1926 this company had $200,800 capital, $43,156 surplus and $371,590 total assets.

In 1926 there were about 33 savings and commercial banks exclusively of the standard stock type. There are probably between 30 and 50 building and loan associations, mutual savings and savings and loan or investment associations owned and operated by Negroes.

Property Ownership.—In 1920 in five northern cities Negroes owned from 27% to 41·9% of the homes they occupied and in nine southern cities, from 20·2% to 40·4%. Of the 488,690 Negro homes owned in 1910, there were 346,867 reported free of encumbrance and 123,044 encumbered, and 18,788 unknown.

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(C. E. HA.)

NEGRO EDUCATION

Prior to the emancipation of Negroes in the United States in 1865 there were isolated instances in both the North and South of the establishment of schools for free Negroes. Negligible effects attended these efforts, however, because of opposition in the North and legislative enactments in the South forbidding the education of Negroes enslaved or free. Despite these barriers, a few Negroes entered northern white academies and universities and some graduated. Any discussion, however, of Negro education in America must begin substantially with the adoption of the reconstruction Constitutions by the former slave States.

Social factors not considered, mixed schools would have been the most economical and effective educational instrument and probably were the only means of insuring equal education for the two races. Several States considered the idea more or less seriously and for a short period South Carolina adopted it. But certain political, social and biological theories concerning the race

placed the Negro at the bottom of the social scale, and tended to restrict the amount, quality and kind of education considered assimilable by the Negro and necessary to fit him for the place assigned him in the social structure.

The extreme biological theory assumed the Negro incapable of education; the extreme social attitude held that education "spoiled" the Negro for useful pursuits; while the liberal attitude is expressed by these words in the doorway of a Negro school in Alabama: "It is the duty of the South to train the descendants of the former slaves to become intelligent, productive, industrial units in the commonwealth." The Negroes bitterly resented these restrictions and their feelings were shared to a considerable degree by many white people interested in Negro education. Private schools for Negroes sprang up all over the South, supported largely by northern philanthropy and conducted by northern white educational missionaries, though many were maintained by Negroes. These schools supplied most of their secondary education and practically all of their collegiate training.

About 1905 a general educational revival began in the South with a new emphasis on education for both races. The Negro had proved his capacity for education. Increasing industrial prosperity in the South and the lessening of isolation effected a general willingness to provide more liberally out of public taxation for Negro education. Since 1915 this tendency has grown steadily. The National Association of Teachers in Colored Schools organized in 1903 and the State associations of Negro teachers have done much to stimulate more liberal public sentiment. Negro college attendance has increased 150% in 1923–28, showing how Negroes have reacted to increased facilities for education.

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NEGRO ART

Negro art, in the broader sense, may be said to include work portraying Negro life by other than Negro artists; in a narrower sense, to include all the work of Negro artists. The Negro himself, though possessing a strong African heritage in craft and decorative art, was hampered in his expression in the field of the formal arts by the conditions of the slave system, and the sudden displacement by Christianity of the pagan background in which the original African arts flourished. However, in favourable centres like Philadelphia, Charleston and New Orleans, craft artisans of exceptional skill in wood and ironwork flourished until the breakdown between 1840–50 of craft skill by the factory system. Of these the most famous were the Negro art-smiths of New Orleans.

In formal painting, the pioneer Negro artist was Edward Bannister (Providence, R.I.), a landscape-painter, prize winner at the Centennial Exposition at Philadelphia (1876) and founder of the Providence Art club. At the same exhibition, Edmonia Lewis, pioneer sculptor, exhibited her busts of William Story, Charles Sumner and Frederick Douglass. Other early Negro artists between 1865 and 1885 were Edward Stidham (Philadelphia), portraitist; William Dorsey (Philadelphia), landscape-painter; and Robert Duncanson (Cincinnati), figure-painter.

These were followed, after a dead interval, by the two Negro artists who have achieved rank in American painting and sculpture, Henry Ossawa Tanner and Meta Warrick Fuller. Tanner's painting, mostly of biblical subjects, in addition to the romantic realism of his French masters, reflects the mysticism and literal faith of his Negro parentage and, like the work of the Israels, combines utmost sophistication of technique with naive simplicity of theme. His technical skill is attested by many prize awards and also by his inclusion in the Luxembourg, Wilstach, Pennsylvania Academy of Fine Arts, Carnegie Institute, Chicago Art Institute and other collections. A school of formal academic painting has followed Tanner: William Harper (1874–1910), landscape painter of note; William Edouard Scott (b. 1884), portraitist and mural painter; William Farrow (b. 1885), landscapist and etcher; Charles Dawson (b. 1889), portrait painter and engraver; Edward A. Harleston (b. 1890), portraitist and figure painter of merit; and Laura Wheeler Waring (b. 1887), type portraitist and decorative illustrator.

In sculpture, the outstanding Negro has been Meta Warrick Fuller (b. 1877), educated at the Pennsylvania School of Industrial Art, and pupil of Colarossi academy, St. Gaudens and Rodin. She achieved recognition in the Paris salons of 1903 and 1904 with her forceful symbolic works,—"Oedipus," "Secret Sorrow," "The Wretched," "The Impenitent Thief" and "John the Baptist." Later she turned to the delineation of Afro-American types with her series of 14 groups representing the history and progress of the Negro, for the Jamestown Exposition (1907) and her "Ethiopia Unbound," executed for the New York Emancipation Semi-Centennial (1913). Later still she turned to portrait sculpture and to abstract symbolic groups. In similar vein but with slightly more attention to racial types, May Howard Jackson (b. 1878) has done meritorious work in sculpture. Though occasionally racial in subject and reflecting somewhat the peculiar emotional background of the Negro, the work of all the foregoing artists has been traditional in ambition, sympathy and technique, and success and recognition have come to them primarily as artists.

The younger Negro artists since 1920 have broken somewhat with academic tradition and there has emerged a school of Negro art along distinctive and original lines devoted consciously to racial portrayal and expression. Activity has mainly focused in a New York or Harlem group, among whom the more outstanding are Palmer Hayden (landscapist), Aaron Douglas (figure painter and illustrator), M. Gray Johnson, W. J. Russell, Albert Smith (painter and etcher), Augusta Savage (sculptor) and a Chicago group among whom the better known are Archibald J. Motley, Hale Woodruff, John Hardrick, Arthur Diggs, painters; and Sargent Johnson and Richmond Barthé, sculptors. The most promising and modernist trend is represented by a series of paintings by Archibald Motley symbolizing the African background and the use of African motifs in the decorative drawings and illustrations of Aaron Douglas.

See B. Brawley, *The Negro in Literature and Art* (1918); W. E. B. Du Bois, *The Gift of Black Folk* (1924); A. Locke, *The New Negro* (1925); P. Guillaume and T. Munro, *Primitive Negro Sculpture* (1926); and A. Locke, "African Art," in *The Arts* (March 1928).
(A. Le R. L.)

NEGRO DRAMA

Negro drama as found in the United States represents the same tendency toward the development of race or group drama as is to be found elsewhere. It exemplifies the development of a group consciousness and the consequent urge for artistic expression of a people possessing a common tradition and race experience. Negro drama is likewise a recognized phase of American drama.

In the period previous to the Civil War the Negro appeared as a minor character in L. Beach's *Post Free* (1807) and in Anna Cora Mowatt's *Fashion* (1845). In the '40s the minstrel show was making its appearance. Charles Callender, Lew Dockstader and Primrose and West, in turn presented caricatures of the Negro that have persisted in the American theatre. Following the Civil War the novel by Harriet Beecher Stowe, *Uncle Tom's Cabin*, was dramatized and produced throughout the North, soon to be followed by another drama of the same type, *The Octoroon*, by Dion Boucicault. These plays accustomed the public to Negro drama designed to appeal to its sympathy rather than its ridicule. The minstrel characterization of the Negro continued until 1895, when John W. Isham organized a musical show, *The Octoroons*, the first of a long line of musical comedies which have opened the doors of opportunity to a group of notable Negro actors, including Williams and Walker, Cole and Johnson, S. H. Dudley, T. Leubie Hill, Ernest Hogan, Sissle and Blake, Miller and Lyles, Florence Mills and Adelaide Hall. These musical shows have contributed little to the direct stream of Negro drama, yet they have demonstrated the exceptional histrionic talents of the race. They may yet furnish the material for the evolution of new dramatic forms in the future. Witness the interesting experiment of Lawrence Stallings and Frank Harland in the jazz opera *Deep River* and Edna Ferber in *Show Boat*.

In 1910, Edward Sheldon's *The Nigger* was produced. In 1913 W. E. B. Du Bois wrote and produced the first important Negro pageant, *The Star of Ethiopia.* On March 3, 1916, *Rachel,* a three-act play written by Angelica Grimke and the first successful drama written by a Negro, was produced.

The first important step in the development of an authentic Negro drama was taken on April 5, 1917, when Mrs. Norman Hapgood, in association with Robert Edmond Jones and others, presented a group of Negro actors in a programme of three one-act plays written for the Negro theatre by the American poet, Ridgely Torrence.

In the years immediately following the termination of the World War Negro drama suddenly assumed a place of major importance in American drama. The production of Eugene O'Neill's, *The Emperor Jones,* proved to be a landmark. Charles Gilpin, a Negro, who played the title rôle of the emperor, was selected by the New York Drama League as one of the ten persons who had contributed the most to the American theatre during that year.

The Colored Folk theatre, later known as the Ethiopian Art theatre, was organized by Raymond O'Neill in co-operation with Mrs. Sherwood Anderson, in Chicago in 1923. Its main contribution to Negro drama was the excellent presentation of a one-act folk play, *The Chip Woman's Fortune,* written by a Negro playwright, Willis Richardson, who has contributed a number of meritorious one-act plays to Negro drama.

Simultaneously with the activities of these Little theatre groups a definite movement for the establishment of an experimental laboratory of Negro drama and for the development of a national Negro theatre was instituted at Howard university, a Negro university in Washington. The organizer and director of this undertaking was Montgomery Gregory, who was ably assisted by Alain Locke, Marie Moore Forrest, Cleon Throckmorton and the university authorities. Their leading idea was that the medium of dramatic expression offered the Negro race its best means of raising itself in the estimate of the American people. The Howard players successfully produced several one-act plays written by members of the group. Hampton institute, Tuskegee institute and Atlanta university are other Negro schools that have done effective work in educational and experimental race drama.

The Carolina playmakers of the University of North Carolina, under the inspired direction of Frederick Koch, have made notable contributions to Negro drama. Prof. Paul Green of this university ranks with Eugene O'Neill as the leading dramatist of Negro life. *White Dresses, Granny Boling, The No 'Count Boy, In the Valley* and the Pulitzer prize play, *In Abraham's Bosom,* are among his successful dramas. The awakened national interest in Negro drama chiefly occasioned by the production of *The Emperor Jones* has resulted in a succession of plays of Negro life on the New York stage. Some of these plays were: *Goat Alley* by E. Howard Culbertson, *Roseanne* by N. Stephens, *Taboo,* by Mary Hoyt Wiborg, *All God's Chillun Got Wings,* by Eugene O'Neill, *Black Boy,* by Jim Tully and Frank Dazy, *In the Bottom of the Cup,* by J. E. M. Bashe and *Porgy,* by Du Bose Heyward.

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NEGRO MUSIC

American Negro music consists almost entirely of folk-music, the proportion of it written by individual composers being comparatively small. This music is of many kinds but it may be divided into two general classifications, sacred and secular. The sacred music consists of the well known Spirituals, while the secular is work, play and love songs, the blues and dance music—ragtime and jazz. The great bulk consists of songs; ragtime and jazz, however, are instrumental as well as vocal.

The Spirituals rank first in value and beauty. They, indeed, constitute one of the finest bodies of folk songs in the world. Just how far back the making of Spirituals by the Negro in America goes cannot be exactly determined, but it is safe to say more than 150 years. It is probable that he began creating these songs shortly after his adoption of Christianity, which came quite early, and along with the establishment of his own separate places of worship.

The Spirituals are primarily a fusion of African music and Christian sentiments. They possess the fundamental characteristics of African music; they have the same strong rhythmic quality and show a marked similarity to African songs in verse forms and intervalic structure. However, the Spirituals, upon the base of the primitive rhythms, rise a step beyond African music through a higher melodic and an added harmonic development. The Spirituals remain distinctive Negro folk-songs.

The texts of the Spirituals are based almost exclusively upon the Bible. The stories in the Bible gave the Negro bards great scope for the play of their imagination and are often told dramatically and in vivid and gorgeously coloured pictures.

It is probable that many of these songs are irretrievably lost, for no systematic effort to record them was made before the Civil War. They were first introduced to the public of America and Europe in 1871 by the Fisk Jubilee singers. They have recently been given a new vogue through the singing of them by Roland Hayes, Paul Robeson, J. Rosamond Johnson, Taylor Gordon and other Negro singers on the concert stage.

Negro secular music, unlike the Spirituals, has gone through many changes and developments. Most of the various styles of Negro secular music have successively been taken over, adapted and made national. And so it appears that as one style of the Negro's secular music became lost to him he set about creating another. Before and for a while after the Civil War the Negro made many plantation songs both of the ballad and the patter type. The plantation songs became the mainstay of the black-face minstrel stage; they were adapted and imitated and remained popular for several decades.

In the last decade of the past century ragtime, a highly syncopated form of music, came into notice. It is fundamentally an instrumental form, and was the result of experiments by Negro players on the piano—then a new instrument to them. Words were adapted to these syncopated rhythms and gave birth to the ragtime song, which achieved great popularity in the first decade or so of the present century. The Negro dialect text of the ragtime song was ultimately discarded for straight English, and this form of Negro music took on a national character, and so remains.

About 1910 a distinctly new type, the blues, was invented in the South and rapidly spread over the country. They are as truly folk-songs as the Spirituals; basic differences being that they are an expression of the individual and not of the group, and that they follow a rigid verse form and are less varied and rich than the Spirituals. This "blue" note has become one of the main elements of American popular music and has been experimented with by serious composers. (*See* BLUES.) Jazz (*q.v.*) is somewhat a combination and culmination of ragtime and the blues.

Another class of Negro folk-songs are the work-songs. These were originated by gangs of men at work which permitted of or called for rhythmic motions performed in unison; the picks or the hammers rising, falling and resting in perfect rhythm with the music.

Outstanding among individual Negro composers of note was James Bland who wrote *Carry Me back to Old Virginia* and *In The Evening by The Moonlight,* two songs which have attained a semi-classic niche. Other composers of note are: Harry T. Burleigh, J. Rosamond Johnson, R. Nathaniel Dett, Will Marion Cook, James P. Johnson, William Edward Still and Clarence Cameron White.

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See BLUES and JAZZ.

NEGRO POETRY

As early as the year 1760 Jupiter Hammon, a slave belonging to a Mr. Lloyd of Queens village, Long Island, N.Y., published a poem 88 lines in length, entitled *An Evening Thought, Salvation by Christ, with Penitential Cries.* Hammon published several other poems, all of them religious. However, it is with Phillis Wheatley (*c.* 1753–84), a young slave, that American Negro poetry properly begins.

Between Phillis Wheatley and Paul Laurence Dunbar there were about 30 Negroes who published poetry, the publications ranging in size from pamphlets to books of from 100 to 300 pages. These writers must be considered more in the light of what they attempted than of what they accomplished. A number of them showed marked talent and feeling, but barely a half-dozen demonstrated more than mediocre mastery of technique. Such were George Horton (1797–1880), Frances E. Harper (1825–1911), Charles Reason (b. 1818), James Madison Bell (b. 1826) and Alberry Whitman (b. 1857).

Paul Laurence Dunbar (1872–1906) (*q.v.*) was the first American Negro poet to show real poetic talent. Contemporary Negro poets were: James Edwin Campbell, Daniel Webster Davis, George M. McClellan, J. Mord Allen, James D. Corrothers, William H. A. Moore and Joseph S. Cotter, sr.

The decade after the death of Dunbar was fallow, but William Stanley Braithwaite (b. 1878) achieved recognition as a poet, critic and anthologist. His work, however, is not in subject-matter or form related to race. In general, his poems are mystic in tone.

Immediately after the entry of the United States into the World War (1917) there emerged a group of poets who almost completely discarded dialect and the traditional material of Negro poetry, including pathos and humour. The distinguishing notes of their poetry were disillusionment, protest and challenge. In this group were Claude McKay, Fenton Johnson, Joseph Cotter, jr., Georgia Douglas Johnson, Roscoe Jamison, Lucien Watkins and James Weldon Johnson. It was in Claude McKay (b. 1890) that this period of protest found its most powerful voice.

A half-dozen years after the beginning of the period of protest, American Negro poetry began discarding propaganda for propaganda's sake, and essayed a more purely artistic use of racial art material and cultural background. Two new poets arose in this latest period. They were Countee Cullen (b. 1903) and Langston Hughes (b. 1902). Cullen is a poet of lyrical power and beauty. He writes only in the well approved forms of literary English, but many of his best poems contain a racial note of deep poignancy. In 1925 he published his first volume, *Color;* this was followed in 1927 by *The Ballad of the Brown Girl* and *Copper Sun.* Hughes is more the folk poet in the selection of subject-matter and forms. Much of his material is taken from the humbler strata of life, and he has made effective use of the form of the Blues (see *Music,* p. 219). He is the author of *The Weary Blues* (1926) and *Fine Clothes to the Jew* (1927). In this period James Weldon Johnson published *God's Trombones —Seven Negro Sermons in Verse* (1927), founded on the old-time Negro plantation sermons. In the group of newer Negro poets writing distinctive verse are: Jean Toomer, Anne Spencer, Arna Bontemps, Angelina Grimke, Lewis Alexander, Jessie Fauset, Sterling Brown, Helene Johnson and Waring Cuney.

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NEGRO FOLKLORE

The folk-lore of the Negro of the United States, for all its surface appearance of naïve simplicity, is a complex thing. Its origins are mixed, and often lost in obscurity. Some elements are clearly African in their beginnings, while others are as definitely related to the lore of the whites. The "big house" of colonial days, as well as the jungle of Africa has had its share in shaping Negro folk-lore. The transplanted race cherishes the superstitions, the ballads, the stories of both the new home and the old, and what it borrows makes its own as distinctly as what it originated.

There is a rich body of folk-tales current among the American Negroes, some of which have been preserved in print, and many of which are transmitted orally by the firesides and door-steps of the south. A still greater mass, no doubt, has been lost for lack of chroniclers and tellers. The best-known body of their published folk-tales is that collected by Joel Chandler Harris—made familiar by the name of Uncle Remus.

In his songs and stories the Negro shows his fondness for animals, his admiration for their craft, his interest in their prowess. He endows them with human attributes of thought and speech, and gives them greater cunning than natural history would authorize.

The Negro shows great variety in his songs, contrary to the popular conception that he sings only spirituals. The spirituals, which are melodious and haunting in their tunes, and which express humility and sweetness of spirit, owe something at least to the hymns and religious songs heard on the southern plantation. There are various groups of secular songs. There are numerous work songs, for the Negro, a truly rhythmic person, works better and faster when he sings at his task.

The American Negro has had his part in transmitting the traditional songs and ballads of England and Scotland, and has made them his own.

There are many ballads that the Negro has made for himself, owing nothing to the whites. There are lullabies, old dance songs or "reels," children's game songs, counting songs, songs of love, of war and of other themes.

There is a mass of folk-beliefs, of superstitions, current among the southern Negroes, belief in ghosts, in witches, in the power of "voodoo" and so forth. In fact, the Negro folk-lore constitutes the largest and most varied body of lore to be found in America to-day. (D. Sc.)

HARLEM

Harlem was originally a village on Manhattan island, now the local name for that part of the borough of Manhattan, New York city, beginning at 106th street and extending north between the East and Harlem rivers and Eighth avenue. Its settlement, on the site of what is now Mount Morris park, dates from 1636. In 1658 Peter Stuyvesant named the village New Haarlem, after Haarlem, the town in Holland from which many of its inhabitants came. The old village is charmingly described by Washington Irving in his *Knickerbocker's History of New York.* Harlem retained its quiet aspect, surrounded by farms, until 1836, when daily communication by horse railroad was established with New York. Thereafter, by degrees, the village became a populous suburb and was finally transformed into a densely built residential section of the metropolis. The name now refers more specifically to the district north of 125th street, which in the 1920's became the most populous urban Negro community in the world.

The Negro Metropolis.—During the World War about 500,000 Negroes, taking advantage of the restrictions placed upon European immigration, and lured by war-time wages, turned from agricultural pursuits in the South to the highly specialized industries of the North. In New York city the migrants, uniting their fortunes with a stream of 60,000 Negroes coming from Central America and the West Indies, swept uptown and formed above 125th street a fabulous Negro city of 250,000 souls. This district does not constitute, however, the only point of Negro mass contact on Manhattan island. On the crest of "San Juan Hill" is a colony of 5,000 to 6,000 Negroes which in point of primitivity and hardihood easily outstrips Harlem. Within the shadow of the Fifty-third street elevated are the remnants of a Negro settlement which antedates by at least a quarter of a century the glamorous "Mecca of the New Negro." But the concentration of the Negro population in Harlem has dwarfed the various settlements of the race in other parts of New York city. In the evolution of Negro communities in the North the dominating motive has always seemed to be economic, until Harlem arose to challenge

the tradition; for here there is no single avenue of employment.

Economic Status.—In Harlem, unlike other American Negro communities, there are no banks, insurance companies, or large realty firms under Negro management. There is no outlet for the young Negro trained in business or finance. Apart from a branch of the Y.W.C.A., a branch of the Y.M.C.A., and half-a-dozen sparsely staffed weekly newspapers, there are few places for Negroes to gain experience as stenographers, book-keepers or accountants. The district has not yet awakened to the necessity of a group consciousness in business. Indeed, the lines of business in which they are engaged are the traditional ones: barbering, hairdressing, operating undertaking establishments, cabarets and employment agencies. Sometimes competition by outsiders is keen in lines which are usually associated with Negro enterprise in cities, such as the management of theatres, restaurants, poolrooms, cabarets and dance halls. With one or two exceptions all the rest—delicatessen stores, drug stores, haberdasheries, ice cream parlors, department stores—are owned and operated by whites. In fact it is recognized in Harlem sociology that the only Negroes of training who dare risk the chances of a career in the community are physicians, lawyers, dentists, preachers, teachers, etc.

Cultural Ascendancy.—In spite of this curious showing Harlem's ascendancy over the rest of the Negro communities of the country is a striking and vital one. Harlem is, to begin with, the goal of the Negro artist, poet, painter, musician or writer. Because Harlem is a part of New York it has done most to focus attention on the creative gifts of the American Negro. Likewise, because of the welter of native Negro races simmering in its orbit, it is a sort of market place for all sorts of ideas concerning Negro life, and the history and the future of the race. It is the fountain head from which spring most of the plans of welfare and conduct and of agitation and protest against mob violence, lynch law, segregation and disfranchisement. So far Harlem represents the most conspicuous civic promise Negroes have enjoyed in the United States of securing the rights and privileges of human equality.

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NEGUS. (1) The title of a king or ruler (Amharic *negūs* or *n'gūs*), in Abyssinia (*q.v.*); the full title of the emperor is *negūs nagasti*, "king of kings." (2) The name of a drink made of wine, most commonly port, mixed with hot water, spiced and sugared. According to Malone (*Life of Dryden, Prose Works*, i. 484), this drink was invented by a Colonel Francis Negus (d. 1732).

NEHEMIAH, governor of Judaea under Artaxerxes (generally thought to be the first, but more probably the second, of that name, 404–359 B.C.). The book of Nehemiah forms the concluding portion of the great compilation, Chronicles–Ezra–Nehemiah. Nehemiah's own account, written throughout in the first person, and confined to chapters i.–vi., is the only authentic information which we possess in regard to his life and work. (*See* further EZRA AND NEHEMIAH [*Books*]; JEWS: *History*.)

NEHRU, PANDIT MOTILAL (1861–), Swarajist leader, a Kashmiri Brahman, was born on May 6, 1861. At the Allahabad Bar he came to the front, earning a large income, and exercising hospitality and friendly intimacy with European society. He was for some years a member of the United Provinces legislative council. After the World War, through repression of disorder in the Punjab in 1919, his views changed. In 1919 he founded the *Independent*, an aggressively Nationalist paper, and accepted the presidentship of what was now the extremist Indian National Congress. His support of Gandhi's campaign of non-co-operation took the form of suspension of his lucrative practice at the bar and the abandonment of luxurious western habits. At the close of 1921 he was imprisoned for six months for breaking the law against seditious assemblies. He so far modified his non-co-operation attitude as to accept election to the second legislative assembly at the close of 1923, and took his place there as leader of the Swaraj party. On the death of C. R. Das in 1925 he was elected president of the all-India Swaraj party, and under his guidance it was fused in the following year into the National Congress party. This organization promoted a boycott of the Simon Commission and took the lead in formulating under his chairmanship the All Parties Conference Report, otherwise known as the Nehru Report. It lays down a scheme of Dominion status for India. He presided at the 43rd annual National Congress at Calcutta in the last week of 1928, when acceptance of the scheme by the British Government within a year was demanded as the alternative to widely-organized non-co-operation. (F. H. BR.)

NEILE, RICHARD (1562–1640), English divine, was educated at Westminster school and at St. John's college, Cambridge. He was dean of Westminster (1605); bishop of Rochester (1608), Lichfield (1610), Lincoln (1614), Durham (1617) and Winchester (1628), and archbishop of York (1631). When at Rochester he appointed William Laud as his chaplain and gave him several valuable preferments. Neile sat regularly in the courts of star-chamber and high commission. His correspondence with Laud and with Sir Dudley Carleton and Sir Francis Windebank (Charles I.'s secretaries of state) are valuable historical sources.

NEILL, JAMES GEORGE SMITH (1810–1857), British soldier, was born near Ayr, Scotland, on May 26, 1810, and educated at Glasgow University. Entering the service of the East India Company in 1827, he received his lieutenant's commission a year later. When the Indian Mutiny broke out Neill, who was in command of the 1st Madras Europeans, left Madras with his regiment at a moment's notice, and proceeded to Benares. The day after his arrival he completely and ruthlessly crushed the mutineers (4th June 1857). He next relieved Allahabad, which became the place of concentration for Havelock's column. The two officers, through a misunderstanding in their respective instructions, disagreed, and when Havelock went on from Cawnpore (which Neill had reoccupied shortly before) he left his subordinate there to command the lines of communication.

The famous march from Cawnpore to Lucknow began on September 19th; on the 21st there was a sharp fight, on the 22nd incessant rain, on the 23rd intense heat. On the 23rd the fighting opened with the assault on the Alum Bagh, Neill at the head of the leading brigade recklessly exposing himself. Next day he was again heavily engaged, and on the 25th he led the great attack on Lucknow itself. The fury of his assault carried everything before it, and his men were entering the city when a bullet killed their commander.

See J. W. Kaye, *Lives of Indian Officers* (1889); and J. C. Marshman, *Life of Havelock* (1867).

NEISSE, a town and fortress in the province of Prussian Silesia, at the junction of the Neisse and the Biela, 32 m. by rail S.W. of Oppeln. Pop. (1925) 32,525. Neisse, one of the oldest towns in Silesia, is said to have been founded in the 10th century, and afterwards became the capital of a principality of its own name, which was incorporated with the bishopric of Breslau about 1200. Its first walls were erected in 1350, and it was thrice besieged during the Thirty Years' War. The end of the first Silesian War left Neisse in the hands of Frederick the Great. The Roman Catholic parish church of St. James (Jakobikirche) dates mainly from the 13th century, but was finished in 1430. The chief secular buildings are the old episcopal residence, the old Rathaus (1499), and the beautiful Renaissance *Kämmerei* (exchequer) with a high gabled roof ornamented with frescoes.

NEISSE, three rivers of Germany. (1) The Glatzer Neisse, 121 m. long, rises on the Schneeberg, at an altitude of 1,400 ft., flows north past Glatz, turns east and pierces the Eulengebirge in the Wartha pass, then continues eastward past Neisse until it joins the Oder (left) between Oppeln and Brieg. It is only used for floating down timber but abounds in fish. (2) The Lausitzer or Görlitzer Neisse, 140 m. long, rises near Reichenberg in Bohemia, on the south side of the Riesengebirge, flows north past Reichenberg, Görlitz, Forst and Güben, and enters the Oder above Fürstenberg. Less than 40 m. are navigable. (3) The Wütende Neisse is a tributary of the Katzbach.

NEJD, a kingdom of Arabia, occupying the core of that ancient land-block. The old block has been uptilted on the west, consequently Nejd tends to slope very gradually from west to east. The name itself implies an upland, and this is its distinc-

tive character as compared with the adjoining coastal districts of Hejāz and El Hasa, representing the shelving down of the plateau on the west and east respectively. In general elevation Nejd varies from 5,000 ft. on its western border to 2,500 in Kasim in the north-east, and somewhat less in the south-east. In the north Jebel Shammar, and in the east J. Tuwēk and J. 'Arid rise about 1,500 ft. above the general level, but, on the whole, Nejd may be described as an open steppe, of which the western and southern portion is desert, or at best pasture land only capable of supporting a nomad population; while in the north and east, owing to greater abundance of water, numerous fertile oases are found with a large settled population. (*See* ARABIA.)

Nomadic tribes, following their flocks and herds over the steppe, have roamed over the territory from time immemorial, raiding the settled dwellers of the oasis in times of difficulty or scarcity. The four most prominent tribes of Bedouin are the Shammar, Harb, 'Ateba and Muter. The first-named represent that part of the great Shammar tribe which has remained in its ancestral home on the southern edge of the Nafud (the northern branch long ago emigrated to Mesopotamia); many of its members have settled down to town life, but the tribe still retains its Bedouin character. The Harb are probably the largest of the Bedouin tribes in the peninsula, and are divided into a number of sections. Their territory is the steppe between Kasim and Medina. The 'Ateba territory extends from near Mecca along the road leading thence to Kasim. The Mutēr occupy the desert from Kasim northwards towards Kuwēt.

Nejd became nominally a dependency of the Turkish empire in 1871, when Midhat Pasha established a small garrison in El Hasa, and created a new civil district under the government of Basra, under the title of Nejd, with headquarters at Hofuf. Its real independence was not, however, affected, and the emirs, Mohammed Ibn Rashid, at Hail, and Abdallah Ibn Sa'ud, at Riad, ruled in Western and Eastern Nejd respectively, until 1892, when the former, by his victory at 'Anēza, became emir of all Nejd. His successor, Abdul Aziz Ibn Rashid, was, however, unable to maintain his position, and in spite of Turkish support, sustained a severe defeat in 1905 at the hands of Ibn Sa'ud, who thus became the dominant power in Nejd. By 1914 Ibn Sa'ud, with his Wahhabi followers had wrested the province of Hasa from the Turks, and his power thus reached the Persian gulf. Remaining inactive during the World War of 1914–18, Ibn Sa'ud in 1920 had captured and annexed Abha and other parts of Asir, leaving only the coastal strip. In 1921, Hail and the dominion of the amir of Jabal Shammar were in his possession, and by the end of 1925 he had overthrown the new Hashimite kingdom of the Hejāz. He was proclaimed at Jidda, in 1926, as king of Hejāz and sultan of Nejd. Thus, from his Nejd capital at Riyādh, Ibn Sa'ud rules over Desert Arabia.

His administration is patriarchal and his law the Sharia, administered by Wahhabi officials. A few simple taxes on cattle and possessions are collected. The chief administrative regions of the sultanate are Hasa; Aridh, with the town of Riyādh; Wadi Dawasir; Aflaj; Kharj; Sudair; Mahmal; Washm; Qasim; Jabal Shammar, with the town of Hail; Jauf; and numerous scattered oasis-groups, each ruled by an amir. Of the towns, Hufuf has a population of about 30,000; Hail, Riyādh, Hauta, Anaiza, Buraida, Jauf, Mubarraz, Shagra and Sakaka have populations between 10,000 and 20,000. The entire population of Nejd is estimated at three millions. Besides the population of the towns mentioned above, and the nomadic tribes, there are many villages in hollows of the valleys that cut into parts of the high calcareous tableland. Travellers tell of countless numbers of these hollows, wherein is concentrated the fertility and much of the population of Nejd; gardens, houses, cultivation and villages lie hidden from view among the depths while one journeys over the dry flats, till one comes suddenly on a mass of emerald green beneath.

The products of Nejd include dates, wheat, barley, hides, wool, fruit, *saman* (clarified butter), camels, sheep, horses, etc. The export of camels to Syria and Egypt is important. Tea, coffee, sugar, rice and piece-goods are imported. (*See* also under ARABIA.)

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NEKRASOV or **NEKRASSOV, NIKOLAY ALEXEIJEVICH** (1821–1877), Russian poet, was born on Nov. 22 (O.S.) 1821, in Podolia, the son of a landowner in the government of Yaroslāv, where the boy was brought up. He studied at St. Petersburg, against the will of his father, who left him to his own resources. At the age of 19 he published a small volume of poems (*Dreams and Sounds*), most of which had appeared in periodicals, and in 1846 he bought from Pletnev the *Sovremennik*, which in his hands became from 1856 onwards the favourite organ of young radical writers. It was suppressed in 1866, but in 1868 Nekrasov acquired, with Saltykov, the *Otechestvennye Zapiski*, in which the traditions of the *Sovremennik* were maintained. He died at St. Petersburg on Dec. 27 (O.S.) 1877.

Nekrasov was a people's poet, and expressed the sorrows and sufferings of the common people in poems which made him the idol of the reformers, and the joy and humour of every-day life in admirable adaptations of folksong, and in charming poems for children. Among the most famous of his works are *The Red-Nosed Frost* (1863), depicting a heroic peasant woman, and the great satirical work "*Who can be happy and free in Russia?*" (1879, Eng. trans. J. M. Soskice, 1901.) The latter is a species of *Canterbury Tales*, though with a definite purpose running through the series. Seven peasants make their way on foot throughout Russia to solve the question of who is happy. They are told a series of tales, by typical characters, landowners, priests, peasants and others, and Nekrasov concludes on a note of hope for the future. This last canto, owing to the censorship, did not appear until 1881. His work includes love poems, elegies and narrative poems. The most recent edition of his poems was published in 2 vols. in 1919, and they have been translated into German by H. J. Köcher (2 vols. Leipzig, 1885–88). English translations of some of his poems, including *The Red-Nosed Frost*, are to be found in C. T. Wilson's *Russian Lyrics* (1887); and J. Pollen, *Rhymes from the Russian* (1891). *See* also a French translation of some of his poems *Poésies populaires*, by E. Halperine-Kaminsky and C. Morice, with a preface by E. M. Vogüé.

NEKTON, the name applied collectively to the larger, actively swimming animals of the open sea (mainly fishes), in contradistinction to the passively drifting plankton (*q.v.*), and the sedentary, bottom-living benthos (*q.v.*). (*See* MARINE BIOLOGY.)

NELEUS, in Greek legend, son of Poseidon and Tyro, brother of Pelias. The two children were exposed by their mother, who afterwards married Cretheus, king of Iolcus in Thessaly. After the death of Cretheus, the boys, who had been brought up by herdsmen, quarrelled for the possession of Iolcus. Pelias expelled Neleus, who migrated to Messenia, where he became king of Pylos (Apollodorus i. 9; Diod. Sic. iv. 68) and ancestor of the Neleidae, who are historically traceable as the old ruling family in some of the Ionic states in Asia Minor, after the Dorian migration. By Chloris, daughter of Amphion, Neleus was the father of 12 sons (of whom Nestor was the most famous) and a daughter Pero; *cf.* MELAMPUS. According to Pausanias (ii. 2. 2, v. 8. 2) Neleus restored the Olympian games and died at Corinth, where he was buried on the isthmus.

NELLORE, a town and district of India, in the Madras presidency. The town is on the right bank of the Penner river, and has a station on the East Coast railway, 109 m. N. of Madras city. Pop. (1921) 35,863. There are Lutheran, American Baptist and Roman Catholic missions, and a college.

The DISTRICT OF NELLORE has an area of 7,973 sq.m. It comprises a tract of low-lying land extending from the base of the Eastern Ghats to the sea. Its general aspect is forbidding: the coast-line is a fringe of blown sand through which the waves occasionally break. Farther inland the country begins to rise, but the soil is not naturally fertile, nor are means of irrigation readily at hand. About one-half of the total area is cultivated; the rest is either rocky waste or is covered with low scrub jungle. Nellore, with the other districts of the Carnatic, passed under

direct British administration in 1801. The population in 1921 was 1,385,553. The principal crops are millets, rice, and pulses. The breed of cattle is celebrated. The East Coast railway runs through the length of the district.

NELSON, HORATIO NELSON, VISCOUNT (1758–1805), duke of Bronte in Sicily, British naval hero, was born at the parsonage house of Burnham Thorpe, in Norfolk, on Sept. 29, 1758. His father, Edmund Nelson, was rector of the parish and his mother, Catherine Suckling, was a grandniece of Sir Robert Walpole (1st earl of Orford). This connection proved useless to the future admiral, who, in a letter to his brother, the Rev. William Nelson, written in 1784, speaks of the Walpoles as "the merest set of cyphers that ever existed—in public affairs I mean." His uncle, Captain Maurice Suckling later became comptroller of the navy.

Early Life.—Horatio, who had received a summary, and broken, education at Norwich, Downham and North Walsham, was entered on the "Raisonnable" when Captain Suckling was appointed to her in 1770 on an alarm of war with Spain. The dispute was settled, and Captain Suckling was transferred to the "Triumph," the guardship at Chatham, whither he took his nephew. In order that the lad might have more practice than could be obtained in a harbour ship, his uncle sent him to the West Indies in a merchant vessel, and on his return gave him constant employment in boat work on the river. In a brief sketch of his life, which he drew up in 1799, Nelson says that in this way he became a good pilot for small vessels "from Chatham to the Tower of London, down the Swin, and the North Foreland; and confident of myself among rocks and sands, which has many times since been of great comfort to me." Between April and October of 1772 he served with Captain Lutwidge in the "Carcass," in an expedition to the Arctic seas under the command of Captain Phipps (Baron Mulgrave). On his return from the north he was sent to the East Indies in the "Seahorse," in which vessel he met his lifelong friend Thomas Troubridge. At the end of two years he was invalided home. In after times he spoke of the depression under which he laboured during the return voyage, till "after a long and gloomy reverie, in which I almost wished myself overboard, a sudden glow of patriotism was kindled within me, and presented my king and my country as my patron. My mind exulted in the idea. 'Well then,' I exclaimed, 'I will be a hero, and, confiding in Providence, I will brave every danger.'" He spoke to friends of the "radiant orb" which from that hour hung ever before him, and "urged him onward to renown." On his return home he served during a short cruise in the "Worcester" frigate, passed his examination as lieutenant on April 9, 1777, and was confirmed in the rank next day. He went to the West Indies with Captain Locker in the "Lowestoft" frigate, was transferred to the flagship of Sir Peter Parker (1721–1811), and was then promoted in rapid succession to the command of the "Badger" brig, and the "Hinchinbrook" frigate. By this appointment, which he received in 1779, he was placed in the rank of post captain (from which promotion to flag rank was by seniority), at the age of twenty. In the main he owed his rapid rise to his power of winning the affection of his comrades or superiors. Parker and his wife remained his friends through life.

Active Service.—In 1780 he saw his first active service in an expedition to San Juan de Nicaragua; he was brought to death's door by fever, and invalided home once more. In 1781 he was appointed to the "Albemarle" frigate, and after some convoy service in the North Sea and the Sound was sent to Newfoundland and thence to the North American station. "Fair Canada," as he has recorded in one of his letters, gave him the good health he had so far never enjoyed. From Quebec he sailed for the West Indies, where he made the personal acquaintance of Admiral Lord Hood. The admiral presented him to the duke of Clarence, afterwards King William IV., as an officer well qualified to instruct him in "naval tactics"—a marked compliment to a very young officer from one of the greatest exponents of the art. He appeared, says the Prince, "to be the merest boy of a captain I ever beheld; and his dress was worthy of attention. He had on a full-laced uniform; his lank unpowdered hair was tied in a stiff Hessian tail of an extraordinary length; the old-fashioned flaps of his waistcoat added to the general quaintness of his figure, and produced an appearance which particularly attracted my notice; for I had never seen anything like it before, nor could I imagine who he was or what he came about. My doubts were, however, removed when Lord Hood introduced me to him. There was something irresistibly pleasing in his address and conversation; and an enthusiasm, when speaking on professional subjects, that showed he was no common being." The slight oddity of appearance, the power to arouse affection, and the glow indicating the fire within, are noted by all who ever looked Nelson in the face.

The Peace of Versailles which closed the American War gave him leisure to visit France, there to study the language of his "country's enemies" and their writings on the subject of naval warfare. And now when the vast majority of naval officers were condemned to idleness on shore, he had the good fortune to be appointed to the command of the "Boreas" frigate, for service in the West Indies. Nelson signalized his arrival in the West Indies by refusing to acknowledge a half-pay officer acting as commissioner of the dockyard at Antigua as his superior. He insisted on enforcing the Navigation Laws against the Americans, who by becoming independent had become foreigners. He called the attention of the government to the corruption prevailing in the dockyard of Antigua. His line impressed the admiralty as somewhat assuming, and his strong measures against the interloping trade brought on him many lawsuits, which, though he was defended at the expense of the government, caused him much trouble for years. In the West Indies on March 12, 1787, he married Frances Nisbet (1761–1831), the widow of a doctor in Nevis, whose favour he first gained by being found romping on all fours with her little boy under the drawing-room table. The marriage was one of affection and prudence, rather than of love.

Outbreak of War.—When war broke out with revolutionary France, Nelson was appointed (Nov. 30, 1793) captain of the "Agamemnon" (64), and joined his ship on Feb. 7. From this date till June 1800, rather more than seven years, he was engaged on continual active service, with the exception of a few months when he was invalided home. This period is the most varied, the busiest, the most glorious and the most debated of a very full career. It subdivides naturally into three sections: (1) From the date of his appointment as captain of the "Agamemnon" till he was disabled by the loss of his arm in the unsuccessful attack on Santa Cruz de Tenerife on July 24, 1797, he served as captain, or commodore, under Hood, Hotham and Jervis, successive commanders-in-chief in the Mediterranean. (2) After an interval of nine months spent at home in recovering from his wound, and from the effects of a badly performed operation, he returned to the Mediterranean, and was at once sent in pursuit of the great French armament which sailed from Toulon under the command of Napoleon for the conquest of Egypt. His victory of the Nile (*q.v.*), on Aug. 1, 1798, placed him at once in the foremost rank among the warriors of a warlike time, and made him a national hero. (3) From his return to Naples after the battle of the Nile until his return to England in the summer of 1800, he was immersed in Mediterranean affairs which, owing to his own presence there, tended to centre round the shores of Naples and Sicily.

The Mediterranean.—The first of these three passages in his life is full of events which must, however, be told briefly. In May he sailed for the Mediterranean with Hood, and was engaged under his orders in the occupation of Toulon by the allied British and Spanish forces. In August 1793 he was despatched to Naples to convoy the troops which the Neapolitan government had undertaken to contribute towards the garrison of Toulon. It was on this occasion that he made the acquaintance of Emma Hamilton (*q.v.*), the wife of Sir William Hamilton, minister at the Court of Naples. References to Lady Hamilton begin to appear in his letters to his wife, but, as might be expected, they indicate little beyond respectful admiration, and he makes a good deal of her kindness to his stepson, Josiah Nisbet, whom he had taken to sea. After the allies had been driven from Toulon by

Napoleon, Nelson was employed throughout 1794 in the operations connected with the occupation of Corsica. In April and May he was engaged in the capture of Bastia, and June and July in the taking of Calvi. During the operations at Calvi, Nelson received a wound in his right eye which healed without leaving disfigurement, though the sight gradually faded. From the date of the occupation of Corsica till the island was evacuated (1794–96) he was incessantly active. He served under Hotham, who succeeded Hood in the command, and was engaged in the indecisive actions fought by him in the Gulf of Lyons in March and July 1795. The complacency of the new admiral fretted the eager spirit of Nelson, who declared that, for his part, he would never think that the British fleet had done very well if a single ship of the enemy got off while there was a possibility of taking her. Happily he was detached to the Riviera of Genoa, where, first as captain, and then as commodore, he had an opportunity to prove his qualities for independent command by harassing the communications of the French, and co-operating with the Austrians. In Sir John Jervis, who superseded Hotham, he found a leader after his own heart. When Spain, after first making peace with France at Basel, declared war on England, and the fleet under Jervis withdrew from the Mediterranean, Nelson was despatched to Elba on a hazardous mission to bring off the small garrison and the naval stores. He sailed in the "Minerve" frigate, having another with him. After a smart action with two Spanish frigates which he took off Carthagena on Dec. 20, and a narrow escape from a squadron of Spanish line of battle ships, he fulfilled his mission, and rejoined the flag of Jervis on the eve of the great battle (Feb. 14, 1797) off Cape St. Vincent. (*See* ST. VINCENT, BATTLE OF.) The judgment, independence and promptitude he showed in this famous engagement revealed him to the nation as one of the heroes of the navy. Nelson receiving the swords of the Spanish officers on the deck of the "San Josef" became at once a popular figure.

Blockade of Cadiz.—A few days after the victory he became rear-admiral by seniority, but continued with Jervis, who was made a peer under the title of Earl St. Vincent. Nelson's own services were recognized by the K.B. During the trying months in which discontent in the fleet was developing toward the mutinies at Spithead and the Nore, he remained with the flag, and in the blockade of Cadiz. In July 1797 he was sent to Santa Cruz de Tenerife and made a desperate attempt to capture the place. The enterprise was, in fact, rash in the last degree, for the soldiers from the garrisons of Elba and Corsica having gone home, no troops were available for the service, and a fortified town was to be taken by man-of-war boats alone. The Spaniards were on the alert, and the attack, made with the utmost daring on the night of July 24, was repulsed with heavy loss. Some of the boats missed the mole in the dark and were stove in by the surf, others which found the mole were shattered by the fire of the Spaniards. Nelson's right elbow was shot through, and he fell back into the boat from which he was directing the attack. The amputation of his arm was badly performed in the hurry and the dark. He was invalided home, and spent months of extreme pain in London and at Bath. On April 10, 1798, he came back to the fleet off Cadiz as rear-admiral, with his flag in the "Vanguard" (74).

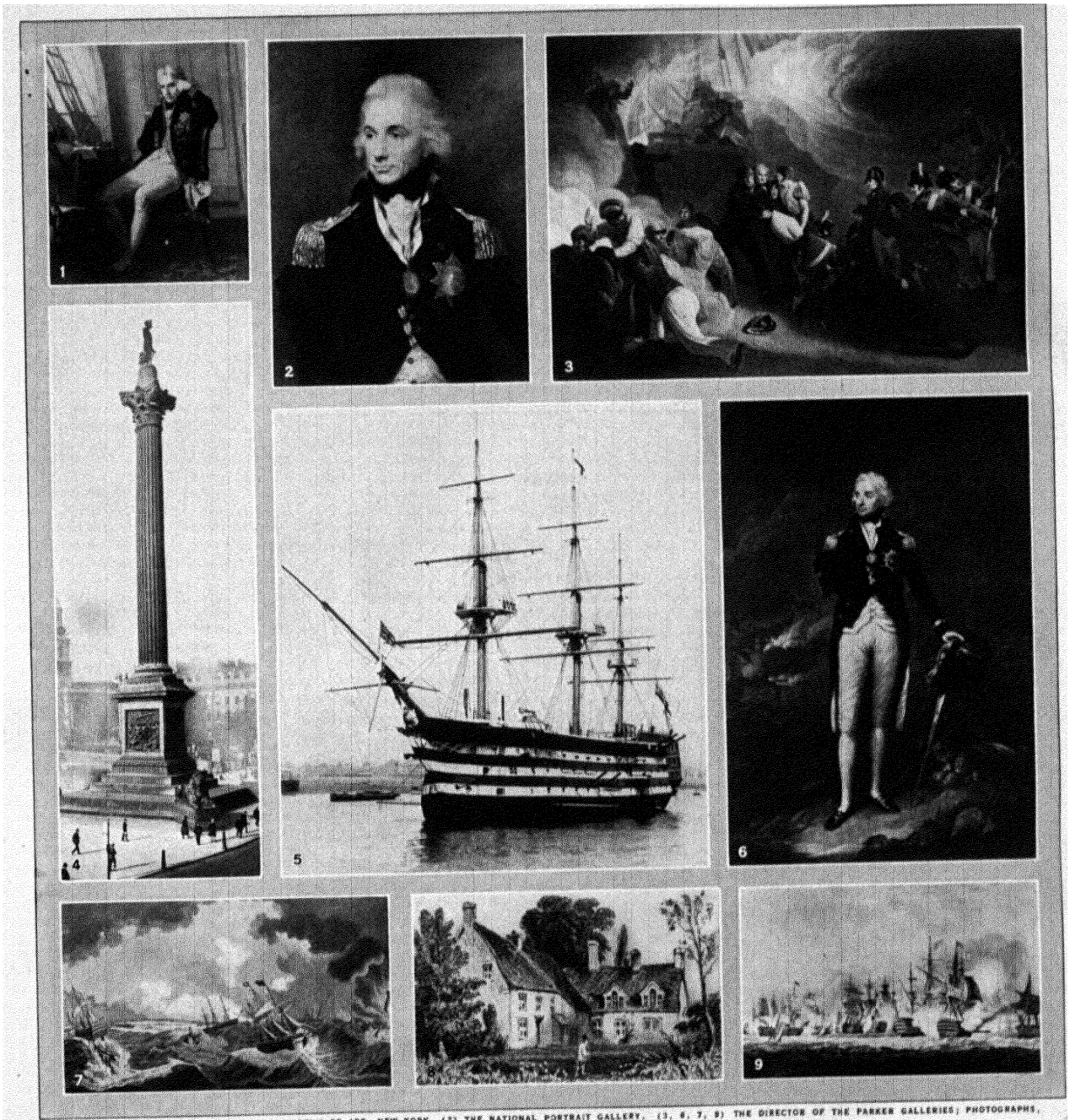
He was now one of the most distinguished officers in the navy. Within the next six months he was to raise himself far above the heads of all his contemporaries. A great armament was preparing at Toulon for some unknown destination. To discover its purpose, and to defeat it, the British government resolved to send their naval forces again into the Mediterranean, and Nelson was chosen for the command not only by Jervis, with whom the immediate decision lay, but also by ministers.

Command in the Mediterranean.—Having joined the flag of Lord St. Vincent outside of the straits of Gibraltar on April 30, Nelson was detached on May 2 into the Mediterranean, with three line-of-battle ships and five frigates, to discover the aim of the Toulon armament. Napoleon had, however, enforced rigid secrecy, and beyond the fact that a powerful combined force was collected in the French port he could learn nothing. On May 20 the "Vanguard" was dismasted in a gale. "I ought not," wrote Nelson, "to call what has happened by the cold name of accident; but I believe firmly that it was the Almighty's goodness to check my consummate vanity." The "Vanguard" was saved from going on shore by the skill of Captain Ball of the "Alexander," for whom Nelson had henceforth a peculiar regard. The "Vanguard" was refitted under cover of the little island of San Pietri off Sardinia. In the meantime the frigates attached to his command had returned to Gibraltar, in the erroneous belief that the liners would be taken there to make good the damage suffered in the gale. "I thought Hope would have known me better," said Nelson. On April 30 he was off Toulon again, only to find that the French were gone. Deprived of his best means of obtaining information by the disappearance of his frigates, he remained cruising till he was joined, on June 7, by Troubridge with ten sail of the line. And now he started on his fierce pursuit of the enemy, seeking him in the dark, for there were no scouts at hand; exasperated at being left without the eyes of his fleet; knowing that St. Vincent would be blamed for choosing so young an admiral; but resolved to follow the enemy to the antipodes if necessary. From Sardinia to Naples, from Naples to Messina, from Messina to Alexandria, from Alexandria, where he found the roadstead empty, back to Sicily, and then when at last a ray of light came to him, back to Alexandria—he swept the central and eastern Mediterranean. Unlike most admirals of his time, he freely discussed his plans with his captains. He had his reward in their devotion and perfect comprehension of what he wished them to do. At the same time he acquired an absolute confidence in the efficiency of his squadron, the magnificent force which had been formed by years of successful war, and by the careful training of his predecessors. The captains were the band of brothers he himself had made them.

The great victory of Aug. 1, 1798 (*see* NILE, BATTLE OF), brought Nelson yet another wound. He was struck on the forehead by a langridge shot, and had for a time to go below. For this victory he was made a baron.

Blockade of Naples.—After providing for the blockade of what remained of the French in Alexandria, Nelson set sail for Naples and arrived there on September 22nd. Pitt's Second Coalition against France was then on the point of completion, and Naples, naturally enough in view of the French behaviour on her borders, was preparing to side with Austria and Russia in the defence of monarchy; indeed she was already organising an army under the direction of the Austrian general, Mack, but no decision as to how the troops should be used had as yet been arrived at. Nelson immediately tried to enliven the proceedings and suggested what should have been a perfectly feasible plan, by which the Neapolitan Army was to advance northwards against the French front, while the fleet was to capture Leghorn, thus cutting the French communications. Leghorn was duly taken, but the army showed little aptitude for fighting, soon becoming a mere disorderly rout, pursued by the French. This had the effect of rousing all the Jacobins in the country which was soon in such an uproar that the royal family found it necessary to retreat to Palermo—an evacuation carried out of course by Nelson and his ships, with the valuable co-operation of Lady Hamilton (*q.v.*), wife of the British Ambassador. From Palermo, Nelson kept up a double blockade—one squadron under Captain Ball was detached to force Malta to capitulate, and another, under Captain Troubridge, was sent to the Bay of Naples to operate against the Neapolitan Jacobins.

The King and Queen, however, found this method of blockade too slow, and determined to appeal to the conservative instincts of many of their subjects, who had lazily acquiesced in the Jacobin coup d'état, through the agency of an eminent ecclesiastic—Cardinal Ruffo. His Eminence landed in Italy, and his appeal for an "Army of the faith" was soon answered by thousands flocking to his banner, and he was even joined by a detachment of Russians and Turks. While these events were taking place, a French fleet of 26 vessels, under Admiral Bruix, set out from Brest and was joined by 17 Spanish warships at Cartagena. Such a force constituted a threat to Nelson who called up his ships



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PORTRAITS OF LORD NELSON AND SCENES RELATING TO HIS LIFE

1. "Lord Nelson in the cabin of the Victory," after a painting by C. Lucy
2. Admiral Lord Nelson, after the portrait by L. F. Abbott
3. "Lord Nelson being carried below in the *Victory* after being fatally wounded at the Battle of Trafalgar, Oct. 21, 1805." Engraved by James Walker after a painting by J. A. Atkinson
4. The Nelson Monument, Trafalgar Square, London. This monument, consisting of a granite column 168½ feet high surmounted by a statue of Nelson, was completed in 1849 and stands in the southern side of the square, which is named in commemoration of the admiral's last victory. On the base are represented four battle scenes in bronze, cast from the metal of captured French cannon
5. The "Victory," Nelson's flagship at Trafalgar, now moored in Portsmouth harbour, England. It was repaired in 1921
6. "Rear Admiral Sir Horatio Nelson in the uniform of the blue." Engraved in 1798 by W. Barnard after a painting by L. F. Abbott
7. "Destruction of the French and Spanish prizes after the victory of Trafalgar." Engraved in 1806 by L. Hall after a painting by J. T. Serres
8. The rectory at Burnham Thorpe, Norfolk, where Nelson was born Sept. 29, 1758. The building was pulled down in 1802
9. "Representation of the Memorable Battle of Trafalgar," an engraving by Jos. Teakes after a contemporary painting, showing the British fleet engaging the combined fleets of France and Spain. The flagship "Victory" is second from the right

from Malta and Naples and prepared for resistance. He managed, however,—and this was important in view of Ruffo's successful beginning—to maintain the blockade of the latter by means of a squadron of small ships placed under Captain Foote of the frigate "Seahorse."

The Franco-Spanish threat proved an idle one and the allied fleet soon retired, but, in the meanwhile, Ruffo was driving all before him and finally shut up the French in the Castle of St. Elmo, in the city of Naples, and the native insurgents in the sea-washed castles of Uovo and Nuovo. From this commanding position he began to parley with the enemy, and the king, hearing of this, and nervous of what the Cardinal might do—he had not been empowered to make terms of peace—asked Nelson to proceed to Naples and take matters into his hands.

Ruffo's Treaty of Peace.—Nelson sailed for Naples, with Sir William and Lady Hamilton on board, on June 21st, and arrived there on the 24th to find the white flag flying from the castles and from his own flotilla. Supposing this to indicate an armistice, he at once made signal for the resumption of hostilities, only shortly to be informed by Captain Foote that matters had gone further and that a treaty of peace had been signed by which the native insurgents were to be allowed to leave their strongholds with all the honours of war, and were to be carried by ship to countries that would be glad to receive them. In making such a treaty there can be no doubt that Ruffo had greatly exceeded his instructions, though it is probable that he was actuated by motives of humanity since his control over his bloodthirsty army was incomplete. Nelson refused to listen to Ruffo's arguments or to admit the validity of his undertakings. Furthermore, he argued, there was no need for the insurgents, if they unconditionally surrendered as he proposed to make them, to trust themselves to the mob on shore, since they could be accommodated in boats without being taken to friendly countries. He agreed to let the armistice run its course, but let it be known that at the end of it he would expect unconditional surrender. This he received, and the rebels were placed in boats. One, Carraciolo, reached the hills, only to be caught at last and brought to Ruffo who, in his turn, because Carraciolo was a naval officer, handed him over to Nelson in his capacity as Commander-in-Chief of the Neapolitan fleet. Nelson at once convened a court martial of Neapolitan officers to try the rebel. The Court sentenced him to death by a majority vote, and this sentence was duly carried out.

For refusing to carry into effect Ruffo's peace terms and for not interfering to prevent the execution of Carraciolo, Nelson has been violently, and at times virulently, attacked, but it cannot be said that his traducers had ever succeeded in making out a very strong case against him. The whole matter is too involved to be fully discussed here; the conclusions which have been reached by scholars on either side have almost invariably reflected the political *parti pris* of the writers.

The whole question of Nelson's conduct at Naples is of course bound up with his friendship with Lady Hamilton. No one denies that it was now that Nelson's friendship for this woman ripened into the intimacy that was eventually to separate him from his wife. But that a private attachment, culpable as it may have been, warped his judgment in public matters no one has yet shown, nor has anyone explained why it should.

Return to England.—These events were shortly followed by the reduction of the French and by the restoration of the Neapolitan royal family in July, while in the same month Nelson laid himself open to a sharp rebuke from the Admiralty for disobeying the orders of Lord Keith who had been appointed to succeed Lord St. Vincent in the Mediterranean command. Keith, puzzled as to the objective of a combined Franco-Spanish fleet, decided that Minorca was in danger, and ordered Nelson to its defence. Nelson decided that it was not in danger and did not go. His judgment was correct, but his disobedience was inexcusable. On Jan. 20th, 1800, having in the meantime been created Duke of Bronté by the King of Naples, Nelson joined Keith at Leghorn to take part in an attempt on Corsica, during which he captured "Le Généreux" which had escaped him at the Nile. Shortly afterwards he obtained leave to go home and, not being spared a battleship, he travelled overland with Sir William and Lady Hamilton, being greatly fêted on the way. He landed in England in November.

Battle of Copenhagen.—His leave, though it was long enough to promote the final separation between him and his wife, was short. He became Vice-Admiral on Jan. 1, 1801, and soon after was offered the post of second-in-command to Sir Hyde Parker in the fleet which was to break up the armed neutrality of the northern powers. It is difficult to see why such a brilliant man was subordinated to one of such ordinary gifts as Parker, who appears at the beginning to have been suspicious of the abilities of his second-in-command. Nelson, however, choked down his natural disgust, and treated Parker with such tact that the Admiral's hostility soon melted into something approaching friendship. Indeed Nelson had his Commander-in-Chief to some extent under his thumb by the time they reached Copenhagen, and so was permitted, with rather more than half the fleet, to carry out his famous attack on the city and its defences that resulted in the battle of Copenhagen (*q.v.*). This battle showed up strongly Nelson's ability to hit upon the weak point in a defensive scheme, and is famous also for his action in putting his telescope to his blind eye when, in the middle of the fight, his attention was directed to Parker's signal ordering his withdrawal, and declaring he could not see it. It was an order that could not be obeyed without serious consequences to the fleet. In May, Parker was recalled and Nelson assumed the command, but the armed neutrality was dissolved and this left him with little to do. His health, too, was bad and in June he came home, his services being recognised by the bestowal of the title of Viscount. In the interval, before the Peace of Amiens, he was in command of a flotilla of small ships that were to combat Napoleon's threat of invasion. More in the hope of satisfying public opinion than for any other reason, an attack was launched on Boulogne with the object of destroying the flat-bottomed boats situated there. The port, however, was too strongly defended even for a Nelson.

During the short period of the Peace of Amiens (1802–3), Nelson, in company with Sir William and Lady Hamilton, lived at his house and estate that he had purchased at Merton in Surrey. Here he passed his days in quiet country pursuits, and his happiness was added to by a reconciliation with his father who had at first found it impossible to overlook his son's association with Lady Hamilton. This, probably the happiest period of his life, was all too short. War reopened in May, and Nelson was at once selected for the Mediterranean Command.

The Mediterranean Command, 1803.—He arrived off Toulon in July 1803, and instituted a strict blockade of that port. The French under Latouche-Tréville continually tried to lure him into indecisive actions in which, by damaging some of his ships, they might force him to withdraw, but Nelson consistently refused such offers and the French Admiral, writing to Napoleon, stated that he had offered battle but the English had withdrawn. Nelson declared that if he captured Tréville he would make him eat the letter, but he never had the chance to fulfil his boast, even figuratively, for Tréville died and was succeeded by Villeneuve. In the spring of 1805 the French eluded the blockade and made for the West Indies. This move was part of a large scheme directed towards the invasion of England and its details are too numerous for discussion. The series of naval movements arising from it are known as the Trafalgar Campaign, and the whole matter will be found fully dealt with under the title NAPOLEONIC WARS. Nelson, after searching the Mediterranean, decided, more by intuition than anything else, that Villeneuve had gone to the West Indies, and thither he followed him. On hearing of his enemy's arrival, Villeneuve returned precipitately to Europe, again pursued by Nelson, and got into Ferrol and then into Cadiz where he was blockaded by Collingwood, Nelson having meanwhile gone home on leave to enjoy again the rural delights of Merton. His enjoyment was indeed brief. No sooner had the news reached England that the allied fleet was in Cadiz than, with the approval and encouragement of Lady Hamilton, he offered his services, "to give M. Villeneuve a drubbing." They were immediately accepted, and he left Merton for the last time

on Sept. 13th and on the 29th was off to Cadiz.

Trafalgar.—The victory of Trafalgar (*q.v.*) which followed on Oct. 21 set the seal on his fame. Tactically it was a masterpiece and his famous signal "England expects that every man will do his duty," made as the fleet moved into battle, together with his death in the moment of victory, added, and still add, to its lustre. The "Victory," after passing through the French line, was engaged with the "Bucentaure" and the "Redoutable," and Nelson, as he walked up and down his quarter-deck with his flag-captain, Thomas Hardy, was struck by a bullet from a sharpshooter firing from the top of the last-named ship. His spine was broken, and he was carried below to the cockpit, suffering great pain. Here, amidst the din and racket of battle and the groans of the injured and dying, he lingered for a few hours. To the last he retained his interest in the battle and Hardy came to him from time to time to tell him of its progress. As his sight grew dimmer and he felt the end approaching he asked Hardy to kiss him. "Now I am satisfied," he said, "Thank God I have done my duty." "These words," says Southey in his moving account, "he repeatedly pronounced and they were the last he uttered." His body was brought home and laid in state in the Painted Hall at Greenwich Hospital, and was buried in St. Paul's.

So died the most famous of English seamen, and, indeed, the most famous of all seamen. He was more than merely a tactically and strategically brilliant Commander; he was a true leader of men—and men of all types, for the common seamen trusted and venerated him as much as did his officers. These latter were, in their turn, trusted by him and were ever in his confidence—his "band of brothers" he called them. No officer under Nelson could ever complain that he went into action not knowing his Commander's plans and intentions—and it is as much to this as to his tactical ability that his successes were due. The common seamen he always treated with humanity and kindness and these qualities were extended to his junior officers whom, remembering his own misery during his first days at sea, he was ever willing to encourage. On the other side it has been said that he was vain, liked flattery, and was an egotist. This is merely to say that he had the common faults of genius.

Nelson had no children by his wife. In November 1805, in recognition of Nelson's great services to his country, his brother William (1757–1835) was created Earl Nelson of Trafalgar, an annuity of £5,000 being attached to the title.

BIBLIOGRAPHY.—Southey's "Life of Nelson" edited by Professor Geoffrey Callender (1922). This contains a full bibliography.

(D. H.; X.)

NELSON, a town in British Columbia, situated at the head of navigation on the west arm of Kootenay lake. Pop. (1921) 5,230. It is the commercial and administrative centre of a mining, lumbering, fruit-growing district and is the headquarters of the Kootenay division of the Canadian Pacific. It is also a station on the Great Northern railway.

NELSON, a municipal borough in the Nelson and Colne parliamentary borough, Lancashire, England, 32½ m. N. from Manchester by L.M.S. railway. Pop. (1921), 39,841. Of modern growth, it possesses a town hall, market hall, free library, technical school, park and recreation ground, and an extensive electric tramway system connecting with Burnley and Colne. Its chief manufacture is cotton weaving, and, in recent years, the weaving of artificial silk. It was incorporated in 1890.

NELSON, a seaport of New Zealand, the seat of a bishop and capital of a provincial district of the same name; at the head of Tasman Bay on the northern coast of the South Island. Pop. (1927) 12,010. The woods and fields in the neighbourhood abound with English song-birds, and the streams are stocked with trout; while the suburbs and the district surrounding are famous for apple orchards; and hops are extensively cultivated. The town possesses boys' and girls' colleges of high repute. The cathedral (Christ Church) is finely placed on a mound which was originally intended as a place of refuge from hostile natives. The harbour, with extensive wharves, is protected by the long and remarkable Boulder Bank, whose southern portion forms the natural breakwater to that anchorage. The settlement was planted by the New Zealand Company in 1842.

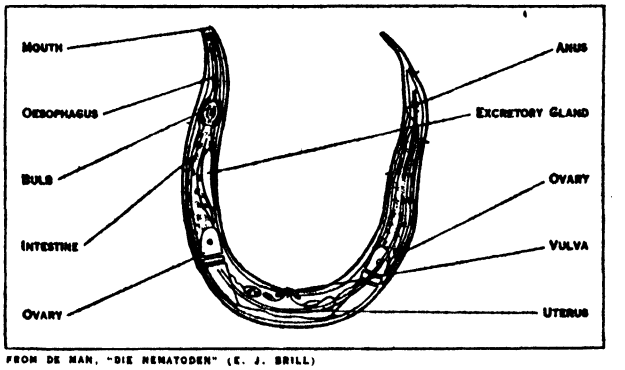
NELSON, a river of Keewatin district, Canada, discharging the waters of Lake Winnipeg in a north-easterly direction into Hudson Bay. It drains an area of 360,000 sq.m. and, including its tributary the Saskatchewan, is 1,450 m. long. It is navigable for small steamers for a distance of about 80 m., after which it is unnavigable except for canoes. It has a total fall between the lake and sea of 710 ft. Here its chief tributary is the Burntwood. Norway House at its source and York Factory at its mouth are important stations of the Hudson's Bay Company.

NELSONVILLE, a city of Athens county, Ohio, U.S.A., 62 m. S.E. of Columbus, on the Hocking river and the Hocking Valley railway. Pop. (1920) 6,440 (94% native white). It is an important coal-mining centre, and makes brick and tile from the clay which abounds in the vicinity. The city was founded in 1818 and incorporated in 1838. It was named after Elisha Nelson, who built the first house.

NEMATHELMINTHES, a term employed in zoology to denote a phylum of animals comprising the round-worms (Nematoda, *q.v.*) hook-worms (Acanthocephala), Nematomorpha (*q.v.*), to which are sometimes added the arrow-worms (Chaetognatha, *q.v.*), and various other groups of minor importance and doubtful affinities. Nemathelminthes is probably, even in its most restricted sense, an artificial group.

NEMATODA, a group of unsegmented worms ("thread-worms"), frequently regarded as forming, with the Nematomorpha and Acanthocephala (*qq.v.*), a phylum Nemathelminthes, but of extremely doubtful affinities. The form of the body is generally cylindrical, and the worms vary in length from a fraction of a millimetre to about a metre. A large number of nematodes (mostly of very small size) are free-living, and occur in water (fresh and marine), soil, moss or decaying substances; while many others are wholly or partly parasitic on plants or in the bodies of other animals, and may be of considerable economic or medical importance.

General Morphology.—The body-wall consists of (1) a tough, elastic, homogeneous cuticle, sometimes provided with spines or bristles; (2) a thin syncytial subcuticular layer; and (3) a single layer of muscle-cells which vary considerably in form and arrangement, but act only in a longitudinal direction. The musculature is divided into four longitudinal strips by internal thickenings of the subcuticular layer, the lateral "fields" and dorsal and ventral lines. The body-cavity, bounded by the muscles, contains a fluid in which the internal organs lie free. The mouth, situated at the anterior end, leads either into a buccal



FROM DE MAN, "DIE NEMATODEN" (E. J. BRILL)

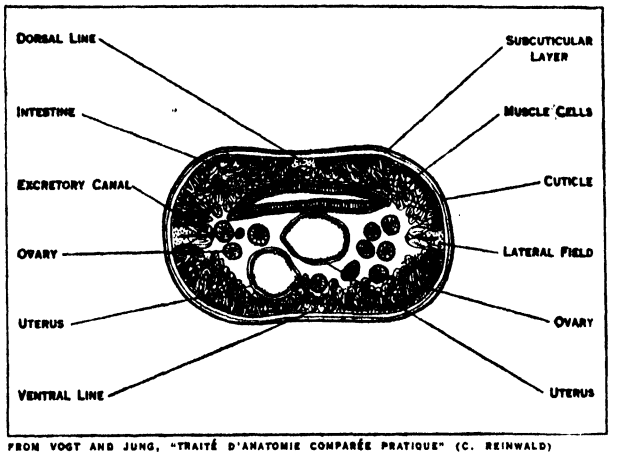
FIG. 1.—LATERAL VIEW OF FREE-LIVING FEMALE NEMATODE

cavity lined with cuticle or directly into the oesophagus, which is usually a three-sided muscular organ, but occasionally consists of a single column of cells surrounding a cuticular tube. The intestine is usually straight, and generally opens through a short rectum and an anus near the hinder end of the body.

The nervous system consists of a perioesophageal ring giving off nerves anteriorly and posteriorly. The chief sense organs are tactile papillae or bristles on the cuticle, situated mainly near the extremities. In certain free-living forms ocelli or "eye-spots" are present internally in connection with the oesophagus, and

sometimes possess lenses. A pair of special lateral cephalic organs, or "amphids," of uncertain function, exists in most free-living forms.

The excretory system consists either of a simple unicellular gland, connected with a minute ventral pore in the oesophageal region, or (in parasitic forms) of a pair of canals running in the

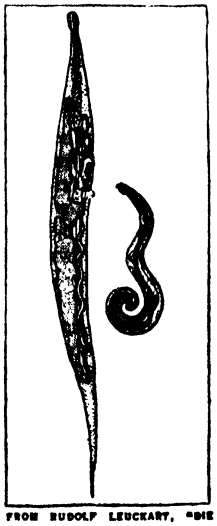


FROM VOGT AND JUNG, "TRAITÉ D'ANATOMIE COMPARÉE PRATIQUE" (C. REINWALD)

FIG. 2.—TRANSVERSE SECTION THROUGH THE BODY OF A FEMALE (ASCARIS LUMBRICOIDES), SHOWING THE BODY CAVITY, BOUNDED BY MUSCLES, IN WHICH THE INTERNAL ORGANS ARE SUSPENDED

lateral fields and joining anteriorly to open by a ventral pore. These canals are without cilia or flame-cells. Special respiratory and circulatory organs are absent.

The sexes are usually distinct. In the male the genital canal and the intestine open into a common cloaca. In the female the anus and genital aperture (vulva) are separate, the latter opening on the ventral surface at a very variable distance in front of the former. The males are usually smaller and less numerous than the females. The reproductive glands are blind, tubular and often much-coiled organs, continuous with their ducts. In the male there is most often a single testis (occasionally two). The spermatozoa are usually tailless, rounded or amoeboid cells. Secondary male organs in the form of chitinoid copulatory spicules and one or more "accessory pieces" are usually present in connection with the cloaca. The vagina of the female leads into a uterus with usually two (sometimes more, or only one) long branches, acting as egg-reservoirs, and each connected distally with its own ovary. The ova are fertilized in the uterus, and here also, in oviparous species, a firm chitinoid shell is usually formed round them before oviposition.



FROM RUDOLF LEUCKART, "DIE PARASITEN DES MENSCHEN"

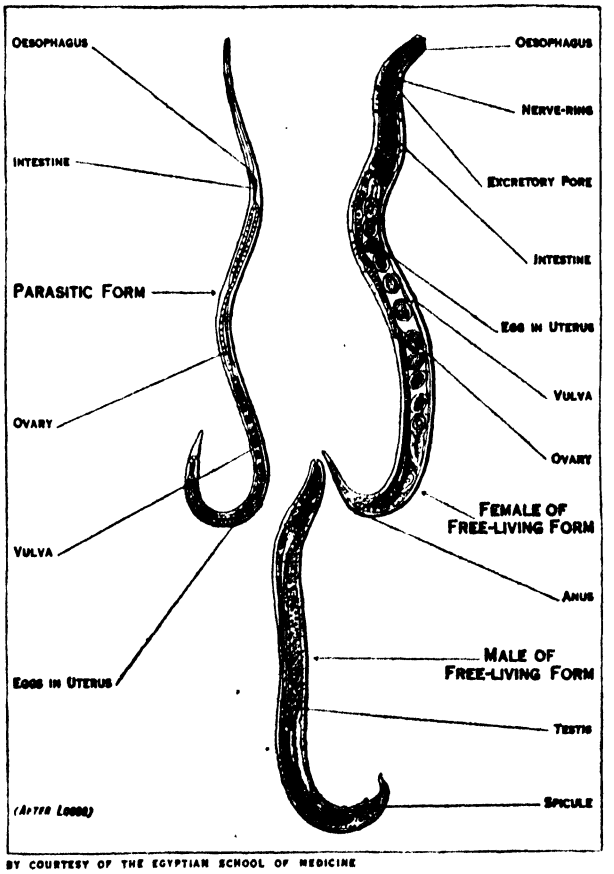
FIG. 3.—ENTEROBIUS VERMICULARIS, MALE ON RIGHT, FEMALE ON LEFT (HIGHLY MAGNIFIED)

Development.—The development of the nematodes is direct and without well marked metamorphosis, the young larvae, when hatched, having the typical cylindrical form of the adults. Four moults usually take place between the growth-periods of the larva, at which the entire cuticle is shed, together with the linings of the mouth, oesophagus and rectum. Changes in the form of the buccal cavity and oesophagus may accompany these moults, but the sexual organs do not become fully differentiated until after the third moult. In many forms the cuticle of the second moult is not immediately shed, but serves as a loose protective sheath until the larva finds its proper habitat. This is especially the case with the "infective" larvae of many parasitic forms, which do not shed the second cuticle until they find their way into the host. At this "ensheathed" stage larval nematodes are often very resistant to low temperatures and to desiccation, and may remain in a state of latent vitality for long periods.

Nematodes may be oviparous, ovoviviparous or viviparous. The free-living forms commonly produce relatively few and large eggs or young. Most of the parasitic forms, however, produce eggs or young, of much smaller relative size, in enormous numbers. These generally reach the exterior with the faeces of the host. The life-history of parasitic species may involve only one host, in which case the larvae (sometimes still in the egg-shell), may be taken in passively by the mouth with contaminated food or water, or may actively penetrate the skin or mucous membranes. On the other hand, an intermediate host (usually an arthropod or lower vertebrate) may be required, in whose tissues or body-cavity the third-stage larva remains encapsuled until swallowed, along with its host, by the final or definitive host.

Classification and Life-Histories.—The nematodes may, for the most part, be classified in five main groups, as follows:

I. Ascaroidea. Free-living or parasitic forms having normally three lips (one dorsal and two subventral). This group embraces several well marked families of parasitic forms (Ascaridae, Heterakidae, Oxyuridae, etc.) as well as almost all the purely free-living forms (Trilobidae, Alaimidae, Chaetosomatidae, Desmoscolecidae, Oncholaimidae, etc.), together with the families



BY COURTESY OF THE EGYPTIAN SCHOOL OF MEDICINE

FIG. 4.—STRONGYLOIDES STERCORALIS

Rhabditidae and Mermithidae, which are partly parasitic, and the Anguillulinidae (Tylenchidae), many of which attack plants.

The life-history of the Ascaroidea is usually direct, though some of the Ascaridae require an intermediate host. The infective larvae of *Ascaris* and some other genera have a complex migration within the body of the final host, travelling by way of the blood-stream to the lungs, whence they return by the trachea to the mouth, before finally settling in the intestine. In the Oxyuridae—*e.g.*, the common "threadworm" or "pinworm" (*Enterobius vermicularis*) of man—the eggs, as soon as laid,

commonly contain infective larvae, rapid infection of new hosts, or constant reinfection of the same host, thus being possible. In some of the Rhabditidae (including the human parasite, *Strongyloides stercoralis*) a free-living bisexual generation alternates with a parasitic generation consisting of "female" forms only. In the Mermithidae the sexual forms are free-living, the larval stages parasitic, chiefly in insects.

II. Strongyloidea. Parasitic forms in which the male is provided with a caudal "bursa" supported by a definite system of "rays." The more important families are the Strongylidae, Ancylostomidae (hookworms), Metastrongylidae and Trichostrongylidae.

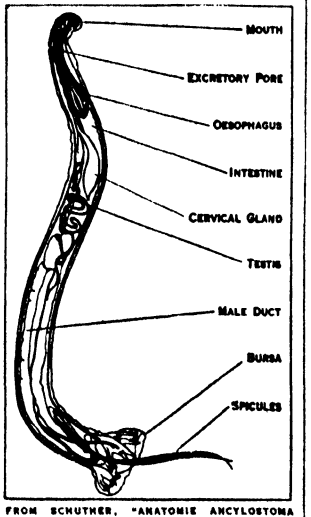
The life-history is usually direct, the infective larvae usually being taken in by the mouth, but in some cases—*e.g.*, the hookworms—being able to penetrate the skin. Migration within the host's body is frequent. In the case of the hookworms it follows a similar course to that of *Ascaris*. The adults of the Metastrongylidae inhabit chiefly the air-passages and blood-vessels of mammals, and are often responsible for bronchial and other disorders. The adults of the other families inhabit mainly the alimentary canal, with the exception of one small group which includes the "gape-worms" (*Syngamus*) of birds and mammals.

III. Filarioidea. Parasitic forms with paired lateral lips, or with or without secondary lip-like structures. The principal families are the Filariidae, Spiruridae, Camallanidae, Cucullanidae and Gnathostomidae.

The life-history is probably indirect in all cases. The adults of the Filariidae occur mainly in the connective tissue or blood-vessels of vertebrates, while the development of their larval stages takes place partly in mosquitoes or other blood-sucking insects, by which infection is transmitted. The Guinea-worm (*Dracunculus*) is transmitted by small water-fleas (*Cyclops*) contained in drinking-water. Among the other families the larvae usually become encapsuled in some intermediate host liable to be ingested by the final host, whose alimentary canal is the habitat of the adults.

IV. Dioctophymoidea. Containing a single family, Dioctophymidae, with three genera of parasitic forms chiefly characterized by the presence, in the male, of a caudal bursa-like structure without rays. To this group belongs *Dioctophyme*, the largest known nematode, a parasite of the urinary system of various mammals.

V. Trichinelloidea. Containing only the family Trichinellidae, parasitic forms in which the oesophagus is a cuticular tube embedded in a single chain of cells. To this group belong *Trichinella*, the cause of "trichinosis," and the "whipworms" (*Trichuris*). The life-history is usually direct, but the adults of *Trichinella*, living in the intestine, give rise to larvae which become encapsuled in the muscles of the same host, and transmission to a new host depends upon the ingestion of the flesh containing them.



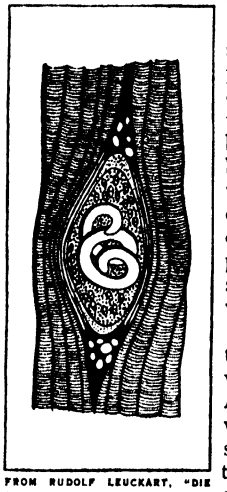
FROM SCHUTHER, "ANATOMIE ANCYLOSTOMA DUODENALE" (WM. ENGELMANN)

FIG. 5.—LATERAL VIEW OF MALE HOOKWORM (ANCYLOSTOMA)

Economic Importance.—Many of the nematodes parasitic in man and animals are of considerable medical and veterinary importance. Their ill effects, generally inappreciable in animals living in a state of nature, tend to become more marked in the artificial conditions under which man and his domestic animals live. Over-crowding and insanitary conditions are the chief causes of heavy infestation with such parasites, and their incidence in man is greatest in tropical and subtropical countries.

The parasites themselves may cause lesions of the tissues in various ways, or their presence may lead to secondary invasion by pathogenic organisms of other kinds. Sometimes the presence of the worms may merely cause mechanical irritation, and so lead to inflammatory conditions. But in many cases they appear to secrete toxic substances which react detrimentally upon the host, and nervous and other disturbances, apart from local effects, may result.

Perhaps the most important of the forms occurring in man are the hookworms (*Ancylostoma* and *Necator*), which are probably responsible, in some countries, for more disease, both physical and mental, than any other single cause. Their ravages are due in part to the ulceration of the intestine caused by their blood-sucking and tissue-destroying habits, but probably in part also to toxic properties. "Hookworm campaigns," having as one of their principal objects the education of the natives in the use of proper sanitary precautions, have been attended with considerable success in many parts of the world.



FROM RUDOLF LEUCKART, "DIE PARASITEN DER MENSCHEN"

FIG. 6.—TRICHINELLA SPIRALIS, SHOWING LARVAE ENCYSTED

Filariasis, or infestation with worms of the Filariid group, is another condition which may be of considerable importance. As has been mentioned, these worms, whose larvae circulate in the blood, and several species of which occur in man, are transmitted by mosquitoes and other blood-sucking flies. There is reason for believing that at least one of these species is concerned in the causation of elephantiasis, a terrible and disfiguring disease of wide occurrence in hot countries. Others cause tumours of the skin and other parts of the body.

Ascariasis, or infestation with Ascarids, has assumed a new importance during recent years, since it has been realized that the migrating larvae, on their passage through the lungs, are capable of inducing a form of pneumonia in their hosts when present in sufficient numbers. This is a frequent cause of death in young pigs, and deserves consideration in connection with human disease. Certain respiratory diseases in domestic animals, more especially "husk" in sheep and calves, are due to various species of lungworms (Metastrongylidae); while "gapes," a disease annually responsible for the death of large numbers of young poultry, is due to the invasion of the trachea and bronchii by a nematode (*Syngamus*). Parasitic gastritis and enteritis in cattle, sheep and horses are commonly due to nematodes, mostly belonging to the order Strongyloidea. The stomach-worm (*Haemonchus*) of sheep and cattle is one of the best known, but several others seem to be also, at times, responsible for losses.

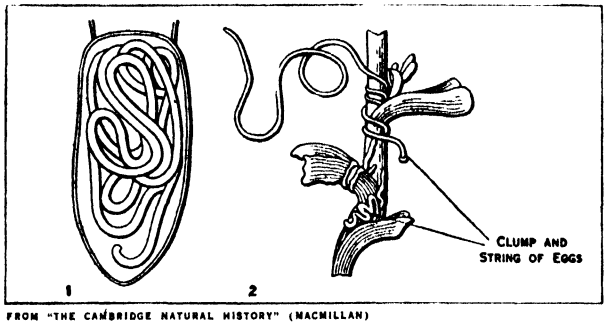
Lastly, mention should be made of certain "free-living" forms, mainly belonging to the genera *Heterodera* and *Anguillulina* (*Tylenchus*), which are important as agricultural pests. These attack the roots, stems, leaves or ears of cultivated plants of various kinds, and may cause great deterioration or even destruction of the crops. (H. A. B.)

NEMATOMORPHA (Gordiacea or "hairworms"), a group of elongate, thread-like, unsegmented worms, probably related to the Nematoda (*q.v.*), but differing from them in certain respects. The adults occur mainly in fresh water (occasionally in wet earth), and are sometimes found in tangled masses. The species vary in length from a few inches to two or three feet, but none are thicker than whipcord. They are usually of a brownish colour.

The body-wall consists of (1) a stout cuticle, with an outer layer (smooth or with shagreen-like "areoles," sometimes bearing spines or bristles of various kinds) and an inner layer of obliquely crossed fibres; (2) a single subcuticular layer of cells; and (3) a layer of longitudinal muscle-fibres. Most of the space within the body-wall is filled with parenchymatous tissue, in which the internal organs are embedded. There is an alimentary canal, opening posteriorly into a cloaca together with the genital ducts. A

mouth is usually absent in the adult. No circulatory or excretory organs are known. There is a single ventral nerve-cord, with anterior and posterior ganglia.

The sexes are separate, the males being usually smaller than the females and, in some genera, distinguishable by having the tail bifurcate. The tail of the female is usually undivided, but in *Paragordius* it has three prongs. The gonads are paired in both



FROM "THE CAMBRIDGE NATURAL HISTORY" (MACMILLAN)

FIGS. 1 AND 2.—GORDIID WORMS (MAGNIFIED)

1. Abdomen of a beetle (*Pterostichus niger*), with the terga removed, showing a Gordiid worm within
2. A female Gordiid worm depositing its eggs on a water plant

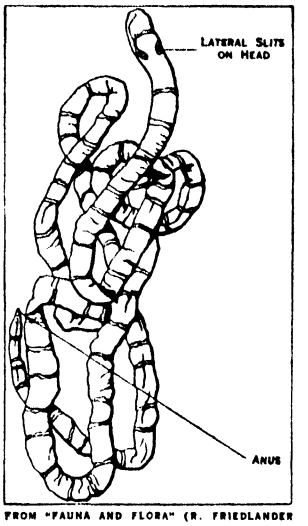
sexes, and are continuous with their ducts. In the gravid female the ovaries give off thin-walled lateral pockets, which ultimately break down and discharge the ova into spaces in the parenchyma. The eggs, held together by a cement-like substance, are laid in strings or masses, usually on plants or stones under water. The first larval stage is a minute creature armed with spines and having a boring organ anteriorly, by means of which it enters a host (usually an aquatic animal). In species which attack insects such as grasshoppers, the second larval stage may apparently be reached without change of host. In others it may develop in a second host, usually a beetle, which preys upon the first. The second larval stage is elongate and worm-like, and develops directly into the adult form. Pigment is developed, and the larval cuticle shed, just before emergence from the host. This usually takes place on contact with water, the worm bursting its way out through a soft place in the body-wall.

The group includes the genera *Gordius, Paragordius, Chordodes* and *Parachordodes,* to which a fifth, *Gordionus,* has been added by G. W. Müller. It is still uncertain whether *Nectonema* (a pelagic marine form provided with rows of bristles) is more closely related to this group or to the Nematoda. (H. A. B.)

NEMEA, BATTLE OF, 394 B.C. This was the decisive battle, in the sense that it broke the force of the hostile offensive, of the "Corinthian War," against Sparta, waged by the coalition of Thebes, Corinth, Athens and Argos, but instigated by Persia. In its initial pattern it was the typical frontal battle of the time, and both lines as they advanced experienced the characteristic "drift" to the right, so that each right wing overlapped the opponent's left wing. Thus on one flank the Spartans dispersed the Athenians, and on the other Sparta's allies were shattered by the Argives and Corinthians. Then, however, the Spartans, instead of pursuing blindly ahead like Clearchus and his men at Cunaxa, checked their pursuit and caught in flank three successive bodies of the enemy as they were marching back to their base. With this success the menace to Sparta waned, and the initiative in further operations passed to her. (*See* further CUNAXA and CORONEA.)

NEMERTINEA (NEMERTINES or NEMERTEANS), a group of unsegmented worms showing considerable resemblances to the Platyhelminthes (*q.v.*), but generally looked upon as a distinct phylum. Almost all nemertines are free-living, and the majority are marine, though a few live in fresh water or even on land. Their most characteristic feature is the possession of a remarkable eversible proboscis lying in a special sheath dorsally to the alimentary canal.

General Morphology.—In shape the body is usually elongate and cylindrical or somewhat depressed. There are no appendages, but in pelagic species certain parts of the body may be flattened out laterally to form fin-like membranes. The skin is often brightly pigmented, brown, red, and green being the most frequent colours, while some species are conspicuously striped or banded with whitish markings, or show various other patterns. The body is completely covered with a ciliated epidermis. In or below this numerous glandular cells are usually present, which discharge their mucoid secretion on to the surface of the body. This secretion frequently forms a tube within which the animal lives. Beneath the epidermis there is a "basement membrane" of dense connective tissue, and below this variously arranged layers of longitudinal and circular muscle-fibres. The spaces between the individual muscle-layers, and between the musculature and the various organs of the body, are mainly filled up with connective tissue or parenchyma, and there is no true perivisceral space or coelom.



FROM "FAUNA AND FLORA" (R. FRIEDLANDER & SON)

FIG. 1.—LINEUS GENICULATUS

The proboscis pore (or rhynchostome) and the mouth may have a common opening at the anterior end, or the mouth may be distinct and situated subterminally on the ventral surface. There is an intestine opening posteriorly by an anus, and sometimes preceded anteriorly by a specialized oesophagus or "stomach" with muscular walls. In many species the intestine has paired lateral pouches, and an appearance of metameric segmentation is produced by the presence of a series of transverse sheets of muscular fibres stretching across the body and separating each pair of pouches from its neighbours. In certain forms there is an anterior, ventral, blind prolongation of the intestine below the "stomach." This has been shown to open in the embryo as the blastopore, and subsequently to lose its connection with the exterior.

The proboscis forms a blind invagination lying loosely within the proboscis sheath, or rhynchocoele. Its anterior portion can be everted by the contraction of the muscular walls of the sheath, and the consequent pressure of the fluid which this contains. The posterior portion is prevented from being everted by a retractor muscle attached to the wall of the rhynchocoele. The proboscis itself is generally very muscular and richly supplied with nerves. In some forms it is unarmed and probably mainly sensory in function. In others, however, it contains, in that region which becomes the anterior end in the everted condition, one or several calcareous stylets mounted on a special base, in close relation with a muscular bulb and a duct which may serve for the expulsion of a "poison." In the walls of the proboscis in armed forms, near the base of the stylet, there are two or more pockets containing "reserve" stylets. These probably take the place of the functional stylet if this is broken off, but how this occurs is unknown. In some forms the lining of the proboscis is said to contain "nematocysts" or stinging-cells like those of the coelenterates.

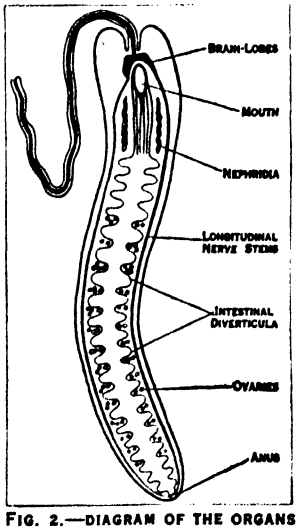
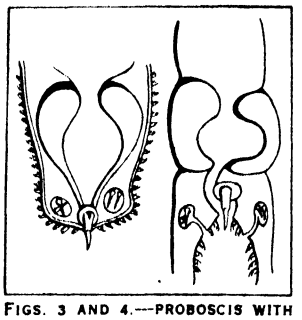


FIG. 2.—DIAGRAM OF THE ORGANS OF A NEMERTINE

The central nervous system, or brain, consists of a ring surrounding the proboscis-sheath anteriorly, and developed into

lateral masses or lobes, of which there are usually two dorsal and two ventral. The brain gives off two main lateral nerve-cords which run throughout the length of the body posteriorly, and sometimes unite dorsally near the anus. It also sends a pair of large nerves to the proboscis, a pair of nerves to the sense-organs of the anterior region, and a pair to the oesophagus. There is, in many forms, a plexus of nervous tissue between the muscular layers of the body wall. In others this is absent, but the various parts and organs of the body are innervated by branches from the lateral cords. In association with the brain there is usually a pair of lateral cephalic pits or grooves, containing mucus-secreting cells and connected by ciliated canals with special masses of nervous tissue. The function of these organs is uncertain. A pair of shallow, eversible, lateral pits, probably sensory, also occurs farther back on the body in certain species. In many forms eyes are present, and these organs may be very numerous. They may be mere spots of dark pigment, or may be provided with a cellular lens.



FIGS. 3 AND 4.—PROBOSCIS WITH STYLET, "RESERVE" SACS AND MUSCULAR BULB OF A HOPLONEMERTINE

There is a closed circulatory system, containing a colourless fluid and nucleated corpuscles which in some species appear to contain haemoglobin. The main vessels are three longitudinal trunks, one median and two lateral. These are connected at both ends of the body. At the anterior end, in some forms, they break up into a system of sinuses, while in others they are joined by a simple loop-like commissure. A series of metamerically arranged transverse vessels is present in many forms, connecting the three longitudinal vessels along their course.

The excretory organs, when present, usually consist of a single pair of nephridia opening laterally by ciliated ducts a little behind the mouth. Their inner ends are branched and terminate in a number of "flame-cells" closely applied to the walls of the lateral blood-vessels in the anterior region.

The sexes in the Nemertinea, with few exceptions, are separate. The gonads are constructed on a very simple plan, in strong contrast with the complicated system usually met with in the Platyhelminthes. They consist of a series of simple sacs, alternating with the lateral pouches of the intestine, and opening, when mature, by separate ducts to the exterior. The sexual products (ova or spermatozoa) are proliferated from the lining epithelium of the sacs. It is probable that the cavities of these sacs represent the coelom.

Classification.—The modern systematic arrangement of the Nemertinea is based chiefly on the armed or unarmed condition of the proboscis, the arrangement of the muscle-layers and the position of the nerve-cords. The group is divided into two subclasses and four orders, as follows:—

SUBCLASS I.—Anopla. Proboscis unarmed.

Order 1.—Palaeonemertidea. Muscle-layers two or three; usually two circular layers with a longitudinal layer between them (the inner circular layer absent in Tubulanidae). Nerve-cords external to the musculature. This order includes the families Tubulanidae, carinomidae, hubrechtiidae and cephalotrichidae.

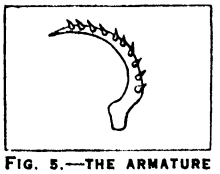


FIG. 5.—THE ARMATURE FROM THE PROBOSCIS OF DREPANOPHORUS

Order 2.—Heteronemertidea. Muscle-layers three; two longitudinal layers with a circular layer between them. Nerve-cords between the outer longitudinal and the circular muscles. Includes the families Baseodiscidae and Lineidae.

SUBCLASS II.—Enopla. Proboscis usually armed with one or several stylets. Muscle-layers two; an outer circular and an inner longitudinal layer. Nerve-cords internal to the musculature.

Order 3.—Malacobdellidea. Body short, with a sucker at the posterior end. Proboscis unarmed, opening with the mouth. Intestine coiled, without pouches. This order contains the leech-like form *Malacobdella*, which lives as a parasite or commensal within the mantle-cavity of marine lamellibranch molluscs.

Order 4.—Hoplonemertidea. Proboscis armed. Intestine straight, with a blind, ventral, anterior diverticulum and paired lateral pouches.

Suborder 1—Polystilifera. Stylet-base crescent-shaped, bearing several stylets along its convex side. This suborder has been divided into two "tribes," the Pelagonemertoidae and Drepanophoroidae. The former consists of pelagic forms, in which cephalic and excretory organs and an oesophagus are absent, and the male gonads are confined to the anterior region. This tribe is further subdivided into ten families (Nectonemertidae, Pelagonemertidae, etc.). The Drepanophoroidae are bottom-living forms in which cephalic and excretory organs and an oesophagus are present, and the gonads extend to the posterior end. This tribe contains the families Alboganemertidae, Uniporidae, and Drepanophoridae.

Suborder 2.—Monostilifera. Stylet-base shaped like the handle of an awl, and bearing a single terminal stylet. This suborder contains five families, of which the best known are the Amphiporidae and the Prostomatidae.

Development and Life-History.—Some nemertines go through a remarkable metamorphosis. In *Cerebratulus* there is a curious free-swimming, ciliated larval stage known as the pilidium, which resembles a helmet with side lobes like ear-lappets, and with an apical "spike" of long cilia. The pilidium is provided with an alimentary tract which is destined to become that of the fully-formed larva. Two pairs of invaginations grow inwards from the outer covering so as to surround the intestine, and ultimately form the skin and muscular body-wall of the animal. The worm is thus developed within the pilidium, which is a mere temporary envelope. It finally becomes ciliated, escapes from the pilidium, and grows into an adult. In *Lineus* there is a creeping larval form known as the "larva of Desor." This has a ciliated envelope corresponding to the pilidium, within which

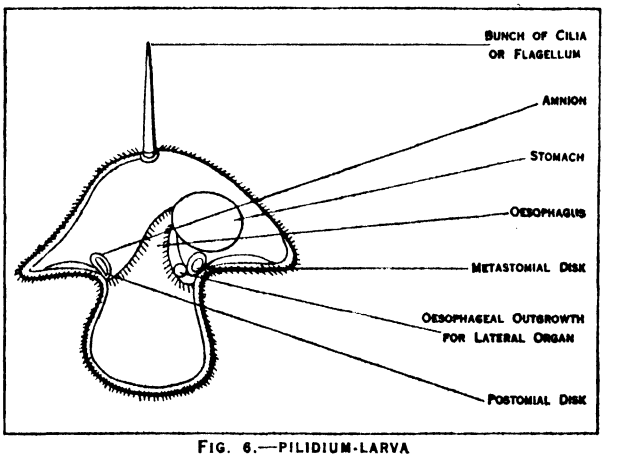


FIG. 6.—PILIDIUM-LARVA

the body of the worm is formed in a similar manner, and which is finally shed. In other forms the development is simple and direct, the pilidium stage being apparently suppressed.

The majority of nemertines live in comparatively shallow water, under stones or among algae and corals, in empty shells, or buried in mud or sand, where they frequently line their burrows with a gelatinous tube. Certain species live as commensals or possibly as parasites of other animals (crustaceans, ascidians, and molluscs). Nemertines usually progress rather slowly by crawling, though some are able to swim actively with an undulating motion. They are carnivorous and extremely voracious animals, capturing their prey with the aid of the proboscis, and being able, in many cases, to engulf creatures of considerable size, the mouth being capable of great distension.

The eggs of some species are laid in strings or masses, embedded in a gelatinous secretion. This appears to serve both as

a protective covering and as food material for the larvae after hatching. In some species the female secretes a definite parchment-like "cocoon" round herself before depositing her eggs. This cocoon is usually attached to a stone or weed. The body of the mother may even disintegrate after the deposition of the eggs, and form a food-supply for the young within the cocoon.

The body of many nemertines is capable of extreme extension and contraction. One common species of *Lineus* is often many yards in length when lying fully extended on a muddy bottom, and has earned the popular names of "bootlaces" and "india-rubber-worm." Another peculiarity of the group is the readiness with which many species will break themselves up into innumerable short fragments under the stimulus of any sudden irritation. Such fragments are often capable of living independently for some time, and lost portions are quickly regenerated, some or all of the pieces developing into complete worms. The proboscis, if broken off, is likewise generally reproduced. (H. A. B.)

NEMESIANUS, MARCUS AURELIUS OLYMPIUS, Roman poet, a native of Carthage, flourished about A.D. 283. He was a popular poet at the court of the Roman emperor Carus (Vopiscus, *Carus*, 11). He wrote poems on the arts of fishing (*Halieutica*), aquatics (*Nautica*) and hunting (*Cynegetica*), but only a fragment of the last, 325 hexameter lines, has been preserved. It is neatly expressed in good Latin, and was used as a school text-book in the 9th century. Four eclogues, formerly attributed to Titus Calpurnius (*q.v.*) Siculus, are now generally considered to be by Nemesianus, and the *Praise of Hercules*, generally printed in Claudian's works, may be by him.

Complete edition of the works attributed to him in E. Bährens, *Poetae Latini Minores*, iii. (1881) and J. P. Postgate's *Corpus Poetarum Latinorum*, ii.; *see* also L. Cisorio, *Studio sulle Egloghe di N.* (1895) and *Dell' imitazione nelle Egloghe di N.* (1896); and M. Haupt, *De Carminibus Bucolicis Calpurnii et N.* (1853), the chief treatise on the subject.

NEMESIS. (1) A goddess worshipped at Rhamnus in Attica. She is closely connected with Artemis, probably a local form of her or of some other very similar goddess. In mythology (posthomeric; the story is told in the cyclic *Cypria*) she is loved by Zeus who catches her after a transformation-race; she lays an egg, from which Helen (*q.v.*) is hatched out, generally by Leda (*q.v.*), it is a disputed point whether Leda or Nemesis is the mother of Helen in the original form of the story. There seems also to have been a legend (Catullus, lxiv., 393) that on some occasion (Marathon?) she appeared in person to encourage her worshippers in battle. (2) The indignant disapproval felt at wrong-doing; in particular, such disapproval on the part of the gods, and the consequent punishment of a sinful (or over-prosperous) man, hence (first in Hesiod) that disapproval personified. There was an old cult of "the Nemeseis" at Smyrna (Pausanias, ix., 35–36) but whether of this abstraction or of the fertility-goddess of Rhamnus, is not clear. That the abstraction was worshipped, at least in later times, is beyond doubt, however; a fragment of Antimachus (in Strabo, xiii., 1, 13) says that Adrastus was the first to erect an altar to her. In Rome especially her cult was very popular, particularly among soldiers, by whom she was worshipped as patroness of the drill-ground (Nemesis campestris); associated with Fortune, she seems also to have been adored as presiding over races; she had a cult-association, the Nemesiaci.

Bibliography.—L. R. Farnell, *Cults of the Greek States*, ii. (1896); O. Rossbach in Roscher's *Lexikon*, *s.v.* (bibl.); G. Wissowa, *Religion und Kultus* (2nd ed., 1912). (H. J. R.)

NEMESIUS (*fl. c.* A.D. 390), a Christian philosopher, author of a treatise *περὶ φύσεως ἀνθρώπου* (*On Human Nature*), was, according to the title of his book, bishop of Emesa (in Syria). His book is an attempt to compile a system of anthropology from the standpoint of the Christian philosophy. Moses and Paul are put side by side with Aristotle and Menander, and there is a clear inclination to Platonic doctrines of pre-existence and metempsychosis. In physiology he is in advance of Aristotle and Galen, though we can hardly assert—as has sometimes been thought—that he anticipated Harvey's discovery of the circulation of the blood.

Editions: Antwerp 1575; Oxford, 1671; Halle, 1802; Migne's *Patrol. Gr.* vol. 40. Versions: Latin by Alsanus, ed. Holzinger (1887); by Burgundio, ed. Burkhardt (1891–96). Literature: Bender, *Untersuch. über Nemesius* (1898).

NEMOPHILA, a genus of North American herbs of the water-leaf family (Hydrophyllaceae), comprising some 20 species found chiefly in the Pacific coast region, 13 of which are native to California. They are more or less diffuse annuals, with parted, divided or lobed leaves, and delicate blue or white flowers, blossoming in early spring. Several are grown as border plants, especially the baby blue-eyes (*N. Menziesii*) and the five-spot (*N. maculata*). Other interesting species are the climbing nemophila or fiesta-flower (*N. aurita*), the small white nemophila (*N. heterophylla*) and the small flowered nemophila (*N. parviflora*), the last named ranging from California to Washington.

NEMORENSIS LACUS (mod. *Nemi*), a lake in the Alban hills, in an extinct subsidiary crater in the outer ring of the ancient Alban crater, east of the Lake of Albano. It is about 3½ m. in diameter and some 110 ft. deep; the precipitous slopes of its basin are over 300 ft. high, and are mainly cultivated. In ancient times it was included in the territory of Aricia and bore the name "Mirror of Diana." The worship of Diana here was originally celebrated with human sacrifices; even in imperial times the priest of Diana was a man of low condition, a gladiator or fugitive slave, who won his position by slaying his predecessor in fight, having first plucked a mistletoe bough from the sacred grove. The temple itself was one of the richest in Latium; Octavian borrowed money from it in 31 B.C. The remains of its precinct are situated a little above the level of the lake, on the north-east—a large platform, the back of which is formed by a wall of concrete, with niches, resting against the cliffs. Excavations (now covered in again) led to the discovery of the temple itself, a comparatively small building, 98 by 52 ft., containing objects, none earlier than the 4th century B.C. A road descended to it from the Via Appia from the south-west. The lake is drained by a tunnel of about 2 m. long, of Roman date.

On the west side of the lake remains of two ships (really floating palaces moored to the shore) have been found, one belonging to the time of Caligula (as is indicated by an inscription on a lead pipe), and measuring 210 ft. long by 66 wide, the other even larger, 233 by 80 feet. The first was decorated with marbles and mosaics, and with some very fine bronze beamheads, with heads of wolves and lions having rings for hawsers in their mouths (and one of a Medusa), now in the Museo delle Terme at Rome. Various attempts have been made to raise the first ship, from the middle of the 15th century onwards, and the ancient emissarium has now been cleared in order to lay bare the remains of the ships. Caesar had a villa constructed there.

See J. G. Frazer, *The Golden Bough* (1913–14); L. Morpurgo in *Monumenti dei Lincei*, xiii. (1903), 297 *sqq.*

NEMOURS, LORDS AND DUKES OF. In the 12th and 13th centuries the lordship of Nemours, in Gâtinais, France, was in possession of the house of Villebeon, a member of which, Gautier, was marshal of France in the 13th century. The lordship was sold to King Philip III. in 1274 and 1276 by Jean and Philippe de Nemours, and was then made a county and given to Jean de Grailly, captal de Buch in 1364. In 1404 Charles VI. of France gave it to Charles III. of Evreux, king of Navarre, and erected it into a duchy in the peerage of France (*duché-pairie*). Charles III.'s daughter, Beatrix, brought the duchy to her husband Jacques de Bourbon, count of La Marche, and by the marriage of their daughter, Eleanor, to Bernard of Armagnac, count of Pardiac, it passed to the house of Armagnac. The duchy reverted to the French crown in 1505, after the extinction of the house of Armagnac-Pardiac. In 1507 it was given by Louis XII. successively to his nephew, Gaston de Foix (d. 1512), Guiliano de Medici and his wife Philiberta of Savoy in 1515, to Louise of Savoy in 1524, and to Philip of Savoy, count of Genevois, in 1528, whose descendants possessed the duchy until its sale to Louis XIV. In 1572 Louis gave it to his brother Philip, duke of Orleans, whose descendants possessed it until the Revolution. The title of duc de Nemours was afterwards given to Louis Charles, son of King Louis Philippe, who is dealt with separately below.

The following are the most noteworthy of the earlier dukes of Nemours.

JAMES OF ARMAGNAC, duke of Nemours (*c.* 1433–1477), was the son of Bernard d'Armagnac, count of Pardiac, and Eleanor of Bourbon-La Marche. As comte de Castres, he served under Charles VII. in Normandy in 1449 and 1450, and in Guienne. Louis XI. loaded him with honours, married him to his god-daughter, Louise of Anjou, and recognized his title to the duchy of Nemours in 1462. Sent by Louis to pacify Roussillon, Nemours felt that he had been insufficiently rewarded for the rapid success of this expedition, and joined the League of the Public Weal in 1465. The king's patience eventually became exhausted by his intrigues; his château at Carlat was attacked, and he was condemned by the parlement, and beheaded on Aug. 4, 1477.

See B. de Mandrot, *Jacques d'Armagnac, duc de Nemours* (1890).

CHARLES EMMANUEL (1567–1595), son of James, duke of Nemours and Anne of Este, widow of Francis, duke of Guise, was called in his youth prince of Genevois. Involved in political intrigues by his relationship with the Guises, he was imprisoned after the assassination of Henry, duke of Guise, and his brother the cardinal of Lorraine, in 1588, but escaped. He was governor of Paris when it was besieged by Henry IV. After quarrelling with his half-brother Charles of Lorraine, duke of Mayenne, he withdrew to his government of Lyonnais, where he endeavoured to make himself independent. He was imprisoned, however, in the château of Pierre-Encise by the archbishop of Lyons. After his escape he attacked Lyons, but was defeated owing to the intervention of the constable de Montmorency. He died at Annecy in July 1595.

His brother HENRY (1572–1632), called originally marquis de Saint-Sorlin, succeeded him as duke. In 1588 he took the marquisate of Saluzzo from the French for his cousin, the duke of Savoy. The princes of Guise, his half-brothers, induced him to join the League, and in 1591 he was made governor of Dauphiné. He made his submission to Henry IV. in 1596. After quarrelling with the duke of Savoy he joined the Spaniards in their war against Savoy. After peace had been proclaimed on Nov. 14, 1616, he retired to the French court. He died in 1632, and was succeeded by his eldest son, Louis, and on the death of the latter in 1641 by his second son, CHARLES AMADEUS (1624–1652), who served in the army of Flanders in 1645, and in 1646 commanded the light cavalry at the siege of Courtrai. In 1652 he took part in the war of the Fronde, and was wounded at the Faubourg St. Antoine. On July 30, 1652, he was killed in a duel by his brother-in-law, François de Vendôme, duke of Beaufort. He had two daughters, Marie Jeanne Baptiste (d. 1724), who married Charles Emmanuel of Savoy in 1665; and Marie Françoise Elisabeth, who married Alphonso VI., king of Portugal, in 1666. His brother Henry (1625–1659), archbishop of Reims, withdrew from orders and succeeded to the title.

In 1657 Henry married MARIE D'ORLEANS-LONGUEVILLE (1625–1707), daughter of Henry II. of Orléans, duke of Longueville. This duchess of Nemours is a famous personage. At an early age she was involved in the first Fronde, which was directed by her father and her stepmother, Anne Geneviève de Bourbon-Condé, the celebrated duchesse de Longueville; and when her husband died in 1659, leaving her childless, her life was mainly spent in contesting her inheritance with her stepmother. She left some interesting *Mémoires*, which are published by C. B. Petitot in the *Collection complète des mémoires* (1819–1829).

NEMOURS, LOUIS CHARLES PHILIPPE RAPHAËL, DUC DE (1814–1896), second son of the duke of Orleans, afterwards King Louis Philippe, was born on Oct. 25, 1814. In 1830 he became a chevalier of the order of the Saint Esprit and entered the chamber of peers. As early as 1825 his name was mentioned for the throne of Greece, and in 1831 he was elected king of the Belgians, but Louis Philippe declined the honour for his son. In Feb. 1831 he accompanied the French army which entered Belgium to support the new kingdom against Holland, and took part in the siege of Antwerp. He accompanied the Algerian expeditions against the town of Constantine in the autumn of 1836, and again in 1837, taking it by assault on Oct. 13. He sailed a third time for Algeria in 1841, and served under General Bugeaud. On his return to France he became commandant of the camp of Compiègne. He had been employed on missions to England in 1835, 1838 and 1845, and to Berlin and Vienna in 1836. His marriage in 1840 with Victoria, daughter of Duke Ferdinand of Saxe-Coburg, was marked by a check to Louis Philippe's government in the form of a refusal to bestow the marriage dowry proposed by Thiers in the chamber of deputies. The death of his elder brother, Ferdinand, duke of Orleans, in 1842 gave him a position of greater importance as the natural regent in the case of the accession of his nephew, the young count of Paris, but he was not popular. On the outbreak of the revolution of 1848 he held the Tuileries long enough to cover the king's retreat, but took no active measures against the mob. He followed his sister-in-law, the duchess of Orléans, and her two sons to the chamber of deputies, but was separated from them by the rioters, and only escaped in the uniform of a national guard. He then settled with his parents in England. His chief aim was a reconciliation between the two branches of the house of Bourbon, as indispensable to the re-establishment of the French monarchy in any form. These wishes were frustrated on the one hand by the attitude of the comte de Chambord, and on the other by the determination of the duchess of Orléans to maintain the pretensions of the count of Paris. Lengthy negotiations ended in 1857 with a letter, written by Nemours, in which he insisted that Chambord should adhere to the tricolour flag and to the principles of constitutional government.

Nemours had lived at Bushey House after the death of Queen Marie Amélie in 1866. In 1871 the exile imposed on the French princes was withdrawn, but he only returned to Paris after their disabilities were also removed. In March 1872 he was restored to his rank in the army as general of division, and placed in the first section of the general staff. In 1881 new decrees against the princes of the blood led to his withdrawal from Parisian society. He died at Versailles on June 26, 1896, the duchess having died at Claremont on Nov. 10, 1857.

See R. Bazin, *Le Duc de Nemours* (1907); Paul Thureau-Dangin, *Histoire de la monarchie de juillet* (4 vols., 1884, etc.).

NEMOURS, a town of France, in the department of Seine-et-Marne, on the Loing and its canal, 26 m. S. of Melun, by rail. Pop. (1926) 4,801. Nemours derives its name from the woods (*nemora*) in which it formerly stood, and discoveries of Gallo-Roman remains indicate its early origin. It derives its historical importance from the lordship of Nemours.

NENADOVIĆ, MATEYA (1777–1854), Serbian patriot, was born in 1777. He is generally called Prota Mateya, since as a boy of 16 he was made a priest, and a few years later became archpriest (Prota) of Valyevo. His father, Alexa Nenadović, *Knez* (chief magistrate) of the district of Valyevo, was one of the prominent Serbs murdered by the Janissaries of the Belgrade Pashalik to intimidate the people (1804). The result, on the contrary, was a general popular rising. Prota Mateya became the deputy-commander of the insurgents of the Valyevo district, but soon exchanged this post for that of chief diplomatic envoy of the insurgents. In the years 1814–15 he visited Vienna to plead the cause of Serbia to the Congress. Prota Mateya's memoirs are the most valuable authority for the history of the first and second Serbian wars of independence. The best edition is that of the Serbian Literary Association in Belgrade (1893).

NENAGH, a town of co. Tipperary, Ireland, near the River Nenagh, 96½ m. S.W. from Dublin by the Ballybrophy and Limerick branch of the Great Southern railway. Pop. (1926) 4,517. Of the old castle, Nenagh Round, dating from King John, there still exists the circular donjon or keep. There are no remains of the hospital founded in 1200 for Austin canons, nor of the Franciscan friary, founded in the reign of Henry III. Nenagh was one of the ancient manors of the Butlers, who received for it the grant of a fair from Henry VIII. In 1550 the town and friary were burned by O'Carroll. In 1641 the town was taken by Owen Roe O'Neill, but shortly afterwards it was recaptured by Lord Inchiquin. It surrendered to Ireton in 1651, and was burned by Sarsfield in 1688.

NENNIUS (*fl.* 796), a Welsh writer to whom we owe the *Historia Britonum*, wrote in Brecknock or Radnor. His work exists in 30 manuscripts, the earliest of which is not much earlier than the year 1000. All are defaced by interpolations which give to the work so confused a character that critics were long disposed to treat it as an unskilful forgery. A new turn was given to the controversy by Heinrich Zimmer, who, in his *Nennius vindicatus* (1893), traced the history of the work and, by a comparison of the manuscripts with the 11th-century translation of the Irish scholar, Gilla Coemgim (d. 1072), succeeded in stripping off the later accretions from the original nucleus of the *Historia*. Zimmer follows previous critics in rejecting the *Prologus maior* (§§ 1, 2), the *Capitula*, or table of contents, and part of the *Mirabilia* of the concluding section. But he proves that Nennius is the compiler of the *Historia* proper (§§ 7–65). The only part of the *Historia* which deserves to be treated as a historical document is the section known as the *Genealogiae Saxonum* (§§ 57–65). This is merely a recension of a work composed *c.* 679 by a Briton of Strathclyde. The author's name is unknown; but he is, after Gildas, our earliest authority for the English conquest of England. Nennius himself gives us the oldest legends relating to the victories of King Arthur; the value of the *Historia* from this point of view is admitted by the severest critics. The chief authorities whom Nennius followed were Gildas' *De excidio Britonum*, Eusebius, the *Vita Patricii* of Murichu Maccu Machtheni, the *Collectanea* of Tirechan, the *Liber occupationis* (an Irish work on the settlement of Ireland), the *Liber de sex aetatibus mundi*, the chronicle of Prosper of Aquitaine, the *Liber beati Germani*. The sources for his notices of King Arthur (§ 56) are unknown.

See J. Stevenson's edition of the *Historia Britonum* (English Hist. Soc., 1838), based on a careful study of the mss.; A. de la Borderie, *L'Historia Britonum* (Paris and London, 1883), which summarizes the older negative criticism; H. Zimmer, *Nennius vindicatus* (Berlin, 1893); T. Mommsen in *Neues Archiv der Gesellschaft für ältere deutsche Geschichtskunde*, xix. 283. (H. W. C. D.)

NEODYMIUM, the third commonest metallic element belonging to the rare-earth group (symbol Nd, atomic number 60, atomic weight 144·3), was discovered by von Welsbach in 1885 when he split "didymium" into praseodymium and neodymium. This metal occurs along with cerium, lanthanum, praseodymium, etc., in the minerals monazite, cerite, allanite, etc. It is best prepared by the fractional crystallisation of the double magnesium nitrate from water. The oxide, Nd_2O_3, is usually obtained as a light blue powder, but traces of praseodymium give it a yellow-brown tint. The oxide is rapidly dissolved by hydrochloric and nitric acids, giving amethyst solutions which show a very intense and characteristic absorption spectrum. The metal is prepared by the electrolysis of the fused anhydrous chloride, $NdCl_3$. It slowly oxidizes in air and is gradually attacked by cold water. It melts at 840° C. (*See* RARE EARTHS.) (C. J.)

NEOGNATHAE, the term now used in ornithology (*q.v.*) instead of the older term Carinatae (*q.v.*) to denote the section of the class Aves to which the majority of modern birds belong.

NEO-GREC, in architecture and the allied arts, a style developed in the second quarter of the 19th century in France, in which an attempt was made to instil into generally classic design a spirit at once modern, original and yet full of the restraint, delicacy and perfection of Greek details. It was largely the result of the efforts of three men—J. Duban, H. Labrouste and L. Duc. It found its most complete expression in Paris, especially in the Colonne de Juillet (1831–40) by Duc; the Library of S. Geneviève (1843–50) by Labrouste; the École des Beaux Arts (1820–39) by Duban; and the west wing of the Palais de Justice (1857–68) by Duc. The style is important, less for these complete works, than for its tremendously widespread influence throughout the middle of the 19th century, not only in Europe, but also in America. Its chief characteristics are modified orders; imaginatively modernized classic detail; much use of simple, flat surfaces, often with chamfered edges; pediment forms without horizontal cornices; and delicate, refined, incised ornament.

NEO-HEGELIANISM. For a decade or a decade and a half after 1860 the history of British and American philosophy is the story of a growing revolt against the empirical method of John Stuart Mill and his school. The movement might have died had it not found something positive to feed upon. But it happened that a wide field of historical thought, largely unexplored by English thinkers, was there for it to turn to, namely, the German philosophy of the opening of the century, both the "criticism" of Kant and the idealistic continuation of Kantianism by Fichte, Schelling and Hegel; and "Neo-Hegelian" is the epithet attached, largely against their will, to the English group who gave the lead in this direction.

Of course no one can be prevented from using the word in other senses. Good precedent can be quoted for applying it indifferently to any revived interest in idealistic ways of thinking occurring in any country since the time of Hegel. The strongest instance in favour of an extension of meaning is the Croce-Gentile school, the most noteworthy product of contemporary thought in Italy. But on the one hand the Italian declarations of independence whenever Neo-Hegelianism is imputed to them have been so emphatic that it is hard for the historian to persist in calling them by the name; and on the other hand custom certainly sanctions the position adopted here, that Neo-Hegelianism used as a quasi-technical term is normally applied to a movement in the recent history of Anglo-Saxon thought. Perhaps the readiest conspectus of the movement will be had by treating it under two heads: its historical background and its essential teaching.

Its Historical Background.—It is important to distinguish the historical setting of the Neo-Hegelian thinkers, which is British, from the story of German thought which bulks most largely in their own account of their historical setting. The latter is a chapter in what they saw, the former yields the reason for their seeing it.

As is well known the scepticism of David Hume provoked a native Scottish reply as well as a German one. This, descending through Reid and Hamilton to Calderwood, Ferrier, Fraser and others in the 19th century set up an independent movement towards idealism which by 1860 had become pronounced especially in Scottish philosophy.

But important as it is for the historian to recognize how the Neo-Hegelian thinkers were thus provided with a reception in advance, it is even more important to consider the historical place in which they saw themselves to be standing, namely, the Kantian succession. When Kant came on the philosophical stage he found philosophy at an impasse. It was precisely the impasse to which they believed the doctrines of the empiricists Mill, Bain, Lewes, Spencer and others had brought it back. The work of Kant had been to examine the assumptions which led philosophy thither; and they held that further progress was impossible until the principle of the Kantian criticism was understood.

When Kant called attention to knowledge his interest was centred upon that which knowledge discloses, the "Nature" with which man is conversant in science and in everyday experience. There were two obvious features of it. First, its constituents were not things as they are in themselves but things as they appear to the human senses. Secondly,—and this was his problem—these appearances were not disconnected sensations. They had a certain order. They displayed themselves before us as objective. Kant asked how such objectivity was possible; and his answer consisted in saying that there was a logic of the process. The original use of the understanding whereby it arranged those appearances as an orderly world proceeded according to a logic which Kant distinguished as synthetic from the traditional formal or analytic logic, and which he called transcendental.

The idealistic successors of Kant—Fichte, Schelling and Hegel—saw in the critical philosophy a principle of reconciliation. The gulf fixed for common sense between mind and the world could be bridged. Kant had bridged it only imperfectly, leaving as he did things-in-themselves quite as much cut off from mind as the objects of common sense seemed to common sense to be. The post-Kantians sought, each in his own way, to bring the wheel full circle. Their instrument, with whatever differences, was still Kant's instrument, logic, the new "transcendental" logic, the logic of synthesis whereby the world is put together, as distinct from the formal analytic logic of the Aristotelian tradition. As

Hegel takes it over this logic has suffered two changes. It has ceased to be a mere theory of thought and become a theory of being; and it has learnt to move by dialectical procession. So reconstituted, logic emerges as an abstract version of the literal process by which the absolute spirit reveals itself as the universe, by dint of breaking forth into all the forms which the universe wears to human consciousness, nature, history, society, art, religion.

The dominion which his principle gave to Hegel over intellectual Europe at the beginning of the 19th century is one of the romances of philosophical history. There were three impressive features of him and his system. First, here was a thinker with apparently sufficient range to confront the entire field of man's then recorded experience of himself and the universe; in the second place he seemed to succeed in throwing whole territories of experience for the first time into some sort of order; and thirdly—the really remarkable circumstance—these results precipitated themselves in obedience to the assumption that the universe was the expression of spirit. It may be difficult to account for the currency of these beliefs about Hegel, but granted their currency there is nothing surprising in the impression he made.

Its Essential Teaching.—The mere existence of the Hegelian *corpus* doubtless touched the imagination of the Neo-Hegelian thinkers. It was there to show what a spiritual view of the world could be; and its presence helped to temper their disbelief in its particulars with a general belief in the possibility of "something of the kind." None of them were disciples in the way in which the original Hegelians had been. Green, more sensitive than most others to the error in some of Hegel's substantial results, even mistrusted the method by which they were obtained. To the Neo-Hegelians, Hegelianism was powerful as criticism. Green in particular was convinced by the critical regress which shows self-consciousness to be the only starting point for philosophy. He sets forth the argument in his *Prolegomena to Ethics* published posthumously in 1883 (5th ed. 1906).

This is one of the important works of the school. It is initially a constructive criticism of the empirical standpoint in ethics, its interest being to show the impossibility of either, with materialism, deriving self-consciousness from something other than itself or, with hedonism, defining the moral end by reference to something other than itself. Against the objection, almost inevitably arising, that Green is here eliminating the possibility of a logical or rational account of these matters at all, there is but one resource. It is to inquire what logic is and how far the new meaning which Kant threw into it is defensible.

Neo-Hegelianism is thus at heart a logical doctrine, and Bosanquet, whose *Logic* (1896, 2nd ed. 1911) together with Bradley's *Principles of Logic* (1883, 2nd ed. 1922) may be said to provide the technique of the whole way of thinking, expresses the spirit of it equally accurately and simply when he suggests that a colour-harmony may have logical necessity as well as a syllogism. The logic which permits such a saying is a logic of coherence. Stress upon coherence is a leading feature of Bosanquet's mind and writing. He does not, in vindicating his general position, press upon his reader the logical compulsiveness of the Kantian starting-point as Green does. He is content to exhibit the coherence which comes into our view of things when we decide to read the universe in the light of our highest experiences in it. Only in those is the coherence of the world revealed to us. And when we see how it coheres we see it as it is.

In the logical doctrine of coherence a metaphysical doctrine is involved, that of "degrees of reality." What we call our "highest" experiences occur only intermittently; and they suggest rather than express what is meant by coherence. As will, I seek the good; I rarely if ever actually find it in realizing the social will. On the other side, as intelligence, I seek the true; I shall only comparatively seldom find it in the propositions which were supremely important to my human nature as it is. None the less these rare experiences are those showing reality, giving reality in proportion as they are full and unqualified. This coincidence of reality with what man encounters when "at his fullest stretch" is the theme of the two volumes of Gifford Lectures in which Bosanquet's long term of philosophical activity culminates, *The Principle of Individuality and Value* (1912, 2nd ed. 1927) and *The Value and Destiny of the Individual* (1913, 2nd ed. 1923).

But since man is not always at his fullest stretch, and since what he encounters and experiences in his casual moods must also be real, a doctrine of grades or degrees of reality is involved. This vital implication of Neo-Hegelianism is bared to the bone only in the metaphysical essay by F. H. Bradley, *Appearance and Reality* (1893, 8th impression, 1925) usually allowed to be the greatest work emanating from the Neo-Hegelian school.

Bradley argues for one ultimate system of experience which is reality, and shows that nothing finite is real taken as it stands. For reasons equally compelling, however, he must insist that the finite is real somehow. "Anything that in any sense 'is' qualifies the absolute reality and so is real." The solution of the antinomy lies in the relativity of everything finite. No exception to this law offers itself. "There is no mere appearance or utter chance or absolute error, but all is relative." The absolute or infinite experience, therefore, which logically must be, can in fact be; and so we are entitled to say that it is. The absolute is vindicated and the finite defended through the admission of degrees in truth and reality.

Bradley's essay made history both within the school and without. All three features of the finite stressed by him, the defects which condemn it, the "relativity" which suggests salvation for it and the absolute in which it is saved, have bitten into contemporary thought. For example, both his line of attack upon the finite and his line of defence have brought mathematics and physics into the idealistic argument. Apropos of his line of defence, we find the "relativity" of recent mathematical theory regarded by Viscount Haldane as a particular case of the general principle of relativity involved in the idealistic construction of experience. Apropos of his attack, we find Royce reducing all Bradley's charges against the finite to one, namely that it involves an infinite regress; and, thinking the very possibility of idealism to be at stake, he evolves a mathematical counter-argument. Besides bringing up mathematical argument in defence of idealism Bradley's dialectical attack on the finite has also provoked mathematical resistance. This has come from Russell and the realists. Curiously enough it takes exactly the same form, a defence of the finite against the charge of involving an infinite regress of a self-contradictory kind. Still deeper has been the bite of the Bradleian Absolute. Intended by him as the saviour of the finite, it has everywhere been taken as annihilating it. It has in consequence drawn upon itself almost the whole resistance of a generation, to that conception of a quiescent absolute, to which the Western mind seems constitutionally averse. Thus it generated Pragmatism in England, and played a great part in differentiating such Neo-Hegelianism as has appeared in America from the English type.

The earliest Neo-Hegelian influences which reached America found, as in England, an idealism already there, one derived largely from the same Scottish sources. There were such teachers as Noah Porter of Yale and Thomas McCosh, of Princeton. A channel through which the Neo-Hegelian interest in America found important expression was the *Journal of Philosophical Studies*, edited by W. T. Harris (1835–1909) of St. Louis (Mo.).

The note of American idealism is its solicitude for personality and the individual. This is conspicuous in Howison and still more where the influence of Lotze was stronger, as in Bowne. The feature of Royce's central work, *The World and the Individual* (1901) is its combination of a doctrine of the absolute with a doctrine of the unique individual. The substance of reality is experience, and every finite idea of which it is composed has an "internal meaning" embodying a purpose which, in the absolute, is fulfilled. The absolute is needed in order that all ideas may reach fulfilment, both those within the experience of individuals and those beyond.

Royce's absolutism can hardly be said to have survived as a school. Yet it would be untrue to say that in America the idealism which recognizes an absolute has merely disappeared, leaving its empty room to be divided between a pragmatism which emphasizes

human values and a realism which thirsts for facts. There are signs of a younger idealistic thought ambitious to vindicate the absolute realistically by touching it, so to speak, at the very nadir of fact, through the perception that all knowledge of objects is necessarily also a revelation of subject, and therefore a traffic with mind. On some such assumption seems to rest the work of W. E. Hocking (*The Meaning of God in Human Experience*, 1912), and it is possibly in a note such as this, not without its echoes on both sides of the Atlantic that the eventual issue of the Neo-Hegelian incident in the history of philosophy is to be discerned.

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NEO-KANTIANISM. The philosophical movement called Neo-Kantianism commenced in Germany in the 1860's. Beginning with certain epistemological enquiries, it extended gradually over the whole field of philosophy. The individual thinkers who belong to this movement differ from each other in their interpretation of the Kantian doctrine as well as in the results which they reach from the Kantian premises. But, notwithstanding differences of detail, there is a certain methodical principle common to all of them. They all see in philosophy not merely a personal conviction, an individual view of the world, but they enquire into the possibility of *philosophy as a science* with the intention of formulating its conditions. They take their cue from the *most general* statement of the Kantian problem in the preface to the *Critique of Pure Reason* and in the *Prolegomena*. But in returning to the fundamental aim of Kant, to lead philosophy "into the safe road of a science," Neo-Kantianism finds itself confronted with a new task inasmuch as it must face a different state of science itself.

Helmholtz.—The first decisive impetus towards the reception and revival of Kant's fundamental ideas started within the circle of natural science itself. Hermann von Helmholtz' particular mentality and his significance for the development of natural science in the nineteenth century is determined by the fact that he is both a physicist and a physiologist. His main work, the *Handbuch der physiologischen Optik* (1856, 3rd ed. 1909–11), shows both methods of enquiry in their mutual interdependence and ideal union. Here the fundamental problem of Kant's *Transcendental Aesthetics*, the question of the epistemological significance of space and spatial perception, is emphatically restated. For the solution of this question, Helmholtz goes back to the researches and results of *Johannes Müller* in the field of the physiology of the senses.

In his *Vergleichende Physiologie des Gesichtssinns* (1826), Johannes Müller had developed the doctrine of the "specific energy" of sense organs; he had shown that the quality of the individual sense data,—the constitution of colour, tone, smell, etc.—is not to be explained from the constitution of the external stimulus, but from the peculiarity of the organ that conveys the sensation. This result is taken up by Helmholtz in his lecture *Ueber das Sehen des Menschen* (1855), and interpreted as an empirical confirmation of that which Kant had determined by general *a priori* considerations. The true and permanent achievement of Kantian philosophy, according to this interpretation, consists in having shown the participation of the innate laws of the mind in the formation of our ideas.

This interpretation was accepted by contemporary philosophers, especially by *Friedrich Albert Lange* (1828–1875). Lange, in his *History of Materialism* (1866), propounds as the essence of Kantian philosophy the proposition that what we call the "reality" of things is in truth nothing but their "appearance for the human species." Thus, the concept of causality, for instance, being rooted, according to this theory, in our psycho-physical organization, is prior to all experience, an *a priori* disposition of the human mind. Accordingly, it has within the field of human experience unlimited validity; but beyond this no significance whatever. By extending this interpretation to all parts of the Kantian system, Lange arrives at the conclusion that not only is the concept of the "thing-in-itself" the "concept of a perfectly problematical something" having significance only as a "limiting term" (*Grenzbegriff*), but that even the "intelligible world," which was used by Kant as the foundation of *ethics*, is a "world of poetry." This poetry, to be sure, is, according to Lange, "a necessary fruit of the mind, issuing from the inner and most vital roots of the species." But in this very implication, which threatened to transform the Kantian transcendental idealism into a *fictionism* of the type developed later by Vaihinger, the deficiencies of the empirico-physiological interpretation of Kantian Apriorism became clearly apparent.

Zeller.—In the meantime, the attempt had already been made in German philosophy to put Kantian Apriorism on a basis broader and more solid than that which the doctrine of the specific energy of sense organs was capable of affording. In a lecture which Eduard Zeller had delivered in the year 1862 as an introduction to his course on logic and epistemology in Heidelberg, he had pointed out that epistemology formed the formal basis of philosophy as a whole, that it was epistemology "from which the final decision on the correct method in philosophy and science generally had to come." Hegel's *Wissenschaft der Logik* and his *Phaenomenologie des Geistes* had been the last grandiose attempts to comprise the whole of knowledge in its content and to develop it constructively from one unifying idea. Zeller tries to show that the attempt did not reach its goal and could not reach it, "because it overlooks the conditions of human knowledge, for it purports to grasp with one swoop from above the ideal of knowledge which, in reality, we can approach only gradually through complicated labour from below." But the magic circle of the Hegelian system—so he says—will not allow itself to be broken, so long as the presuppositions of the latter are not investigated anew and more thoroughly than before; and this very investigation necessarily leads back to Kant.

What is here expressed as a purely programmatic idea, Otto Liebmann (1840–1912) tried to carry out in his main philosophical writings. The very first of Liebmann's writings, *Kant und die Epigonen* (1865), attempts to show that the successors of Kant all missed the way which he had clearly recognized and indicated. In an intensive criticism of the "idealistic," the "realistic" and the "empirical" tendencies of post-Kantian philosophy, Liebmann tries to point out that all these movements—the systems of Fichte, Schelling and Hegel, as well as the systems of Herbart, Fries and Schopenhauer—suffer from a common fault. They all assign to the concept of the "Absolute" or of the "thing-in-itself" a central place and make it the fundamental concept of metaphysics, whereas Kant's doctrine, if rightly understood and further developed, implies the very opposite, namely, that this concept is a non-concept, that all cognition moves within the realm of mere relationships, but can never grasp or positively determine an "Absolute."

Hermann Cohen.—However, it was only in Hermann Cohen (1842–1918) that neo-Kantianism reached its climax. In his three great works on Kant: *Kants Theorie der Erfahrung* (1871, 2nd ed. 1885); *Kants Begründung der Ethik* (1877, 2nd ed. 1910); *Kants Begründung der Aesthetik* (1888), Cohen gave for the first time a critical interpretation of the entire Kantian system which, with all its penetration into the specific detail of Kant's fundamental doctrines, sets, nevertheless, one single systematic idea into the centre of the investigation. This idea is that of the "transcendental method."

From Friedrich Albert Lange, with whom Cohen was closely connected by ties of personal friendship, Cohen differs especially in that he rejects any psychological interpretation of Kant's Apriorism, any explanation of the *a priori* by the "psycho-physical organization" of man.

In his study *Das Prinzip der Infinitesimal methode und seine Geschichte* (1883), he tries to prove that the concept of the "infinitely small," as it was established in the Leibnizian differential calculus, and in the Newtonian calculus of "fluxions," is, at the same time, the indispensable and basic intellectual means for any scientific cognition of "reality." Reality is never "given" in any sense, neither in sensation nor in mere intuition, but it must

be produced by means of pure thought. The various ways and directions in which thought moves in this "production of the object" are the problems which logic has to trace.

This idea found its development in Cohen's main systematic work, the *Logik der reinen Erkenntnis* (1902, 2nd ed. 1914), to which were added, as a second and third part of his system of philosophy, the *Ethik des reinen Willens* (1904), and the *Aesthetik des reinen Gefühls* (1912).

Natorp.—In closest personal and scientific contact with Cohen, Paul Natorp (1854–1924) further pursued and carried out the fundamental methodical idea of "critical idealism." For him, too, the object of knowledge is not given in itself as a ready-made thing, but "becomes" only in the eternal process of knowing, in a constantly renewed production of objects. This process never lies completed before us, as a firm and final result, an "Absolute" in the dogmatic-metaphysical meaning of the term; it is, however, possible to recognize the direction in which it moves, the general form of the production of the object. Natorp developed this main idea of his theoretical philosophy especially in his study, *Die logischen Grundlagen der exakten Wissenschaft* (1910) and in a more concentrated survey in the essay, *Philosophie, ihr Problem und ihre Probleme* (1911). Of especial importance, furthermore, is his *Allgemeine Psychologie nach kritischer Methode* (1912), which established an entirely new view of its aim and method and anticipated in decisive points Husserl's Phenomenology.

Riehl.—Cohen's insistent reference to the doctrine of Kant as the basis of all scientific philosophy and his account of the "transcendental" had a great effect even on thinkers who ultimately differed from Cohen in the conception of the critical system. Thus, for instance, the main work of Alois Riehl: *Der philosophische Kritizismus und seine Bedeutung für die positive Wissenschaft* (1876, 1879, 1887) is in its first edition still under the influence of Cohen's view of the transcendental.

Riehl, too, emphasizes that the question of the objective stock and the objective validity of knowledge should not be confounded with the question of the formation of ideas within the subjective consciousness. Kant's decisive achievement, according to Riehl, consists just in this, that he distinguished clearly the two questions, the "transcendental" and the "psychological," that he separated the problem of the objective significance of knowledge from the *genetic* question of its derivation.

But this idealism of the *general* forms of pure intuition and pure understanding constitutes, according to Riehl, only *one* phase of the Kantian doctrine, which has its counterpart in another equally legitimate and equally indispensable one. For the particulars of experience, the definite spatial and temporal order of empirical phenomena, as well as the specific causal laws subsisting between them, are never to be deduced from those general forms. Here we find ourselves necessarily referred to that other factor which Kant called the "material" factor of knowledge. The concepts of understanding as well as the pure forms of space and time give only the universal and necessary *form* of experienced reality, while its *content* can never be given to us otherwise than through *sensation*, through immediate sense-perception. Thus the latter forms the specific and indispensable basis of our conviction regarding the reality of things.

Riehl characterizes this view as "critical realism" and sees in it the specific kernel of Kant's teaching. "For the specific and definite forms of things as given in empirical intuition, that is, the position, shape, size, the definite and determinate duration and sequence of things, there must be, according to the explicit teaching of Kant, a source in the things themselves. For they cannot be derived from the universal form of intuition which originates solely in the mentality of the subject. . . . The things-in-themselves, with their proportions as expressed in the specific forms of intuition and the empirical laws of nature, are for Kant a presupposition just as essential as the *a priori* elements of cognition. The necessary combination of both, their union in experience, is the upshot of his teaching. Our knowledge of things is a mediate cognition of the things themselves through the appearances of the things to our senses" (*Zur Einführung in die Philosophie der Gegenwart*, 4th edition, 1913, p. 109f).

The Positivistic View.—Among all the thinkers of the Neo-Kantian movement, Riehl is the one who is most strongly influenced by the *positivistic* view of the nature and the task of philosophy. Scientific philosophy, in the strict sense of the word, is for him almost synonymous with pure epistemology and the methodology of the special sciences.

Hence, there remains no special field of study reserved as its proper domain; rather it is merely the texture and the logical structure of knowledge, of science itself, with which philosophic reflection can be concerned. "Instead of things, it investigates the understanding which recognizes things; instead of nature, the science of nature; instead of phenomena, their presuppositions in the consciousness of man." However, through this confinement of philosophy to the *pure science of knowledge*, Riehl ends by allowing the *theory of values* to fall out of it entirely.

To be sure, Riehl admits that there must be a "teleology of human life" for which mere knowledge of nature is not sufficient; but he himself did not study systematically the problems of this teleology, especially the ethical and aesthetic problems and the philosophy of history; he touched upon them only occasionally. "Views of the world" (*Weltanschauungen*)—so he declares explicitly—are not a matter of mere understanding; and they are for that reason subjective in the main; they do not belong to science but to *faith*. This separation of knowledge from faith carried with it the danger that scientific value was attributed to natural knowledge exclusively, while the pure *sciences of the mind* (*Geisteswissenschaften*), the sciences of the historical reality of man's mental achievements, were deprived of their specific methodical foundation.

Windelband and Rickert.—Here lies the problem from which started that tendency of Neo-Kantianism which was founded by Wilhelm Windelband and carried on by Heinrich Rickert. The epochal works of Wilhelm Dilthey (1833–1912), especially his *Einleitung in die Geisteswissenschaften* (1883), had led the attention of 19th century German philosophy back to the foundations of the historical world in the sciences of the mind. In trying to present, and to solve, this problem in the spirit of the strictly critical philosophy, it was first of all necessary to draw a sharp line between the form of science exemplified by history and that represented by natural science.

This is the task which Windelband sets himself in his address: *Geschichte und Naturwissenschaft*. The pure "sciences of laws" are here contrasted with the "sciences of events," the "nomothetic" procedure of natural science with the "ideographic" procedure of history. Rickert elaborates this distinction in his work, *Die Grenzen der naturwissenschaftlichen Begriffsbildung*, which he calls a logical introduction to the historical sciences (1896–1902, 2nd ed. 1913). In this justification, the isolated place which the pure science of knowledge had received with Riehl is abolished.

For Windelband and Rickert (*cf.* especially Rickert's *Der Gegenstand der Erkenntnis*, 1892, 2nd ed. 1904) the theory of knowledge, too, is included in the group of the *sciences of values*, because it is a science of *"oughts,"* of the universally valid *norms* of truth. In this respect, it stands on the same level as the other studies of values, especially with ethics and aesthetics. Philosophy, as a general theory of values, as the science of the "consciousness of norms" (*Normalbewustsein*), is essentially a philosophy of culture. Its task may be said to consist in establishing a connection between the realm of "reality" and the realm of values. It is only the concept of value that makes history possible as a science: for only through the values attached to culture can we obtain a definite principle of selection within the infinite manifold of the historical facts, and thus establish the conception of an historical individuality which is capable of description. If we now survey the path of the Neo-Kantian movement from its first beginnings to its present stage, we may say by way of summary that it has gradually encircled the total orbit of knowledge by trying to advance more and more from the "abstract" to the "concrete," from the general principles of knowledge to the specific content of mental culture. (E. Cr.)

NEOLITHIC: *see* Archaeology.

NEON, one of the "rare gases" of the atmosphere (*q.v.*), in which it occurs to the extent of about ten parts per million. (Symbol Ne, atomic number 10, atomic weight 20·2.) It was discovered in 1898 by Sir W. Ramsay and M. W. Travers, and has acquired publicity owing to its use for advertising signs. Of recent years it has become of great scientific importance owing to the part it has played in the investigation of isotypes (*q.v.*).

NEOPHYTE, a word used in the Eleusinian and other mysteries to designate the newly initiated, and in the early church applied to newly baptized persons. These usually wore the white garments which they received at their admission to the church (*see* BAPTISM) for eight days, from Easter eve till the Sunday after Easter (hence called *Dominica in albis*), but they were subject to strict supervision for some time longer.

See Bergier, *Dict. de théologie*, s.v.; Martigny, *Dict. des antiquités*, pp. 433–435; Siegel, *Christliche Alterthümer*, iii. 17 *seq.*; Riddle, *Christ. Antiquities*, pp. 313, 522; Walcott, *Sacred Archaeology*, s.v., and the *Catholic Encyclopaedia*, s.v.

NEOPLATONISM, the name given specially to the last school of pagan philosophy, which grew up mainly among the Greeks of Alexandria from the 3rd century onwards. The term has also been applied to the Italian humanists of the Renaissance, and in modern times, somewhat vaguely, to thinkers who have based their speculations on the Platonic metaphysics or on Plotinus, and incorporated with it a tendency towards a mystical explanation of ultimate phenomena.

Historical Position and Significance.—Just as the Later Roman empire was at once the supreme effort of the old world and the outcome of its exhaustion, so Neoplatonism is in one aspect the consummation, in another the collapse, of ancient philosophy. Never before in Greek or in Roman speculation had the consciousness of man's dignity and superiority to nature found such adequate expression; never before had real science and pure knowledge been so undervalued and despised by the leaders of culture as they were by the Neoplatonists.

It is a proof of the strength of the moral instincts of mankind that the only phase of culture which we can survey in all its stages from beginning to end culminated not in materialism, but in the boldest idealism. This idealism, however, is also in its way a mark of intellectual bankruptcy. Contempt for reason and science leads in the end to barbarism—its necessary consequence being the rudest superstition. As a matter of fact, barbarism did break out after the flower had fallen from Neoplatonism. The philosophers themselves, no doubt, still lived on the knowledge they repudiated; but the masses were trained to a superstition with which the Christian church, as the executor of Neoplatonism, had to reckon and contend. By a fortunate coincidence, at the very moment when this bankruptcy of the old culture must have become apparent, the stage of history was occupied by barbaric peoples. This has obscured the fact that the inner history of antiquity, ending as it did in despair of this world, must in any event have seen a recurrence of barbarism. The present world was a thing that men would neither enjoy nor master nor study. A new world was discovered, for the sake of which everything else was abandoned.

Such is Neoplatonism. The pre-Socratic philosophy took its stand on natural science, to the exclusion of ethics and religion. The systems of Plato and Aristotle sought to adjust the rival claims of physics and ethics (although the supremacy of the latter was already acknowledged); but the popular religions were thrown overboard. The post-Aristotelian philosophy in all its branches makes withdrawal from the objective world its starting-point. It might seem, indeed, that Stoicism indicates a falling off from Plato and Aristotle towards materialism, but the ethical dualism, which was the ruling tendency of the Stoa, could not long endure its materialistic physics, and took refuge in the metaphysical dualism of the Platonists. But this originated no permanent philosophical creation. From one-sided Platonism issued the various forms of scepticism, the attempt to undermine the trustworthiness of empirical knowledge. Neoplatonism, coming last, borrowed something from all the schools. First, it stands in the line of post-Aristotelian systems; it is, in fact, as a subjective philosophy, their logical completion. Secondly, it is founded on scepticism; for it has neither interest in, nor reliance upon, empirical knowledge. Thirdly, it can justly claim the honour of Plato's name, since it expressly goes back to him for its metaphysics, directly combating those of the Stoa. Yet even on this point it learned something from the Stoics; the Neoplatonic conception of the action of the Deity on the world and of the essence and origin of matter can only be explained by reference to the dynamic pantheism of the Stoa. Fourthly, the study of Aristotle also exercised an influence on Neoplatonism. This appears not only in its philosophical method, but also—though less prominently—in its metaphysic. And, fifthly, Neoplatonism adopted the ethics of Stoicism; although it was found necessary to supplement them by a still higher conception of the functions of the spirit. Philosophy as represented by Neoplatonism, its sole interest being a religious interest, and its highest object the supra-rational, must be a philosophy of revelation.

This is not a prominent feature in Plotinus or his immediate disciples, who still exhibit full confidence in the subjective presuppositions of their philosophy. But the later adherents of the school did not possess this confidence; they based their philosophy on revelations of the Deity, and they found these in the religious traditions and rites of all nations. The Stoics had taught them to overstep the political boundaries of states and nationalities, and rise from the Hellenic to a universal human consciousness. Through all history the spirit of God has breathed; everywhere we discover the traces of His revelation. The older any religious tradition or mode of worship is, the more venerable is it, the richer in divine ideas. Hence the religions of the East had a peculiar interest for the Neoplatonist. Neoplatonism seizes on the aspiration of the human soul after a higher life, and treats this psychological fact as the key to the interpretation of the universe. Hence the existing religions, after being refined and spiritualized, were made the basis of philosophy.

Neoplatonism thus represents a stage in the history of religion; indeed this is precisely where its historical importance lies. In the progress of science and enlightenment it has no positive significance, except as a necessary transition which the race had to make in order to get rid of nature-religion, and that under-valuing of the spiritual life which formed an insuperable obstacle to the advance of human knowledge. Neoplatonism, however, failed as signally in its religious enterprise as it did in its philosophical. While seeking to perfect ancient philosophy, it really extinguished it; and in like manner its attempted reconstruction of ancient religions only resulted in their destruction. For in requiring these religions to impart certain prescribed religious truths, and to inculcate the highest moral tone, it burdened them with problems to which they were unequal. And further, by inviting them to loosen, though not exactly to dissolve, their political allegiance—the very thing that gave them stability—it removed the foundation on which they rested.

There is one other question which we are called upon to raise here. Why did not Neoplatonism set up an independent religious community? Why did it not provide for its mixed multitude of divinities by founding a universal church, in which all the gods of all nations might be worshipped along with the one ineffable Deity? The answer to this question involves the answer to another—Why was Neoplatonism defeated by Christianity? Three things were wanting in Neoplatonism; they are admirably indicated in Augustine's *Confessions* (vii. 18–21). First, and chiefly, it lacked a religious founder; second, it could not tell how the state of inward peace and blessedness could become permanent; third, it had no means to win those who were not endowed with the speculative faculty. The philosophical discipline which it recommended for the attainment of the highest good was beyond the reach of the masses; and the way by which the masses could attain the highest good was a secret unknown to Neoplatonism.

Yet the influence of Neoplatonism on the history of our ethical culture is immeasurable, above all because it begot the consciousness that the only blessedness which can satisfy the heart must be sought higher even than the sphere of reason. That man shall not live by bread alone, the world had learned before Neoplato-

nism; but Neoplatonism enforced the deeper truth—a truth which the older philosophy had missed—that man shall not live by knowledge alone.

Origin.—As forerunners of Neoplatonism we may regard, on the one hand, those Stoics who accepted the Platonic distinction between the sensible world and the intelligible, and, on the other hand, the so-called Neopythagoreans and religious philosophers like Plutarch of Chaeronea and especially Numenius of Apamea. The Jewish and Christian thinkers of the first two centuries approach considerably nearer than Numenius to the later Neoplatonism. Here we have Philo, to begin with. Philo, who translated the Old Testament religion into the terms of Hellenic thought, holds as an inference from his theory of revelation that the divine Supreme Being is "supra-rational," that He can be reached only through "ecstasy," and that the oracles of God supply the material of moral and religious knowledge. The religious ethics of Philo—a compound of Stoic, Platonic and Neopythagorean elements—already bear the peculiar stamp which we recognize in Neoplatonism. While his system assigns the supremacy to Greek philosophy over the national religion of Israel, it exacts from the former, as a sort of tribute to the latter, the recognition of the elevation of God above the province of reason. The claim of positive religion to be something more than the intellectual apprehension of the reason in the universe is thus acknowledged. Religious syncretism is also a feature of Philo's system, but it differs essentially from what we find in later Neoplatonism. For Philo pays no respect to any cultus except the Jewish; and he believed that all the fragments of truth to be found amongst Greeks and Romans had been borrowed from the books of Moses. The earliest Christian philosophers, particularly Justin and Athenagoras, likewise prepared the way for the speculations of the Neoplatonists—partly by their attempts to connect Christianity with Stoicism and Platonism, partly by their ambition to exhibit Christianity as "hyperplatonic." In the introduction to his *Dialogue with Trypho*, Justin follows a method which bears a striking resemblance to the later method of Neoplatonism: he seeks to base the Christian knowledge of God—that is, the knowledge of the truth—on Platonism, Scepticism and "Revelation." A still more remarkable parallel to the later Neoplatonism is afforded by the Christian Gnostics of Alexandria, especially Valentinus and the followers of Basilides. Like the Neoplatonists, the Basilidians believed, not in an emanation from the Godhead, but in a dynamic manifestation of its activity. The same is true of Valentinus, who also placed an unnameable being at the apex of his system, and regarded matter, not as a second principle, but as a product of the one divine principle.

But were the oldest Neoplatonists really acquainted with the speculations of Philo, or Justin, or Valentinus, or Basilides? Did they know the Oriental religions, Judaism and Christianity in particular? And, if so, did they really derive anything from these sources?

To these questions we cannot give definite answers. Since Neoplatonism originated in Alexandria, where Oriental modes of worship were accessible to every one, and since the Jewish philosophy had also taken its place in the literary circles of Alexandria, we may safely assume that even the earliest of the Neoplatonists possessed an acquaintance with Judaism and Christianity. But if we search Plotinus for evidence of any actual influence of Jewish and Christian philosophy, we shall search in vain. We have to come down to Iamblichus and his school before we find complete correspondence with the Christian Gnosticism of the 2nd century; that is to say, it is only in the 4th century that Greek philosophy in its proper development reaches the stage at which certain Greek philosophers who had embraced Christianity had arrived in the 2nd century. The influence of Christianity—whether Gnostic or Catholic—on Neoplatonism was at no time very considerable, although individual Neoplatonists, after Amelius, used Christian texts as oracles, and put on record their admiration for Christ.

History and Doctrines.—The founder of the Neoplatonic school in Alexandria is supposed to have been Ammonius Saccas (*q.v.*). But the *Enneads* of his pupil Plotinus are the primary and classical document of Neoplatonism. The doctrine of Plotinus is mysticism, and like all mysticism it consists of two main divisions. The first or theoretical part deals with the high origin of the human soul, and shows how it has departed from its first estate. In the second or practical part the way is pointed out by which the soul may again return to the Eternal and Supreme. Since the soul in its longings reaches forth beyond all sensible things, beyond the world of ideas even, it follows that the highest being must be something supra-rational. The system thus embraces three heads—(1) the primeval Being, (2) the ideal world and the soul, (3) the phenomenal world.

The primeval Being is, as opposed to the many, the One; as opposed to the finite, the Infinite, the unlimited. It is the source of all life, and therefore absolute causality and the only real existence. It is, moreover, the Good, in so far as all finite things have their purpose in it, and ought to flow back to it. But one cannot attach moral attributes to the original Being itself, because these would imply limitation. It has no attributes of any kind; it is being without magnitude, without life, without thought; in strict propriety, indeed, we ought not to speak of it as existing; it is "above existence," "above goodness." It is also active force without a substratum; as active force the primeval Being is perpetually producing something else, without alteration, or motion, or diminution of itself. This production is not a physical process, but an emission of force; and, since the product has real existence only in virtue of the original existence working in it, Neoplatonism may be described as a species of dynamic pantheism. Directly or indirectly, everything is brought forth by the "One."

The original Being first of all throws out the *nous*, which is a perfect image of the One and the archetype of all existing things. It is at once being and thought, ideal world and idea. As image, the *nous* corresponds perfectly to the One, but as derived it is entirely different. What Plotinus understands by the *nous* is the highest sphere accessible to the human mind, and, along with that, pure thought itself.

The image and product of the motionless *nous* is the soul, which, according to Plotinus is, like the *nous*, immaterial. Its relation to the *nous* is the same as that of the *nous* to the One. It stands between the *nous* and the phenomenal world, is permeated and illuminated by the former, but is also in contact with the latter. The *nous* is indivisible; the soul *may* preserve its unity and remain in the *nous*, but at the same time it has the power of uniting with the corporeal world and thus being disintegrated. It therefore occupies an intermediate position. As a single soul (world-soul) it belongs in essence and destination to the intelligible world; but it also embraces innumerable individual souls; and these can either submit to be ruled by the *nous*, or turn aside to the sensual and lose themselves in the finite.

The human souls which have descended into corporeality are those which have allowed themselves to be ensnared by sensuality and overpowered by lust. They now seek to cut themselves loose from their true being; and, striving after independence, they assume a false existence. They must turn back from this; and, since they have not lost their freedom, a conversion is still possible.

Here, then, we enter upon the practical philosophy. Along the same road by which it descended the soul must retrace its steps back to the supreme Good. It must first of all return to itself. This is accomplished by the practice of virtue, which aims at likeness to God, and leads up to God. In the ethics of Plotinus all the older schemes of virtue are taken over and arranged in a graduated series. The lowest stage is that of the civil virtues, then follow the purifying, and last of all the divine virtues. The civil virtues merely adorn the life, without elevating the soul. That is the office of the purifying virtues, by which the soul is freed from sensuality and led back to itself, and thence to the *nous*. By means of ascetic observances the man becomes once more a spiritual and enduring being, free from all sin. But there is still a higher attainment; it is not enough to be sinless, one must become "God." This is reached through contemplation of the primeval Being, the One—in other words, through an ecstatic approach, the soul may see God, the fountain of life, the source of being, the origin of all good, the root of the soul. In that

moment it enjoys the highest indescribable bliss; it is as it were swallowed up of divinity, bathed in the light of eternity. Porphyry tells us that on four occasions during the six years of their intercourse Plotinus attained to this ecstatic union with God.

Such is the religious philosophy of Plotinus, and for himself personally it sufficed, without the aid of the popular religion or worship. Nevertheless he sought for points of support in these. God is certainly in the truest sense nothing but the primeval Being; but He reveals Himself in a variety of emanations and manifestations. The *nous* is a sort of second god, the λόγοι which are wrapped up in it are gods, the stars are gods.

Amongst his pupils, Amelius and Porphyry are the most eminent. Amelius modified the teaching of Plotinus on certain points; and he also put some value oh the prologue to the Gospel of John. To Porphyry (*q.v.*) belongs the credit of having recast and popularized the system of his master Plotinus. He was not an original thinker, but a diligent student, distinguished by great learning, by a turn for historical and philological criticism, and by an earnest purpose to uproot false teaching, especially Christianity, to ennoble men and train them to goodness. The system of Porphyry is more emphatically practical and religious than that of Plotinus. The object of philosophy, according to Porphyry, is the salvation of the soul. The origin and the blame of evil are not in the body, but in the desires of the soul. Hence the strictest asceticism (abstinence from flesh, and wine, and sexual intercourse) is demanded, as well as the knowledge of God. As he advanced in life, Porphyry protested more and more earnestly against the rude faith of the common people and their immoral worships. His work *Against the Christians* was directed, not against Christ, nor against what he believed to be Christ's teaching, but against the Christians of his own day and their sacred books, which, according to Porphyry, were the work of deceivers and ignorant people. In his trenchant criticism of the origin of what passed for Christianity in his time, he spoke bitter and severe truths, which have gained for him the reputation of the most rabid and wicked of all the enemies of Christianity. His work was destroyed, it was condemned by an edict of the emperors Theodosius II. and Valentinian in the year 448, and the copious extracts which we find in Lactantius, Augustine, Jerome, Macarius Magnus and others show how profoundly he had studied the Christian writings, and how great was his talent for real historical research.

Porphyry marks the transition to a new phase of Neoplatonism, in which it becomes completely subservient to polytheism, and seeks before everything else to protect the Greek and Oriental religions from the formidable assault of Christianity. In the hands of Iamblichus (*q.v.*), the pupil of Porphyry, Neoplatonism is changed "from a philosophical theory to a theological doctrine."

The numerous followers of Iamblichus—Aedesius, Chrysanthius, Eusebius, Priscus, Sopater, Sallust, and, most famous of all, Maximus (*q.v.*), rendered little service to speculation. Some of them (Themistius in particular) are known as commentators on the older philosophers, and others as the missionaries of mysticism. The work *De mysteriis Aegyptiorum* is the best sample of the views and aims of these philosophers. Their hopes rose high when Julian ascended the imperial throne (361–363). But the emperor himself lived long enough to see that his romantic policy of restoration was to leave no results; and after his early death all hope of extinguishing Christianity was abandoned.

But undoubtedly the victory of Christianity in the age of Valentinian and Theodosius had a purifying influence on Neoplatonism. During the struggle for supremacy, the philosophers had been driven to make common cause with everything that was hostile to Christianity. But now Neoplatonism was thrust from the great stage of history. The church and church theology, to whose guidance the masses now surrendered themselves, took in along with them their superstition, their polytheism, their magic, their myths, and all the machinery of religious witchcraft. The more all this settled and established itself—certainly not without opposition—in the church the purer did Neoplatonism become. While maintaining intact its religious attitude and its theory of knowledge, it returned with new zest to scientific studies, especially the study of the old philosophers. If Plato still remains the divine philosopher, yet we can perceive that after the year 400 the writings of Aristotle are increasingly read and valued. In the chief cities of the empire Neoplatonic schools flourished till the beginning of the 5th century; during this period, indeed, they were the training-schools of Christian theologians. At Alexandria the noble Hypatia (*q.v.*) taught, to whose memory her impassioned disciple Synesius, afterwards a bishop, reared a splendid monument. But after the beginning of the 5th century the fanaticism of the church could no longer endure the presence of "heathenism." The murder of Hypatia was the death of philosophy in Alexandria, although the school there maintained a lingering existence till the middle of the 6th century. But there was one city of the East which, lying apart from the crowded highways of the world, had sunk to a mere provincial town, and yet possessed associations which the church of the 5th century felt herself powerless to eradicate. In Athens a Neoplatonic school still flourished.

The most distinguished teachers at Athens were Plutarch (*q.v.*), his disciple Syrianus (who did important work as a commentator on Plato and Aristotle, and further deserves mention for his vigorous defence of the freedom of the will), but above all Proclus (411–485). Proclus is the great schoolman of Neoplatonism. Forty-four years after the death of Proclus the school of Athens was closed by Justinian (A.D. 529); but it had already fulfilled its mission in the work of Proclus. The works of Proclus, as the last testament of Hellenism to the church and the middle ages, exerted an incalculable influence on the next thousand years. They not only formed one of the bridges by which the mediaeval thinkers got back to Plato and Aristotle; they determined the scientific method of thirty generations, and they partly created and partly nourished the Christian mysticism of the middle ages.

The disciples of Proclus are not eminent (Marinus, Asclepiodotus, Ammonius, Zenodotus, Isidorus, Hegias, Damascius). The last president of the Athenian school was Damascius (*q.v.*). When Justinian issued the edict for the suppression of the school, Damascius along with Simplicius (the painstaking commentator on Aristotle) and five other Neoplatonists set out to make a home in Persia. They found the conditions were unfavourable and were allowed to return (*see* CHOSROES I.).

At the beginning of the 6th century Neoplatonism had ceased to exist in the East as an independent philosophy. Almost at the same time, however—and the coincidence is not accidental—it made new conquests in the church theology through the writings of the pseudo-Dionysius. It began to bear fruit in Christian mysticism, and to diffuse a new magical leaven through the worship of the church.

In the West, where philosophical efforts of any kind had been very rare since the 2nd century, and where mystical contemplation did not meet with the necessary conditions, Neoplatonism found a congenial soil only in isolated individuals. C. Marius Victorinus (*q.v.*) translated certain works of Plotinus, and thus had a decisive influence on the spiritual history of Augustine (*Confess.* vii. 9, viii. 2). It may be said that Neoplatonism influenced the West only through the medium of the church theology, or, in some instances, under that disguise. Even Boetius (it may now be considered certain) was a catholic Christian, although his whole mode of thought was certainly Neoplatonic (*see* BOETIUS).

Neoplatonism and the Theology of the Church.—The question as to the influence of Neoplatonism on the development of Christianity is not easily answered, because it is scarcely possible to get a complete view of their mutual relations. The answer will depend, in the first instance, upon how much is included under the term "Neoplatonism." If Neoplatonism is understood in the widest sense, as the highest and fittest expression of the religious movements at work in the Graeco-Roman empire from the 2nd to the 5th century, then it may be regarded as the twin-sister of the church dogmatic which grew up during the same period; the younger sister was brought up by the elder, then rebelled against her and at last tyrannized over her. In so far as Neoplatonism and the church dogmatic set out from the felt need of redemption, in so far as both sought to deliver the soul from sensuality and recognized man's inability without divine

aid—without a revelation—to attain salvation and a sure knowledge of the truth, they are at once most intimately related and at the same time mutually independent. It must be confessed that when Christianity began to project a theology it was already deeply impregnated by Hellenic influences. But the influence is to be traced not so much to philosophy as to the general culture of the time, and the whole set of conditions under which spiritual life was manifested. When Neoplatonism appeared, the Christian church had already laid down the main positions of her theology; or if not, she worked them out alongside of Neoplatonism—*that* is not a mere accident—but still independently. It was only by identifying itself with the whole history of Greek philosophy, or by figuring as pure Platonism restored, that Neoplatonism could stigmatize the church theology of Alexandria as a plagiarism from itself. These assumptions, however, were fanciful. Although our sources are unfortunately very imperfect, the theology of the church does not appear to have learned much from Neoplatonism in the 3rd century—partly because the latter had not yet reached the form in which its doctrines could be accepted by the church dogmatic, and partly because theology was otherwise occupied. Her first business was to plant herself firmly on her own territory, to make good her position and clear away old and objectionable opinions. Origen was quite as independent a thinker as Plotinus; only, they both drew on the same tradition. From the 4th century downwards, however, the influence of Neoplatonism on the Oriental theologians was of the utmost importance. The church gradually expressed her most peculiar convictions in dogmas, which were formulated by philosophical methods, but were irreconcilable with Neoplatonism (the Christological dogmas); and the further this process went the more unrestrainedly did theologians resign themselves to the influence of Neoplatonism on all other questions. The doctrines of the incarnation, the resurrection of the flesh and the creation of the world in time marked the boundary line between the church's dogmatic and Neoplatonism; in every other respect, theologians and Neoplatonists drew so closely together that many of them are completely at one. In fact, there were special cases, like that of Synesius, in which a speculative reconstruction of distinctively Christian doctrines by Christian men was winked at. If a book does not happen to touch on any of the above-mentioned doctrines, it may often be doubtful whether the writer is a Christian or a Neoplatonist. In ethical precepts, in directions for right living (that is, asceticism), the two systems approximate more and more closely. But it was here that Neoplatonism finally celebrated its greatest triumph. It indoctrinated the church with all its mysticism, its mystic exercises and even its magical cultus as taught by Iamblichus. The works of the pseudo-Dionysius contain a gnosis in which, by means of the teaching of Iamblichus and Proclus, the church's theology is turned into a scholastic mysticism with directions on matters of practice and ritual. And as these writings were attributed to Dionysius, the disciple of the apostles, the scholastic mysticism which they unfold was regarded as an apostolic, not to say a divine, science. The influence exercised by these writings, first on the East, and then—after the 9th (or 12th) century—on the West, cannot be overestimated. It is impossible to enlarge upon it here; suffice it to say that the mystical and pietistic devotion of our own day, even in the Protestant churches, is nourished on works whose ancestry can be traced, through a series of intermediate links, to the writings of the pseudo-Areopagite.

In the ancient world there was only one Western theologian who came directly under the influence of Neoplatonism; but that one is Augustine, the most important of them all. It was through Neoplatonism that Augustine got rid of scepticism and the last dregs of Manichaeism. In the seventh book of his *Confessions* he has recorded how much he owed to the perusal of Neoplatonic works. On all the cardinal doctrines—God, matter, the relation of God to the world, freedom and evil—Augustine retained the impress of Neoplatonism; at the same time he is the theologian of antiquity who most clearly perceived and most fully stated wherein Neoplatonism and Christianity differ. The best ever written by any church father on this subject is to be found in chaps. ix.-xxi. of the seventh book of the *Confessions*.

Why Neoplatonism succumbed in the conflict with Christianity is a question which the historians have never satisfactorily answered. As a rule, the problem is not even stated correctly. We have nothing to do here with our own private ideal of Christianity, but solely with catholic Christianity and catholic theology. These are the forces that conquered Neoplatonism, after assimilating nearly everything that it contained. Further, we must consider the arena in which the victory was won. The battlefield was the empire of Constantine and Theodosius. It is only when these and all other circumstances of the case are duly realized that we have a right to inquire how much the essential doctrines of Christianity contributed to the victory, and what share must be assigned to the organization of the church.

In mediaeval theology and philosophy mysticism appears as the powerful opponent of rationalistic dogmatism. The empirical science of the Renaissance and the two following centuries was itself a new development of Platonism and Neoplatonism, as opposed to rationalistic dogmatism, with its contempt for experience. Magic, astrology and alchemy—all the outgrowth of Neoplatonism—gave the first effectual stimulus to the observation of nature, and consequently to natural science, and in this way finally extinguished barren rationalism. Thus in the history of science Neoplatonism has played a part and rendered services of which Plotinus or Iamblichus or Proclus never dreamt. So true is it that sober history is often stranger and more capricious than all the marvels of legend and romance.

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(A. HA.; J. M. M.)

NEOPTOLEMUS (also called PYRRHUS), in Greek legend, the son of Achilles (*q.v.*) and Deïdameia. He was brought up by his grandfather Lycomedes in the island of Scyros, and taken to Troy in the last year of the war by Odysseus, since Helenus had declared that the city could not be captured without the aid of a descendant of Aeacus. He distinguished himself by his valour and took part in the capture, slaying Priam. He was the ancestor of the Molossian kings, who therefore claimed to be of pure Hellenic stock. He was murdered by Orestes at Delphi, where he was buried, and a festival held in his honour every 8th year.

NEOPYTHAGOREANISM, a Graeco-Alexandrian school of philosophy, which became prominent in the 1st century A.D. Very little is known about the members of this school, and there has been much discussion as to whether the Pythagorean literature which was widely published at the time in Alexandria was the original work of 1st-century writers or merely reproductions of and commentaries on the older Pythagorean writings. The only well-known members of the school were Apollonius of Tyana and Moderatus of Gades. In the previous century Cicero's learned friend P. Nigidius Figulus (d. 45 B.C.) had made an attempt to revive Pythagorean doctrines, but he cannot be described as a member of the school. Further, it is necessary to distinguish from the Neopythagoreans a number of Eclectic Platonists, who, during the 1st century of our era, maintained views which had a similar tendency (*e.g.* Apuleius of Madaura, Plutarch of Chaeronea and, later, Numenius of Apamea).

Neopythagoreanism was the first product of an age in which abstract philosophy had begun to pall. The Stoics discovered that their "perfect man" was not to be found in the luxurious, often morbid society of the Graeco-Roman world; that something more than dialectic ethics was needed to reawaken a sense of responsibility. A degenerate society cared nothing for syllogisms grown threadbare by repetition. Neopythagoreanism was an attempt to introduce a religious element into pagan philosophy in place of what had come to be regarded as an arid formalism. The founders of the school sought to invest their doctrines with the halo of tradition by ascribing them to Pythagoras and Plato, and there is no reason to accuse them of insincerity. They went back to the later period of Plato's thought, the period when Plato endeavoured to combine his doctrine of Ideas with the Pythag-

orean number-theory, and identified the *Good* with the *One*, the source of the duality of the Infinite and the Measured (*τὸ ἄπειρον* and *πέρας*) with the resultant *scale of realities* from the *One* down to the objects of the material world. They emphasized the fundamental distinction between the Soul and the Body. God must be worshipped spiritually by prayer and the will to be good, not in outward action. The soul must be freed from its material surrounding, the "muddy vesture of decay," by an ascetic habit of life. Bodily pleasures and all sensuous impulses must be abandoned as detrimental to the spiritual purity of the soul. God is the principle of Good; Matter the groundwork of Evil. In this system we distinguish not only the asceticism of Pythagoras and the later mysticism of Plato, but also the influence of the Orphic mysteries and of Oriental philosophy. The Ideas of Plato are no longer self-subsistent entities; they are the elements which constitute the content of spiritual activity. The Soul is no longer an appanage of *οὐσία*, it is *οὐσία* itself: the non-material universe is regarded as the sphere of mind or spirit.

Thus Neopythagoreanism is a link in the chain between the old and the new in pagan philosophy. It connects the teaching of Plato with the doctrines of Neoplatonism and brings it into line with the later Stoicism and with the ascetic system of the Essenes. A comparison between the Essenes and the Neopythagoreans shows a parallel so striking as to warrant the theory that the Essenes were profoundly influenced by Neopythagoreanism. Lastly Neopythagoreanism furnished Neoplatonism with the weapons with which pagan philosophy made its last stand against Christianity.

See PYTHAGORAS, NEOPLATONISM, ESSENES; and Zeller's *Philosophie d. Griechen*. For members of the school *see* APOLLONIUS OF TYANA and MODERATUS OF GADES.

NEPAL, an independent State, situated on the north-eastern frontier of India, lying between 80° 15′ and 88° 10′ E., and 26° 20′ and 30° 10′ N.; area, 54,000 square miles. Its extreme length is about 525 m., and its breadth varies from 90 to 140 miles. It is bounded on the north by Tibet; on the east by Sikkim; on the south by Bengal and the United Provinces; on the west by Kumaon from which it is separated by the Kali river. Its population is locally estimated at about 5,500,000.

Physical Features.—Nepal consists physically of two distinct territories: (1) the *tarai*, or strip of level, cultivated and forest land lying along the southern border; and (2) the great mountainous tract stretching northwards to Tibet. Along the northern frontier stand many of the highest peaks of the Himalayan range, such as Dhaulagiri (26,837 ft.), Machapuchar, Gaurishankar and Yasa (24,000), Gosain Than (26,313), Mount Everest (29,002), Kinchinjunga (28,146), and numerous peaks varying from 20,000 to 24,000 feet. In clear weather this magnificent snowy range may be seen in an almost continuous line from the top of some of the lower ranges near Kathmandu. South of these are numerous parallel lower ranges, varying from 16,000 to 6,000 ft. in height, which are broken up by cross ranges.

These mountain ranges determine the course of the rivers, which are divided by the cross ranges into four groups. The first of these extends from Kumaon eastward as far as Dhaulagiri, and consists of the affluents of the Kali (Sarda), Sarju, Kurnali, Eastern Sarju and Rapti, all of which ultimately form the Gogra or Gogari, and flow into the Ganges. The second group, known to the Nepalese as the Sapt Gandaki, rises from the peaks between Dhaulagiri and Gosain Than, and unites at Tribeni Ghat to form the Gandak. The third is a group of smaller rivers draining the great valley of Nepal, the valleys of Chitlong, Banepa and Panouti, and portions of the tarai around the Churiaghati range of hills. These are the various branches of the Bara Gandak, the lesser Rapti, the Baghmati and Kumla. East of this again is the fourth group, known to the Nepalese as the Sapt Kosi, rising from the peaks between Gosain Than and Kinchinjunga, and uniting to form the Sun Kosi, which falls into the Ganges. There is thus a natural division of the country into four portions. The most western is the country of the Baisi (twenty-two) rajas, and contains the towns of Jumla, Doti and Sulliana. The second is the country of the Chaubisi (twenty-four) rajas, and contains the towns of Malebum, Palpa, Gorkha and Nawakot. The third is the district containing Nepal proper, with the capital and many large towns. The fourth is the eastern portion of Nepal, comprising the country of the Kiratis, and many small towns, such as Dhankota, Ilam and Bijapur.

The only portion of Nepal (with the exception of some portions of the *tarai* country which lies at the foot of the hills), ever visited by Europeans is the Valley of Kathmandu, and even this can only be entered by special permission of the Nepal Government. A narrow gauge railway was opened by the Nepal Government in Feb. 1927 and now runs to Amlekhganj, 25 m. from the British Indian border at Raxaul, a small junction on the Bengal and North-West railway in the Champaran district in northern Bihar, due south of Kathmandu. The road from Raxaul to Kathmandu is 75 m., the first 50 of which lie across the alluvial plain of the tarai through a sal forest to the foot of the hills, whence the road follows the beds of rivers and across low ridges till the small hamlet of Bhimphedi is reached. Up to this point the road is practicable for wheeled traffic. Motor-cars run over it throughout the year except when abnormal rains cause breaches of the road. From Bhimphedi there is only a mountain track, which crosses two ridges (elevation about 8,000 ft.), and reaches the valley of Kathmandu some 9 m. from the city, whence a fair carriage road is available. A ropeway has been constructed from near Bhimphedi to the Kathmandu valley operated by electricity from the power station in the valley, which also supplies electric light to the city.

In and around the Nepal valley the year may be divided into the rainy, cold and hot seasons. The rains begin in June and last till October, the average fall being about 60″ annually. The cold season extends from the middle of October to the middle of April. From April to the beginning of the rains is the hot season, but the thermometer seldom exceeds 90° in the shade. The mean temperature is 60°. Violent thunderstorms are common, and occasionally severe earthquakes occur.

Flora and Fauna.—The flora and fauna are very varied. Nepal may again be divided into three zones: (1) the *tarai* and lower ranges of hills up to 4,000 ft. in height; (2) the central ranges and high-lying valleys, up to 10,000 ft.; and (3) the alpine region, from 10,000 to 29,000 ft. in height.

The low alluvial land of the tarai is the granary of Nepal; but the greater portion consists of swamps, jungles and forests. Considerable stretches of land are, however, being reclaimed from year to year. The productions here are those of British India—cotton, rice, wheat, pulse, sugar-cane, tobacco, opium, indigo and some fruits and vegetables. The forests yield a magnificent supply of sal, sisu and other valuable forest trees, and acacias, mimosas, cotton tree (*Bombax*), dak (*Butea frondosa*), large bamboos, rattans, palms, and numerous ferns and orchids. On the Churiaghati range the common *Pinus longifolia* grows freely. Tea can be grown at a height of from 2,000 to 4,000 feet. The middle zone supplies rice, wheat, maize, barley, oats, ginger, turmeric, chillies, potatoes, Cucurbitaceae, pineapples and many varieties of European fruits, vegetables and flowers. The forests contain tree rhododendrons, *Pinus longifolia*, oaks, horse-chestnuts, walnuts, maples, hill bamboos, wild cherry, pear, allies of the tea plant, paper plants (*Daphne*), roses, and many other inhabitants of temperate climes, and orchids, ferns and wild flowers. In the alpine zone exist Coniferae of many kinds, junipers, yew, box, hollies, birch, dwarf rhododendrons and other alpine flora.

The fauna follows a similar distribution. In the lowest zone are found the tiger, leopard, wolf, hyena and jackal, the elephant and rhinoceros, the gaur (*Gavaeus gaurus*), gayal (*Gavaeus frontalis*) wild buffalo or arna, many species of deer, and the black bear (*Ursus labiatus*), pea-fowl, francolins, wild jungle fowl, and the smaller vultures, etc. In the middle zone the leopard, the Himalayan black bear (*Ursus tibetanus*), the wild dog, cats of many sorts, squirrels, hares, porcupines, the pangolin, and some species of deer and antelope, the larger vultures and eagles, pheasants (*Gallophasis*), *chikor*, hill partridges, etc. In the alpine zone are found the true bear (*Ursus isabellinus*, or brown bear), the yak, musk deer, wild goats and sheep, marmots, the eagle-

vulture (*Gypaetus*), the blood pheasant (*Ithaginis cruentus*), snow pheasant (*Tetraogallus himalayensis*), snow partridge (*Lerwa nivicola*), the horned pheasant (*Ceriornis saiyra*), crested pheasant (*Catreus wallichi*), etc. Geese, ducks, waders of all sorts, and other migratory birds abound in the two lower zones.

Minerals.—The lowest zone abounds in fossils; and deposits of lignite, and even of true coal, are met with, the latter notably at a place south of Palpa. The middle zone is rich in limestone, marbles and minerals, such as iron, copper, zinc, lead and sulphur. Copper is found near the surface in many places, and there are remains of mines both at Markhu and in the great valley of Nepal. Mineral springs, hot and cold, are numerous. Traces of silver and gold have been found in the alpine zone.

People.—The races occupying Nepal are of mixed Mongol origin. To the north, in the higher mountains and valleys, dwell the Bhotias or Tibetans, to the west the Gurungs and Magars. The Murmis, Gorkhalis and Newars occupy the central parts, the Kiratis, Limbus and Lepchas the eastern. There are also Brahmans and Chhatris in the hills. There are other lesser tribes in the *tarai* and other malarious districts, known as Kumhas, Tharus, Manjis, etc., but generally classed together by the Nepalese as Aoulias, or dwellers in the districts where the *aoul*, a special type of malaria prevails. The Gorkhalis or Gurkhas are descendants of the Brahmans and Rajputs who were driven out of India by the Muslims, and took refuge in the western hilly lands, where they ultimately became dominant, and intermarried with the other races.

Religions and Languages.—The Bhotias, Newars, Limbus, Keratis and Lepchas are all Buddhists, but their religion has become so mixed up with Hinduism that it is now hardly recognizable. The Newars have entirely abandoned the monastic institutions of Buddhism, and have in great measure adopted the rules of caste, though these sit but lightly upon them. They burn their dead, eat the flesh of buffaloes, goats, sheep, ducks and fowls, and drink beer and spirits. The Gorkhalis, Magars and Gurungs are Hindus, but the last two are by no means strict in the observance of their religion. Where temples are so numerous (there are 2,733 shrines in the valley) priests both Hindu and Buddhist abound. The festivals too are many, and holidays incessant. The Raj Guru, or high priest, is an influential person in the State, a member of council, and has a large income from Government lands as well as from fines for offences against caste.

The various races have separate languages, or at least dialects. The Gorkhalis and western tribes use Parbatia (*see* PAHARI), which, unlike the other dialects, is of Sanskrit origin. The Newars have a distinct language and alphabets, of which three are known to their pandits, though only one is now in use. Their language, called Gubhajius, resembles Tibetan, but is interspersed with many Sanskrit words. The Bhotias use the Tibetan language and alphabet.

Education and Health.—There is a college at Kathmandu affiliated to the Patna university, and many schools in the valley of Nepal. This central institution has three departments, English, Sanskrit and Persian—or more correctly perhaps Urdu.

Kathmandu is a storehouse of ancient Sanskrit literature, and some of the oldest mss. in that language known to scholars have been found there. There is also a fair English library.

All families of good position have at least one *baid*, or medical man, in constant attendance, and there are also many general practitioners. There are two large central hospitals, civil and military, at Kathmandu and other smaller hospitals distributed over the country, with free beds, and provision for outdoor treatment. There is also a small hospital for the British Legation.

Towns.—There are three large towns in the Nepal valley, Kathmandu, the capital, said to contain approximately 90,000 inhabitants, and Patan and Bhatgaon about 30,000 each. The houses are from two to four storeys in height, built of brick and tiled. The windows and balconies are of wood, and many are elaborately carved. There are numerous handsome temples in all the towns, the majority of which are pagoda-shaped and built of brick, with roofs of tiles or copper, which is sometimes gilt. The streets are narrow, many of them paved with brick or stone.

Agriculture.—Military service is the main occupation of the Gorkhalis: the agriculture of the valley is carried on chiefly by the Newars. The soil varies from light micaceous sand to dense ferruginous clay. The whole valley is cultivated and irrigated where practicable, and the slopes of the hills are terraced, so that there is little grazing ground, and few sheep or cattle are kept. There are some milch cows and buffaloes, which are stall-fed or grazed in the jungles at the foot of the hills. Animals for food and sacrifice are all imported, and are consumed as fast as they are brought in. In the cold season the Bhotias bring large flocks of sheep and goats laden with bags of borax, salt and saltpetre. These are sold for food except for a few that are retained to carry back the bags. Poultry are kept and used by the Newars, especially ducks, the eggs of which are in great demand even among the orthodox Hindus. The crops grown in the valley consist of rice, wheat, pulse, murwah, maize, buckwheat, chillies, radishes, mustard, garlic, onions, ginger, turmeric, sugar-cane, potatoes, ground nuts, cucumbers and pumpkins, etc. Only foodstuffs may be grown in the valley; hence its suitability for producing tea, cotton and tobacco is unknown. These, however, are grown in other parts of the country, both in the hills and the *tarai*. Large cardamoms are extensively grown in the eastern hills, and form an important article of export. The hemp plant (*Cannabis indica*) grows wild.

Many European fruits, flowers and vegetables have been introduced and grow freely. The country is famous for its oranges and pineapples. Garden and wild flowers are sold for use as religious offerings, and for wear in the hair. Apples and pears, of English stock; apricots, peaches and plums do well; grapes grow freely, but seldom ripen before the rains begin, when they rot.

Trade and Manufacture.—All the trade and manufactures of the country are in the hands of the Newars, and a few Kashmiris and natives of India. The trade in European goods is chiefly carried on by the latter, whilst the Newars deal in corn, oil, salt, tobacco and articles of domestic manufacture. The trade with India is carried on at numerous marts along the frontier, at each of which a customs station is established, and the taxes are collected by a *thikadar* or farmer. The Newars also carry on the trade with Tibet, through a colony which has been for many years established at Lhasa, but this trade has diminished since the opening of the Lhasa-Darjeeling route. There are two principal routes to Tibet. One runs north-east from Kathmandu to the frontier station of Kuti or Nilam, crossing the Himalayan range at a height of 14,000 ft.; the other passes out of the valley at the north-west corner, and runs at first upwards along the main branch of the Gandak, crossing the Himalayas, near Kerung, at 9,000 ft. All goods on these routes are carried on men's backs, except the salt, etc., carried in bags by the Bhotia sheep and goats.

The Newars are skilful workmen. Their bricks are good, as is also their pottery. There are excellent carpenters, though the use of the large saw is still unknown, and planks are cut with chisel and mallet. Many of the wood carvings on the temples are of the highest artistic excellence. The modern coinage is struck by machinery, a regular mint having been established by Sir Jung Bahadur at Kathmandu, and since improved by his successors.

Government.—Till the fall of the Chinese Empire Nepal maintained relations with China and sent periodically an embassy with presents to Peking. The country is entirely independent as regards its foreign relations and domestic affairs. The British Envoy at the court is a purely diplomatic official. Theoretically the Government of Nepal is a despotism, and His Majesty the Maharajadhiraj or king is paramount. In practice, all the real power has long been in the hands of His Highness the Maharaja or prime minister, who is also supreme commander-in-chief. Under the prime minister there is a council, consisting of the relatives of the king, the Raj Guru, the generals, and a few other officials known as *Kajis*, *Sirdars* and *Bhardars*, which is consulted on all important business, and which forms a court of appeal for disputed cases from the courts of law. There are civil and criminal courts.

The old savage legal code with its ordeals by fire and water, and its punishments by mutilation and torture was abolished by the prime minister Sir Jung Bahadur after his return from England in 1851. Treason, rebellion and desertion in war-time are punishable by death. Murder and the killing of cows are capital offences. Manslaughter and maiming of cows are punishable by imprisonment for life, and other offences against the person, property or caste by imprisonment or fine. Brahmans and women are exempt from capital punishment. Bankruptcy laws have been recently introduced. The marriage laws are peculiar. Among the Gurkhas the laws resemble those of other Hindus as regards the marriage of widows, polygamy, etc., but among the Newars every girl while still an infant is married with much ceremony to a bel fruit, which is then thrown into some sacred stream. As the fate of the fruit is unknown, a Newari is supposed never to become a widow. At the age of puberty a husband is selected, but the woman can at any moment divorce herself by placing a betel-nut under her husband's pillow. Slavery was completely abolished throughout the kingdom in 1925 by the prime minister, General Sir Chandra Shumshere Jung.

The revenue is mainly drawn from the land-tax, customs, mines, forests and monopolies. About 10% of the *tarai* lands, and 20% of the hill lands, are private property. Some lands were assigned by the Gorkhali rajas to Brahmans, soldiers and others, and these are untaxed. Others, which were the gifts of the old Newar kings, pay from 4 to 8 annas *per bigha*. A considerable revenue in the shape of royalty is obtained from mines of copper, iron, etc. The taxes on merchandise amount to from 12 to 14% on the value of the goods carried to and from British India, and from 5 to 6% on goods exported to Tibet.

Army.—The Gorkhalis are a military race. The standing army consists of about 45,000 men, in a fair state of efficiency. There is also a reserve, consisting of men who have served for a few years and taken their discharge, but can be called on again to enter the ranks. These would probably raise the strength to between 70,000 and 80,000 men. The regiments are formed on the British system, and similarly drilled and officered. Each man carries in addition to a bayonet a *kukri* or native knife. There is practically no cavalry, the country not being suited for horses. The artillery is on a larger scale, and consists nearly entirely of mountain guns. There is a large arsenal well provided with supplies of gunpowder and military stores. Rifles and ammunition are for the most part obtained from India.

In addition to its own army, Nepal supplies to the British army in India a large force of splendid soldiers. (H. Wn.; X.)

HISTORY

Nepal and the somewhat similar country of Kashmir are peculiar among the Hindu states of India in possessing an historical literature. The Nepalese *Vamçāvalī* professes to start from a very early period in the Satya Yuga, when the present valley was still a lake. The earlier portion of it is devoted to the Satya and Treta Yugas, and contains mythological tales and traditions having reference to various sacred localities in the country. During these two Yugas, and also the Dwapara Yuga, the *Vamçāvalī* deals in round numbers of thousands of years.

In the beginning of the Kali Yuga, the Gupta dynasty is said to have been founded by Ne-Muni, from whom the country takes its name of Nepal. Lists are then given of the various dynasties, with the lengths of the reigns of the rajahs. The dynasties mentioned are the Gupta, Ahir, Kirāti, Somavanshi, Suryavanshi, Thakuri or first Rajput, Vaishya Thakurī, second Rajput and Karnataki dynasties. The country was then invaded by Mukundasena, and after his expulsion various Vaishya Thakurī dynasties are said to have held the throne for a period of 225 years. The chronology of the *Vamçāvalī* up to this period is very confused and inaccurate; but the records begin to be clearer from the time of the invasion and conquest of the country by Harisinha-deva, the rajah of Simraun, 1324. He was driven from Simraun by Tughlak Shah of Delhi, but seems to have found little difficulty in the conquest of Nepal. There were only four rajahs of this Ayodhya dynasty, and then the throne was occupied by Jayabhadra-Malla, a descendant of Abhaya-Malla, one of the Rajput dynasty, who reigned in the 13th century. The seventh rajah of this dynasty, Jayastithi-Malla, who reigned for 43 years (1386–1429), instituted legal codes and introduced the caste system to the Newars. In the reign of the eighth rajah, Yaksha-Malla, the kingdom was divided into four separate states—Banepa, Bhatgaon or Bhaktapur, Kantipur or Katmandu, and Lalitapur or Patan. The Malla dynasty in the other three branches continued in power up to the conquest of the country by the Gurkhas in 1768. (*See* Gurkha.)

The Gurkhas were driven out of their own country by the victorious Muslims, and took refuge in the hilly districts about Kumaon, whence they gradually pushed their way eastwards to Lamjung, Gurkha, Noakote, and ultimately to the valley of Nepal, which under Rajah Prithwi Narayana they finally captured. In the struggle which took place at Bhatgaon, Jayaprakasa (the rajah of Katmandu) was killed. Ranjit-Malla, the aged rajah of Bhatgaon, retired to Benares, where he died. Tej Narsinha, the rajah of Patan, died in confinement. During the latter years of the war Jayaprakasa applied to the British for assistance, and a small force, under Captain Kinloch, was sent into the tarai in 1765, but it was repulsed by the Gurkhas.

Prithwi Narayana died in 1774. He left two sons, Pratapasinha Sah and Bahadur Sah. The former succeeded his father, but died in 1777, leaving an infant son, Rana Bahadur Sah, and his brother, who had been in exile, returned to Nepal as regent. The mother of the infant king, however, was opposed to him, and he had again to flee to British territory, where he remained till the death of the rani, when he again became regent. In 1790 the Gurkhas invaded Tibet, and were at first successful; but they were brought into contact with the Chinese, who in 1791 sent a large force to invade Nepal. In 1792 the Chinese advanced as far as Noakote, and there dictated terms to the Nepalese. In 1791 the Gurkhas had entered into a commercial treaty with the British and Kirkpatrick was therefore despatched to Nepal, and reached Noakote in the spring of 1792, after the conclusion of peace. This embassy resulted in the ratification of another commercial treaty on March 1, 1792.

In 1795 Rana Bahadur removed his uncle, Bahadur Sah, from the regency, and two years later put him to death. From this time up to 1799 the king, who seems to have been insane, perpetrated the most barbarous outrages and his conduct became so intolerable that he was forced to abdicate in favour of his infant son, Girvan-yuddha Vikrama Sah. Rana Bahadur recovered the throne in 1804, but was assassinated in 1805.

In Oct. 1801 another treaty was signed by the British and Nepalese authorities, and a British resident was sent to the Nepalese court, but was withdrawn in 1803, from which time the Nepalese carried on a system of encroachment and outrage on the frontier, which led to a declaration of war by the British in Nov. 1814. The fortunes of war were not constant on either side, and fighting was almost continuous. A treaty was concluded in March 1816 by which the Nepalese relinquished much of their newly acquired territory and agreed to allow a British residency to be established at Katmandu. In November the rajah died and was succeeded by his infant son, Surendra Bikran Sah, General Bhimsena Thapa acting as regent.

In 1839 Bhimsena's enemies succeeded in driving him from power, and he committed suicide, or was murdered, in prison. The Kala Pandry faction then came into power, and there were frequent grave disputes with the British. In 1843 Matabar Singh, the nephew of Bhimsena, returned from exile, gained favour at court, and speedily effected the destruction of his old enemies, the Kala Pandrys, who were seized and executed in May 1843. At this time a nephew of Matabar Singh, Jung Bahadur, the eldest of a band of seven brothers, rose rapidly in the army and in favour at the court, especially with one of the ranis. On May 18, 1845, he killed his uncle, obtained, with the aid of the rani, a prominent position in the government, and soon after destroyed his enemies by what is known as the Kot massacre, on Sept. 15, 1846. From that time till the day of his death Jung Bahadur was in reality the ruler of Nepal. His old friend, the rani, was ban-

ished, and all posts of any consequence in the state were filled by Jung and his relations. In 1850 Jung Bahadur paid a visit to England, and there proved himself to be a staunch friend of the British. On his return in 1851 he devoted himself to reforming the administration of the country, and it must be allowed that he eventually proved himself the greatest benefactor his country has ever possessed. In 1853 a treaty for the extradition of criminals was proposed, and ratified in Feb. 1855. In 1854 the Nepalese commenced a war against Tibet, which ended with a peace very favourable to Nepal in March 1856.

In June 1857 intelligence of the mutiny of the native troops in Hindustan reached Nepal. Jung Bahadur, in spite of great opposition, stood firm as a friend of the British. On June 26, 4,000 troops were despatched and rendered excellent service. Jung followed on Dec. 10 with a force of 8,000 men, 500 artillerymen and 24 guns, but too late to be of much use. Many of the mutineers and rebels, including the infamous Nana Sahib, took refuge in the Nepalese tarai, and it was not till the end of 1859 that they were finally swept out of the country. Jung Bahadur was knighted and decorated for his services and his troops received pay and handsome donations if wounded. Quantities of arms were presented to the Nepalese government and some territory was restored. This ground contains most valuable sal and sisu forests, and yields yearly a revenue of several lākhs of rupees.

From the termination of the mutiny Nepalese history has been uneventful. In spite of friendly relations with the British, many of the early restrictions against entering the country and trading there are still rigidly enforced. Sir Jung Bahadur died suddenly in 1877. His brother, Sir Ranadip Singh Bahadur, G.C.S.I., succeeded him as prime minister. Shortly after his accession to power a plot was formed against him, but nearly 40 of the conspirators were seized and executed, while others escaped into exile. He was, however, murdered in 1885, and was succeeded by his nephew Sir Shamsher Jung, G.C.S.I., who died in 1901 and was succeeded by his brother Deb Shamsher Jung. In June of that year a palace revolution placed another brother, Chandra Shamsher Jung, in power, whilst Deb Shamsher fled to India. Chandra Shamsher ruled Nepal with much ability. He gave effective aid to the British during the Tibet war of 1904, and the relations with the government of India became more cordial after his accession. In 1906 Chandra Shamsher was created a G.C.S.I., and in 1908 he visited England as a guest of the Government, when he was invested with the G.C.B., and created major-general in the British army and honorary colonel of the 4th Gurkha Rifles.

During the World War, Sir Chandra Shamsher Jung placed the whole resources of his country at the disposal of the Allies. From 1915–18 some 10,000 men of the Nepalese army served in India and on the Indian frontier. The 20 Gurkha battalions of the Indian army were increased to 40. Exclusive of the Maharajah's personal numerous subscriptions to military hospitals and charitable war-funds, nearly £1,000,000 was contributed by the Nepalese government. Cardamoms, tea, blankets, and timber were also given. In the brief Afghan war (1919), 2,000 Nepalese troops assisted the Indian government. Chandra Shamsher Jung was also responsible for the abolition of slavery in Nepal.

Replacing the old Treaty of Segowlie (1815) a new treaty of friendship was signed on Dec. 21, 1923, an important provision of which is the recognition by the British Government of the complete independence of Nepal.

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NEPENTHES, an Egyptian drug spoken of by Homer in the *Odyssey* (iv. 221). Generally in the form "nepenthe" the name is given to any drug producing exhilaration and also occasionally to the herb or plant from which such a drug is produced. It is also applied to an interesting genus of plants, comprising 60 species, chiefly East Indian, known as the "pitcher-plants" on account of the formation of the leaves. Numerous varieties and artificial hybrids of several species, especially *N. ampullaria* and *N. Rafflesiana*, are grown as curiosities in hothouses.

NEPHELINE, a rock-forming mineral consisting of sodium, potassium and aluminium silicate, with the approximate formula $Na_3K_3Al_4Si_4O_{16}$. Its crystals belong to the hexagonal system, and usually have the form of a short six-sided prism terminated by the basal plane. The hardness is 5·5. The specific gravity (2·6), the low index of refraction and the feeble double refraction are nearly the same as in quartz; but since in nepheline the sign of the double refraction is negative, while in quartz it is positive, the two minerals can be distinguished under the microscope. An important determinative character of nepheline is the ease with which it is decomposed by hydrochloric acid, with separation of gelatinous silica (which may be readily stained by colouring matters) and cubes of salt. A clear crystal of nepheline when immersed in acid becomes for this reason cloudy; hence the name, from Gr. *νεφέλη*, a cloud.

Although in naturally occurring nepheline sodium and potassium are always present in approximately the atomic ratio 3 : 1, artificially prepared crystals have the composition $NaAlSiO_4$; the corresponding potassium compound, $KAlSiO_4$, which is the mineral kaliophilite, has also been prepared artificially. It has therefore been suggested that the orthosilicate formula, $(Na,K)AlSiO_4$, represents the true composition of nepheline, and that the excess of silica is due to the presence of albite, leucite, or silica molecules in "solid solution" in the mineral.

The mineral is specially liable to alteration, and in the laboratory various substitution products of nepheline have been prepared. In nature it is frequently altered to zeolites (especially natrolite), sodalite, kaolin, or compact muscovite. Two varieties are distinguished, differing in external appearance and mode of occurrence. "Glassy nepheline" has the form of small, colourless, transparent crystals and grains with a vitreous lustre. It is characteristic of the later volcanic rocks rich in alkalis, such as phonolite, nepheline-basalt, leucite-basalt, etc., and also of certain dike-rocks, such as tinguaite. The best crystals are those which occur with mica, sanidine, garnet, etc., in the crystal-lined cavities of the ejected blocks of Monte Somma, Vesuvius. The other variety, known as elaeolite, occurs as large, rough crystals, or more often as irregular masses, which have a greasy lustre and are opaque, or at most translucent, with a reddish, greenish, brownish or grey colour. It forms an essential constituent of certain alkaline plutonic rocks of the nepheline-syenite series, which are typically developed in southern Norway.

The colour and greasy lustre of elaeolite (Gr. *ἔλαιον*, oil, and *λθος*, stone; Ger. *Fettstein*) are due to the presence of numerous microscopic enclosures of other minerals, possibly augite or hornblende. These enclosures sometimes give rise to a chatoyant effect like that of cat's-eye and cymophane; and elaeolite when of a good green or red colour and showing a distinct band of light is sometimes cut as a gem-stone with a convex surface.

NEPHELINE-SYENITE or **ELAEOLITE-SYENITE,** a holocrystalline plutonic rock which consists largely of nepheline and alkali felspar. The rocks are mostly pale coloured, grey or pink, and in general appearance they are not unlike granites, but dark green varieties are also known. They do not contain quartz, as that mineral and nepheline are mutually exclusive. From ordinary syenites they are distinguished not only by the presence of nepheline but also by the occurrence of many other minerals rich in alkalis or in rare earths. Orthoclase and albite are the principal felspars; usually they are intergrown to form perthite. In some rocks the potash felspar, in others the soda felspar predominates. Soda-lime felspar such as oligoclase and andesine are rare or entirely absent. Fresh clear microcline is very characteristic of some types of nepheline-syenite. Sodalite, colourless and transparent in the slides, but frequently pale blue in the hand specimens, is the principal felspathoid mineral in addition to nepheline. As a rule these two crystallize before felspar, but they may occur in perthitic intergrowth with it. The commonest ferro-magnesian mineral is pale green augite, which may be surrounded by rims of dark-green, pleochroic soda-augite

(aegirine). The latter forms long flat prisms or bundles of radiating needles. A dark reddish-brown biotite is very common in some of these rocks and a white mica, probably not muscovite but lepidolite, is occasionally present. The hornblende may be brown, brownish-green, blue or blue-black, belonging as a rule to the varieties which contain soda; it is often intergrown with the pyroxene or enclosed in it. The dark-brown triclinic hornblende aenigmatite occurs also in these rocks. Olivine is rare, but may be found in some basic forms of nepheline-syenite.

The commonest accessories are sphene, zircon, iron ores and apatite. Cancrinite occurs in several nepheline-syenites; in others there is fluor-spar or melanite garnet. Small amounts of primary calcite also occur in some nepheline-syenites. A great number of interesting and rare minerals have been recorded from these rocks and the pegmatite veins which intersect them. Among these we may mention eudialyte, eukolite, mosandrite, rinkite, johnstrupite, låvenite, hiortdahlite, perofskite and lamprophyllite. Many of these contain fluorine and the rare earths.

Nepheline-syenites are rare rocks; there is only one occurrence in Great Britain and one each in France and Portugal. They are known also in Bohemia and in several places in Norway, Sweden and Finland. In America these rocks have been found in Texas, Arkansas and Massachussetts, also in Ontario, British Columbia and Brazil. South Africa, Madagascar, India, New South Wales, Tasmania, Timor and Turkestan are other localities for the rocks of this series. They exhibit also a remarkable individuality, as each occurrence has its own special features; moreover a variety of types characterizes each occurrence, as these rocks are very variable. For these reasons, together with the numerous rare minerals they contain, they have attracted a great deal of attention from petrographers.

Many types of nepheline-syenite have received designations derived from the localities in which they were discovered. The laurdalites (from Laurdal in Norway) are grey or pinkish, and in many ways closely resemble the laurvikites of southern Norway, with which they occur. The foyaites include the greater number of known nepheline-syenites and are called after Foya in the Serra de Monchique (southern Portugal), from which they were first described. They are grey, green or reddish, and mostly of massive structure with preponderating potash felspar, some nepheline, and a variable (often small) amount of femic minerals. Pyroxene-, hornblende- and biotite-foyaites have been recognized according to their mineral composition. Examples of the first-named occur in southern Norway with the laurdalites; they contain aegirine and black mica. At Alnö Island in the Gulf of Bothnia (Sweden) similar rocks are found bearing enclosures of altered limestone with wollastonite and scapolite. In Transylvania there is a well-known rock of this group, very rich in microcline, blue sodalite and cancrinite. It contains also orthoclase, nepheline, biotite, aegirine, acmite, etc. To this type the name ditroite has been given from the place where it occurs (Ditro). Pyroxene-foyaite has been described also from Pouzac in the Pyrenees (S. France). Mica-foyaite is not very common, but is known at Miask in the Ural Mountains (miaskite), where it is coarse-grained, and contains black mica, sodalite and cancrinite. Hornblende-foyaites occur in Brazil (Serra de Tingua) containing sodalite and often much augite, in the western Sahara and Cape Verde Islands; also at Zwarte Koppies in the Transvaal, Madagascar, São Paulo (in Brazil), Paisano Pass (West Texas) and Montreal, Canada. The rock of Salem, Mass., U.S.A., is a mica-foyaite rich in albite and aegirine; it accompanies granite and essexite.

Litchfieldite is another well-marked type of nepheline-syenite, in which albite is the dominant felspar. It is named after Litchfield, Maine, U.S.A., where it occurs in scattered blocks. Biotite, cancrinite and sodalite are characteristic of this rock. A similar nepheline-syenite is known from Hastings Co., Ontario, and contains hardly any orthoclase, but only albite felspar. Nepheline is very abundant and there is also cancrinite, sodalite, scapolite, calcite, biotite and hornblende. The lujaurites are distinguished from the rocks above described by their dark colour, which is due to the abundance of minerals such as augite, aegirine, arfvedsonite and other kinds of amphibole. Typical examples are known near Lujaur on the White Sea, where they occur with umptekites and other very peculiar rocks. Other localities for this group are at Julianehaab in Greenland (with sodalite-syenite); at their margins they contain pseudomorphs after leucite. The lujaurites frequently have a parallel banding or gneissose structure.

Sodalite-syenites in which sodalite very largely or completely takes the place of nepheline occur in Greenland, where they contain also microcline-perthite, aegirine, arfvedsonite and eudialyte. Cancrinite-syenite, with a large percentage of cancrinite, has been described from Dalekarlia (Sweden) and from Finland.

The chemical peculiarities of the nepheline-syenites are well marked, as will be seen from the following analyses. They are exceedingly rich in alkalis and in alumina (hence the abundance of felspathoids and alkali felspars) with silica varying from 50 to 56%, while lime, magnesia and iron are never present in great quantity, though somewhat more variable than the other components. As a group, also, these rocks have a low specific gravity.

	SiO_2	Al_2O_3	FeO	Fe_2O_3	CaO	MgO	K_2O	Na_2O
Laurdalite	54·55	19·07	3·12	2·41	3·15	1·08	4·84	7·67
Ditroite	56·30	24·14	...	1·09	0·69	0·13	6·79	9·28
Litch-fieldite	60·30	22·57	2·26	0·42	0·32	0·13	4·77	8·44
Lujaurite	54·14	20·01	2·08	3·28	1·85	0·83	5·25	9·87

(J. S. F.)

NEPHELINITES. The group of effusive rocks which contains nepheline with plagioclase felspar is subdivided into nepheline-tephrites and nepheline-basanites, while those which contain nepheline but not felspar are nephelinites and nepheline-basalts. The tephrites differ from the basanites in the absence of olivine, and the same distinction subsists between the nephelinites and nepheline-basalts.

Lavas with nepheline, plagioclase and augite = nepheline-tephrites; lavas with nepheline, plagioclase, augite and olivine = nepheline-basanites; lavas with nepheline and augite nephelinites; lavas with nepheline, augite and olivine = nepheline-basalts.

In their essential and accessory minerals, appearance and structure, these rocks have much in common, and tend to occur in a natural association as basic rocks comparatively rich in alkalis and alumina. The nephelinites and tephrites are linked to the phonolites and pass into them by various gradations. They are usually richer in alkalis and silica and contain less iron, lime and magnesia than the basanites and nepheline-basalts, a difference which finds expression in the presence of olivine and the smaller amount of felspars and felspathoids in the latter.

Leucite appears in some tephrites; haüyne is more frequent as small dodecahedra often filled with black inclusions. The pyroxene varies a good deal, and includes green aegirine and the purple titan-augite. It has often good crystalline form, and occurs as eight-sided monoclinic prisms. Hornblende is much less common, but biotite is very characteristic of certain nephelinites. Of the felspars, labradorite is probably the most common, with more acid varieties of plagioclase. Sanidine is by no means absent, but may be considered as an accessory. The olivine presents no peculiarities. Melilite, perofskite, pseudobrookite, melanite garnet, iron oxides, apatite and chromite are occasionally met with.

All these rocks are practically confined to lavas of Tertiary and recent age, though some occur as dikes or small intrusive masses. The plutonic facies of these rocks are found among the theralites, shonkinites, essexites and ijolites. In the British Isles they are exceedingly scarce, though nepheline-basanite occurs in a dike which is presumably Tertiary, cutting the Triassic rocks at Butterton, Staffs., and nepheline-basalt has been found in a single neck at John o' Groat's and at one or two places near North Berwick. They attain a great development in the Canary Islands and in the Azores, Cape Verde Islands and Fernando Noronha. In Germany they are represented among the Tertiary eruptive rocks of the Rhine district and Thuringia, at the extinct craters of the Eifel and at the Kaiserstuhl. In central Bohemia there are many occurrences of nepheline-tephrites, basanites and basalts which though

fine grained contain all their minerals in excellent preservation. The nephelinite of Katzenbuckel in the Odenwald is well known. Contrasted with the phonolites and leucitophyres they are scarce in Italy and the Mediterranean province, but leucite-bearing nepheline-tephrites occur at Monte Vulture and nepheline-basalts in Tripoli. In America these rocks occur in Texas, in the Bearpaw mountains of Montana and at Cripple Creek, Colorado. From Argentina some members have been described: they have a great extension in East Africa (Somaliland and Masai-land) and occur also in North Nigeria. A few also have been described from New South Wales, New Zealand (Dunedin) and Tasmania.

(J. S. F.)

NEPHRITIS: *see* BRIGHT'S DISEASE; KIDNEY, DISEASES OF.

NEPOMUK or **POMUK, JOHN OF,** the national saint of Bohemia. It is necessary to distinguish between the John of Nepomuk of history and the legendary one. A John of Pomuk, son of a German called Wölfel, was vicar-general to the archbishop of Prague, John of Jengenstein, in 1393, and having thwarted King Wenceslaus IV. of Bohemia in a plan to seize the revenues of the abbey of Kladrub, was arrested and tortured, finally being carried to the bridge of Prague and thrown into the Vltava. It is difficult to connect this historical event with the legend of St. John of Nepomuk, who was canonized by Rome in 1729, mainly through the influence of the Jesuits, who hoped that this new cult would obliterate the memory of Hus. The Austrian chronicler Thomas Ebendorffer of Haselbach, who lived two generations later, first states that it was reported that King Wenceslaus had ordered that the confessor of his queen—an office that John of Pomuk never held—should be thrown into the Vltava because he would not reveal the secret of confession. The story is afterwards told in greater detail by the untrustworthy Bohemian historian Wenceslaus Hajek. It appears certain that the person canonized in 1729 was not the historical John of Pomuk or Nepomuk.

See A. H. Wratislaw, *Life, Legend and Canonization of St. John Nepomuk* (1873), a valuable work founded on the best Bohemian authorities; also A. Frind, *Der geschichtliche Heilige Johann von Nepomuk* (1861); O. Abel, *Die Legende vom heiligen Johann von Nepomuk* (1855); and particularly vol. iii. of W. W. Tomek's *History of the Town of Prague* (Czech) (12 vols., Prague, 1855–1901).

NEPOS, CORNELIUS (*c.* 99–24 B.C.), Roman historian, friend of Catullus, Cicero and Atticus, was born in Upper Italy (perhaps at Verona or Ticinum). He wrote: *Chronica,* an epitome of universal history; *Exempla,* a collection of anecdotes; letters to Cicero; lives of Cato the elder and Cicero; and *De viris illustribus,* parallel lives of distinguished Romans and foreigners, in sixteen books. One section of this work (more commonly known as *Vitae excellentium imperatorum*) and the biographies of Cato and Atticus from another (*De Latinis historicis*), have been preserved. Erotic poems and a geographical treatise are also attributed to him. The *Lives* contain many errors (especially in chronology), but supply information not found elsewhere. The language is as a rule simple and correct. The *Lives* were formerly attributed to Aemilius Probus of the 4th century A.D.; but the view maintained by Lambinus (in his famous edition, 1569)—that they are all the work of Nepos—is now generally accepted. In modern times G. F. Unger (*Der sogenannte C. N.,* 1881) has attempted to prove that the author was Hyginus, but his theory has not been favourably received.

Editions of the *Lives* (especially selections) are extremely numerous; text by E. O. Winstedt (Oxford, 1904), C. L. Roth (1881), C. G. Cobet (1881), C. Halm and A. Fleckeisen (1889), with lexicon for school use; with notes, O. Browning and W. R. Inge (1888), J. C. Rolfe (U.S. 1894), A. Weidner and J. Schmidt (1902), C. Erbe (1892), C. Nipperdey and B. Lupus (ed. maj., 1879, school ed., 1895), J. Siebelis and O. Stange (1897).

NEPOS, JULIUS, emperor of the West (474–475), was the nephew and successor of Marcellinus, count of Dalmatia. Being connected by marriage with Leo I., he was selected by him as emperor after the death of Olybrius. After capturing his rival Glycerius (*q.v.*), he was recognized as emperor in Italy, Rome and Gaul. The only event of his reign was the cession of Auvergne to the Visigoths. Nepos was overthrown in 475 by the Patrician Orestes, and fled to Salona, where he was assassinated (480 or 481), possibly at the instigation of Glycerius, who had been compelled to enter the Church.

NEPTUNE (*Neptunus,* Etruscan *Nethuns*). An Italian god of fresh water, associated with Salacia (? from *salire,* referring to the bubbling of springs). Not later than 399 B.C. (*see* Livy, v. 13, 6), he was identified with Poseidon (*q.v.*) and henceforth was known as a sea-god. His ancient festival (Neptunalia) was on July 23; *i.e.,* in the heat of summer, when water is most wanted and streams are drying up. He had no temple until the 3rd century B.C., so far as we know; it was near the Circus Flaminius. In like manner Portunus, originally the god of city gates (*portae*) became god of harbours (*portus*) as Roman overseas trade became important.

See Wissowa, *Religion und Kultur,* 2nd ed., p. 225.

NEPTUNE, ♆ in astronomy, is the outermost of the known planets, its mean distance from the Sun being 2,793,500,000 miles; and the time occupied in completing a revolution is 164·8 years. It is noteworthy that "Bode's law" (*see* PLANET) which expresses with considerable accuracy the relative distances of the other planets from the Sun breaks down badly at Neptune, giving the value 38·8 units, whereas the actual distance is but 30·1 units. The light of Neptune being only equal to that of a star of the eighth magnitude, the planet is, of course, invisible without optical aid, but a telescope of moderate aperture will show that its image, unlike that of a star, possesses a sensible disc. This is of a greenish hue and about 2·5″ in diameter, which, at the planet's distance, corresponds to some 33,000 miles. It has not been possible, however, to detect any features on its surface from which its rotation period could be derived, but from a comparison of its brightness with that of neighbouring stars Maxwell Hall in 1883, and again in 1915, found temporary periodic fluctuations suggesting rotation is about 7^h 50^m or a little more. Moore and Menzel have found by spectroscopic methods a period of $15^h.8 \pm 1^h$, and, since it has been shown by Jackson and others that a period of $7^h 50^m$ is inconsistent with the shift in the mode of the satellite, it seems probable that the photometric value is half the true period. The spectroscopic results also indicate that the rotation of the planet is direct or in a direction contrary to that of the orbital motion of the satellite.

As regards its physical condition it is known that Neptune is similar to the other members of the outer group of planets in possessing a low density. Its mass, which is derived from the motion of its satellite, is about 16·9, and its density 0·24, the corresponding values for the earth being taken as unity.

As is the case with the other major planets Neptune is enveloped in a dense atmosphere, and its spectrum shows a number of strong absorption bands, the origin of which is not yet known. These bands show a well marked progression in intensity from Jupiter outwards through Saturn and Uranus to Neptune (*see* Plate, *Planets*).

Neptune's Satellite.—Neptune possesses only one moon. This was discovered by William Lassell within a month of the finding of the planet itself, and it is interesting in that it was the first of the satellites in the Solar system known to possess retrograde motion, the inclination of its orbit to the ecliptic being 145°. Its period of revolution is 5^d 21^h. The name Triton has been given to it but it is more generally known as "the satellite of Neptune."

The Discovery of Neptune.—By far the most interesting thing about Neptune is the story of its discovery. The account which follows was written by the late Professor Simon Newcomb.

The detection of Neptune through its action upon Uranus before its existence had been made known by observation is a striking example of the precision reached by the theory of the celestial motions. So many agencies were concerned in the final discovery that the whole forms one of the most interesting chapters in the history of astronomy. The planet Uranus, before its actual discovery by Sir William Herschel in 1781, had been observed as a fixed star on at least 17 other occasions, beginning with Flamsteed in 1690. In 1820 Alexis Bouvard of Paris constructed tables of the motion of Jupiter, Saturn and Uranus, based upon a discussion of observations up to that year. Using the mutual perturbations of these planets as developed by Laplace in the *Mé-*

canique Céleste, he was enabled satisfactorily to represent the observed positions of Jupiter and Saturn; but the case was entirely different with Uranus. It was found impossible to represent all the observations within admissible limits of error, the outstanding differences between theory and observation exceeding 1″. In these circumstances one of two courses had to be adopted, either to obtain the best general representation of all the observations, which would result in the tables being certainly erroneous, or to reject the older observations which might be affected with errors, and base the tables only on those made since the discovery by Herschel. A few years of observation showed that Uranus was deviating from the new tables to an extent greater than could be attributed to legitimate errors of theory of observation, and the question of the cause thus became of growing interest. Among the investigators of the question was F. W. Bessel, who tried to reconcile the difficulty by an increase of the mass of Saturn, but found that he could do so only by assigning a mass not otherwise admissible. Although the idea that the deviations were probably due to the action of an ultra-Uranian planet was entertained by Bouvard, Bessel and doubtless others, it would seem that the first clear statement of a conviction that such was the case, and that it was advisable to reach some conclusion as to the position of the disturbing body, was expressed by the Rev. T. J. Hussey, an English amateur astronomer. In a letter to Sir George B. Airy in 1834 he inquired Airy's views of the subject, and offered to search for the planet with his own equatorial if the required estimate of its position could be supplied. Airy expressed himself as not fully satisfied that the deviation might not arise from errors in the perturbations. He therefore was not certain of any extraneous action; but even if there was, he doubted the possibility of determining the place of a planet which might produce it. In 1837 Bouvard, in conjunction with his nephew Eugène, was again working on the problem; but they appear not to have gone farther than to collect observations and to compare the results with Bouvard's tables.

In 1835 F. B. G. Nicolai, director of the observatory at Mannheim, in discussing the motion of Halley's comet, considered the possibility that it was acted upon by an ultra-Uranian planet, the existence of which was made probable by the disagreement between the older and more recent observations.

In 1838 Airy showed in a letter to the *Astronomische Nachrichten* that not only the heliocentric longitude, but the tabulated radius vector of Uranus was largely in error, but made no suggestions as to the cause. In 1843 the Royal Society of Sciences of Göttingen offered a prize of 50 ducats for a satisfactory working up of the whole theory of the motions of Uranus, assigning September 1846 as the time within which competing papers should be presented. It is also recorded that Bessel, during a visit to England in 1842, in a conversation with Sir John Herschel, expressed the conviction that Uranus was disturbed by an unknown planet. He went so far as to set his assistant Fleming at the work of reducing the observations, but died before more was done.

The question had now reached a stage when it needed only a vigorous effort by an able mathematician to solve the problem. Such a man was found in John Couch Adams, then a student of St. John's College, Cambridge, who seriously attacked the problem in 1843, the year in which he took his bachelor's degree. He soon found that the observations of Uranus could be fairly well represented by the action of a planet moving in a radius of twice the mean distance of Uranus, which would closely correspond to Bode's law. During the two following years he investigated the possible eccentricity of the orbit, and in September 1845 communicated his results to Professor James Challis. In 1845, about the 1st of November, Adams also sent his completed elements to Airy, stating that according to his calculations the observed irregularities in the motion of Uranus could be accounted for by the action of an exterior planet, of which the motions and orbital elements were given. It is worthy of note that the heliocentric longitude of the unknown body as derived from these elements is only between one and two degrees in error, while the planet was within half a degree of the ecliptic. Two or three evenings assiduously devoted to the search could not therefore have failed to make the planet known. Adams's paper was accompanied by a comparison of his theory with the observations of Uranus from 1780, showing an excellent agreement. Airy in replying to this letter inquired whether the assumed perturbation would also explain the error of the radius-vector of Uranus, which he seemed to consider the crucial test of correctness.

The Elements.—At Arago's suggestion the investigation had been taken up by U. J. J. Leverrier, who had published some excellent work in theoretical astronomy. Leverrier's first published communication on the subject was made to the French Academy on the 10th of November 1845, a few days after Adams's results were in the hands of Airy and Challis. A second memoir was presented by Leverrier in 1846 (June 1). His investigation was more thorough than that of Adams. He first showed that the observations of Uranus could not be accounted for by the attraction of known bodies. Considering in succession various explanations, he found none admissible except that of a planet exterior to Uranus. Considering the distances to be double that of Uranus he then investigated the other elements of the orbit.

The following are the elements found by Adams and Leverrier:

	Leverrier	Adams	
		Hypothesis I	Hypothesis II
Semi-major axis	36·154	38·38	37·27
Eccentricity	0·1076	0·16103	0·12062
Long. of perihelion	284° 45′	315° 57′	299° 11′
Mean longitude	318° 47′	325° 8′	323° 2′
Epoch	1847, Jan. 1	1846, Oct. 1	1846, Oct. 1
True longitude	326° 32′	328°	329°

The longitude of the planet was 327° 57′ on Oct. 1, 1846.

The close agreement of these elements led Airy to suggest to Challis, on the 9th of July 1846, a search for the planet with the Northumberland telescope. He proposed an examination of a part of the heavens 30° long in the direction of the ecliptic and 10° broad, and estimated the number of hours' work likely to be employed in this sweep. The proposed sweeps were commenced by Challis on the 29th of July. The plan required each region to be swept through twice, and the positions of all the known stars found to be compared, in order that the position of the planet might be detected by its motion. On the 31st of August Leverrier's concluding paper was presented to the French Academy, and on the 18th of September he wrote to John G. Galle (1812–1910), then chief assistant at the Berlin observatory, suggesting that he should search for the computed planet, with the hope of detecting it by its disk, which was probably more than 3″ in diameter. This letter, probably received on the 23rd of September, was communicated to J. F. Encke, the director of the observatory, who approved of the search. H. L. d'Arrest, a student living at the observatory, expressed a wish to assist. In the evening the search was commenced, but it was not found possible to detect any planet by its disk. Star charts were at the time being prepared at the observatory under the auspices of the Berlin Academy of Sciences. It was suggested by d'Arrest that this region might be covered by one of the charts. Referring to the chart, which was lying in a drawer, it was found that such was the case. Comparing the stars on the chart one by one with the heavens it was found that an eighth magnitude star now visible was not on the chart. This object was observed until after midnight, but no certain motion was detected. On the following evening the object was again looked for, and found to have moved. The existence of the planet was thus established. It was afterwards found that Challis had observed the planet on Aug. 4, but had failed to detect it.

The question whether Leverrier should receive the sole credit of the discovery was warmly discussed. Arago took the extreme ground that actual publication alone should be considered, rejecting Adams's communications to Airy and Challis as quite unworthy of consideration. He also suggested that the name of Leverrier should be given to the planet, but this proposal was received with so little favour outside of France that he speedily withdrew it, proposing that of Neptune instead.

The observations at the first opposition showed that the planet was moving in a nearly circular orbit, and was at a mean distance from the sun much less than that set by Leverrier as the smallest possible. The latter had in fact committed the error of determining the limits by considering the variations of the elements one at a time, assuming in the case of each that while it varied the others remained constant. But a simultaneous variation of all the elements would have shown that the representation of the observations of Uranus would be improved by a simultaneous diminution of both the eccentricity and the mean distance, the orbit becoming more nearly circular and the planet being brought nearer to the sun. But this was not at first clearly seen, and Benjamin Peirce of Harvard University went so far as to maintain that there was a discontinuity between the solution of Adams and Leverrier and the solution offered by the planet itself, and that the coincidence in direction of the actual and computed planet was an accident. But this view was not well founded, and the only explanation needed was to be found in Leverrier's faulty method of determining the limits within which the planet must be situated. As a matter of fact the actual motion of the planet during the century preceding, as derived from Leverrier's elements, was much nearer the truth than the elements themselves were. This arose from the fact that his very elliptic orbit, by its large eccentricity, brought the planet near to the sun, and therefore near to its true position, during the period from 1780 to 1845, when the action on Uranus was at its greatest.

The observations of the first opposition enabled Sears Cook Walker of the National Observatory, Washington, in February 1847 to compute the past positions of the planet, and identify it with a star observed by Lalande at Paris in May 1795. This being communicated to the Paris observatory, an examination of Lalande's manuscript showed that he had made two observations of the planet, on the 8th and 10th of May and finding them discordant had rejected one as probably in error, and marked the other as questionable. A mere re-examination of the region to see which observation was in error would have led him to the discovery of the planet more than half a century before it was actually recognized. The identity of Lalande's star with Neptune was also independently shown by Petersen of Altona.

BIBLIOGRAPHY.—The principal sources for the history of the discovery of Neptune are the *Astronomische Nachrichten*, vols. xxv., xxvi., xxviii., and Lindenau's paper in the *Ergänzungsheft* to this publication, pp. 1–31 (Altona, 1849). In the *Memoirs of the Royal Astronomical Society*, vol. xvi., Airy gave a detailed history of the circumstances connected with the discovery, so far as he was cognizant of them. Documents pertaining to the subject are found in the *Monthly Notices of the Royal Astron. Society*. B. A. Gould, *Report to the Smithsonian Institution on the History of the Discovery of Neptune*, published by the Smithsonian Institution (Washington, 1850), is the most complete and detailed history of all the circumstances connected with the discovery, and with the early investigations on the orbit of the planet, that has been published. Leverrier's investigation was published *in extenso* as an addition to the *Connaissance des temps*, and Adams's as an appendix to the *Nautical Almanac* for 1851. Peirce's discussions, so far as published at all, are found in the *Proceedings of the American Academy of Arts and Sciences*. The first computations of the orbit after the discovery were made by Sears Cook Walker, and published by the Smithsonian Institution (1848–1850). General tables of the motion of Neptune are in Kowalski's *Tables du mouvement de la planète Neptune;* Newcomb's *Investigation of the Orbit of Neptune*, Washington, Smithsonian Institution (1866); Leverrier's *Annales de l'Observatoire de Paris; Memoirs*, vol. xiv. (1877), and lastly Newcomb's "Tables" in *Astron. Papers of the American Ephemeris*, vol. vii., part iv. Tables of the satellite are found in Newcomb, *The Uranian and Neptunian Systems;* appendix to the Washington observations for 1873.

(S. N.; T. E. R. P.)

NÉRAC, a town of France in the department of Lot-et-Garonne, 16 m. W.S.W. of Agen by road. Pop. (1926) 3,597. Nérac in the 11th century was a possession of the monks of St. Pierre de Condom. The lords of Albret deprived them of their authority and at the beginning of the 14th century founded a castle on the Baise. Nérac, the inhabitants of which had adopted the Reformed religion, was seized by the Catholics in 1562. The conferences, held there at the end of 1578 between the Catholics and Protestants, ended in the peace of Nérac, 1579. In 1580 the town was used by Henry IV. as a base for attacks on the Agenais, Armagnac and Guienne. A Chambre de l'Edit for Guienne and a Chambre des Comptes were established there by Henry IV. In 1621, however, the town took part in the Protestant rising, was taken by the troops of Louis XIII. and its fortifications dismantled. Soon after it was deprived both of the Chambre de l'Edit and of the Chambre des Comptes, and its ruin was completed by the revocation of the Edict of Nantes in 1685. The town, once the capital of the dukes of Albret, is divided by the Baise into Grand-Nérac and Petit-Nérac. The river is spanned by the 16th century bridge of Pont Vieux, and by the Pont Neuf, of modern construction. From the left bank a staircase leads to the rue Henri Quatre, where stands a wing of the castle in which Henry IV. lived. The former palace of the Chambre des Comptes is now occupied by the tribunal of commerce, the library and the museum. The remains of a Roman villa have been found near the promenade of La Garenne. A road leads from the south end of La Garenne to the ruins of the feudal castle of Nazareth. The Château du Tasta of the 15th century is within a short distance of Nérac. The industries include brewing and cork-working. It has a large trade in wines, brandy, corks, fruit and vegetables.

NERBUDDA: *see* NARBADA.

NERCHINSK, a town of Asiatic Russia, in the Sretensk district of the Far Eastern area, in lat. 52° 10′ N., long. 116° 32′ E., on the left bank of the Nercha, 2½ m. above its confluence with the Shilka. Pop. (1926) 6,545. It is a centre for the collection of furs, cattle and brick-tea from China and for the distribution of manufactured goods imported from industrial Russia. There are tanneries, candle factories and a fur coat factory. The town is a market for the agricultural products of the fertile river valley.

The fort dates from 1654, and the town was founded in 1658 by Pashkov, who in that year opened direct communication between the Russian settlements in Transbaikalia and those on the Amur which had been founded by Cossacks and fur-traders coming from the Yakutsk region. In 1689 was signed between Russia and China the Treaty of Nerchinsk, which stopped for two centuries the further advance of the Russians into the basin of the Amur. After that Nerchinsk became the chief centre for the trade with China. The opening of the western route through Mongolia, by Urga, and the establishment of a custom-house at Kiakhta in 1728 diverted this trade into a new channel. But Nerchinsk acquired fresh importance from the influx of immigrants into eastern Transbaikalia, the discovery of rich mines and the arrival of great numbers of convicts. In 1812 it was transferred from the banks of the Shilka to its present site.

NERCHINSK (in full NERCHINSKIY ZAVOD), a town and silver-mine of Asiatic Russia in the Sretensk district of the Far Eastern Area, in lat. 51° 59′ N., long. 116° 39′ E., 150 m. E.S.E. of another Nerchinsk (*q.v.*) (with which it is often confused), on a small affluent of the Argun. Pop. (1926) 3,153. It has a chemical laboratory for mining purposes, and a meteorological and magnetic observatory (51° 18′ N., 119° 37′ E., 2,200 ft. above sea-level) founded in 1842. The average yearly temperature is 25·3° F, with extremes of 97·7° and −52·6°.

NERCHINSK MINING DISTRICT (29,450 sq.m.) includes all the silver, lead and tin mines and gold-fields between the Shilka and the Argun, together with a few on the left bank of the Shilka. It is traversed by several parallel chains of mountains which rise to 4,500 ft., and are intersected by a complicated system of deep, narrow valleys, densely wooded, with a few expansions along the larger rivers, where the inhabitants with difficulty raise some rye and wheat. The Nerchinsk mountains, not yet fully surveyed, form the watershed between the streams flowing south-east into the Argun and the Onon, Unda and Shilka on the north-west. They consist of crystalline slates and limestones interspersed with granite, syenite and diorite; they contain rich ores of silver, lead, tin and iron, while the diluvial and alluvial valley formations contain auriferous sands; asbestos is found near the tin.

The Nerchinsk silver mines began to be worked in 1704, but during the first half of the 18th century their yearly production did not exceed 8,400 oz., and the total amount for the first 150 years (1704–1854) amounted to 11,540,000 ounces. Transport

and climatic difficulties have prevented the exploitation of the minerals in the region and the silver mines were closed in 1900. If the present scheme of linking the mines to the main railway is carried out, production may redevelop. The more easily reached veins of silver have been exhausted and expensive plant would be needed to work the deeper veins. Gold was first discovered in 1830, and between 1833 and 1855 260,000 oz. of gold dust were obtained. In 1864 a large number of auriferous deposits were discovered. Until 1863 all the labour was performed by serfs and convicts, numbering usually nearly four thousand. The output of gold up to 1914 was about 171,000 oz. troy, but is very small at present (1928).

NEREUS, in Greek mythology, the eldest son of Pontus and Gē, and father of the Nereïds. He is represented as a beneficent and sage old man of the sea. The only myth concerning him is that Heracles compelled him, although, like Proteus, he assumed various forms, to tell him the way to the Hesperides (Apollodorus ii. 115). The Nereïds are mermaids. Amphitrite (consort of Poseidon) and Thetis (*see* PELEUS) are the best known; Galatea is a Sicilian figure, loved by the Cyclops Polyphemus. The name has nothing to do with the modern Greek *νερόν* (really *νεαρόν*, "fresh" [water]).

NERGAL, the name of a solar deity in Babylonia, the main seat of whose cult was at Kutha or Cuthah, represented by the mound of Tell-Ibrahim. The importance of Kutha as a religious and at one time also as a political centre led to his surviving the tendency to concentrate the various sun-cults of Babylonia in Shamash (*q.v.*). He becomes, however, the representative of a certain phase only of the sun and not of the sun as a whole. Portrayed in hymns and myths as a god of war and pestilence, Nergal represents the sun of noon-time and of the summer solstice which brings destruction to mankind. Nergal is pictured also as the deity who presides over the nether-world, and stands at the head of the special pantheon assigned to the government of the dead, who are supposed to be gathered in a large subterranean cave known as Arallis or Irkalla. In this capacity there is associated with him a goddess Allatu or Erishkigal, though there are indications that at one time Allatu was regarded as the sole mistress of Arâlu. Ordinarily the consort of Nergal is Laz. Nergal was pictured as a lion and his symbol is a griffin with panther's head, sometimes supporting his other symbol, a weapon with two panther heads.

As in the case of Nin-urta, Nergal appears to have absorbed a number of minor solar deities, which accounts for the various names or designations under which he appears, such as Lugalgira, Sharrapu, ("the burner," perhaps a mere epithet), Ira or Gira, Gibil (though this name more properly belongs to Nusku, *q.v.*). A certain confusion exists in cuneiform literature between Nin-urta and Nergal, perhaps due to the traces of two different conceptions regarding these two solar deities. Nergal is called the "raging king," the "furious one," and the original Sumerian name consists of three elements, Ne-urugal, "might of the great dwelling" and thus at the head of the nether-world a pantheon is indicated. In the astral-theological system he is the planet Mars, while in ecclesiastical art the great lion-headed colossi serving as guardians to the temples and palaces seem to be a symbol of Nergal, just as the bull-headed colossi probably typify Nin-urta.

The name of his chief temple at Kutha was E-shid-lam, from which the god receives the designation of Shidlamtäea, "the one that rises up from Shidlam." The cult of Nergal does not appear to have been as widespread as that of Nin-urta. He is frequently invoked in hymns and in votive and other inscriptions of Babylonian and Assyrian rulers, but we do not learn of many temples to him outside of Kutha. Sennacherib speaks of one at Tarbisu to the north of Nineveh, but although Nebuchadrezzar II. (606–586 B.C.), the great temple-builder of the neo-Babylonian monarchy, alludes to his operations at E-shid-lam in Kutha, he makes no mention of a sanctuary to Nergal in Babylon. Local associations with his original seat—Kutha—and the conception formed of him as a god of the dead acted in making him feared rather than actively worshipped. He is often spoken of as a god who passed judgment on the souls of the dead, and in the late period arose the theory of compensation at his hands in Arallu for the righteous, and thus arose the late Hebrew belief in rewards after death to explain the problem of providence.

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NERI, PHILIP (FILIPPO DE), Saint (1515–1595), Italian churchman, was born at Florence on July 21, 1515, the youngest child of Francesco Neri, a lawyer of that city, and his wife Lucrezia Soldi. He received his early teaching from the friars at San Marco, the famous Dominican monastery in Florence. At sixteen Philip was sent to his uncle, Romolo, a merchant at San Germano, to assist him in his business, and with the hope that he might inherit his possessions. But in 1533 Philip went to Rome, where he acted as a private tutor, and was able to study under the Augustinians, and to begin those labours amongst the sick and poor which gained him in later life the title of "Apostle of Rome." His nights were spent in prayer and meditation in the churches of the city and in the catacombs. In 1538 he began his missionary work; somewhat in the manner of Socrates he traversed the city, seizing opportunities of entering into conversation with persons of all ranks, and of leading them on, with playful irony, questions and counsel, to consider the topics he desired to set before them.

In 1548 he founded the confraternity of the Santissima Trinità de' Pellegrini e de' Convalescente, to minister to the thousands of poor pilgrims to Rome, and also to relieve the patients discharged from hospitals. In 1551 he was ordained priest. He settled, with some companions, at the hospital of San Girolamo della Carità, and while there tentatively began, in 1556, the institute with which his name is more especially connected, that of the Oratory. The scheme at first was for a series of evening meetings in a hall (the Oratory), at which there were prayers, hymns, readings from Scripture, from the fathers, and from the *Martyrology*, followed by a lecture, or by discussion of some religious question proposed for consideration. The musical selections (settings of scenes from sacred history) were called *oratorios*. In 1564 the Florentines invited Philip to take charge of their church in Rome, San Giovanni dei Fiorentini, then newly built. At this time the new society included amongst its members Caesar Baronius, the ecclesiastical historian, Francesco Maria Tarugi, afterwards archbishop of Avignon, and Paravicini, all three subsequently cardinals, and also Gallonius, author of a work on the *Sufferings of the Martyrs*, Ancina, Bordoni, and other men of ability and distinction.

The Florentines, however, built in 1574 a large oratory or mission-room for the society contiguous to San Giovanni. Eventually the society took the church of Santa Maria in Vallicella, in the middle of Rome. The building was pulled down, and a splendid church erected on the site. Neri then formally organized, under permission of a bull dated July 15, 1575, a community of secular priests, entitled the Congregation of the Oratory. The new church was consecrated early in 1577, but Neri himself did not migrate from San Girolamo till 1583, and then only in virtue of an injunction of the pope that he, as the superior, should reside at the chief house of his congregation. He was at first elected for a term of three years (as is usual in modern societies), but in 1587 was nominated superior for life. He desired that all congregations formed on his model outside Rome should be autonomous, a regulation formally confirmed by a brief of Gregory XV. in 1622. Neri's only interference in political matters was in 1593, when he induced Clement VIII., to withdraw the excommunication and anathema of Henry IV. of France. Neri administered the Oratory until his death (May 26, 1595) at Rome. He was succeeded by Baronius. Neri was beatified by Paul V. in 1600, and canonized by Gregory XV. in 1622.

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NERNST, WALTER (1864–), German physical chemist, was born on June 25, 1864, at Briesen, West Prussia. He studied at the universities of Zürich, Berlin, Graz and Würzburg and became an assistant at the University of Leipzig, subsequently going in this capacity to Göttingen, where he later became a professor. In 1905 he was appointed ordinary professor of physics in the University of Berlin, and later became director of the Physikal. Techn. Reichsanstalt, Charlottenburg, a position he held until 1924. In 1925 he became director of the Physical Institute in the University of Berlin. On the technical side Nernst is known for the invention of an electric glow lamp which was more efficient although more complicated, than the old carbon lamps. In comparison with the modern metal filament lamps, however, the Nernst lamp has no general value, but in scientific work it is still used to a small extent as a concentrated source of light. In physical chemistry Nernst is responsible for a great deal of the fundamental work on reversible galvanic cells; he has also made considerable contributions to the theory of solutions, more especially in connection with diffusion, hydration and dissociation of electrolytes. With H. von Wartenberg he devised a method for measuring vapour densities at very high temperatures; they investigated the dissociation of various elements and compounds. Nernst is noted for the statement of the so-called third law of thermo-dynamics and for initiating important measurements of specific heats at low temperatures. In 1920 he received the Nobel Prize for physics.

He has edited the *Jahrbuch der Elektrochemie*, the *Zeitschrift für angewandte Chemie*, and the *Zeitschrift für Elektrochemie*. His *Experimental and Theoretical Applications of Thermodynamics to Chemistry* has appeared in a number of German and English editions. His new contribution to thermodynamics is described in *Die theoretischen und experimentellen Grundlagen des neuen Warmesatzes* (1918); an English translation has been published.

NERO (NERO CLAUDIUS CAESAR AUGUSTUS GERMANICUS) (A.D. 37–68), Roman emperor 54–68, was born at Antium on Dec. 15, 37. He was the son of Gnaeus Domitius Ahenobarbus and Agrippina the younger, and his name was originally L. Domitius Ahenobarbus. His father died when Nero was scarcely three years old. In the previous year (39) his mother had been banished by order of her brother Caligula (Gaius), and Nero early found shelter in the house of his aunt Domitia. The emperor Claudius recalled Agrippina, who spent the next 13 years in a struggle to obtain the succession of the throne for Nero. She married Claudius in 49, and in 50 he adopted Nero as his son. Seneca was recalled from exile to be his tutor. On his fourteenth birthday he assumed the *toga virilis*, and was introduced to the Senate by Claudius with the title of *princeps iuventutis*. This made his succession almost certain, and Agrippina subsequently got rid of the partisans of Britannicus and installed Burrus as praefect of the praetorian guard.

Succession.—In 52, in Claudius' absence, Nero was praefect of the city. He married Claudius's daughter Octavia. On Oct. 13, 54 Claudius died, poisoned by Agrippina's orders and Nero was presented to the soldiers on guard as their new sovereign. From the palace steps he proceeded to the praetorian camp, and thence to the senate-house, where he was made emperor.

Agrippina's bold stroke has been completely successful. Only a few voices were raised for Britannicus; nor is there any doubt that Rome was prepared to welcome the new emperor with genuine enthusiasm. His prestige and his good qualities, carefully fostered by Seneca, made him popular, while his darker passions were as yet unsuspected. His first acts confirmed this favourable impression. He modestly declined the title of *pater patriae*; the memory of Claudius, and that of his own father Domitius were duly honoured. He promised to follow the principles of Augustus, and his clemency, liberality and affability were the talk of Rome.

Much of the credit of all this is due to Seneca and Burrus. Seneca had seen from the first that the real danger with Nero lay in the savage vehemence of his passions, and he made it his chief aim to stave off by every means in his power the dreaded outbreak. The policy of indulging his tastes and helping him to enjoy the sweets of popularity without the actual burdens of government succeeded for the time. During the first five years of his reign, little occurred to damp the popular enthusiasm. Nero's promises were fulfilled, and the senate found itself free to discuss and even to decide important administrative questions. Abuses were remedied, the provincials protected from oppression, and the burdens of taxation lightened. On the frontiers no serious disaster occurred, and even the murder of Britannicus was accepted as a necessary measure of self-defence. But an essential part of Seneca's policy was to remove Nero from the influence of his mother.

Agrippina's Eclipse.—In 55, he found a powerful ally in Nero's passion for the beautiful freedwoman Acte, a passion which he deliberately encouraged. Agrippina's angry remonstrances served only to irritate Nero, and caresses equally failed. She then threatened to espouse the cause of Britannicus. Nero retaliated by poisoning Britannicus. Agrippina then tried to win over Nero's neglected wife Octavia, and to form a party of her own. Nero dismissed her guards, and placed her in a sort of honourable confinement (Tac. *Ann.* xiii. 12–20). During nearly three years she disappears from the history, and with her retirement things again for the time went smoothly. In 58 Nero was enslaved by Poppaea Sabina, a woman of a very different stamp from her predecessor. She was resolved to be Nero's wife, and her first object was the removal of Agrippina. By rousing Nero's jealousy and fear she induced him to seek her death, with the aid of a freedman Anicetus, praefect of the fleet of Misenum. Agrippina was invited to Baiae, and after an affectionate reception, was conducted on board a vessel so constructed as, at a given signal, to fall to pieces. But Agrippina saved herself by swimming, and wrote to her son, announcing her escape, and affecting entire ignorance of the plot. A body of soldiers under Anicetus then surrounded her villa, and murdered her in her own chamber. Nero was horrorstruck at the enormity of the crime and terrified at its possible consequences. But a six months' residence in Campania, and the congratulations which poured in upon him from the neighbouring towns, where the report had been officially spread that Agrippina had fallen a victim to her treacherous designs upon the emperor, gradually restored his courage. In Sept. 59 he re-entered Rome amid universal rejoicing. Races, exhibitions and games in the Greek fashion rapidly succeeded each other.

Poppaea.—The result of the death of Agrippina was the growing influence over Nero of Poppaea and her friends. In 62 Burrus died, it was said by poison, and Seneca retired from his post. Their place was filled by Poppaea, and the infamous Tigellinus, whose sympathy with Nero's sensual tastes had gained him the command of the praetorian guards in succession to Burrus. The fear of conspiracy was skilfully used by them to direct Nero's suspicions against possible opponents. Cornelius Sulla, who had been banished to Massilia in 58, was put to death on the ground that his residence in Gaul was likely to arouse disaffection in that province, and a similar charge proved fatal to Rubellius Plautus, who had for two years been living in retirement in Asia. Nero's taste for blood thus whetted, Octavia was divorced, banished to the island of Pandateria and murdered. Poppaea's triumph was now complete. She was married to Nero; her head appeared on the coins with his; and her statues were erected in the public places of Rome.

In the course of 61 occurred the rebellion of Boudicca (Boadicea) and the Iceni in Britain, resulting in the sack of Colchester and the destruction of the ninth legion before it was suppressed by Suetonius Paulinus. Further disasters were the destruction of Pompeii and the evacuation of Armenia in 63.

The Burning of Rome.—A far deeper and more lasting impression was produced by the great fire in Rome. The fire broke out on the night of July 18, 64, among the wooden booths at the south-east end of the Circus Maximus. Thence in one direction it rapidly spread over the Palatine and Velia up to the low cliffs of the Esquiline, and in another it laid waste the Aventine, the Forum Boarium and Velabrum till it reached the Tiber and the solid barrier of the Servian wall. After burning fiercely for six days it started afresh and desolated the regions of the Circus Flaminius and the Via Lata, and after it was finally quenched only four of the 14 *regiones* remained untouched; three had been utterly destroyed and seven reduced to ruins. The conflagration is said by all authorities later than Tacitus to have been deliberately caused by Nero himself. But Tacitus, though he mentions the rumours,

declares that its origin was uncertain, and in spite of such works as Profumo's *Le fonti ed i tempi dello incendio Neroniano* (1905), there is no proof of his guilt. By Nero's orders, the open spaces in the Campus Martius were utilized to give shelter to the homeless crowds, provisions were brought from Ostia and the price of corn lowered. In rebuilding the city every precaution was taken against the recurrence of such a calamity. Broad regular streets replaced the narrow winding alleys. The new houses were limited in height, built partly of hard stone and protected by open spaces.

This disaster undoubtedly told against Nero, being widely regarded as evidence of the wrath of the gods. The work of rebuilding included the erection of Nero's famous palace, the "golden house," and the laying-out of its wonderful grounds.

To defray the enormous cost, Italy and the provinces, says Tacitus, were ransacked, and in Asia and Achaia especially the rapacity of the imperial commissioners recalled the days of Mummius and of Sulla. It was the first occasion on which the provincials had suffered from Nero's rule, and the discontent it caused helped to weaken his hold over them at the very moment when the growing dissatisfaction in Rome was gathering to a head. Early in 65 Nero was panic-stricken by the discovery of a conspiracy involving such men as Faenius Rufus, Tigellinus's colleague in the prefecture of the praetorian guards, Plautius Lateranus, one of the consuls elect, the poet Lucan, and, lastly, not a few of the tribunes and centurions of the praetorian guard itself. Their chosen leader, whom they destined to succeed Nero, was C. Calpurnius Piso (*q.v.*), a handsome, wealthy and popular noble, and a boon companion of Nero. The plan to murder Nero was betrayed by a freedman Milichus. Piso, Faenius Rufus, Lucan and Seneca himself were executed.

In the next few months many more fell victims to his fear and resentment. Conspicuous among them was Paetus Thrasea, whose unbending virtue had long made him distasteful to Nero, and who was now suspected, possibly with reason, of sympathy with the conspirators. Poppaea died in the autumn of 65, and the general gloom was increased by a pestilence which followed the fire. Early in the summer of 66 the Parthian prince Tiridates came to Italy to receive the crown of Armenia at Nero's hands. It represented the final triumph of the arms and policy of Corbulo in the East, and at least a temporary solution of the Parthian problem.

Greece.—Towards the end of 66 Nero visited Greece with a retinue of soldiers, courtiers, musicians and dancers. The spectacle presented by Nero's visit was unique. He went professedly as an enthusiastic worshipper of Greek art and a humble candidate for the suffrages of Greek judges. At each of the great festivals, which to please him were for once crowded into a single year, he entered in regular form for the various competitions, scrupulously conformed to the tradition and rules of the arena, and awaited in nervous suspense the verdict of the umpires. The dexterous Greeks humoured him to the top of his bent. He planned and commenced the cutting of a canal through the Isthmus of Corinth.

Meanwhile the general dissatisfaction was coming to a head, as we may infer from the urgency with which the imperial freedman Helius insisted upon Nero's return to Italy. Revolt started in Gaul with the insurrection of Julius Vindex, governor of Gallia Lugdunensis. It is probable that the aims of Vindex included the liberation of northern Gaul, which would explain both the enthusiasm of the Gallic chiefs, and the opposition of the legions of the Rhine. This force defeated Vindex at Vesontio (Besançon) and offered the throne to their own commander Virginius Rufus, who refused it. Meanwhile the governors of Hispania, Tarraconensis and Galba and Otho, had rebelled, and Galba had claimed the throne. Nero returned from Greece to Naples for further revels.

Suicide.—The revolts in Spain and Germany terrified him too late into something like energy. The senate almost openly intrigued against him, and the populace were silent or hostile. The fidelity of the praetorian sentinels even was more than doubtful. When finally the palace guards forsook their posts, Nero despairingly stole out of Rome to seek shelter in a freedman's villa some four miles off. There he heard of the senate's proclamation of Galba as emperor, and of the sentence of death passed on himself. On the approach of the horsemen sent to drag him to execution, he collected sufficient courage to save himself by suicide. Nero died on June 9, 68, in the 31st year of his age and the fourteenth of his reign, and his remains were deposited by the faithful Acte in the family tomb of the Domitii on the Pincian hill. With his death ended the line of the Caesars, and Roman imperialism entered a new phase. His statues were broken, his name everywhere erased, and his "golden house" demolished.

The Roman populace for a long time reverenced his memory as that of an open-handed patron, and in Greece the recollections of his magnificence, and his enthusiasm for art, were still fresh when the traveller Pausanias visited the country a century later. The belief that he had not really died, but would return again to confound his foes, was long prevalent, not only in the remoter provinces, but even in Rome itself; and more than one pretender was able to collect a following by assuming the name of the last of the race of Augustus. More lasting still was the implacable hatred of those who had suffered from his cruelties. Roman literature, faithfully reflecting the sentiments of the aristocratic salons of the capital, while it almost canonized those who had been his victims, fully avenged their wrongs by painting Nero as a monster of wickedness. In Christian tradition he even appears as the mystic Antichrist, who was destined to come once again to trouble the saints. Even in the middle ages, Nero was still the very incarnation of splendid iniquity, while the belief lingered that he had only disappeared for a time, and as late as the 11th century his restless spirit was supposed to haunt the slopes of the Pincian hill.

The chief ancient authorities for Nero's life and reign are Tacitus (*Annals*, xiii.–xvi., edit. Furneaux), Suetonius, Dio Cassius (*Epit.* lxi., lxii., lxiii.) and Zonaras (*Ann.* xi.). The most important modern work is that of B. W. Henderson, *The Life and Principate of the Emperor Nero* (1903; *see* an important notice in *Class. Rev.* vol. xviii. p. 57), which contains full bibliography of ancient and modern writers: *see* also H. Schiller's *Nero*, and *Geschichte d. Kaiserzeit;* Lehmann, *Claudius und Nero;* Desider Kostolanyi, *Nero* (1928).

NERVA, MARCUS COCCEIUS (A.D. ?35–98), Roman emperor from Sept. 18, 96 to Jan. 25, 98, was born at Narnia in Umbria on Nov. 8, probably in the year 35. He came of a senatorial family, his father and grandfather having been jurists.

He was praetor (66) and twice consul, in 71 with the emperor Vespasian for colleague and again in 90 with Domitian. Towards the close of the latter's reign (93) he is said to have been banished to Tarentum on a charge of conspiracy. On the murder of Domitian in September 96 Nerva was declared emperor by the people and the soldiers. He is described as a quiet, kindly, dignified man, honest of purpose, but unfitted by his advanced age to bear the weight of empire. Nevertheless, his selection, in spite of occasional exhibitions of weakness, justified the choice. The new emperor recalled those who had been exiled by Domitian; what remained of their confiscated property was restored to them, and a stop was put to the vexatious prosecutions which Domitian had encouraged. But the popular feeling demanded more than this. The reaction against the informers became as dangerous as the previous system. It was checked by Nerva, who was actuated by the taunt of Titus Catius Caesius Fronto that, "bad as it was to have an emperor who allowed no one to do anything, it was worse to have one who allowed everyone to do everything."

Nerva seems to have followed the custom of announcing the general lines of his future policy. He showed himself anxious to respect the traditional privileges of the senate, and such maxims of constitutional government as still survived. He pledged himself to put no senator to death. His councillors in all affairs of state were senators, and the hearing of claims against the *fiscus* was entrusted to a praetor and a court of *indices*.

The economical condition of Italy evidently excited his alarm and sympathy. The last mention of a *lex agraria* in Roman history is connected with his name. Under the provisions of this *lex*, large tracts of land were bought up and allotted to poor citizens. The cost was defrayed partly from the imperial treasury, but partly also from Nerva's private resources, and the execution of the scheme was entrusted to commissioners. He also founded or restored colonies at Verulae, Scyllacium and Sitifis in Mauretania. An entirely new departure was the main-

tenance at the public cost of the children of poor parents in the towns of Italy, which was combined ingeniously with the provision of loans for farmers. The treasury found the money, which was lent on the security of farms, and the farmers paid the interest to their municipality for the maintenance of poor children.

Private individuals were also encouraged to follow the imperial example. In the hands of Trajan, Hadrian and the Antonines, Nerva's example bore fruit in the institution of the *alimentationes*, the most genuinely charitable institution of the pagan world. These measures Nerva supplemented by others which aimed at lightening the financial burdens on the declining industry of Italy. The cost of maintaining the imperial postal system (*vehiculatio*) was transferred to the *fiscus;* from the same source apparently money was found for repairing the public roads and aqueducts; and lastly, the lucrative but unpopular tax of 5% on all legacies or inheritances (*vicesima hereditatum*), was so readjusted as to remove the grosser abuses connected with it. At the same time Nerva did his best to reduce the overgrown expenditure of the state. A commission was appointed to consider the best modes of retrenchment, and the outlay on shows and games was cut down to the lowest possible point. Early, apparently, in 97 he detected a conspiracy against his life headed by L. (or C.) Calpurnius Crassus, but he contented himself with a hint to the conspirators that their designs were known, and with banishing Crassus to Tarentum. The praetorian guards, at the instigation of one of their two prefects, Casperius Aelianus, whom Nerva had retained in office, imperiously demanded the execution of Domitian's murderers, the chamberlain Parthenius and Petronius Secundus, Aelianus's colleague. Nerva vainly strove to save, even at the risk of his own life, the men who had raised him to power, but the soldiers brutally murdered the unfortunate men, and forced him to propose a vote of thanks for the deed. This humiliation convinced Nerva of the necessity of placing the government in stronger hands than his own. He resolved to adopt as his colleague and destined successor, M. Ulpius Trajanus, a distinguished soldier, at the time in command of the legions on the Rhine. In Oct. 97, in the temple of Jupiter on the Capitol, Trajan was formally adopted as his son and declared his colleague in the government of the empire. For three months Nerva ruled jointly with Trajan, but on Jan. 25, 98, he died somewhat suddenly. He was buried in the sepulchre of Augustus, and divine honours were paid him by his successor. The verdict of history upon his reign is best expressed in his own words—"I have done nothing which should prevent me from laying down my power, and living in safety as a private man." The memory of Nerva is still preserved by the ruined temple in the Via Alessandrina (il Colonacce) which marks the site of the Forum begun by Domitian, but which Nerva completed and dedicated.

BIBLIOGRAPHY.—Dio Cass. lxviii. 1–4; Aurelius Victor 12, and *Epit.* 24; Zonaras xi. 20; compare also Pliny, *Epistolae* and *Panegyricus;* Tillemont, *Histoire des empereurs romains*, ii.; C. Merivale, *History of the Romans under the Empire*, ch. 63; H. Schiller, *Geschichte der römischen Kaiserzeit*, i. pt. 2 (1883), p. 538; J. Asbach, *Römisches Kaiserthum und Verfassung bis auf Trajan* (Cologne, 1896); A. Stein in Pauly-Wissowa's *Realencyclopädie* (*s.v.* Cocceius, 16); J. B. Bury, *The Student's Roman Empire*, ch. 23 (1893); M. I. Rostovtsev, *Social and Economic History of the Roman Empire* (1926); B. W. Henderson, *Five Roman Emperors* (1927). (H. F. P.; X.)

NERVAL, GÉRARD DE (1808–1855), the adopted name of Gérard Labrunie, French man of letters, born in Paris on May 22, 1808. His father was an army doctor, and the child was left with an uncle in the country, while Mme. Labrunie accompanied her husband in his campaigns. She died in Silesia. In 1811 his father returned, and beside Greek and Latin taught the boy modern languages and the elements of Arabic and Persian. Gérard found his favourite reading in old books on mysticism and the occult sciences. His first work, *La France guerrière, élégies nationales*, was published while he was still a schoolboy at the Collège Charlemagne. In 1828 he published a translation of Goethe's *Faust*, the choruses of which were afterwards used by Berlioz for his legend-symphony, *The Damnation of Faust*. A number of poetical pieces and three comedies combined to acquire for him, at the age of 21, a considerable reputation, and led to his association with Théophile Gautier in the preparation of the dramatic *feuilleton* for the *Presse*. He conceived a violent passion for the actress Jennie Colon, in whom he thought he recognized a certain Adrienne, who had fired his childish imagination. Her marriage and her death in 1842 were blows from which his nervous temperament never really recovered. He travelled in Germany with Alexandre Dumas, and alone in various parts of Europe, leading a very irregular and eccentric life. In 1843 he visited Constantinople and Syria, where, among other adventures, he nearly married the daughter of a Druse sheikh. He contributed accounts of his travels to the *Revue des Deux Mondes* and other periodicals. After his return to Paris in 1844 he resumed for a short time his *feuilleton* for the *Presse*, but his eccentricities increased and he committed suicide by hanging, on Jan. 25, 1855. The literary style of Gérard is simple and unaffected, and he has a peculiar faculty of giving to his imaginative creations an air of naturalness and reality. In a series of novelettes, afterwards published under the name of *Les Illuminés, ou les précurseurs du socialisme* (1852), containing studies on Rétif de la Bretonne, Cagliostro and others, he gave a sort of analysis of the feelings which followed his third attack of insanity. Among his other works the principal are *Les Filles du feu* (1854), which contains his masterpiece, the semi-autobiographical romance of *Sylvia; Scènes de la vie orientale* (1848–50); *Contes et facéties* (1852); *La Bohême galante* (1856); and *L'Alchimiste*, a drama in five acts, the joint composition of Gérard and Alexandre Dumas. His *Poésies complètes* were published in 1877.

See the notices by Théophile Gautier and Arsène Houssaye, prefixed to the posthumous *Le Rêve et la vie* (1855); Maurice Tourneux's sketch in his *Âge du romantisme* (1887); and a sympathetic study of temperament in the *Névrosés* (1898) of Mme. Arvède Barine. *See* also G. Ferrières, *Gérard de Nerval* (1906).

NERVE, originally a sinew or tendon (*cf.* "strain every nerve") but now used for the conducting fibres of the nervous system in anatomy and secondarily as a psychical term for courage or firmness and in "nervousness" for the opposite quality. Here the anatomy of the nerves is dealt with; *see* also NERVOUS SYSTEM, MUSCLE AND NERVE, NEUROPATHOLOGY, etc.

CRANIAL

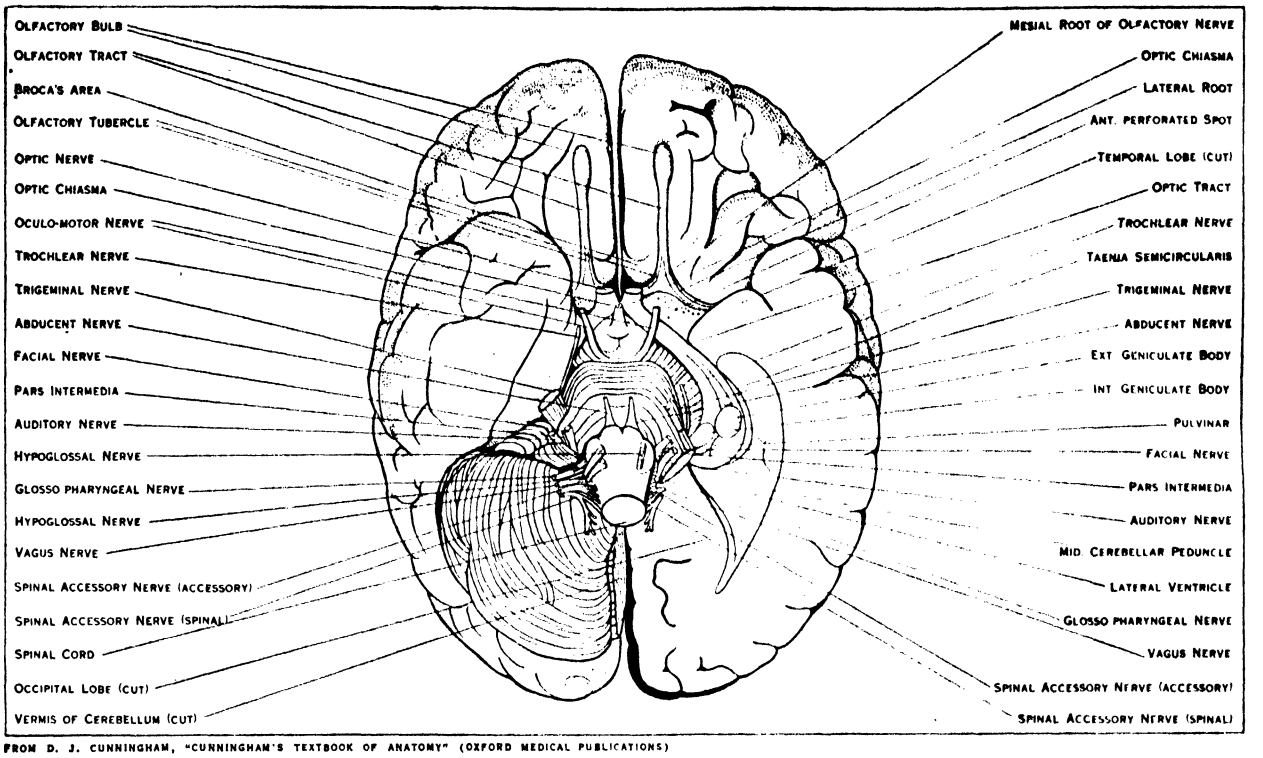
The 12 pairs of cranial nerves rise directly from the brain. With one exception they all contain medullated fibres (*see* NERVOUS SYSTEM). The following is a list:—

(1) Olfactory; (2) Optic; (3) Oculo-motor or Motor oculi; (4) Trochlearis or Patheticus; (5) Trigeminal or Trifacial; (6) Abducens; (7) Facial; (8) Auditory; (9) Glosso-pharyngeal; (10) Vagus or Pneumogastric; (11) Spinal accessory; (12) Hypoglossal.

Olfactory.—The first, or olfactory nerve, consists of the *olfactory bulb* and *tract*, which are a modified lobe of the brain and lie beneath the sulcus rectus on the frontal lobe of the brain (fig. 1). At its posterior end the tract becomes continuous with the brain; anteriorly is the bulb from which some twenty small non-medullated nerves pass through the cribriform plate of the ethmoid to supply the sensory organs in the olfactory mucous membrane (*see* OLFACTORY SYSTEM).

Optic.—The second or optic nerve consists of the *optic tract*, the *optic commissure* or *chiasma*, and the *optic nerve* proper. The optic tract begins at the lower visual centres or internal and external geniculate bodies, the superior quadrigeminal body and the pulvinar (fig. 1), but these again are connected with the higher visual centre in the occipital lobe by the optic radiations (fig. 2). In the chiasma some of the fibres cross and some do not, so that the right optic tract forms the right half of both the right and left optic nerves. In addition, the fibres from the internal geniculate body of one side cross in the chiasma to the same body of the opposite side, forming *Gudden's commissure*. The optic nerve passes through the optic foramen into the orbit, where it is penetrated by the central artery of the retina, and pierces the sclerotic internal to the posterior pole of the eyeball. *See* EYE.

Oculomotor.—The third or oculomotor nerve rises from a nucleus in the floor of the aqueduct of Sylvius and comes to the surface on the inner side of the crus cerebri (fig. 1), pierces the dura mater, and lies in the outer wall of the cavernous sinus,



FROM D. J. CUNNINGHAM, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 1.—VIEW OF INFERIOR SURFACE OF BRAIN, WITH LOWER PORTION OF THE TEMPORAL AND OCCIPITAL LOBES; THE CEREBELLUM ON THE LEFT SIDE IS REMOVED TO SHOW ORIGINS OF THE CEREBRAL NERVES

where it divides into an upper and lower branch. Both these enter the orbit through the sphenoidal fissure, the upper branch supplying the superior rectus and levator palpebrae superioris muscles, the lower the inferior and internal rectus and the inferior oblique, thus supplying five of the seven orbital muscles.

Trochlear.—The fourth or trochlear nerve is very small, and comes from a nucleus a little lower than that of the third nerve. It crosses to the opposite side in the fourth ventricle, winds round the outer side of the crus cerebri (fig. 1) and enters the outer wall of the cavernous sinus to reach the orbit through the sphenoidal fissure. Here it enters the superior oblique muscle on its orbital surface.

Trigeminal.—The fifth or trigeminal nerve consists of motor and sensory roots. The motor root rises from a nucleus in the upper lateral part of the floor of the fourth ventricle, and by a descending (mesencephalic) tract near the Sylvian aqueduct (fig. 3). The large sensory root goes to a sensory nucleus a little external to the motor one, and also, by a spinal or descending root, to the substantia gelatinosa Rolandi as low as the second spinal nerve (fig. 3). The superficial origin of the fifth nerve is from the side of the pons (fig. 1), and the two roots at once pass into a small compartment of the dura mater, where the large crescentic *Gasserian ganglion* is formed upon the sensory root, and from this the three branches, ophthalmic, maxillary, mandibular, come off. The motor root only joins the mandibular branch. The *ophthalmic division* runs in the outer wall of the cavernous sinus, where it divides into frontal, lachrymal and nasal branches. They all enter the orbit through the sphenoidal fissure. The *maxillary division* leaves the skull through the foramen rotundum, and then runs across the roof of the spheno-maxillary fossa; here the *spheno-maxillary* or *Meckel's ganglion* hangs from it by two roots. The nerve then runs in the floor of the orbit, giving off *superior dental* branches, until it emerges on to the face at the infraorbital foramen, where it divides into *palpebral, nasal* and *labial branches*. The *mandibular division* leaves the skull through the foramen ovale, and at once gives off motor branches for the muscles of mastication; these are derived from the motor root of the fifth, except that for the buccinator, which really supplies only the skin and mucous membrane in contact with the muscle. After the motor branch is given off, the nerve divides into *lingual, inferior dental* and *auriculo-temporal*. The lingual is joined by the *chorda tympani* branch of the facial nerve.

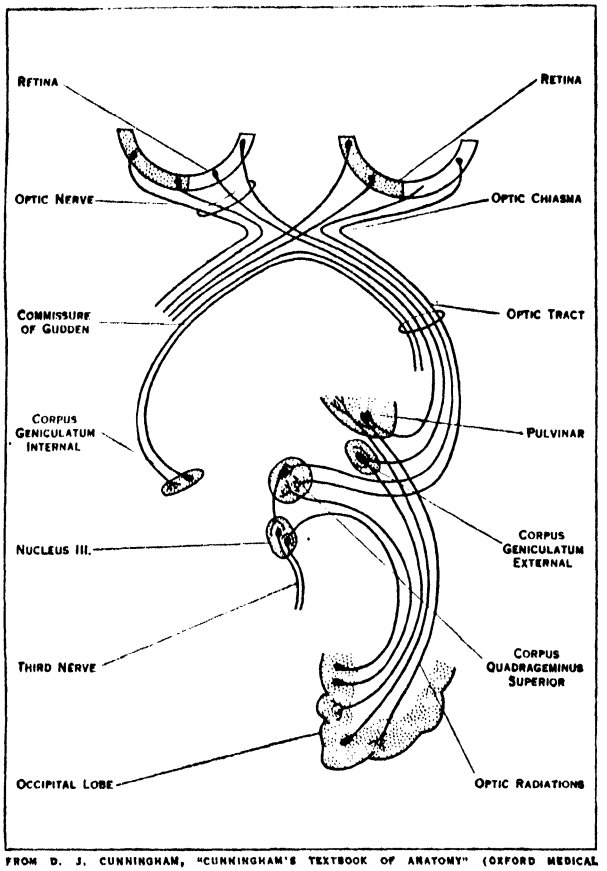
Abducent.—The sixth or abducent nerve rises from a nucleus in the floor of the fourth ventricle deep to the eminentia teres (fig. 3). It appears on the surface of the brain just below the pons and close to the middle line (fig. 1), pierces the dura mater and runs in the floor of the cavernous sinus to the sphenoidal fissure. Entering the orbit it supplies the external rectus muscle.

Facial.—The seventh or facial nerve begins in a nucleus which is about the same level as that for the sixth, but much deeper from the floor of the fourth ventricle as well as farther from the middle line (fig. 3). The fibres of the facial loop round the nucleus of the sixth, and then emerge in the triangular interval between the medulla, pons and cerebellum, close to the eighth nerve (fig. 1). Entering the internal auditory meatus the facial nerve passes into a canal in the petrous bone (*aqueductus Fallopii*), emerges at the stylo-mastoid foramen on the base of the skull, and enters the parotid gland, in which it forms a plexus called the *pes anserinus*. From this, branches pass to all the muscles of the face except those of mastication.

Auditory.—The eighth or auditory nerve is in two bundles, *cochlear* and *vestibular*. The former comes from the cochlear nuclei which lie deep to the acoustic tubercle in the floor of the fourth ventricle (fig. 3); the latter rises from the dorsal nucleus, nucleus of Deiters and the nucleus of the descending root, which are more deeply placed. The *nucleus of Deiters* is connected with the cerebellum, and is concerned in maintaining the equilibrium (*q.v.*) of the body; the cochlear nuclei are connected with the inferior quadrigeminal body by the lateral fillet as well as with the internal geniculate body, and thus with the higher auditory centre in the temporo-sphenoidal lobe by the auditory radiations. The vestibular root passes in front of the restiform body (fig. 3), and the cochlear behind that body. Together they enter the internal auditory meatus, pierce the lamina cribrosa, the vestibular nerve supplying the utricle and superior and external semicircular canals, the cochlear nerve, the posterior canal, the saccule

and the cochlea (*see* EAR).

Glossopharyngeal.—The ninth or glossopharyngeal nerve is chiefly, if not entirely, sensory, and its deep termination in the brain is the solitary bundle (fig. 3). It appears on the surface between the olive and restiform body (fig. 1), leaves the skull through the posterior lacerated foramen, runs downward and forward, between the internal and external carotid arteries, and



FROM D. J. CUNNINGHAM, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

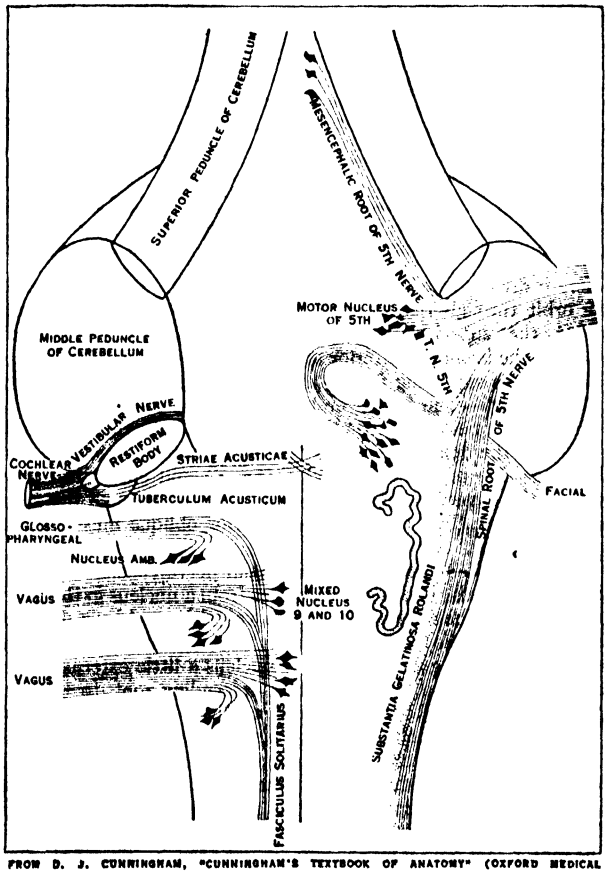
FIG. 2.—DIAGRAM OF THE CENTRAL CONNECTIONS OF THE OPTIC NERVE AND OPTIC TRACT

eventually reaches the back of the tongue (*see* TONGUE).

Vagus.—The tenth nerve or vagus has sensory and motor fibres; the former go to the solitary bundle mentioned in the description of the last nerve (fig. 3), while the latter come from the dorsal nucleus and nucleus ambiguus, both of which are found deep to the lower half of the fourth ventricle. The nerve appears on the surface between the olive and restiform body and just below the ninth (fig. 1). It leaves the skull through the posterior lacerated foramen, gives off *auricular* and *pharyngeal branches* and the *superior laryngeal branch* which is the sensory nerve of the larynx (fig. 4). The accessory part of the eleventh nerve joins the tenth, and from this communication motor twigs to the pharynx, larynx, alimentary and respiratory tracts are derived, as well as inhibitory fibres of the heart. In the neck the vagus accompanies the carotid artery and internal jugular vein, and gives off cardiac branches. It enters the thorax between the subclavian artery and vein. On the right side its recurrent laryngeal branch loops under the subclavian artery (fig. 4), and runs up to supply all the muscles of the larynx except one (*see* RESPIRATORY SYSTEM). In the thorax the left vagus passes in front of the arch of the aorta, under which the left recurrent laryngeal loops, and on both sides a thoracic cardiac branch is given to the deep cardiac plexus. Both vagi pass behind the root of their own lung, and break up to form the *pulmonary plexus;* they then reach the oesophagus, where they again break up into an *oesophageal plexus*. As the diaphragm is approached the two nerves become distinct again, but the left one now lies in front and the right behind the food tube, so that, when the stomach is reached, the left vagus supplies the front of the organ and communicates with the *hepatic plexus*, while the right goes to the back and communicates with the *coeliac, splenic* and *renal plexuses*.

Spinal Accessory.—The eleventh or spinal accessory nerve is entirely motor, and consists of a *spinal* and an *accessory* part. The former rises from the anterior horn of the grey matter of the spinal cord as low as the fifth cervical nerve. Its fibres come to the surface mid-way between the anterior and posterior nerve-roots, and run up through the foramen magnum to join the accessory part, the deep origin of which is the lower part of the nucleus ambiguus. The accessory part joins the vagus, while the spinal part pierces the sterno-mastoid muscle and runs downward and backward across the posterior triangle of the neck to enter the trapezius; both these muscles are in part supplied by the nerve.

Hypoglossal.—The twelfth or hypoglossal nerve is motor, and rises from a nucleus in the floor of the fourth ventricle. It emerges from the brain between the anterior pyramid and the olive (fig. 1), and leaves the skull in two bundles through the



FROM D. J. CUNNINGHAM, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

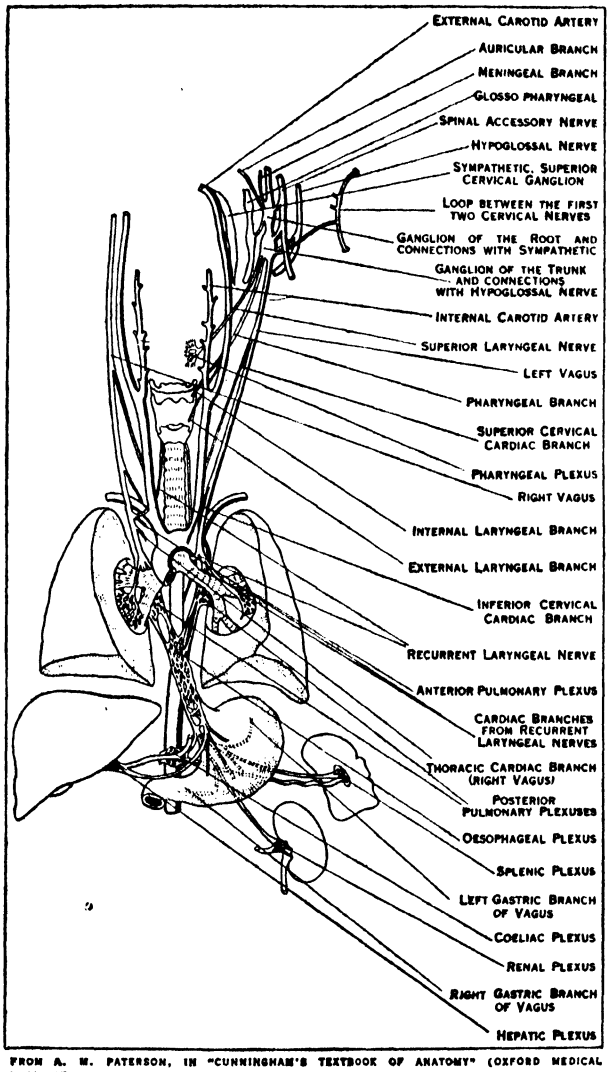
FIG. 3.—DEEP ORIGINS OF CRANIAL NERVES FROM THE FLOOR OF THE FOURTH VENTRICLE

anterior condylar foramen. Soon after it is closely bound to the vagus, and receives contributions from the loops between the first and second and the second and third cervical nerves. The nerve then passes downward and runs forward on the surface of the hyo-glossus to the muscles of the tongue. It gives off branches to many of the depressor muscles of the hyoid bone and larynx. All the true muscles of the tongue are supplied by the medullary part of the nerve.

For the embryology and comparative anatomy of the cranial nerves, *see* NERVOUS SYSTEM.

SPINAL

The spinal nerves arise from each side of the spinal cord and are distributed to the trunk and limbs, though some of the upper ones supply the lower parts of the head and face. There are generally thirty-one pairs, eight cervical (abbreviated C.), twelve thoracic (Th.)—formerly called dorsal,—five lumbar (L.), five sacral (S.) and one coccygeal (Coc.). As the thoracic nerves are



FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

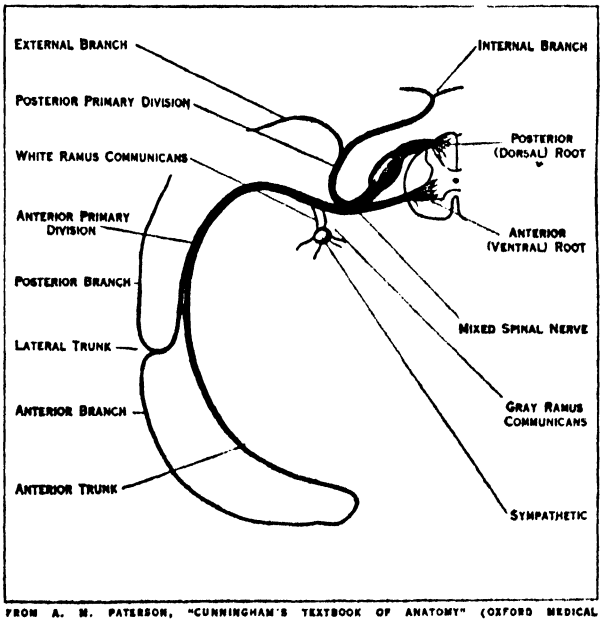
FIG. 4.—THE DISTRIBUTION OF THE 10TH (PNEUMOGASTRIC OR VAGUS) NERVE

the simplest and most generalized in their arrangement, a typical one of these, say the fourth or fifth, will be first described.

The nerve is attached to the spinal cord by two roots, of which the ventral is purely efferent or motor and the dorsal purely afferent or sensory. On the dorsal root is a fusiform ganglion which lies in the foramen between the vertebrae through which the nerve passes. The two roots then join together to form a mixed nerve (fig. 5), but very soon divide once more into anterior (ventral) and posterior (dorsal) primary divisions. These, however, each contain sensory and motor fibres. Just before it divides in this way the mixed nerve gives and receives its rami communicantes with the sympathetic (*see* NERVOUS SYSTEM).

The anterior primary division runs round the trunk, between the ribs, forming an intercostal nerve and giving off a lateral cutaneous branch, when the side of the body is reached, which divides into anterior and posterior secondary branches. The rest of the division runs forward, supplying the intercostal muscles, as far as the edge of the sternum, when it ends in an anterior cutaneous branch to the front of the chest. The dorsal primary division divides into an external (lateral) and internal (mesial) branch through which the skin and muscles of the back are supplied.

It will be seen from the foregoing that the thoracic nerves are almost completely segmental in their distribution, in other words, each supplies a slice of the body, but in the other regions this segmental character is masked by the development of the branchial skeleton and the limbs. In the cervical region the first cervical or *suboccipital nerve* comes out between the occiput and atlas and does not always have a posterior root. When it has not, it obviously can supply no skin. Its anterior primary division joins those of the second, third and fourth cervical nerves to form the *cervical plexus*, from which the skin of the side of the neck and lower part of the head and face are supplied by means of the *small occipital, great auricular, superficial cervical, supra-sternal, supraclavicular* and *supraacromial* nerves (fig. 7), as well as those muscles of the neck which are not supplied by the cranial nerves. The *phrenic nerve*, which comes chiefly from the fourth cervical, runs down, through the thorax, to supply the greater part of the diaphragm. The explanation of this long course (*see* DIAPHRAGM) is that the diaphragm is formed in the neck region of the embryo. The posterior primary division of the second cervical nerve is large, and its inner (mesial) branch (*great occipital*) supplies most of the back of the scalp (fig. 7). The fifth, sixth, seventh and eighth anterior primary divisions of the cervical nerves as well as a large part of that of the first thoracic are prolonged into the arm, and in the lower part of the neck and armpit communicate with one another to form the *brachial plexus*. It will be seen from fig. 8 that each component nerve except the first thoracic divides into an anterior (ventral) and a posterior (dorsal) division which are best spoken of as secondary divisions in order to prevent confusion with the anterior and posterior



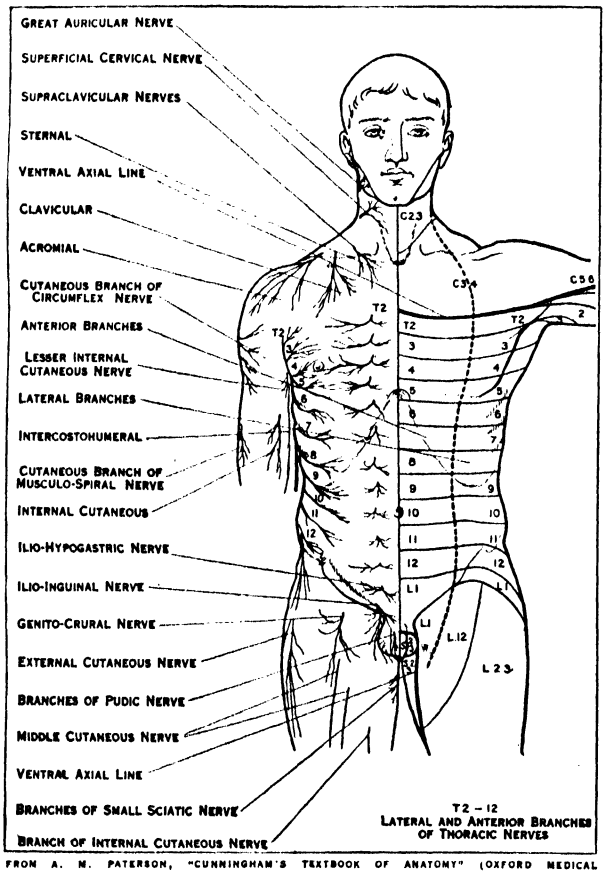
FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 5.—SCHEME OF THE DISTRIBUTION OF A TYPICAL SPINAL NERVE

primary divisions which all the spinal nerves undergo. In the diagram the anterior secondary divisions are white, while the posterior are shaded. Later on in the plexus three cords are formed of which the posterior is altogether made up of the posterior secondary divisions, while the anterior secondary divisions of the fifth, sixth and seventh cervical nerves form the external cord, and those of the eighth cervical and first thoracic the inner. As a general rule the nerves which rise from the ventral secondary divisions of the limb plexuses run only to that surface of the limb which was ventral in the embryo, while the

dorsal secondary divisions are confined to the original dorsal area, but, in order to apply this to the human adult, it must be realized that the limbs are at one time flattened buds coming off at right angles from the side of the body and having dorsal and ventral surfaces, one (preaxial) border toward the head of the embryo, and one (postaxial) toward the tail.

Brachial Plexus.—With regard to the muscular supply of a limb the general rule is that each muscle is supplied by fibres



FROM A. N. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 6.—DISTRIBUTION OF THE CUTANEOUS NERVES ON THE FRONT OF THE TRUNK, SHOWING, ON THE LEFT SIDE OF THE FIGURE, THE DISTRIBUTION OF THE SEVERAL NERVES

derived from more than one spinal nerve; this is made possible by the redistribution of fibres in the plexuses. Moreover, the muscular supply does not necessarily correspond to that of the overlying skin, because (*see* MUSCULAR SYSTEM) some of the primitive muscles have been suppressed, others have fused together, while others have shifted their position to a considerable distance. Bearing the foregoing facts in mind, the main distribution of the nerves of the brachial plexus may be surveyed. The outer cord of the plexus gives off the *external anterior thoracic nerve* (C. 5, 6, 7) to the pectoralis major, the *musculo-cutaneous* nerve (C. 5, 6) to the muscles on the front of the arm, and to the skin of the outer side of the forearm and the outer head of the *median nerve* (C. 5, 6, 7), which joins the inner head (C. 8, Th. 1) and supplies most of the flexor muscles of the front of the forearm as well as those of the ball of the thumb.

From the inner cord come the inner head of the median just mentioned, the *ulnar nerve* (C. 8, Th. 1), which passes down behind the internal condyle of the humerus, where it is popularly known as the "funny bone" and supplies the flexor carpi ulnaris, half the flexor profundus digitorum, and most of the muscles of the hand as well as the inner digit and a half on the palmar and dorsal aspects. Other branches of the inner cord are the *internal cutaneous* (C. 8, Th. 1) supplying the inner side of the forearm, the *lesser internal cutaneous* (Th. 1) which often joins the *intercosto-humeral* or lateral cutaneous branch of the second intercostal nerve to supply the skin on the inner side of the upper arm, and the *internal anterior thoracic nerve* (C. 8, Th. 1) to the pectoralis minor and major.

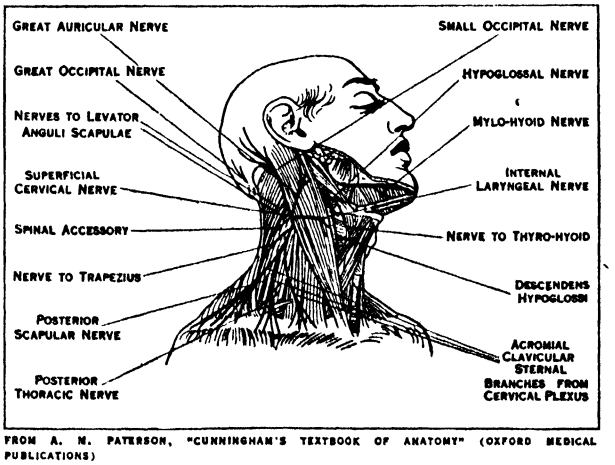
From the posterior cord are derived the three *subscapular nerves* (C. 5, 6, 7, 8) which supply the subscapularis, teres major and latissimus dorsi muscles, the *circumflex nerve* (C. 5, 6) supplying the deltoid and teres minor muscles, and the skin over the lower part of the deltoid, and the *musculo-spiral nerve* (C. 5, 6, 7, 8) which is the largest branch of the brachial plexus and gives off cutaneous twigs to the outer side and back of the arm and to the back of the forearm, as well as muscular twigs to the triceps and adjacent muscles. At the elbow this nerve divides into the *radial* and *posterior* interosseous. The radial is entirely sensory and supplies the skin of the outer side of the back of the hand, including three digits and a half, while the posterior interosseous is wholly muscular, supplying the muscles on the back of the forearm. It will be seen that the posterior cord is derived altogether from posterior secondary divisions of the plexus, but there are three other nerves derived from these which should be mentioned.

The *posterior thoracic* or respiratory nerve of Bell comes off the back of the fifth, sixth and seventh cervical nerves before the anterior and posterior secondary divisions separate, and runs down to supply the serratus magnus muscle.

The *posterior scapular* or nerve to the rhomboid muscles runs to those muscles from the fifth cervical.

The *suprascapular nerve* (C. 5, 6) passes through the suprascapular notch to supply the supraspinatus and infraspinatus muscles.

Lumbo-Sacral Plexus.—The spinal nerves which are distributed to the lower limbs first intercommunicate in the lumbar and sacral plexuses, which, with the perineal nerves, are sometimes spoken of together as the lumbo-sacral plexus. The *lumbar plexus* (fig. 9) is formed as a rule of the first four lumbar nerves, though the greater part of the first lumbar is segmental in its distribution and resembles one of the thoracic nerves. It early divides into an *ilio-hypogastric* and *ilio-inguinal* branch, which run round the abdominal wall in the substance of the muscles, and of which the former gives off an iliac branch, which is in

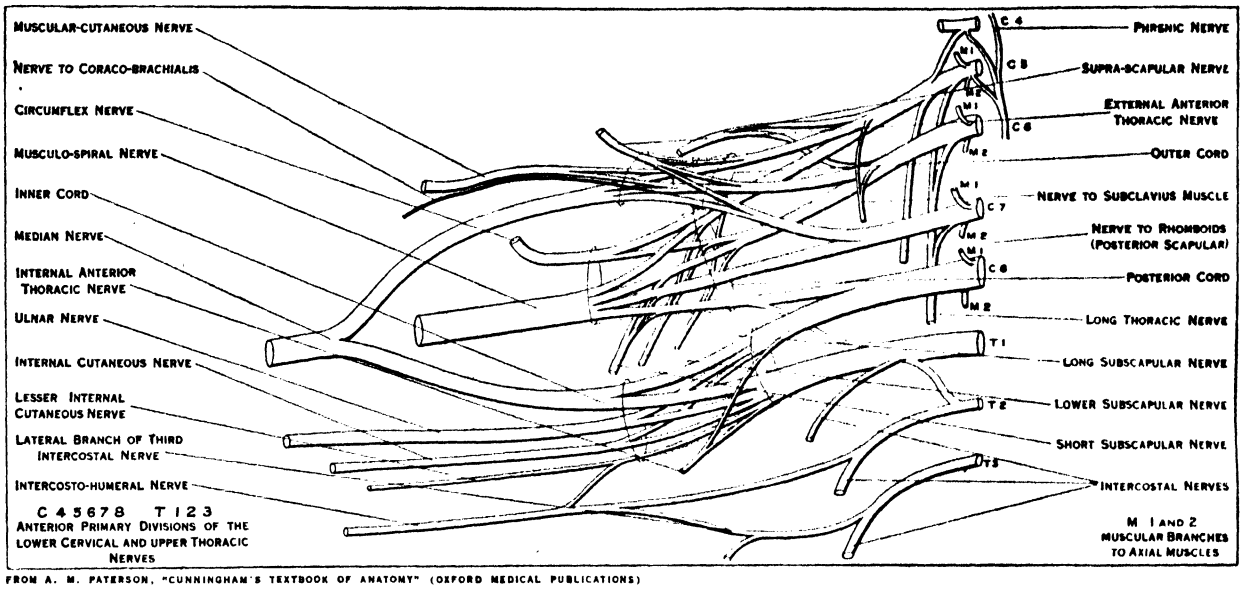


FROM A. N. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 7.—THE TRIANGLES OF THE NECK, SHOWING THE NERVES

series with the lateral cutaneous branches of the intercostal nerves and passes over the crest of the ilium to the gluteal region, while the hypogastric branch runs round to the skin of the pubic region.

The other anterior secondary division of the lumbar plexus is the obturator (fig. 9). The *obturator nerve* (L. 2, 3, 4) supplies the adductor group of muscles on the inner side of the thigh as well as the hip and knee joints; it occasionally has a cutaneous branch on the inner side of the thigh. The posterior secondary branches of the plexus are the genito-crural, the external cutaneous and the anterior crural. The genito-crural nerve (L. 1, 2)



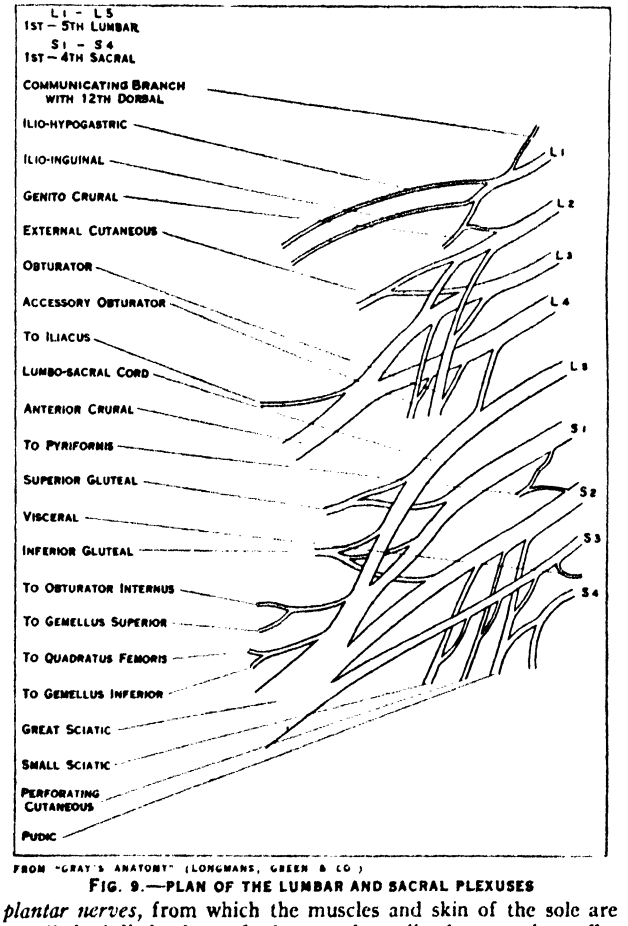
FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 8.—THE NERVES OF THE BRACHIAL PLEXUS

is partly anterior (ventral) and partly posterior (dorsal). It sends one anterior branch through the inguinal canal to supply the cremaster muscle, and another (posterior) to the skin of the thigh just below the groin.

The *external cutaneous nerve* (L.2, 3) supplies the skin of the outer side of the thigh, while the *anterior crural* (L.2, 3, 4) innervates the muscles on the front of the thigh, the skin on the front and inner side of the thigh, through its *middle* and *internal cutaneous* branches, and the skin of the inner side of the leg and foot through the *internal saphenous* branch. At first sight it is difficult to understand how the anterior crural nerve, which supplies the skin of the front of the thigh, is a posterior secondary division of the lumbar plexus, but the explanation is that the front of the human thigh was originally the dorsal surface of the limb bud, and the distribution of the nerve is quite easily understood if the position of the hind limb of a lizard or crocodile is glanced at. The fourth lumbar nerve is sometimes called the *nervus furcalis*, because, dividing, it partly goes to the lumbar, and partly to the sacral plexus (fig. 9), though, when the plexus is prefixed, the third lumbar may be the nervus furcalis, or, when it is postfixed, the fifth lumbar.

All the constituent nerves of the plexus run into one huge nerve, the *great sciatic*, which runs down the back of the thigh and, before reaching the knee, divides into *external* and *internal popliteal nerves*. These two nerves are sometimes separate from their first formation in the plexus, and may always be separated easily by the handle of a scalpel, since they are only bound together by loose connective tissue to form the great sciatic nerve. When they are separated in this way it is seen that the external popliteal is made up entirely of posterior (dorsal) secondary divisions (fig. 9), and is derived from the fourth and fifth lumbar and first and second sacral nerves, while the internal popliteal is formed by the anterior (ventral) secondary divisions of the fourth and fifth lumbar and first, second and third sacral nerves. The *external popliteal nerve* supplies the short head of the biceps femoris (*see* MUSCULAR SYSTEM), and, just below the knee, divides into anterior tibial and musculo-cutaneous branches, which both supply the dorsal surface of the leg and foot. The *anterior tibial nerve* is chiefly muscular, innervating the muscles in front of the tibia and fibula as well as the extensor brevis digitorum pedis on the dorsum of the foot, though it gives one small cutaneous branch to the cleft between the first and second toes. The *musculo-cutaneous nerve* supplies the peroneus longus and brevis muscles, and the rest of the skin of the dorsum of the foot and lower part of the leg, while the skin of the upper part of the dorsum of the leg, below the knee, is supplied by the external popliteal before its division. The *internal popliteal nerve*, after supplying the hamstrings, is continued into the calf of the leg as the *posterior tibial* and innervates all the muscles on this, the ventral, surface. Behind the inner ankle it divides into the *external* and *internal*



FROM "GRAY'S ANATOMY" (LONGMANS, GREEN & CO.)

FIG. 9.—PLAN OF THE LUMBAR AND SACRAL PLEXUSES

plantar nerves, from which the muscles and skin of the sole are supplied. A little above the knee each popliteal nerve gives off a contribution to help form the *external* or *short saphenous nerve*. These join about the middle of the back of the calf, and the, now

formed, *short saphenous nerve* runs down behind the outer ankle to supply the outer side of the foot. Sometimes it encroaches on the dorsum of the foot, replacing part of the musculo-cutaneous. To return to the sacral plexus: branches are given off from the anterior secondary divisions to the short external rotator muscles of the hip (pyriformis, quadratus femoris, etc.), while from the posterior secondary divisions come the superior gluteal (L. 5, S. 1) and the inferior gluteal (L. 5, S. 1, 2) to the muscles of the buttocks.

In modern descriptions the lower branches of the lumbo-sacral plexus are grouped into a *pudendal plexus*, and the plan, though open to criticism on morphological grounds, has such descriptive advantages that it is followed here. Contributions from the first, second, third and fourth sacral, and the coccygeal nerve, form it, and these contributions are almost all anterior (ventral) secondary divisions. The branches of this plexus are the small sciatic, pudic, visceral, perforating cutaneous, muscular and sacro-coccygeal nerves. The *small sciatic* (S.1, 2, 3) is partly dorsal and partly ventral in its origin and distribution; it supplies the skin of the perineum, buttock and the back of the thigh. The *pudic nerve* (S.2, 3, 4) helps to supply the skin and muscles of the perineum and genital organs. The *visceral branches* form the pelvic stream of white rami communicantes (*see* NERVOUS SYSTEM); they run from the second and third or third and fourth sacral nerves to the pelvic plexuses of the sympathetic system. The *perforating cutaneous nerve* (S.2, 3) pierces the great sacro-sciatic ligament and supplies the skin over the lower internal part of the buttock. The *muscular branches* (S.3, 4) supply the external sphincter, levator ani and coccygeus.

The *sacro-coccygeal nerve* (S.4, 5; Coc.1) runs down on each side of the coccyx to supply the adjacent skin, and represents the ventro-lateral nerve of the tail of lower mammals.

(F. G. P.; X.)

The function of the nerves is to transmit messages from the sense organs to the central nervous system and from the central nervous system to the muscles and gland cells. The incoming (or "afferent") messages are decoded, so to speak, in the spinal cord and brain and the outgoing ("efferent") messages are elaborated there, the nerves acting merely as the conducting mechanism between the periphery and the central controlling station. A nerve appears to the naked eye as a long cord of whitish, translucent

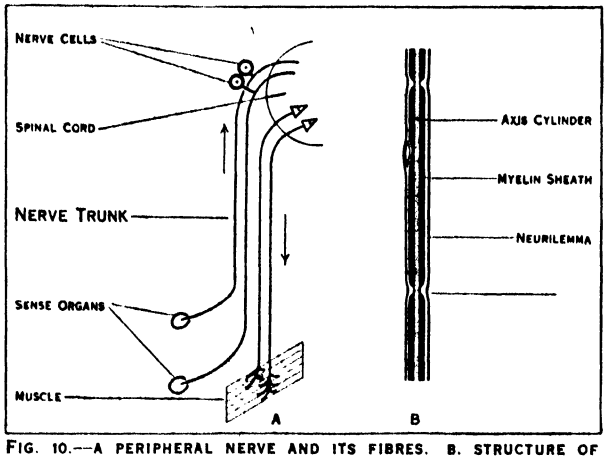


FIG. 10.—A PERIPHERAL NERVE AND ITS FIBRES. B. STRUCTURE OF NERVE FIBRE

material; the large nerve trunks like the sciatic (in man) may be half an inch in breadth, but the ultimate branches are so thin as to be scarcely visible. Microscopically the nerve is made up of a number of fibres, about $\frac{1}{100}$ mm. in diameter, each of which acts as an independent conducting path: so that a nerve of medium size may contain several thousand fibres, some terminating in sense organs and some in muscles or glands.

The nerve fibre itself is made of a central core or "axis cylinder" of protoplasm arising from the body of a nerve cell which is generally stationed in or near the spinal cord: the axis cylinder runs from one end of the fibre to the other enclosed in a sheath of fatty material (myelin) interrupted by occasional constrictions or "nodes" and this in turn is enclosed in a membranous sheath called the neurilemma. Either or both sheaths may be absent in certain fibres. A diagram of the general structure of the nerve and its fibres is shown in fig. 10.

The impulse set up by an electric shock in an isolated nerve might have little connection with the normal working of the

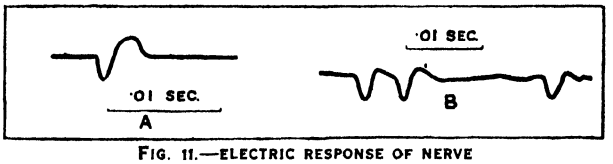


FIG. 11.—ELECTRIC RESPONSE OF NERVE

A. Record of "action current" in a frog's sciatic nerve, stimulated electrically. B. Action of currents in sensory nerve fibres, by light touch

nerve in the body, but there is now no doubt that the messages normally conveyed by the nerve fibres do consist of these impulses and of nothing else. To show this it is necessary to magnify the electric changes in the nerve trunk several thousand times by valve amplification; it is then possible to record the discharge of impulses travelling towards the central nervous system from the sense organs or away from it to the muscles. A portion of such a record is given in fig. 11. A sense organ has been stimulated by touching the skin and a series of impulses passes up the sensory fibres. Each impulse has the usual brief action current and all are of the same size whatever the strength of the stimulus. This does not prevent the nerve fibre from signalling the intensity of stimulation, for it is found that the frequency of the discharge (the number of impulses per second) depends on the stimulus, and the frequency may vary over a wide range (from 5 to 150 a second in the frog).

The impulses from the different sense organs are not all exactly alike, for their rate of travel depends on the size of the fibre and the fibres from different organs are not all of the same diameter; but all impulses whether motor or sensory seem to be of the same type and up to the present we have no evidence of any other kind of nervous conduction. (E. D. A.)

NERVI, a coast town of Liguria, Italy, province of Genoa, 7½ m. S.E. of Genoa by rail (also electric tramway), 82 ft. above sea-level. Pop. (1921), 7,994. It is much frequented as a winter resort. It is surrounded with groves of olives, oranges and lemons, and its villas have beautiful gardens. At Quarto, 2½ m. N.W., 1,000 Garibaldians embarked for Marsala in 1860.

NERVOUS SYSTEM. The nervous system forms an extremely complicated set of links between different parts of the body, and is divided into (A) the central nervous system, composed of (1) the brain, and (2) spinal cord; (B) the peripheral nervous system, consisting of (1) the cranial nerves, (2) the spinal nerves, (3) the various sense organs, such as the eye, ear, olfactory organ, taste organ and tactile organs, and (4) the motor end plates; (C) the sympathetic system. The anatomy and physiology of many of these parts are treated in separate articles (*see* BRAIN; SPINAL CORD; NERVE; EYE; EAR; OLFACTORY SYSTEM; TASTE; TOUCH; MUSCLE AND NERVE; and also SYMPATHETIC SYSTEM). The object here is to deal with anatomical points which are common to the whole system, or for which a place does not conveniently occur elsewhere.

HISTOLOGY OF THE NERVOUS SYSTEM

Three kinds of tissue are found in the nervous system, *nerve fibres*, *nerve cells* and a supporting tissue called *neuroglia*.

Nerve Fibres may be medullated or non-medullated, but, whichever they are, they consist of the long process or *axon* of a nerve cell; in a non-medullated nerve this process is either naked or enclosed in a delicate membrane called the *primitive sheath* or *neurilemma*, but in a medullated nerve the process or *axis cylinder* is encased by a white fatty substance called myelin, and so the term "myelinated" is often used instead of "medullated" for these nerves (fig. 1). Outside this white sheath the neurilemma is present in most nerves, but is lost when they are massed to form

the white matter of the central nervous system and in the optic nerve. At regular intervals the myelin is interrupted by some substance which stains deeply with silver nitrate, and these breaks are known as *nodes of Ranvier*. They do not, however, affect the axis cylinder. In a large nerve, *e.g.*, the median, the nerve fibres are collected into small bundles (*funiculi*), enclosed in a connective tissue sheath (*perineurium*), and separated from it by a lymph space. From this sheath delicate processes penetrate among the fibres (*endoneurium*). The funiculi are collected into bundles called *fasciculi*, and the whole nerve consists of a variable number of fasciculi surrounded by a dense fibrous sheath, the *epineurium*.

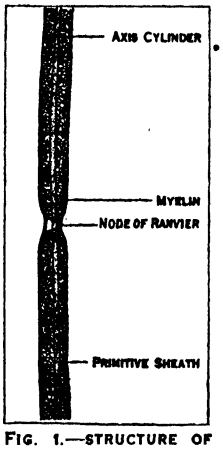
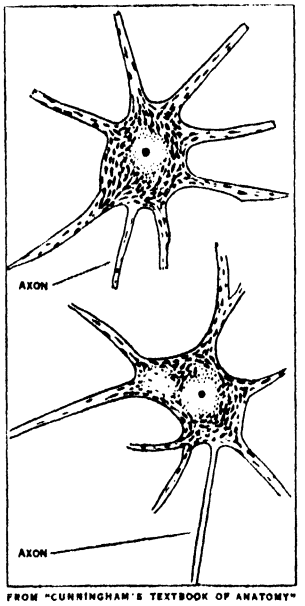


FIG. 1.—STRUCTURE OF A SINGLE NERVE FILAMENT

Nerve Cells are unipolar, bipolar or multipolar. *Unipolar cells* are found in the ganglia on the posterior roots of the spinal nerves, and only give off an axon or axis cylinder process; this, however, soon divides in a T-shaped manner, and all these cells were originally bipolar, though the cell has grown away from its two axons (or, as they are often regarded, axon and dendrite), leaving a stalk joining it to them at right angles. *Bipolar cells* are found as an embryonic stage of unipolar, though in fish they persist in the spinal ganglia throughout life. They are also sometimes found in the sympathetic ganglia. *Multipolar cells* are found in the brain and cord, and are best studied in the anterior horns of the grey matter of the latter, where they are nearly visible to the naked eye (fig. 2).

Neuroglia.—This is the delicate connective tissue which supports and binds together the nervous elements of the central nervous system. One part of it, which lines the central canal of the cord and ventricles of the brain, is formed of columnar cells (*ependyma*), while the rests consists of small cells with numerous processes which sometimes branch and sometimes do not.



FROM "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

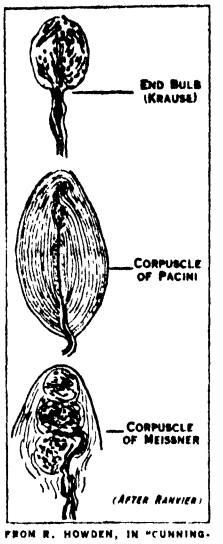
FIG. 2.—NERVE CELLS FROM THE ANTERIOR HORN OF GREY MATTER OF THE HUMAN SPINAL CORD

Nerve Endings.—Sensory nerves end by breaking up into fibrillae or by various tactile organs. In the former case the minute fibrils composing the axons or nerve fibres separate and end among epithelial cells of the mucous membrane or skin. In the latter case the nerve fibres lose their myelin sheath and end in one of the seven following organs:—

1. *End bulbs of Krause* (*see* fig. 3), oval bulbs composed of elongated cells among which the nerve fibrils end in knobs or coils; each is surrounded by a sheath of neurilemma, and the organs are found in the lips, tongue, conjunctiva, epineurium of nerves, synovial membranes of joints, and in the glans penis et clitoridis, where they have a mulberry-like appearance.

2. *Pacinian corpuscles* (fig. 3) are large enough to be seen by the naked eye, and are oval bodies made up of a series of concentric capsules of connective tissue rather resembling the structure of an onion; in the centre is a structureless core, at the distal extremity of which the nerve fibre ends in one or more knobs. These bodies are found in the palm and sole, in the mesentery, the genital organs and in joints.

3. *Tactile corpuscles of Meissner and Wagner* (fig. 3) are oval bodies found in certain of the skin papillae and mucous membrane, especially of very sensitive parts like the hand and foot, lips, tongue and nipple. They are oval and made of a connective tissue capsule from which septa enter the interior. The nerve fibre generally takes a spiral course through them, loses its myelin sheath, and ends by breaking up into its fibrils, which eventually become bulbous.



FROM R. HOWDEN, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY"

FIG. 3.—TACTILE CORPUSCLES

4. *Tactile corpuscles of Grandry* are found in the skin of those parts devoid of hair, and consist of a capsule containing two or more largish cells, between which the nerve fibre ends in the so-called tactile discs.

5. *Ruffini's endings* are flattened oval bodies with a thick connective tissue capsule, in which the nerve fibre divides into many varicose branches, form a rich plexus, and end in knobs. They are found between the true skin and subcutaneous tissues of the fingers.

6. *Organs of Golgi* occur in tendons. Nerve fibres penetrate the tendon bundles and divide in a tree-like manner to end in little disks and varicosities.

7. *Neuro-muscular spindles* are small fusiform bundles of embryonic muscle fibres, among which the nerve fibres end by encircling them and forming flattened disks. These are sensory endings, and must not be confused with the motor end plates.

Motor nerves end in striped muscle by *motor end plates*. These are formed by a nerve fibre approaching a muscle fibre and suddenly losing its myelin sheath while its neurilemma becomes continuous with the sarcolemma of the muscle fire. The axis cylinder divides, and its ramifications are surrounded by a disk of granular matter containing many clear nuclei.

THE SYMPATHETIC SYSTEM

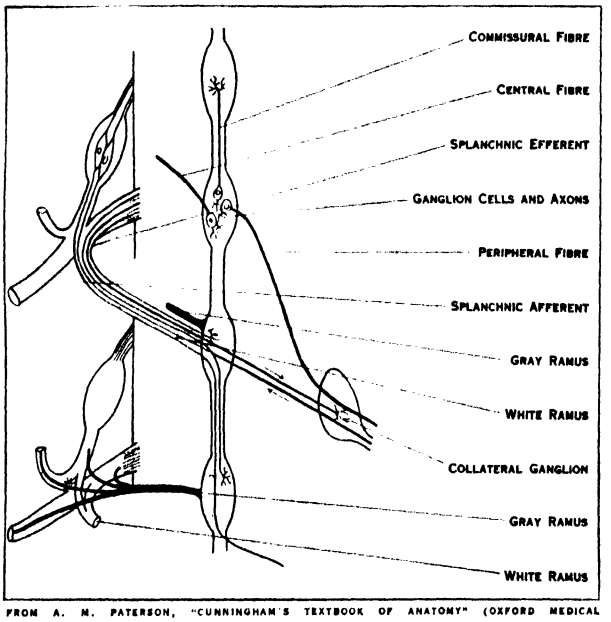
This system is made up of two gangliated cords running down one on each side of the vertebral column and ending below in the median coccygeal ganglion. In the neck the cords lie in front of the anterior tubercles of the transverse processes of the cervical vertebrae, in the thorax, in front of the heads of the ribs, while in the abdomen they lie in front of the sides of the bodies of the vertebrae. In addition to these cords there are numerous ganglia and plexuses through which the sympathetic nerves pass on their way to or from the viscera and blood-vessels.

A typical ganglion of the sympathetic chain is connected with its corresponding spinal nerve by two branches called *rami communicantes*, one of which is grey and the other white (fig. 4). The white consists of medullated fibres belonging to the central nervous system, and these are splanchnic afferent or centripetal, and efferent or centrifugal. The efferent fibres lie in the anterior roots of the spinal nerves, and, like all the fibres there, are either motor or secretory. They are the motor paths for the unstriped muscle of the vessels and viscera, and the secretory paths for the cells of the viscera. In the course of each fibre from the nerve cell in the spinal cord, of which it is an axon, to the vessel or viscus it supplies, there is always a break where it arborizes round a ganglion cell, and this may be in its own ganglion of the sympathetic chain, in a neighbouring ganglion above or below, or in one of the so-called collateral ganglia interposed between the sympathetic chain and the viscera.

The grey rami communicantes are found in connection with all the spinal nerves, though they are irregular in the paths by which they reach the sympathetic ganglia from the cells of which they spring; their fibres are mainly non-medullated, and pass into both roots of the spinal nerves and also into the anterior and posterior primary divisions of those nerves. In this way they reach the body wall and limbs, and are somatic vaso-motor, secretory and pilomotor fibres, supplying the vessels, glands and hair muscles of the

skin and its glands.

In the gangliated chain there is a ganglion corresponding to nearly each spinal nerve, except in the neck, where only three are found; of these the superior cervical ganglion is more than an inch long, and is connected with the first four spinal nerves as well as with the ninth, tenth and twelfth cranial nerves (fig. 5). Branches of distribution pass from it to the pharyngeal plexus,



FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 4.—SCHEME OF THE CONSTITUTION AND CONNECTIONS OF THE GANGLIATED CORD OF THE SYMPATHETIC

the heart and the two carotid arteries. Of these the branch accompanying the internal carotid artery passes to the carotid and cavernous plexuses, and through these communicates with the sphenomaxillary, otic and ciliary ganglia, while the branch to the external carotid communicates with the submaxillary ganglion. The middle cervical ganglion (fig. 5), when it is present, gives rami communicantes to the fifth and sixth cervical nerves, as well as branches of distribution to the thyroid body and heart.

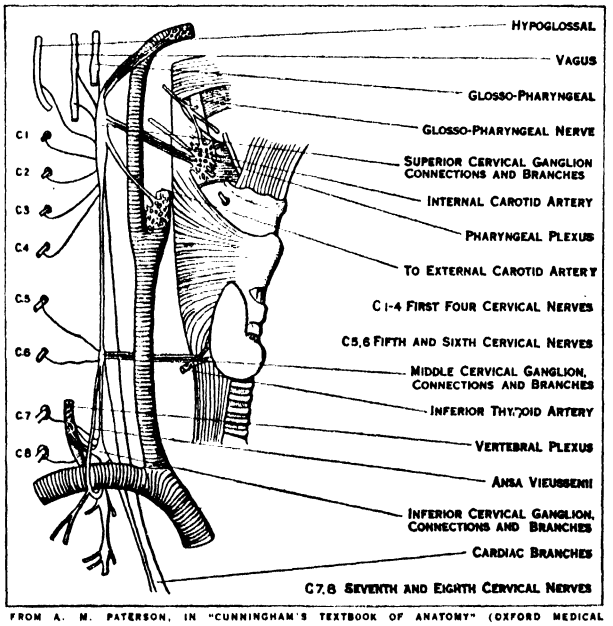
The inferior cervical ganglion (fig. 5) lies behind the subclavian artery, and, besides the main connective cord, has a loop (ansa Vieussenii) joining it to the middle cervical ganglion in front of that vessel. It communicates with the seventh and eighth spinal nerves, and gives branches of distribution to the heart and to the subclavian artery and its branches, especially the vertebral. The thoracic part of the sympathetic cord has usually eleven ganglia, which receive both white and grey rami communicantes from the spinal nerves (fig. 6); of the former the upper ones run up in the chain and come off from the cervical ganglia as already described, while the lower ones form the three abdominal splanchnics which pass through the diaphragm (*q.v.*) and join the abdominal plexuses.

The great splanchnic (fig. 6) comes from the sixth to the ninth ganglia, and ends in the semi-lunar ganglion of the solar plexus. The small splanchnic comes from the ninth and tenth, or tenth and eleventh ganglia, and ends in the aortico-renal ganglion of the solar plexus, while the smallest splanchnic comes from the last thoracic ganglion, whether it be the tenth or eleventh, and ends in the renal plexus.

In the lumbar region the gangliated cord is very irregular; there may be four or more ganglia, and these are often fused. Gray rami communicantes are given to all the lumbar spinal nerves, and white ones are received from the first two. Most of the branches of distribution pass to the aortic plexus. The sacral gangliated cord runs down just internal to the anterior sacral foramina; it usually has four small ganglia, and the two cords end by joining the coccygeal ganglion or ganglion impar, though the two-fourth sacral ganglia are united by transverse interfunicular commissures. The white rami communicantes, already mentioned as the pelvic stream, from the second to the fourth sacral spinal nerves, do not enter the ganglia but pass directly to the pelvic plexuses (fig. 6).

Sympathetic Plexuses.—In the thorax are the superficial and deep cardiac plexuses and the coronary plexuses; the former receives the left superior cervical cardiac of the vagus, and lies in the concavity of the arch of the aorta. The deep cardiac plexus is larger, and lies in front of the bifurcation of the trachea; it receives all the other cardiac nerves, and communicates with the anterior pulmonary plexuses of the vagus (*see* NERVE: *Cranial*).

In the abdomen the solar plexus is by far the most important. It lies behind the stomach and surrounds the coeliac axis; in it are situated the semilunar, aortico-renal and superior mesenteric ganglia, and from it are prolonged subsidiary plexuses along the main arteries, so that diaphragmatic, suprarenal, renal, spermatic, coeliac, superior mesenteric, aortic and inferior mesenteric plexuses, are recognized. The hypogastric plexus is the continuation downward of the aortic, and lies just below the bifurcation of the aorta (fig. 6); it divides into two branches, which accompany the internal iliac arteries and are joined by the pelvic stream of white rami communicantes from the sacral spinal nerves and some twigs from the ganglia of the sacral sympathetic to form the pelvic plexuses. These are prolonged to the viscera along the branches of the internal iliac artery, so that haemorrhoidal, vesical, prostatic, vaginal and uterine plexuses are found. By the side of the neck of the uterus in the last-named plexus several



FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

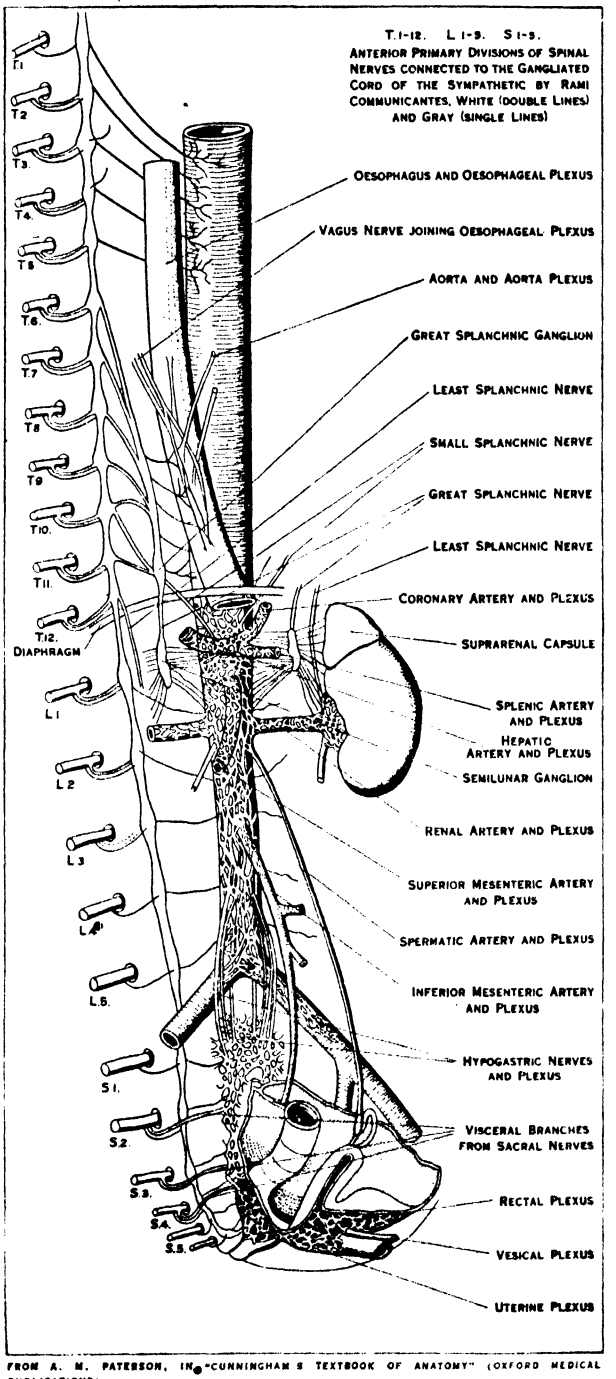
FIG. 5.—THE DISTRIBUTION OF THE SYMPATHETIC GANGLIATED CORD IN THE NECK

small ganglia are seen. (For the literature of the sympathetic system, *see* Quain, *Anatomy*, London.)

EMBRYOLOGY OF NERVOUS SYSTEM

The development of the brain, spinal cord and organs of special sense (eye, ear, tongue), will be found in separate articles. Here that of the cranial and spinal nerves and the sympathetic system is dealt with. The thoracic spinal nerves are the most typical, and one of them is the best to begin with. In fig. 7 the ganglion on the dorsal root is seen growing out from the neural crest, and the cells or neuroblasts of which it is composed become fusiform and grow in two directions as the ganglion recedes from the cord. Those which run toward the spinal cord are the axons, while those growing into the mesoderm are probably enlarged dendrites. The ventral roots rise as the axons of the large cells in the ventral

horn of the grey matter, and meet the fibres of the dorsal root on the distal side of the ganglion. As the two roots join each divides into an anterior (ventral) and a posterior (dorsal) primary division, the latter growing into the dorsal segment of its muscle plate and the skin of the back. The anterior primary division grows till it reaches the cardinal vein and dorsal limit of the coelom, and there forks into a somatic branch to the body

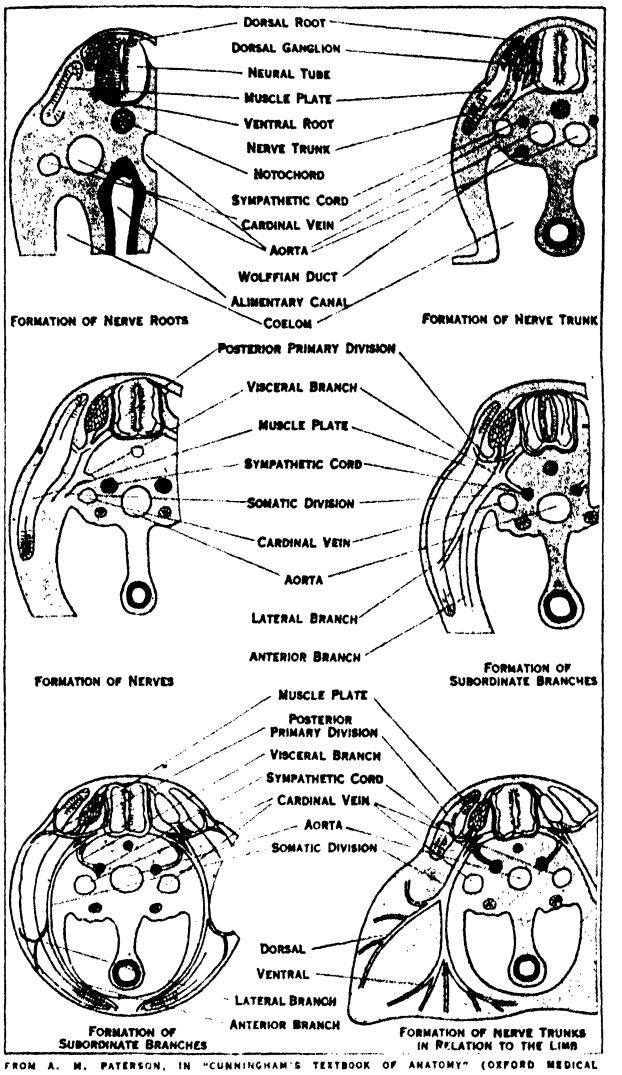


FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 6.—THE ARRANGEMENT OF THE SYMPATHETIC SYSTEM IN THE THORAX, ABDOMEN AND PELVIS

wall, and a splanchnic or visceral branch which joins the sympathetic and forms the white ramus communicans. The somatic branch grows round the body wall and gives off lateral and anterior branches.

The cranial nerves are developed in the same way as the spinal, so far as concerns the facts that the motor fibres are the axons of cells situated in the basal lamina of the mesencephalon and



FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 7.—DEVELOPMENT OF THE SPINAL NERVES

rhombencephalon (*see* BRAIN), and the sensory are the axons and dendrites of cells situated in ganglia which have budded off from the brain. The evidence of comparative anatomy, however, shows that the cranial nerves cannot be directly homologized with the spinal, nor can the fact of there being twelve of them justify us in assuming that the head contains the rudiments of twelve fused or unsegmented somites.

The sympathetic system is developed from the posterior root ganglia of the spinal nerves, by cells which in man migrate a few at a time. A. M. Paterson, however, believes that the sympathetic is developed, independently of the cerebro-spinal system, in the mesoderm (*Phil. Trans.*, B. clxxxi.).

COMPARATIVE ANATOMY

The comparative anatomy of the brain and spinal cord is dealt with in the separate articles devoted to them.

In *Amphioxus* the dorsal and ventral roots of the spinal nerves do not unite with one another but alternate, a dorsal root on one side being opposite a ventral on the other. The dorsal roots are both sensory and motor, the ventral only motor. In the Cyclostomata (*Petromyzon*) the arrangement is nearly the same, but in some regions there are two ventral roots to one dorsal. In the

fishes and higher vertebrates the dorsal and ventral roots unite, though in selachian (shark) embryos the dorsal and ventral roots alternate (F. M. Balfour, *The Development of Elasmobranch Fishes*, London, 1878).

The cranial nerves are only represented by two pairs in *Amphioxus*. In the Cyclostomata, fishes and Amphibia, ten pairs of nerves are found, which in their distribution do not always agree with those of man. In the Amniota or reptiles, birds and mammals, the eleventh and twelfth nerves have been added. The cranial nerves are formed of at least five components: (1) ventral motor, (2) lateral motor, (3) somatic sensory, (4) visceral sensory, (5) lateral line nerves.

The *ventral motor components* are those which rise from cells situated close to the mid line, and probably correspond to the ventral roots of the spinal nerves. The nerves to the eye muscles (motor oculi, trochlearis and abducens) have this origin (*see* NERVE: *Cranial*), as also has the hypoglossal, which doubtless is a cephalized spinal nerve.

The *lateral motor components* rise from cells situated more laterally, and comprise the motor roots of the fifth (trigeminal), seventh (facial), and ninth, tenth and eleventh (glossopharyngeal, vagus and spinal accessory). These nerves supply muscles belonging to the branchial skeleton, instead of the muscles of the primitive cranium, of which the eye muscles are the remnants.

The *somatic sensory components* supply the skin, and end in cells which, among the cyclostomes and fishes, form a considerable elevation in the rhombencephalon, known as the nucleus quinti (fig. 8). These components, in the lower forms, are found in the fifth, seventh and tenth nerves, but in mammals practically only the fifth contains them. They correspond to the dorsal roots of the spinal nerves.

The *splanchnic sensory* or *viscero sensory components* end in the brain in the medullary cells known as the *fasciculus communis* in fishes, and named the *fasciculus solitarius* in mammals, as well as in the nucleus vagi (fig. 8). They are found in the fifth, seventh, ninth, tenth and eleventh nerves, and supply visceral surfaces. In mammals the lingual and palatine branches of the fifth, the chorda tympani and great superficial petrosal of the seventh, and all the sensory fibres of the ninth and tenth except Arnold's nerve, represent these. In fishes and Amphibians the palate is supplied by the seventh nerve instead of the fifth.

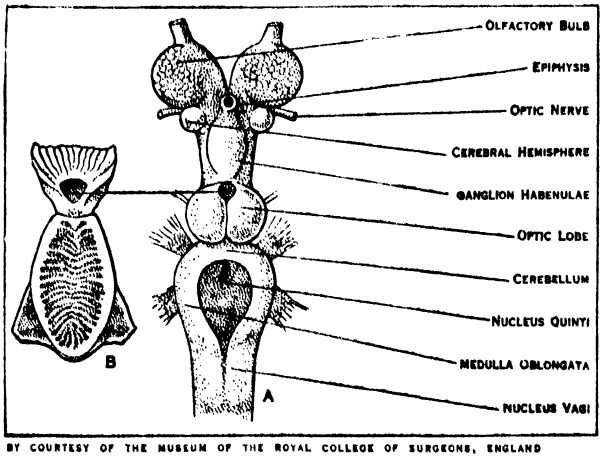


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FIG. 8.—A. BRAIN. B. CHOROID PLEXUSES OF LAMPREY

The system of the lateral line or acustico-lateralis component is sometimes regarded merely as a subdivision of the somatic sensory. It is best developed in the fish, and may be divided into pre- and post-auditory and auditory. The pre-auditory part comprises the pit and canal end organs supplied by the seventh, and also probably the olfactory organ supplied by the first nerve. The auditory apparatus, supplied by the eighth nerve, is, according to modern opinion, undoubtedly a part of this system, while the tenth nerve sends a large branch along the lateral line supplying the special end organs of the post-auditory part.

The following table, slightly modified from the one drawn up by J. McMurrich, gives a fair idea of the present state of our knowledge of the nerve components in the Mammalia.

Nerve	Ventral motor	Lateral motor	Somatic sensory	Splanchnic sensory	Lateral line
I.	..	..	..	..	+(?)
II.*	..	..	..	..	..
III.	+	..	..	..	..
IV.	+	..	..	..	..
V.	..	+	+	+	..
VI.	+	..	..	..	..
VII.	..	+	..	+	..
VIII.	..	..	..	..	+
IX., X., XI.	..	+	+	+	+
XII.	+	..	..	..	..
Spinal	+	(?)	+	+	..

*A tract of the brain.

BIBLIOGRAPHY.—For further details and literature of the nervous system *see* Quain, *Anatomy* (latest edition); R. Wiedersheims, *Comp. Anat. of Vertebrates* (London, 1907); Bronn, *Classen und Ordnungen des Thierreichs*, McMurrich, *Development of the Human Body* (London, 1923). For the theory of nerve components *see* Onèra Merritt, *Journ. Anat. and Phys.*, vol. xxxix. A general discussion on the comparative anatomy and morphology of limb plexuses will be found in Miss C. W. Saberton's paper (1906), "Nerve Plexuses of *Troglodytes niger*," *Studies in Anatomy* (Manchester, 1906). She refers to most of the literature on the subject, but the papers of H. Braus, *Jena Zeitschr.* (1898), on fish, of M. Davidoff, *Morph. Jahrb.* (1879), on the pelvic plexuses of fish, and of M. Fürbringer, *Gegenb. Festschr.* (1897), on the spino-occipital nerves and brachial plexus of fish, are also important. *See* also S. W. Ransom, *The Anatomy of the Nervous System* (Philadelphia, 1927; bibl.); A. Pitres and L. Testut, *Les nerfs en schémas* (Paris, 1925); L. Bianchi, *The Mechanism of the Brain and the Function of the Frontal Lobes* (Edinburgh, 1922; bibl.); J. R. Whitaker, *Anatomy of the Brain and Spinal Cord* (Edinburgh, 1921); C. U. A. Kappers, *Die Vergleichende Anatomie des Nervensystems der Wirbelthiere und des Menschen* (Haarlem, 1920–21; bibl.). (F. G. P.)

NESFIELD, WILLIAM EDEN (1835–1888), British architect, one of the leaders of the Gothic revival in England, was born in Bath on April 2, 1835, and died in Brighton on March 25, 1888. His father, Maj. William Andrews Nesfield, a well-known landscape gardener, laid out Regent's park and St. James's park and remodelled Kew. Nesfield was educated at Eton and articled successively to William Burn, a classicist, and Anthony Salvin of the Gothic school. He then travelled for study in France, Italy and Greece. The volume of his *Sketches from France and Italy* (1862) became one of the text-books of the Gothic revival. In 1859 Nesfield settled in London and began in 1862 a nominal partnership with Norman Shaw, when they shared rooms, but never collaborated. Nesfield's principal work was in domestic architecture, wherein he showed a mastery of planning and construction and a conscientious regard for detail. As he progressed he forsook the early French style of his earlier work, as seen in Combe abbey and Cloverly hall (1864) and developed a purely English manner, coming at last to English renaissance, as at Kinmel park. Among his other notable works are the lodge at Regent's park (1864) and at Kew gardens (1866); Farnham Royal house, Leawood, Loughton hall, Westcombe park, the Rose and Crown hotel and the bank at Saffron Walden. Many of his sketches and measured drawings are in the library of the Royal Institute of British Architects.

NEST. Nidification or the practice of making nests concerns all that appertains to the preparation for the reception of eggs, or newly-born young, and the subsequent care thereof on emergence. Our conceptions of nidification are commonly derived from observations on birds; but mammals, reptiles, amphibia and fishes, as well as invertebrates, include species which make more or less elaborate preparation in advance for the reception of their young.

The first stage in this sequence commonly consists in the selection of a definite site whereon, with a few exceptions, a nest is built in, or on which the eggs, or young, are deposited. Two factors govern this preparation,—the conditions of the environment, and the state of the young on emergence.



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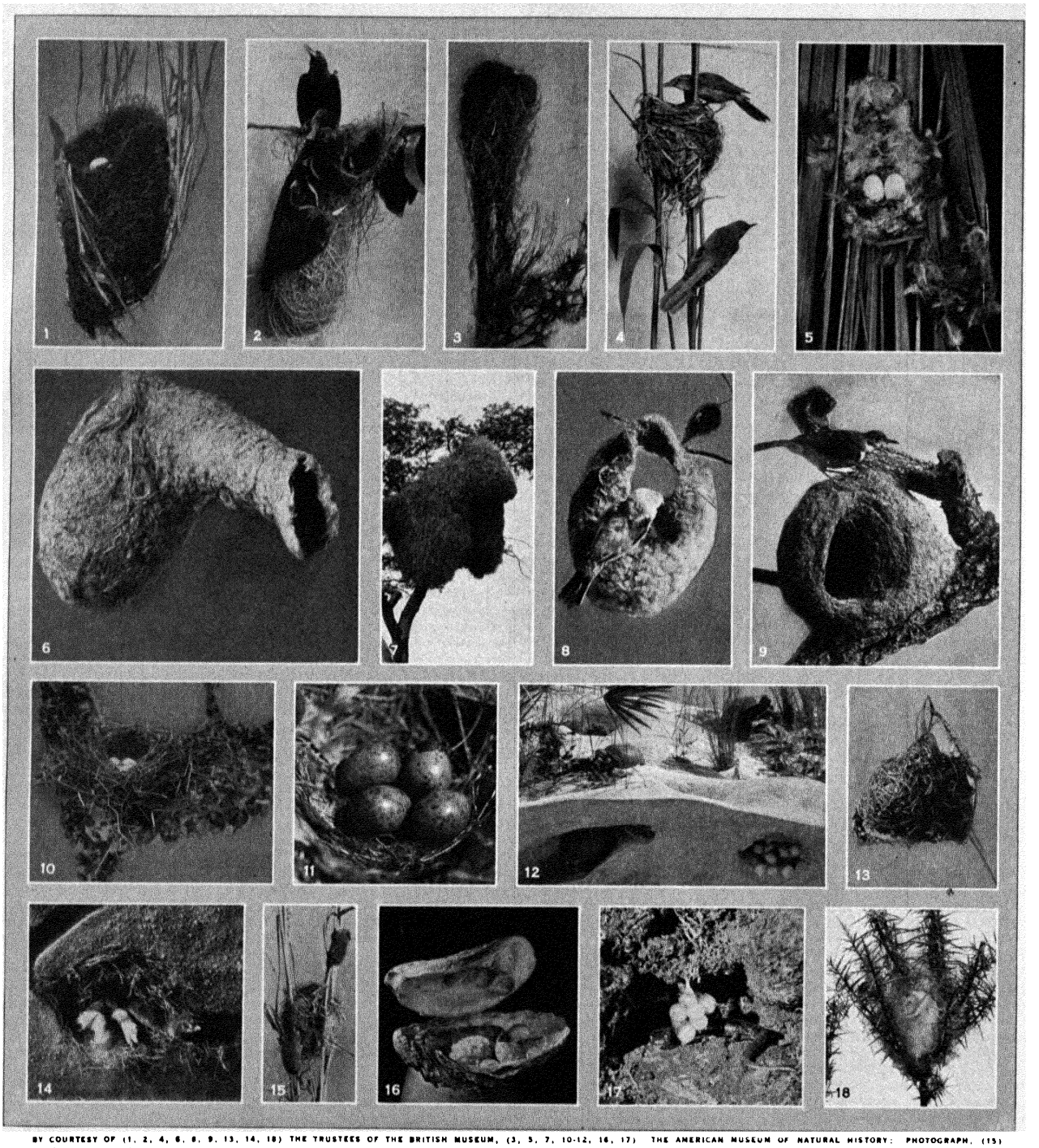
NESTS AND NESTING SITES OF VARIOUS BIRDS

1. Sparrow hawk in a nest of sticks, England. 2. Storks on a chimney top, France; the nest of sticks and reeds is added to year by year. 3. Nest of the golden eagle, built on a high mountain ledge. 4. Female kestrel about to feed her young in an abandoned crow's nest, England. 5. Community of brown pelicans showing nests, Florida. 6. Nest of American egret, Florida. 7. Community of flamingoes, Bermuda, showing mud nests 8. Neighbouring nests of an ibis and a little blue heron, Florida. 9. Sandhill crane approaching its nest built in a marsh, Florida. 10. Derby flycatchers in a loosely made nest, Texas. 11. Blackcap feeding her young, England. 12. American crow on a bulky nest of sticks placed high in a tree. 13. Edible nests of an East Indian swift, made of solidified saliva. 14. Nest of the North American hermit thrush, placed on the ground

NEST



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NESTING HABITS OF BIRDS, MAMMALS, INVERTEBRATES AND FISHES

1. Nest of the humming bird (*Panterpe insignis*), Costa Rica, made of moss and spiders' webs. 2. Japim Hang-nests (*Cassicus persicus*), Amazon, with their nest of woven grass suspended from a tree branch. 3. Nest of the black and yellow crested cacique, Mexico, sometimes several feet in length, made of grass and strips of palm leaf. 4. Reed warbler, England, and its cup-shaped nest of reed stems supported by several upright reeds. 5. The feathered nest of the palm swift, usually agglutinated to the under surfaces of palm leaves or grass roofs of huts. 6. Hanging nest of the Turkistan *Remera*, formed of dried grasses and feathers. The bottle-neck entrance affords protection against intruders. 7. Nest of the social weaver bird, Africa. It consists of an umbrella-shaped roof of grass sheltering an under surface honeycombed with numerous feather lined cavities. 8. Hanging nest of the *Remera* of Rumania, constructed of lichens, mosses and grass, lined with feathers. 9. Clay nest of the red oven-bird (*Furnarius rufus*), South America, usually about a foot in diameter. 10. Nest of twigs lined with dry leaves built by a group of Anis, Mexico. It is large enough to accommodate all the females of the company who deposit their eggs in layers separated by leaves. 11. Nest of the woodcock, a hollow scratched in the ground. 12. View of a gopher turtle habitat (*Gopherus polyphemus*) (Daudin) in a sand dune showing the pile in front of the burrow where the turtle deposits its eggs. 13. Nest of the cape (African) weaver birds, constructed of grass stems and vegetable fibers suspended by long "arms" from trees, bushes or eaves. 14. Underground burrow of the mole, lined with grass. 15. Nest of the harvest mouse, woven of grass and leaves of corn and attached to cornstalks. 16. Butterfish (*Pholis gunnellis*) coiled around an egg mass in the reversed upper valve of a dead oyster shell. 17. Red backed salamander (*Plethodon cinereus*) guarding its eggs in the moist shadow of a cave nest. 18. Grass spider (*Agalena*)

Birds.—With the birds a nest is not invariably made, as for example with the guillemot whose single egg is deposited on a bare ledge of rock projecting from the face of a cliff rising steeply from the sea. Species which haunt sandy wastes make little or no preparation by way of a nest. This receptable seems originally to have been made for the purpose of keeping the incubating bird, and the eggs, from contact with cold, damp earth.

Much more elaborate are the nests of the smaller species. These placed in hedgerows, or bushes, or even on the ground, are bowl-shaped structures made of fine grass-stems interwoven with horse-hair, and cunningly masked by moss or lichen, as in the case of the long-tailed titmouse. Some, like the thrush, use a foundation of clay, and line the interior of the nest with a mixture of decayed wood and cow-dung. Some of the African weaver-birds, and of the American hang-nests, suspend the nest, which is made of long grass-stems, and vegetable fibres, by a long "rope" attached to the bough of a tree. Towards the end this rope is enlarged to form a spherical chamber, with an entrance at the side in the hang-nests; and at the end of a further extension of the rope beneath the nest in the weavers.

Some of the flower-peckers of Africa build a nest of felted cotton-down. A few species make a more or less extensive use of saliva as a cement for mud-built nests, as with the swallow-tribe, the oven-bird, and the flamingo. The use of salivary glands in nest-building attains to its maximum with the edible swifts which use saliva alone. Such nests are used by the Chinese in making bird's nest soup.

Hollow trees are used by many birds, such as the parrots and the woodpeckers, the eggs being deposited on the rotten wood at the bottom of the hole. Others, like the sand-martin and the kingfisher drive long tunnels into the face of a sand-bank, enlarging the end of the tunnel to form a nest-chamber. The greatness of this achievement is commonly overlooked; for it would be difficult to find birds more apparently unsuited for such a task, since the sand-martin has the feeblest of feet and an extremely short beak, while the short legs, and syndactyle toes of the kingfisher, coupled with its long, pointed beak, seem still less fitted for burrowing.

While there is general conformity of type characteristic of the nests of the different groups of birds, there are striking exceptions to the rule. Thus the stork-tribe are content with a simple platform of sticks; but the hammer-head (*Scopus umbretta*) builds a huge nest of mud and sticks, covered in by a roof so substantial as to bear easily the weight of a man. This roof may be as much as 6ft. across. The flamingo, again, builds a steep pedestal of mud, the top of which is scooped out to receive the eggs. Parrots nest in hollow trees, but the quaker-parrot (*Myopsittacus*) of South America builds a large domed nest of sticks.

The Gallinaceous birds make little more than an apology for a nest, fashioned in a depression in the ground. But the megapodes of Celebes, New Guinea and Australia build a huge mound of decaying vegetable matter, and laying their eggs deep down in the fermenting mass leave them to hatch by the heat thus engendered.

One of the most remarkable cases of nidification among birds is furnished by the horn-bills. The eggs are laid at the bottom of a cavity in a tree, and as soon as the female has started incubation, the entrance-hole is closed by the male by means of clay; but a space is left open wide enough for his mate to push her beak through to receive food.

NON-AVIAN NEST-MAKERS

Mammals.—Few other animals have attained to the skill in weaving displayed by birds. The harvest-mouse among the mammals is, however, the rival of most birds. The rabbit builds a nest in her burrow, and lines it with the under-fur plucked from her body, forming a parallel to the case of the ducks, geese and swans, which line the nest with down similarly plucked from the breast for this purpose.

The only nest-building mammals which produce eggs are the *Echidna*, or spiny ant-eater, and the duck-billed platypus or *Ornithorhynchus*. The nest is of the simplest character, placed in a chamber at the end of a long tunnel dug by the animal.

Reptiles.—Among the reptiles nest-building goes little or no further than digging a hole in the ground, and depositing the eggs within it, leaving them to their fate as in the case of the megapodes among the birds. The European pond-tortoise, however, takes a little more trouble. She first prepares the ground by watering it from the bladder, and from special anal water-sacs. Then, boring a hole with the tail, as one would use a stick, the feet are used to enlarge it. When about five inches deep the eggs are laid at the bottom, and the soil is put back again and beaten down flat.

The crocodile digs a hole in the sand nearly two feet deep, laying her eggs therein and covering them up. But she returns periodically to sleep above her treasures. She is thus at hand to assist the young to escape at the time of hatching. She is warned of this by the noise they make in endeavouring to break through the shell; just as young birds announce their advent by cheeping before the shell is actually broken. When they have all emerged the mother escorts them to the water. The alligator, on the other hand, builds a great mound of decaying leaves, mixed with fine earth, to a height of about three feet, and as much as eight feet in diameter. Some eight inches from the surface the eggs, twenty to thirty, white and hard-shelled, are laid.

The python, among the snakes, like *Ichthyophis* among the Amphibia coils her body around the eggs until they hatch, and guards her young for some time after.

Amphibia.—The Amphibia furnish instances of nidification of a very remarkable character, and at the same time, provide valuable material for the study of behaviour in regard to the parental instincts to serve as a standard of comparison with the higher vertebrates on the one hand, and the lower on the other.

The frogs of the genus *Phyllomedusa* build nests recalling that of the tailor-bird. The process of this nest-making has been watched in *Phyllomedusa hypochondria*, the *Wollenkukk* of the Paraguayan Chaco. The female carries the male upon her back while searching for a suitable leaf—which must be of some tree overhanging the water. This found, both then seize it and hold the edges together with their hind-feet, while the female pours her eggs into the funnel thus formed, the male fertilizing them as they pass in. The gelatinous envelope of the eggs suffices to hold the leaf-edges in position as they are brought together in the filling process which goes on until about 100 eggs are laid.

Fishes.—Among the fishes the fresh-water sticklebacks (*Gastrosteus*) and the marine fifteen-spine stickleback (*Spinachia*) build nests of weeds, the task being undertaken by the male, who uses, as a binding material, a secretion formed by the kidneys. He undertakes the sole charge of the eggs and young. The gourami (*Osphromenus*) of the Malay Archipelago fashions a nest of air-bubbles toughened by a kind of saliva, and mounts guard over both eggs and young. The Cichlid fishes both of America and the Old World, as well as some of the Siluroid fishes, carry the young in the mouth; in some species both sexes do this, in others the male alone. The male pipe-fish carries the eggs and young in a pouch running along the belly. The Aspredo of the Guianas carries her eggs attached to the under surface of the head, belly and paired-fins. For their accommodation the skin assumes a spongy condition so that each comes to lie within a deep depression, recalling the egg-pits of the Surinam toad, but in the case of Aspredo the pits are shallow and the larvae are not retained there.

Invertebrates.—Among the insects the elaborate care for the eggs and young displayed by the ants, bees and wasps is too well known to need further mention. The scorpions and the wolf-spiders carry their young about on their backs until they can fend for themselves; and some of the scorpions, again, like the wolf-spiders, bear their eggs about closely packed within a spherical silken bag.

Among the Echinoderms we find an Antarctic sea-slug (*Cucumaria crocea*) carrying the young on its back. One of the sea-urchins (*Hemiaster philippi*), and a starfish (*Asterias spirabilis*) carry the young in brood-pouches on the back in the case of the sea-urchin, and around the mouth in the starfish. It would seem that only Arctic and Antarctic species behave after this fashion.

In all other cases the young leave the parent as minute, free-swimming larvae, undergoing a complicated metamorphosis before attaining to the adult form. Here, then, we must regard the care of the young as an entirely impersonal, unconscious act, determined by the physical peculiarities of the external environment. This is a factor to be borne in mind in considering the origin, and evolution, of nidification in animals of all grades. (W. P. P.)

NESTOR (*c.* 1056–*c.* 1114), the reputed author of the earliest Russian chronicle, was a monk of the Pecherskiy cloister of Kiev from 1073. The only other known fact of his life is that he was commissioned with two other monks to find the relics of St. Theodosius, a mission which he succeeded in fulfilling. The chronicle begins with the deluge, as those of most chroniclers of the time did. The compiler appears to have been acquainted with the Byzantine historians; he makes use especially of John Malalas and George Hamartolus. He also had in all probability other Slavonic chronicles to compile from, which are now lost. Many legends are mixed up with Nestor's *Chronicle;* the style is occasionally so poetical that perhaps he incorporated *bilini* which are now lost. The early part is rich in these stories, among which are the arrival of the three Varangian brothers, the founding of Kiev, the murder of Askold and Dir, the death of Oleg, who was killed by a serpent concealed in the skeleton of his horse, and the vengeance taken by Olga, the wife of Igor, on the Drevlians, who had murdered her husband. The account of the labours of Cyril and Methodius among the Slavs is also very interesting, and to Nestor we owe the tale of the summary way in which Vladimir suppressed the worship of Perun and other idols at Kiev. As an eyewitness he could only describe the reigns of Vsevolod and Sviatopolk (1078–1112), but he gathered many interesting details from the lips of old men, two of whom were Giurata Rogovich of Novgorod, who gave him information concerning the north of Russia, Petchora, and other places, and Jan, a man ninety years of age, who died in 1106, and was son of Vishata the voivode of Yaroslavl and grandson of Ostromir the Posadnik, for whom the *Codex* was written. Many of the ethnological details given by Nestor of the various races of the Slavs are of the highest value.

The latest theory about Nestor is that the *Chronicle* is a patchwork of many fragments of chronicles, and that the name of Nestor was attached to it because he wrote the greater part or perhaps because he put the fragments together.

The Chronicle has come down to us in several manuscripts, but unfortunately no contemporary ones, the oldest being the so-called Lavrentievski of the 14th century (1377). It was named after the monk Lavrentii, who copied it out for Dimitri Constantinovich, the prince of Souzdal. The work, as contained in this manuscript, has had many additions made to it from previous and contemporary chronicles, such as those of Volinia and Novgorod. Soloviev, the Russian historian, remarks that Nestor cannot be called the earliest Russian chronicler, but he is the first writer who took a national point of view in his history, the others being merely local writers. The language of his work, as shown in the earliest manuscripts just mentioned, is Palaeo-Slavonic with many Russisms.

The *Chronicle* has been translated into Polish, Bohemian, German and French. The compiler cannot very well be the author of the lives of Boris and Gleb, the martyrs, and of the life of St. Theodosius, because they contradict many passages in the *Chronicle*. The work is of primary importance for early Russian history, and has amusing episodes of an Herodotean character. The reputed body of the ancient chronicler may be seen among the relics preserved in the Pecherskiy monastery at Kiev.

See Louis Leger, *Chronique dite de Nestor* (Paris, 1884); Bestuzhev Riumin, *On the Composition of the Russian Chronicles till the end of the 14th century* (in Russian) (St. Petersburg, 1869). (W. R. Mo.)

NESTOR, in Greek legend, son of Neleus and Chloris, king of Pylos (Kakovátos) in Elis. When all his brothers were slain by Heracles, in consequence of the refusal of Neleus to purify him for the murder of Iphitus, Nestor alone escaped. In the *Iliad*, he is about 70 years old, full of good advice and of stories of his early exploits. In the *Odyssey*, he is seen by Telemachus at Pylos. The name is used in modern times for any old man of ripe experience, or the oldest member of a class or corporation.

NESTOR, the name of a small group of parrots peculiar to New Zealand. The type is *Nestor meridionalis*, the kaka, an olive-brown bird about as big as a crow. The larger *N. notabilis*, the kea (*q.v.*) has developed the habit of attacking sheep to obtain the kidneys. It also eats carrion, grubs, fruits and seeds. A third, more brightly coloured species is said to have inhabited Norfolk Island and a fourth Phillip Island; both of these are now extinct and no specimens of the former are known to exist.

NESTORIANS. The present article deals not with the life and doctrine of Nestorius (*q.v.*) but with the Eastern Churches called by his name.

A christology of the kind usually called Nestorian was eagerly and successfully propagated in Syria and Persia by Ibas, bishop of Edessa (435) and Barsumas, bishop of Nisibis. In Persia the old churches were stimulated into vigour and new ones founded. Their centre was at Ctesiphon on the Tigris, a busy trading city. The church traced its doctrines to Theodore of Mopsuestia rather than to Nestorius, whose name at first they repudiated, not regarding themselves as having been proselytized to any new teaching. After the Mohammedan invasion of Persia early in the 7th century the Nestorians were able to come to terms with the invaders; and for five centuries the Nestorians were a recognized institution within the territory of Islam, though their treatment varied from kindly to harsh. But the barbaric invasions of the 13th and 14th centuries fell with crushing force on the Nestorians. In 1258 Hulagu Khan took Baghdad, and about 1400 Timur again seized and sacked the city. Though the Nestorians were numerous, their moral influence and their church life had greatly deteriorated. Those who escaped capture by Timur fled to the mountains of Kurdistan, and the community that had played so large a part in Mesopotamian history for a thousand years was thus shattered. Various attempts during the 16th century to promote union between the Nestorians and Rome proved fruitless, but the Roman Church has never ceased in its efforts to absorb this ancient community.

The Nestorians showed a zeal for evangelization which resulted in the establishment of their influence throughout Asia, as is seen from the bishoprics founded not only in Syria, Armenia, Arabia and Persia, but at Halavan in Media, Merv in Khurasan, Herat, Tashkent, Samarkand, Baluk, Kashgar, and even at Kambaluk (Pekin) and Singan fu (Hsi'en fu) in China, and Kaljana and Kranganore in India. Mongolian invasions and Mohammedan tyranny have, of course, long since swept away all traces of many of these. The 400,000 Syrian Christians ("Christians of St. Thomas," *see* THOMAS, ST.) who lived in Malabar no doubt owed their origin to Nestorian missionaries, the stories of the evangelization of India by the Apostles Thomas and Bartholomew having no real historical foundation, and the Indian activity of Pantaenus of Alexandria having proved fruitless, in whatever part of India it may have been exercised. The theology of the Indian Syrian Christians is of a Nestorian type, and Cosmas Indicopleustes (6th century) puts us on the right track when he says that the Christians whom he found in Ceylon and Malabar had come from Persia (probably as refugees from persecution, like the Huguenots in England and the Pilgrim Fathers in America). Pehlevi inscriptions found on crosses at St. Thomas's Mount near Madras and at Kottayam in Travancore, are evidence both of the antiquity of Christianity in these places (7th or 8th century), and for the semi-patri-passianism (the apparent identification of all three persons of the Trinity in the sufferer on the cross) which marked the Nestorian teaching. In 745 Thomas of Kana brought a new band of emigrants from Baghdad and Nineveh, and possibly the name "Christians of St. Thomas" arose from confusion between this man and the apostle. Other reinforcements came from Persia in 822, but the Malabar church never developed any intellectual vigour or missionary zeal. They had their own kings, lived as a close caste, and even imitated the Hindus in caste regulations of food and avoidance of pollution. In 1330 Pope John XXII. issued a bull appointing Jordanus, a French Dominican, bishop of Quilon, and inviting the Nestorians to enter "the Christian Church." The

invitation was declined, but in the 16th century the Syrian Christians sought the help of the Portuguese settlers against Mussulman oppression, only to find that before long they were subjected to the fiercer perils of Jesuit antagonism and the Inquisition. The Syrians submitted to Rome at the synod of Dampier in 1599, but it was a forced submission, and in 1653 when the Portuguese arrested the Syrian bishop just sent out by the catholicus of Babylon, the rebellion broke out. The renunciation was not quite thorough, one party adhering to the Roman Church as Romo-Syrians, the others reverting wholly to Syrian usages and forming to-day about three-fourths of the whole community.

WIDESPREAD MISSIONS

Early evidence of Nestorian missions in China is extant in the tablet found in 1625 at Chang'an in the district of Hsi'en-fu, province of Shensi. It commemorates "the introduction and propagation of the noble law of Ta t'sin in the Middle Kingdom," and beneath an incised cross sets out in Chinese and Syriac an abstract of Christian doctrine and the course of a Syrian mission in China beginning with the favourable reception of Olopan, who came from Judaea in 636. For two generations the little cause prospered, and again after persecutions in 699 and 813. Later on a second mission arrived, many churches were built and several emperors patronized the faith.

In the 10th century the Nestorians introduced Christianity into Tartary proper; in 1274 Marco Polo saw two of their churches. The legend of Prester John is based on the idea of the conversion of a Mongol tribe, the Karith, whose chieftain Ung Khan at baptism received the title Malek Juchana (King John). Their activity may well be said to have covered the continent. Their campaign was one of deliberate conquest, one of the greatest ever planned by Christian missionaries. Marco Polo is witness that there were Nestorian churches all along the trade routes from Baghdad to Pekin.

The Modern Nestorians.—The Nestorians or East Syrians (*Surayi*) of Turkey and Persia now inhabit a district bounded by Lake Urmia, or Urumia, on the east, stretching westwards into Kurdistan, to Mosul on the south, and nearly as far as Van on the north. It is only of late years, under the influence of the different missions, that education, ruined by centuries of persecution, has revived amongst the Nestorians; and even now the mountaineers, cut off from the outer world, are as a rule destitute of learning, and greatly resemble their neighbours, the wild and uncivilized Kurds. They are, however, extraordinarily tenacious of their ancient customs, and, almost totally isolated from the rest of Christendom since the 5th century, they afford an interesting study to the ecclesiastical student. Their churches are rude buildings, dimly lighted and destitute of pictures or images, save that of the Cross, which is treated with the deepest veneration. There are three liturgies—of the Holy Apostles, of Theodore and of Nestorius. The first is quite free from Nestorian influence, dates from some remote period, perhaps prior to 431, and is certainly the most ancient of those now in use in Christendom; the other two, though early, are undoubtedly of later date. The Nestorian canon of Scripture seems never to have been fully determined, nor is the sacramental system rigidly defined. Nestorian writers, however, generally reckon as sacraments the Priesthood, the Oil of Unction, the Offering of the Body and Blood of Christ, Absolution, the Holy Leaven and the Signation of the life-giving Cross. The "Holy Leaven" is reputed to be a part of the original bread of the first Eucharist, brought by Addai and Mari and maintained ever since in the Church; it is used in the confection of the Eucharistic wafers, which are rather thicker than those used in the Western Church. Communion is given in both kinds, as throughout the East; likewise, confirmation is administered directly after baptism. Sacramental confession is enjoined, but has recently become obsolete; prayers for the departed and invocation of saints form part of the services. The bishops are always celibates and are chosen from episcopal families. The service-books were wholly in ms. until the press of the archbishop of Canterbury's mission at Urmia issued the *Takhsa* (containing the liturgies, baptismal office, etc.) and several other liturgical texts.

The Nestorians commemorate Nestorius as a saint, and invoke his aid and that of his companions. They reject the Third Oecumenical Council, and though showing the greatest devotion to the Blessed Virgin, deny her the title of *Theotokos, i.e.*, the mother or bearer of God. Their theological teaching is misty and perplexing; but systematic or even consistent theological thinking is not their primary interest (*see* J. F. Bethune-Baker, *Nestorius and his Teaching*). The peculiar circumstances, both ecclesiastical and temporal, of the Nestorians have attracted much attention in western Christendom, and various missionary enterprises amongst them have resulted (*see* authorities named below).

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NESTORIUS (d. *c.* 451), Syrian ecclesiastic, patriarch of Constantinople from 428 to 431, was a native of Germanicia at the foot of Mount Taurus, in Syria. The year of his birth is unknown. He received his education at Antioch, probably under Theodore of Mopsuestia. As monk in the neighbouring monastery of Euprepius, and afterwards as presbyter, he became famous in the diocese for his asceticism, his orthodoxy and his eloquence. He was nominated by Theodosius II. patriarch of Constantinople, and was consecrated on April 10, 428. He immediately set to work to extirpate heresy in his diocese, beginning by the suppression of the assemblies of the Arians. These, by a bold stroke of policy, anticipated his action by themselves setting fire to their meeting-house, Nestorius being forthwith nicknamed "the incendiary." His repression of the Novatians and the Quartodecimans led to serious disturbances at Sardis and Miletus. The toleration the followers of Macedonius had long enjoyed was also broken, the recently settled Pelagians alone finding any respite. One of the practices assailed by Nestorius was the custom, which had become almost universal in Constantinople, of bestowing the epithet Θεοτόκος "Mother of God," upon Mary the mother of Jesus. From Antioch Nestorius had brought along with him to Constantinople a co-presbyter named Anastasius, who enjoyed his confidence and is called by Theophanes his "syncellus." This Anastasius, in a pulpit oration which the patriarch himself is said to have prepared for him, caused great scandal to the partisans of the cult of Mary by saying, "Let no one call Mary the mother of God, for Mary was a human being; and that God should be born of a human being is impossible."

Cyril (*q.v.*) of Alexandria seized his opportunity. He stirred up his own clergy, he encouraged the dissidents at Constantinople, he addressed himself to the sister and wife of the emperor, and he bribed the officials of the court. He also sent to Rome a careful selection of Nestorius's sayings and sermons. Nestorius himself, on the other hand, having occasion to write to Pope Celestine I. about the Pelagians (whom he was not inclined to regard as heretical), gave from his own point of view an account of the disputes which had recently arisen within his patriarchate. Celestine naturally resented any questioning of the Roman decision concerning the Pelagians, and was jealous of the growing power of the Constantinople see. In a synod which met in 430, he decided in favour of the title Θεοτόκος, bade Nestorius retract his erroneous teaching, on pain of instant excommunication, and entrusted the execution of this decision to the patriarch of Alexandria.

In this situation of affairs the demand for a general council became irresistible, and accordingly Theodosius and Valentinian III. issued letters summoning the metropolitans of the Catholic church to meet at Ephesus at Whitsuntide 431, each bringing with him some able suffragans. Nestorius, with sixteen bishops and an armed following, Cyril with fifty bishops, Juvenal of Jerusalem, and Flavian of Thessalonica arrived. John of Antioch was delayed on his journey, and wrote requesting that the opening of the

synod should not be delayed on his account. Cyril and his friends assembled in the church of the Theotokos on June 22, and summoned Nestorius to give an account of his doctrines. He replied that he would appear when all the bishops were assembled; and the imperial commissioner, Candidian, formally protested against the opening of the synod. Cyril and the 159 bishops who were with him nevertheless proceeded to read the imperial letter of convocation, and afterwards the letters which had passed between Nestorius and Cyril. The entire assembly then cried anathema on Nestorius and his doctrines, and the decree of his exclusion from the episcopate and from all priestly communion was solemnly read and signed by all present. The accused and his friends never had a hearing.

The populace accompanied the members with torches and censers to their lodgings, and there was a general illumination of the city. A few days afterwards (June 26th or 27th) John of Antioch arrived; whether inclined or not to the cause of his former copresbyter, he disapproved the precipitancy with which Cyril had acted, and at a *conciliabulum* of forty-three bishops held in his lodgings he was induced by Candidian, the friend of Nestorius, to depose the bishops of Alexandria and Ephesus on the spot. The Ephesians intervened to prevent the execution of this decision on the next Sunday. Meanwhile a letter from the emperor declared invalid the session at which Nestorius had been deposed unheard; numerous sessions and counter-sessions were afterwards held, the conflicting parties both seeking the imperial support. In the end Theodosius decided to confirm the depositions which had been pronounced on both sides, and Cyril and Memnon as well as Nestorius were by his orders laid under arrest. Representatives from each side were now summoned before him to Chalcedon, and at last, yielding to the sense of the evident majority, he gave a decision in favour of the "orthodox," and the council of Ephesus was dissolved. Maximian, one of the Constantinopolitan clergy, a native of Rome, was promoted to the vacant see, and Nestorius was henceforward represented in the capital only by one congregation, which presently became extinct.

But the Antiochenes maintained for some time an attitude of antagonism towards Cyril and his creed, and were not pacified until an understanding was reached in 433 on the basis of a new formula involving some concessions by him. The union even then was opposed by certain bishops, who were deposed from their sees. Their school at Edessa was closed by Zeno in 489. Immediately after his deposition Nestorius withdrew into private life in his old monastery of Euprepius, Antioch, until 435, when the emperor ordered his banishment to Petra in Arabia. A second decree, it would seem, sent him to Oasis, probably the city of the Great Oasis, in Upper Egypt, where he was still living in 439, at the time when Socrates wrote his *Church History*. He was taken prisoner by the Blemmyes, a nomad tribe that gave much trouble to the empire in Africa, and when they set him free in the Thebaid near Panopolis (Akhmim) *c.* 450, they exposed him to further persecution from Schenute, the hero of the Egyptian monks. There is some evidence that he was summoned to the Council of Chalcedon, though he could not attend it, and in the concluding portion of his book known as *The Bazaar of Heraclides* he not only gives a full account of the "Robber Synod" of Ephesus 449, but knows that Theodosius is dead (July 450) and seems aware of the proceedings of Chalcedon and the flight of Dioscurus, the unscrupulous successor of Cyril at Alexandria. Nestorius was already old and ailing and must have died very soon after. There are still Nestorians in Kurdistan, and the Syriac Church is Nestorian in theology, as are the churches in Asia founded by Nestorian missionaries in the middle ages.

Modern View.—Only recently has an attempt been made to judge Nestorius from some other evidence than that afforded by the accusations of Cyril and the inferences drawn therefrom. This other evidence consists partly of letters from Nestorius, preserved among the works of those to whom they were written, some sermons collected in a Latin translation by Marius Mercator, an African merchant who was doing business in Constantinople at the time of the dispute, and other material gathered from Syriac manuscripts. Since the helpful collection of *Nestoriana* published by Dr. F. Loofs in 1905 there has also come to our knowledge the most valuable evidence of all, Nestorius's own account of the whole difficulty, viz., *The Bazaar*[1] *of Heraclides of Damascus*. This pseudonym served to protect the book against the fate that overtook the writings of heretics, and in a Syriac version it was preserved in the Euphrates valley where the followers of Nestorius settled. Ebed Jesu in the 14th century mentions it together with *Letters* and *Homilies*, as well as the *Tragedy*, or a *Letter to Cosmas*, the *Theopaschites* (of which some fragments are still extant) and the *Liturgy*, which is still used by the Nestorian Church. The discovery of *The Bazaar*, which is the *Apologia* of Nestorius, was made public by Dr. H. Goussen (though members of the Archbishop of Canterbury's Mission to the Assyrian Christians had previously been acquainted with the book). The text has been edited by P. Paul Bedjan (Leipzig, 1910) and a French translation has been made by M. l'abbé F. Nau. A representative selection of extracts has been given to English readers in J. F. Bethune-Baker's *Nestorius and his Teaching* (Cambridge, 1908), chapter ii. of which describes the ms. and its accounts.

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NET. A fabric of thread, cord or wire, the intersections of which are knotted so as to form a mesh. The art of netting is intimately related to weaving, knitting, plaiting and lace-making, from all of which, however, it is distinguished by the knotting of the intersections of the cord. It is one of the most ancient and universal of arts, having been practised among the most primitive tribes, to whom the net is of great importance in hunting and fishing. Net is a common Teut. word, of which the origin is unknown; it is not to be connected with "knit" or "knot." The term "net," *i.e.*, remaining after all deductions, charges, etc., have been made, as in "net profit," is a variant of "neat," tidy, clean, Lat. *nitidus*, shining. Net-making, as a modern industry, is principally concerned with the manufacture of the numerous forms of net used in fisheries, but netting is also largely employed for many other purposes, as for the temporary division of fields, for protecting fruit in gardens, for screens and other furniture purposes, for bags, appliances used in various games, etc. Since the early part of the 19th century numerous machines have been invented for netting, and several of these have attained commercial success. Fishing nets were formerly made principally from hemp fibre —technically called "twine."

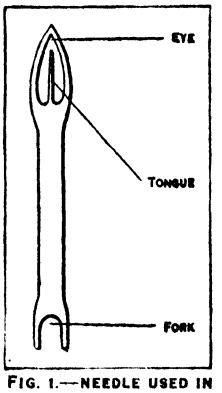


FIG. 1.—NEEDLE USED IN NET-MAKING

The forms of fishing nets vary according to the manner in which they are intended to act. This is either by entangling the fish in their complicated folds, as in the trammel; receiving them into pockets, as in the trawl; suspending them by the body in the meshes, as in the mackerel-net; imprisoning them within their labyrinth-like chambers, as in the stake-net; or drawing them to shore, as in the seine. The parts of a net are the head or upper margin, along which the corks are strung upon a rope called the head-rope; the foot is the opposite or lower margin, which carries the foot-rope, on which in many cases leaden plummets are made fast. The meshes are the squares composing the net. The width of a net is expressed by the term "over"; *e.g.*, a day-net is three fathoms long and one over or wide. The lever is the first row of a net. There are also accrues, false meshes or quarterings, which are loops inserted in any given row, by which the number of meshes is increased. To bread or breathe a net is to make a net.

[1] Syriac, *tĕgûrtā*, lit. "merchandise." The Greek word may have been ἐμπορίου. Nothing is certainly known of any such Heraclides.

Hand-Netting.—The tools used in hand-netting are the needle, an instrument for holding and netting the material; it is made with an eye E, a tongue T, and a fork F (fig. 1). The twine is wound on it by being passed alternately between the fork and round the tongue, so that the turns of the string lie parallel to the length of the needle, and are kept on by the tongue and fork. A spool or mesh-pin is a piece of round or flat wood on which the loops are formed, the perimeter of the spool determining the size of the loops. Each loop contains two sides of the square mesh; therefore, supposing that it be required to make a mesh 1in. square—that is,

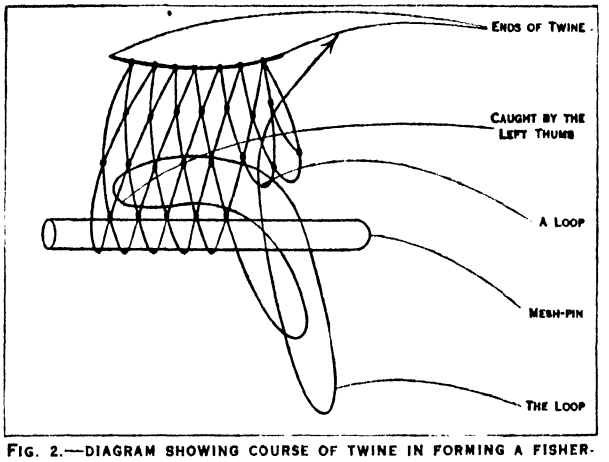


FIG. 2.—DIAGRAM SHOWING COURSE OF TWINE IN FORMING A FISHERMAN'S KNOT IN NET-MAKING

measuring 1in. from knot to knot—a spool 2in. in circumference must be used. Large meshes may be formed by giving the twine two or more turns round the spool, as occasion may require; or the spool may be made flat, and of a sufficient width. The method of making the hand-knot, known as the fisherman's knot, is more easily acquired by example than described in writing. Fig. 2 shows the course of the twine in forming a single knot. From the last-formed knot the twine passes over the front of the mesh-pin, and is caught behind by the little finger of the left hand, forming the loop, thence it passes to the front and is caught by the left thumb, then through the loops as sketch indicates, after which the twine is released by the thumb and the knot is drawn taut. Fig. 3 is a bend knot used for uniting two ends of twine.

Machine-Netting.—In 1778 a netting-machine was patented by William Horton, William Ross, Thomas Davies and John Golby. In 1802 the French Government offered a reward of 10,000 francs to the person who would invent an automatic machine for net-making. Jacquard submitted a model of a machine which was brought under the notice of Napoleon I. and Carnot, and he was summoned to Paris by the emperor who asked—"Are you the man who pretends to do what God Almighty cannot—tie a knot in a stretched string?" Jacquard's model, which is incomplete, was deposited in the Conservatoire des Arts et Métiers; it was awarded a prize, and he himself received an appointment in the conservatoire, where he perfected his famous attachment to the common loom. In the United Kingdom, the first to succeed in inventing an efficient machine and in establishing the industry of machine net-making was James Paterson of Musselburgh. Paterson, originally a cooper, served in the army through the Peninsular War, and was discharged after the battle of Waterloo. He established a net factory in Musselburgh about 1820; but the early form of machine was imperfect, the knots it formed slipped readily and, there being much prejudice against machine nets, the demand was small. Walter Ritchie, native of Musselburgh, devised a method for forming the ordinary hand-knot on the machine nets, and the machine, patented in July 1835, became the foundation of an extensive and flourishing industry. The Paterson machine is very complex. It consists of an arrangement of hooks, needles and sinkers, one of each being required for every mesh in the breadth being made. The needles hold the meshes, while the hooks seize the lower part of each and twist it into a loop. Through the series of loops so formed a steel wire is shot, carrying with it twine for the next range of loops. This twine the sinkers successively catch and depress sufficiently to form the two sides and loop of the next mesh to be formed. The knot formed by threading the loops is now tightened up, the last formed mesh is freed from the sinkers and transferred to the hooks, and the process of looping, threading and knotting thus continues.

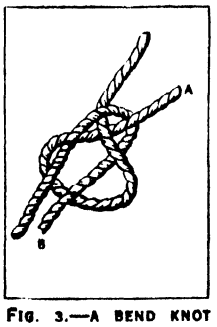


FIG. 3.—A BEND KNOT USED TO JOIN TWO ENDS. A AND B

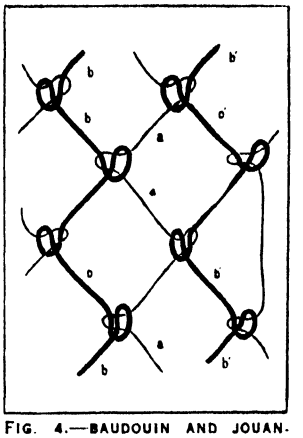


FIG. 4.—BAUDOUIN AND JOUANNIN'S NET LOOM, WHERE THE "A" SERIES IS DRAWN INTO LOOPS, OVER AND THROUGH WHICH THE "B" SERIES PASSES

Another form of net-loom, working on a principle distinct from that of Paterson, was invented and patented in France by Onésiphore Pecqueur in 1840, and again in France and in Great Britain in 1849. This was improved by many subsequent inventors; especially by Baudouin and Jouannin.

Net Manufacture in the United States.—The manufacture of nets for the fisheries in the United States dates back to about 1844, being initiated by a manufacturer of cotton yarns at Canton, Massachusetts. The popularity with which the first experimental cotton twines were received led the manufacturer to devote his whole time to their manufacture and improvement. In 1858 the first netting-machine in the United States was seen. The limitations of this machine led to the development of new inventions, particularly those designed for handling heavy twines.

In 1919, there were 19 establishments manufacturing nettings, nets, scrape bags and seines. These establishments were capitalized at $4,156,000, employing 859 persons, the value of the output being $5,114,000. The fibre materials used are flax, cotton and manila.

In view of the wholly inadequate supply of domestic flax and as but little of it is suitable for the manufacture of netting, domestic manufacturers are dependent upon imports for their raw materials. The use of cotton in the making of nets has increased until the quantities used in 1920 exceeded those for linen. Manila is used by the domestic manufacturers in the making of trawls or other bag-nets.

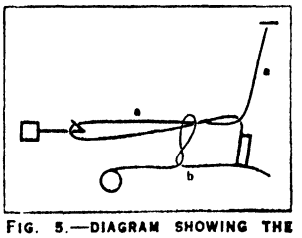


FIG. 5.—DIAGRAM SHOWING THE CONTINUATION OF THE PROCESS

Fishery apparatus employed in the fisheries of the United States and Alaska is valued at more than $16,000,000, the greater part of which is invested in nets, nettings and lines chiefly cotton, flax and hemp. Much of this material lasts but two years at best, so that the annual investment in new netting each year is an important factor in the fisheries.

NETHERLANDS. The Netherlands first became known to the Romans through the campaigns of Julius Caesar. He found the country peopled partly by tribes of Gallo-Celtic, partly by tribes of Germanic stock, the river Rhine forming roughly the line of demarcation between the races. The Gallo-Celtic tribes bore the general appellation of Belgae, and among these the Nervii, inhabiting the district between the Scheldt and the Sambre were at the date of Caesar's invasion, 57 B.C., the most warlike and important. To the north of the Meuse, and more especially in the low-lying ground enclosed between the Waal and the Rhine

(*insula Batavorum*) lived the Batavi. Beyond these were found the Frisians (*q.v.*), who gave their name to the territory between the Rhine and the Ems.

Julius Caesar, after a severe struggle with the Nervii and their confederates, was successful in bringing the Belgic tribes into subjection to Rome. Under Augustus, 15 B.C., the conquered territory was formed into an imperial province, *Gallia Belgica*, and the frontier was strongly fortified. The Batavians were first brought under Roman rule in the governorship of Drusus A.D. 13. They were not incorporated in the empire, but were ranked as allies. In 69 they revolted under a native leader, known only under his Roman name of Claudius Civilis. After the rising, they returned to their position of *socii*. Their land became a recruiting ground for the Roman armies and they were henceforth faithful in their steady allegiance to Rome.

When at the end of the 3rd century the Franks (*q.v.*) began to swarm over the Rhine into the Roman lands, the names of the old tribes had disappeared. The branch of the Franks—who were a confederacy, not a people—which gradually overspread Gallia Belgica, bore the name of Salii, from their position on the river Saale. In the days of their great king Clovis (481–511) they were in possession of the whole of the southern and central Netherlands. The strip of coast between the mouths of the Scheldt and Ems remained, however, in the hands of the Frisians (*q.v.*), and the Saxons (*q.v.*) had occupied a portion of the districts known later as Gelderland, Overyssel and Drente.

The conversion of the Franks tended to facilitate fusion between them and the Gallo-Roman population, and to accentuate the enmity between the Franks and the heathen Frisians and Saxons. In the south of the Netherlands bishoprics were set up at Cambrai, Tournai, Arras, Thérouanne and Liége. In the north progress was much slower and success was due rather to the arms of the Carolingian kings than to missionary efforts. Towards the end of the century, Charlemagne, himself a Netherlander by descent and ancestral possessions, after a severe struggle thoroughly subdued the Frisians and Saxons, and compelled them to embrace Christianity.

The Duchy of Lower Lorraine.—The Verdun treaty (843) assigned the central part of the Empire to the Emperor Lothaire, separating the kingdom of East Francia (the later Germany) from West Francia (the later France). This middle kingdom included the whole of the later Netherlands with the exception of the portion on the left bank of the Scheldt, which river was made the boundary of West Francia. On the death of the emperor, his son Lothaire II. received the northern part of his father's domain, known as *Lotharii Regnum*, corrupted later into Lotharingia and Lorraine. Lothaire had no heir, and in 870 by the Treaty of Mersen his territory was divided between the kings of East and West Francia. In 879 East Francia acquired the whole; from 912 to 924 it formed part of West Francia. In 924 Lorraine passed in the reign of Henry the Fowler under German overlordship. Henry's son, Otto the Great, placed it in 953 in the hands of his able brother, Bruno, archbishop of Cologne, for pacification. Bruno, who kept for himself the title of archduke, divided the territory into the two duchies of Upper and Lower Lorraine. Godfrey of Verdun was invested by him with the government of Lower Lorraine. The history of the Netherlands from this time forward—with the exception of Flanders, which continued to be a fief of the French kings—is the history of the various feudal States into which the duchy of Lower Lorraine was gradually broken up. (*See* FLANDERS; HOLLAND; BRABANT; GELDERLAND; LIMBURG; UTRECHT; LIÉGE.)

The development of feudalism in the Netherlands was largely due to the necessity of protecting the land against the Scandinavian attacks of the 9th and 10th centuries. For a time near the middle of the 9th century the Northmen were masters of all Holland and Friesland, though they never established permanent settlements there. On one occasion, in 880, the emperor, Charles the Fat, led an army against the Northmen, then encamped at Elsloo, but the remoteness of the Netherlands from the centres of either French or imperial power threw the burden of defence upon local magnates, and a great increase in their authority was the inevitable consequence. Long before the end of the 11th century the system of feudal States had been firmly established in the Netherlands. The part which their rulers played in the Crusades is a proof of their order and prosperity.

EARLIEST CHARTERS

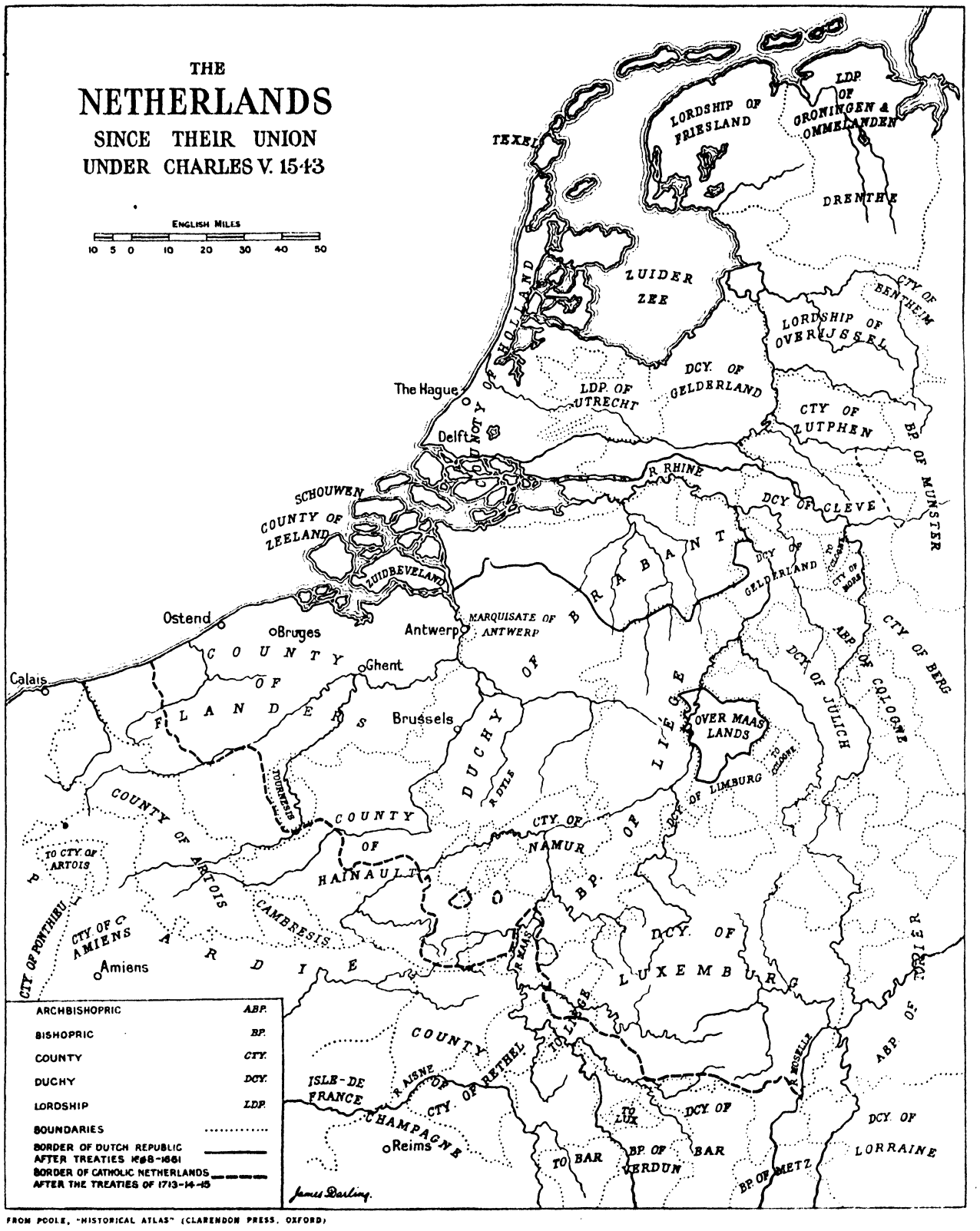
Rise of the Cities in the Netherlands.—Little is known about the Netherlands towns before the 12th century. The earliest charters date from that period. The charters were of the nature of a treaty between the city and its feudal lord, and they differed much in character according to the importance of the place and the pressure it was able to put upon its sovereign. The extent of the rights which the charter conceded determined whether the town was a free town or a commune. In the case of a commune the concessions included generally the right of inheritance, justice, taxation, use of wood, water, etc. The lord's representative, entitled "justiciary" (*schout*) or "bailiff" (*baljuw*), presided over the administration of justice and took command of the town levies in war. The *gemeente*—consisting only of those bound by the communal oath for mutual help and defence—elected their own magistrates. These electors were often a small proportion of the whole body of inhabitants: sometimes a few influential families alone had the right, and it became hereditary. The magistrates bore the name of *scabini*, and at their head was the seigneurial official—the *schout* or *baljuw*. These *scabini* appointed from the citizens a body of sworn councillors to assist them whose presidents, styled "burgomasters," had the supervision of the communal finances.

The most powerful and flourishing of all were those of Flanders —Ghent, Bruges and Ypres. In the 13th century these towns had become the seat of large industrial populations employed upon the weaving of cloth with its dependent industries, and closely bound up by trade interests with England, whence they obtained the wool for their looms. Bruges, at that time connected with the sea by the river Zwijn and with Sluis as its port, was the central mart and exchange of the world's commerce. In these Flemish cities the early oligarchic form of municipal government speedily gave way to a democratic. The great mass of the townsmen organized in trade gilds—weavers, fullers, dyers, smiths, leather-workers, brewers, butchers, bakers and others, of which by far the most powerful was that of the weavers—as soon as they became conscious of their strength rebelled against the exclusive privileges of the patricians and succeeded in ousting them from power. The patricians relied upon the support of the French Crown, but the fatal battle of Courtrai (1302), in which the handicraftsmen laid low the chivalry of France, secured the triumph of the democracy. The power of the Flemish cities rose to its height during the ascendancy of Jacques van Artevelde (1285–1345), the famous citizen-statesman of Ghent, but after his downfall the mutual jealousies of the cities undermined their strength, and with the crushing defeat of Roosebeke (1382) in which Philip van Artevelde perished, the political greatness of the municipalities entered upon its decline.

In Brabant—Antwerp, Louvain, Brussels, Malines (Mechlin)—and in the episcopal territory of Liége—Liége, Huy, Dinant—there was a more feeble repetition of the Flemish conditions. Flourishing communities were likewise to be found in Hainault, Namur, Cambrai and the other southern districts of the Netherlands, but nowhere else the vigorous independence of Ghent, Bruges and Ypres, nor the splendour of their civic life. In the north also the 13th century was rich in municipal charters. Dordrecht, Leyden, Haarlem, Delft, Vlaardigen, Rotterdam in Holland and Middelburg and Zierikzee in Zealand, repeated with modifications the characteristics of the communes of Flanders and Brabant. But the growth and development of the northern communal movement, though strong and instinct with life, was slower and less tempestuous than the Flemish. In the bishopric of Utrecht, in Gelderland and Friesland, the privileges accorded Utrecht, Groningen, Zutphen, Stavoren, Leeuwarden followed rather on the model of those of the Rhenish "free cities" than of the Franco-Flemish commune.

THE BURGUNDIAN DOMINION

Consolidation of Power.—It was at this time that Flan-



FROM POOLE, "HISTORICAL ATLAS" (CLARENDON PRESS, OXFORD)

ders, and gradually the other feudal States of the Netherlands, by marriage, purchase, treachery or force, fell under the dominion of the house of Burgundy. The foundation of the Burgundian rule in the Netherlands was laid by the succession of Philip the Bold to the counties of Flanders and Artois in 1384 in right of his wife, Margaret de Mâle. In 1404 Antony, Philip's second son (killed at Agincourt, 1415), became duke of Brabant by bequest of his great-aunt Joan. The consolidation of the Burgundian power was effected by Philip the Good, grandson of Philip the Bold, in his long and successful reign of 48 years, 1419–67. He inherited Flanders and Artois, purchased the county of Namur (1427) and compelled his cousin Jacqueline, the heiress of Holland, Zealand, Hainault and Friesland, to surrender her possessions to him in 1428. On the death, in 1430, of his cousin Philip, duke of Brabant, he took possession of Brabant and Limburg; the duchy of Luxemburg he acquired by purchase, 1443. He made his bastard son David bishop of Utrecht, and from 1456 onwards that see continued under Burgundian influence.

This extension of the Burgundian dominion implied the establishment of a strong monarchical authority. The dukes had united under their sway a number of provinces with different histories, institutions and languages, and their aim was to centralize their government. The nobility and clergy were on the side of the ducal authority; its opponents were the municipalities, especially those of Flanders. Their strength had been seriously weakened by the overthrow of Roosebeke, but Philip on his accession found them once more advancing rapidly in power and prosperity. He was quite aware that the industrial wealth of the great Flemish communes was financially the mainstay of his power, but their very prosperity made them the chief obstacle of his schemes of unifying into a solid dominion the loose aggregate of States over which he was the ruler. On this matter Philip would brook no opposition. Bruges was forced after strenuous resistance to submit to the loss of its most cherished privileges in 1438, and the revolt of Ghent was quenched in the "red sea" of Gavre in 1453. The splendour and luxury of the court of Philip surpassed that of any contemporary sovereign. A permanent memorial of it remains in the famous Order of the Golden Fleece, which was instituted by the duke at Bruges in 1430 on the occasion of his marriage with Isabel of Portugal, a descendant of John of Gaunt.

Before the accession of Charles, the only son of Philip, two important steps had been taken towards unification. The first was the appointment of a grand council with supreme judicial and financial functions, whose seat was finally fixed at Malines in 1473; the other the summoning of deputies of all the provincial "States" of the Netherlands to a States-general at Brussels in 1465. But Charles did not possess the qualities of a builder of States. At first all went well with him. By his ruthless suppression of revolts at Dinant and Liége he made his authority undisputed throughout the Netherlands. His campaigns against the French king were conducted with success. His creation of a formidable standing army, the first of its kind in that age of transition from feudal conditions, gave to the Burgundian power all the outward semblance of stability and permanence. But Charles, though a brave soldier and good military organizer, was neither a capable statesman nor a skilful general. At the very height of his power all his schemes of aggrandisement came to sudden ruin through a succession of disastrous defeats at the hands of the Swiss. At Nancy, Jan. 5, 1477, Charles was himself among the slain, leaving his only daughter, Mary of Burgundy, then in her 20th year, sole heiress to his possessions.

The catastrophe of Nancy threatened the loosely knit Burgundian dominion with dissolution. Louis XI. claimed the reversion of the French fiefs, and seized Burgundy, Franche Comté and Artois. But the Netherland provinces, though not loving the Burgundian dynasty, had no desire to have a French master. Deputies representing Flanders, Brabant, Hainault and Holland met at Ghent, where Mary was detained almost as a prisoner, and compelled her (Feb. 10, 1477) to sign the "Great Privilege." This charter provided that no war could be declared nor marriage concluded by the sovereign, nor taxes raised without the assent of the States, that natives were alone eligible for high office and that the national language should be used in public documents. The central court of justice at Malines was abolished, but the Grand Council was reorganized and made thoroughly representative. The Great Privilege was supplemented by provincial charters, the Flemish Privilege (Feb. 10), the Great Privilege of Holland and Zealand (Feb. 17), the Great Privilege of Namur and the *Joyeuse Entrée* of Brabant, both in May, thus curtailing the sovereign's power of interference with local liberties. On these conditions Mary obtained the hearty support of the States against France. Her marriage four months later to Maximilian of Austria was the beginning of the long domination of the house of Habsburg. The next 15 years were for Maximilian a stormy and difficult period. The duchess Mary died from the effects of a fall from her horse (March 1482), and Maximilian became regent (*mambourg*) for his son. The peace of Arras with France (March 1483) freed him to deal with the discords in the Netherland provinces, and more especially with the turbulent opposition in the Flemish cities. With the submission of Ghent (June 1485) the contest was decided in favour of the archduke, who in 1494, on his election as emperor, was able to hand over the country to his son Philip in a comparatively tranquil and secure state. Philip was 15 years of age, and his accession was welcomed by the Netherlanders with whom Maximilian had never been popular. Gelderland, however, which had revolted after Nancy, had Charles of Egmont for its duke, and the two bishoprics of Liége and Utrecht were no longer subject to Burgundian authority. In 1496 Philip married Joanna of Aragon, who in 1500 became heiress apparent to Castile and Aragon, and she gave birth at Ghent to a son, afterwards the Emperor Charles V. On the death of Queen Isabel, Philip and Joanna succeeded to the crown of Castile and took up their residence in their new kingdom (Jan. 1506). A few months later Philip unexpectedly died at Burgos (Sept. 25). His Burgundian lands passed without opposition to his son Charles, then six years of age. (X.)

RELIGIOUS DIFFICULTIES

Charles V.—The emperor Maximilian, who was regent during the minority of his grandson, appointed his daughter Margaret, widow of Philibert duke of Savoy, as governor-general, an office which she held with varying success for eight years. In 1515, at the instance of the States-General, the 15-year-old Charles was suddenly declared of age. Born and brought up in the Netherlands he was personally popular there and the country was prosperous. Unfortunately, however, his accession brought the Netherlands into the huge and incongruous collection of states which the wars and marriages of the Habsburgs had heaped together. By the time he was 20 Charles was king of Aragon and Castile, with their Italian and American possessions, head of the house of Austria, and emperor. This meant first that he had to spend most of his life in his other dominions, leaving the Netherlands again to his aunt Margaret, and after her death (Nov. 27, 1530) to his sister Mary, the widow of that king of Hungary who had fallen at Mohacz. It meant also that he had to make large financial demands on these rich provinces for the purposes of his many wars. Opposition to the taxes led at last to one serious collision: the great city of Ghent resisted, and on Feb. 14, 1540, Charles entered it as a conqueror and humbled it by annulling its liberties and exacting a heavy fine. Another difficulty was the rapid growth of protestantism. A series of severe edicts against heresy was issued and enforced; but though many heretics were executed, every form of protestant belief continued to make converts. None of these dangers however, came as yet to a head. The rule of Charles and the "governesses" was on the whole moderate and successful. He rounded off the dominions by the purchase and subjugation of Friesland (1524), the annexations of the lands of the bishops of Utrecht (1528) and the defeat of an opponent who tried to establish himself in the duchy of Gelderland (1538). By 1543 he ruled over the 17 provinces which are usually meant by the name "Netherlands," though oddly enough there are several different ways of enumerating them. It is due not to any geographical or racial factors, but simply to the subsequent course of political history that there was no further expansion of the frontiers to the east or south. In the task of welding these

provinces together by constitutional links Charles made some headway, but not much. He made the rules of hereditary succession the same for all of them, so that they should never be divided among different heirs. He carried out a nominal, but in the result quite ineffective, incorporation of the provinces in the Holy Roman empire. He governed the provinces by executive councils of the type usual in the monarchies of the period, and, in addition to the provincial estates, he liked to summon, when he needed grants of money, States-General such as his predecessors had sometimes used. These stood, however feebly, for the principle of the unity of the Netherlands.

Philip II.—Conflict was precipitated in the Netherlands under Philip II., who succeeded his father on his abdication in 1555. In the first 12 years of his reign all the latent quarrels burst out. In 1559 the Peace of Cateau Cambrésis (a town better known now as Le Cateau) removed the pressure of war with France, and so cleared the way for the Dutch revolt and for the French wars of religion. As Philip was not emperor and ceased to be king of England on the death of his wife Queen Mary in 1558, the Netherlands now belonged to a combination of states, in which no other part was infected with protestantism: the religious struggle there was consequently more uncompromising than in Germany. Philip was determined to crush heresy. His policy was in a sense no more harsh than that of Charles; but as protestantism grew its repression caused greater discontent. Philip began, but never completed, the carrying out of a scheme which had been for some time in contemplation for rectifying the anomalies of the boundaries of the episcopal sees, and for making smaller dioceses with a more efficient episcopate. This not only intensified the fear of persecution, but alienated the greater nobles.

Prelude to the Revolt.—These religious questions would not by themselves have led to a revolution. The most powerful class in the Netherlands were the great nobles, from whom the "stadholders" or lieutenants of the provinces were chosen, and on whom the privileged order of the Golden Fleece was often conferred. Among these there was a widespread feeling against Spanish rule, and a desire to subordinate the power of the king's ministers to their own and that of the estates. The period from 1559 (when Philip departed to Spain) to 1567, during which the governor-general was the king's illegitimate half-sister Margaret duchess of Parma, is known as the prelude to the revolt. Its first stage lasted till 1564. By this time the magnates, led by William of Orange (*see* WILLIAM I., PRINCE OF ORANGE), Egmont and Hoorn had succeeded in two things. They had brought about the withdrawal of the Spanish troops, and they had got rid of the minister Cardinal Granvelle, archbishop of the new see of Mechlin, whom they somewhat mistakenly blamed for most of their grievances. Margaret's decision to rely on co-operation with the magnates did not, however, promote real harmony. The religious troubles increased and led to a conflict between the Government and the chartered privileges of the towns and estates, in the course of which the magnates formulated demands for the summoning of the States-General and for government by councils of aristocratic composition. In the summer of 1565 a new element came forward. More than 300 of the lesser nobles or gentry signed the Compromise by which they undertook to help and protect one another against persecution and to put an end to the inquisition. They were actuated by religious conviction, not, like the magnates, by the tolerance of the man of the world, and there were many among the rich burghers who were prepared to back up this determined party. On April 5, 1566, the signatories presented to Margaret a petition called the Request. On this occasion a nobleman contemptuously referred to them as beggars (*gueux*). They adopted this nickname and wore as badges the curious medals with a beggar's wallet which may still be seen in museums. Margaret made an ambiguous concession to their demands; but the result was only to precipitate the conflict (*see* GUEUX, LES). Extreme Calvinists and religious fanatics of all sects redoubled their activity. Field-preaching spread like wildfire and became something very little different from rebellion. In August many places, especially Antwerp, were alarmed by formidable riots for the smashing of the images, altars, pictures and painted windows of the churches. The Calvinist burghers and gentry were forming armies and preparing to defend the towns where they were most influential. The general confusion, however, caused many of their adherents to fall away and most of the magnates to rally to the Government. William of Orange, by attempting to mediate, lost the confidence of both sides. Margaret raised a considerable force of German mercenary troops, which took possession of Valenciennes and Tournay and destroyed the ill-organized rabble of Calvinists in West Flanders and before Antwerp.

The troubles had reached a stage in which there was to be no more mercy or hesitation on the side of the Government; but the only one of the discontented magnates who grasped this was William of Orange, who departed to his German estates in April 1567. The veteran Spanish general the duke of Alva was already on the march from Italy with a model force of about 10,000 men.

THE REVOLT OF THE NETHERLANDS

Alva's rule, from 1568 to 1573, is the classical example of military despotism. Margaret resigned soon after his arrival: Egmont and Hoorn had already been arrested. An illegal tribunal, the Council of Troubles, nicknamed the Council of Blood, was set up to try those who had taken part in the disturbances. There were wholesale executions. Crowds of refugees fled by sea and land. Orange was outlawed (Jan. 24, 1568) and his estates confiscated; his eldest son and heir, a student at Louvain, was kidnapped and carried away to Spain. The father meanwhile, acting in his capacity as a sovereign prince and making war nominally only on Alva, not on his master Philip, had raised an army in Germany which was led by his brother Louis of Nassau into Friesland. Here it won a fight at Heiligerlee (May 23); but at Jemgum or Jemmingen it was completely defeated on July 21 by Alva in person. Before setting out from Brussels he had struck a characteristic blow. Egmont and Hoorn and 20 other nobles had been beheaded. In September Orange appeared with another army; but Alva, avoiding battle, starved him back into Germany. He was now undisputed master in the Netherlands and settled down to the military, ecclesiastical, judicial and other measures which were needed to consolidate his success. These measures caused subterranean discontent and was growing opposition.

Campaigns of 1572–73.—In 1572 affairs took a new turn. William had been in the habit of granting to some of his followers commissions to act as privateers. These fierce sea-rovers, the Sea-Beggars (*gueux de mer*) had committed many depredations on commerce and had not abstained from cruelties, especially against priests, but they had had to operate from foreign parts, such as England or East Friesland. Now, on April 1, 1572, they seized the port of Brill, at the mouth of the Maas. Soon after this they took Flushing, which commands the other great waterway, the Scheldt. Henceforth the rebels had a foothold of their own in the Netherlands. In comparison with this great fact it was of minor importance, though few saw it at the time, that an almost simultaneous movement of rebellion in the southern provinces was overpowered. William's brother Louis met with disaster in his seizure of Mons, from which the promised help of the French Huguenots was cut off by the massacre of St. Bartholomew. The co-operating army of William failed as his other armies had failed. Within three months of the capture of Brill Amsterdam was the only town still remaining to the Spaniards in the province of Holland. The States of Holland assembled and put the finances and administration of the rebels on a sound footing. When the south fell away after his and Louis's failure, William took up his residence at Delft. He had been converted to Lutheranism at an earlier stage, but was soon to throw in his lot with the Calvinists of Holland. Alva moved northwards to stamp out the rebellion. At Mechlin there were three days of butchery. The duke's son Don Frederick de Toledo sacked Zutphen and massacred the whole population of Naarden. But a new element was making its appearance in history: the burghers began to show a heroism with which the Spaniards could not cope. Haarlem held out all through the winter. On July 12, 1573, it surrendered: the townsfolk were spared, but the garrison, except the German merce-

naries, were killed to a man. At Alkmaar victory began: the dikes were cut and Don Frederick withdrew his army before the advancing inundations. In October Alva's fleet was defeated on the Zuider Zee and the admiral captured. On land his troops were unpaid and mutinous; he had lost the confidence of the king; on Dec. 18 he left Brussels, having served the master as badly as he had served the subjects.

Requesens.—His successor, Don Luis de Requesens, grand commander of Castile, arrived in Nov. 1573. Both sides were now ready for compromise. The south was suffering from the maritime war, but the north insisted on freedom of religious belief and the negotiations which were begun broke down in July 1574. Meanwhile the war had gone on, with serious reverses for the rebels but on the whole in their favour. In Feb. 1574 the fall of Middleburg ended the hold of the Spaniards on Zeeland; but on March 14 Louis of Nassau was defeated and killed at Mook Heath near Nijmwegen. The siege of Leyden was a turning-point. After enduring every extremity the town was at last relieved on Oct. 3 by ships which crossed the flooded countryside. This triumph was commemorated by the foundation of the university which soon made Leyden one of the famous places of the world. During the summer support had been falling away from the inefficient Requesens: only Hainault, Artois and Namur appeared at a meeting of the States-General. On the other hand the north set about strengthening its organization. Holland and Zeeland made an agreement for union, and entrusted William of Orange, their stadholder, with the command of the naval and military forces and the final appointment to all political and judicial offices and to vacant city magistracies.

The fighting was still not uniformly favourable to the north. In October the Spaniards Mondragon and Ulloa began the reconquest of the islands of Duiveland and Schouwen in Zeeland. But this availed little. On March 5, 1576, Requesens died and the council of state took over the Government. The fighting in Zeeland had used up all the money, so in July the troops there mutinied and marched into Brabant where they established themselves at Alost. Popular opinion turned against the council of state. The States of Brabant had troops in their service, and on Sept. 5 these arrested the members of the council in the name of the States, though not by their order.

The Pacification of Ghent and Its Failure.—William of Orange saw the chances of the moment and, with a picked body of troops, advanced into Flanders, occupied Ghent and entered into negotiations with the States-General. His overtures were favourably received, the council at Brussels was dissolved, and a conference was opened at Ghent on Oct. 19. While it was at work the news came of the Spanish Fury at Antwerp. On Oct. 3 the mutinous troops had marched thither from Alost, had overpowered the garrison and had sacked the greatest city of the Netherlands with barbarous ferocity. This news silenced all differences among the Netherlanders and on Nov. 8 there was signed the Pacification of Ghent.

This marked in a sense the zenith of the revolt; but the nobles of Brabant and Hainault were not under William's leadership, and the religious articles left the way open for a later split. The first problem was that of Don John of Austria. This famous man, bastard brother of the king and victor of Lepanto, had been appointed governor and had arrived at Luxembourg on the day of the Spanish Fury. Orange opposed his recognition as governor and persuaded the States-General to recognize him only on condition that he should accept the Pacification. Negotiations led to a deadlock. At this crisis the hands of Orange and the patriotic party were greatly strengthened by a new compact, the Union of Brussels (Jan. 1577), which was signed by all the provinces represented in the States-General. This engaged its signatories to unite in ejecting the foreign soldiery, in carrying out the Pacification, in recognizing Philip's sovereignty, and at the same time in maintaining the charters and constitutions which the king on his accession had sworn to observe. It added the north-east to the area which had accepted the Pacification; many signatories were Catholics. Luxembourg was left outside it. Faced by this opposition, Don John had to yield, and on Feb. 12 he signed the Perpetual Edict (ratified soon after by Philip) in which he accepted the programme of William of Orange, except that catholicism was to be maintained.

On May 1 Don John made his state entry into Brussels, but only to find that he had no real authority. He wrote to Philip: "The prince of Orange has bewitched the minds of all men. They keep him informed of everything and take no resolution without consulting him." In July with some Walloon troops Don John suddenly left Brussels for Namur. This was practically a renewal of civil war. It alienated the States-General and the southern aristocrats, and on Sept. 23 William of Orange triumphantly returned to Brussels after an absence of ten years.

The unanimity on which this triumph was based did not last long: in October the States-General repudiated him as their leader. The prospect of success ended unity. The growth of Calvinism alarmed the Catholics. At the secret invitation of the Catholic nobles of the south headed by the duke of Aerschot there arrived in Brussels the archduke Matthias, brother of the emperor, and afterwards emperor himself. He was 20 years of age. On Jan. 18, 1578, he assumed the title of governor, which he nominally held till 1581.

Alienation of the South.—Philip, now thoroughly alarmed, sent Alexander Farnese with a veteran force of 20,000. With these Don John at Gembloux near Namur routed the rebel army. He became master of Louvain, Judoigne, Tirlemont, Aerschot, Bouvignes, Sichem, Nivelles, Roeux, Soignies, Binch, Beaumont, Walcourt, Maubeuge and Chimay. The malcontent Catholics now turned from Matthias to the duke of Anjou, formerly Alençon, who had invaded the Netherlands with a French force and seized Mons. At the same time John Casimir, brother of the elector palatine, at the invitation of the Calvinist party and with the secret financial aid of Queen Elizabeth, entered the country at the head of a body of German mercenaries from the east. In Ghent under his protection there were Calvinist excesses which alienated the southern Catholic nobles, the States-General and the town patriciates. Orange prevailed on Anjou to accept the title of "Defender of the liberties of the Netherlands," and Anjou promised, if the provinces would raise an army of 10,000 foot and 2,000 horse, to come to their aid with a like force. John Casimir and Anjou both left the Netherlands in the winter of 1578–79, the latter to return at a later stage of events. Meanwhile Don John had aroused the distrust of Philip by his dreams of invading England and marrying Mary Queen of Scots, and Philip cut off supplies. Don John died on Oct. 1, 1578.

On Jan. 5, 1579, the deputies of Hainault, Artois, Douai, formed themselves into a league for the defence of the Catholic religion, and, subject to his observance of the political stipulations of the Union of Brussels, professed loyal allegiance to the king. This league of Arras called forth the answering protestant Union of Utrecht, the work of John of Nassau. Both were nominally under the Pacification of Ghent, but the signatories were cleanly divided by religion. At this point it is convenient to end the narrative of the history of the Netherlands, treating henceforth as separate political units the obedient provinces of the south and the seven northern provinces which had already as good as won their independence and were to maintain it as a republic. (*See* BELGIUM: *History*, and HOLLAND: *History*.)

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same author's *Wilhelm von Oranien und der niederländische Aufstand*, 3 vols. (The Hague, 1906–24) is a minute study of the period down to 1569. (G. N. C.)

NETHERLANDS OVERSEA TRUST: *see* RATIONING (BLOCKADE).

NETHERSOLE, OLGA (1863–), English actress, of Spanish descent, was born in London, and made her stage début at Brighton in 1887. In 1888 she played with John Hare at the Garrick, London, and, after other engagements, in 1894 took the Court Theatre on her own account. She was manager at His Majesty's (1898), at the Adelphi (1902) and at the Shaftesbury (1904). She took the Théâtre Bernhardt, Paris, in 1907, appearing herself in leading rôles. She toured in Australia and America, playing leading parts in modern plays, notably Clyde Fitch's *Sapho* (produced in London in 1902). Miss Nethersole worked during the World War on various Red Cross organizations.

NETHINIM, the name given to the members of a class of assistants in the service of the temple of Jerusalem. In the Old Testament they are specially mentioned, and thus designated, only by the compiler of Chronicles-Ezra-Nehemiah (3rd century B.C.). The name means "given" or "dedicated," *i.e.*, to the temple; *cf.* Num. iii. 9, viii. 19, where the same term is applied to the Levites. In 1 Esdras and Josephus they are called ἱερόδουλοι, as are also the Levites in 1 Esdras i. 3. In the census lists compiled by the Chronicler, where a complete classification is desired, we find the order: Levites, singers, porters, Nethinim, *e.g.*, in Ezra ii. Of these classes, the first three are of equal rank; the singers and porters are Levites (1 Chr. ix. 2, Neh. xi. 3, 15–18, xiii. 22, etc.), though sometimes expressly distinguished from them, when the special duties of the several orders are thought of (2 Chr. xxxv. 15, Ezra ii. 70, etc.). In the time of the Chronicler the Nethinim were free men and members of the Israelite community. They were registered by families and were exempt from taxation. Like the priests and Levites they served in rotation, being assigned to a certain portion of Jerusalem (Ophel), and also to neighbouring Levitical cities or villages. In Neh. x. 29 *seq.* they join in the solemn covenant, promising among other things not to intermarry with "the peoples of the land."

It is generally supposed, and not without good reason, that the Nethinim had their origin in a class of foreign menials (slaves) employed in the temple. In the time of the Chronicler it was customary to describe the Nethinim as "those given by David for the Levitical service" (Ezra viii. 20), and similar to this is the designation of one portion of them as the "children of Solomon's servants" (Ezra ii. 55, Neh. vii. 57, xi. 3). (C. C. T.)

NETLEY, a village in Hampshire, England, 3 m. S.E. of Southampton, and on a branch of the S.Rly. Pop. of ecclesiastical district (1921) 1,396. A Cistercian abbey was founded in 1237 by Henry III.; its ruins include a great part of the cruciform church, abbot's house, chapter house and domestic buildings. The style is Early English and Decorated. The gatehouse was transformed into a fort in the time of Henry VIII. Netley Hospital for wounded soldiers, built after the Crimean War is one of the principal military hospitals in Great Britain.

NETSCHER, GASPAR (1639–1684), German portrait and genre painter, was born at Heidelberg in 1639. As a boy he was adopted by a physician named Tullekens, who placed him under an artist named de Koster, and afterwards under Ter Borch. He then went to Italy, but finally settled at Bordeaux, where he made a living by painting the small cabinet pictures which are now so highly valued on account of their exquisite finish. After removing to The Hague, he turned his attention to portrait-painting, which proved more lucrative. His sons Constantyn (1668–1722), and Theodorus (1661–1732), were also painters after their father's style, but inferior in merit.

NETTLE, the common name for the plants of the botanical genus *Urtica*, which gives its name to the family Urticaceae. It contains about 30 species found in the temperate parts of both hemispheres. They are herbs covered with stinging hairs, and with very small, greenish, unisexual flowers on the same or on different plants. The stinging hairs consist of an elongated tubular cell the extremity of which is finely pointed. By this point the hair penetrates the skin, breaks off and its contents pass out. The fluid contains formic acid and has a temporary irritant effect. Nettle tops, or the very young shoots of the nettle, may be used as a vegetable like spinach; but from the abundance of crystals (*cystoliths*) they contain they are apt to be gritty. The fibre furnished by the stems of several species is used for cordage or paper-making. Three species of nettle are wild in the British Isles: the common or great nettle (*U. dioica*), which is a hairy perennial with staminate and pistillate flowers in distinct plants; the small nettle (*U. urens*), which is annual and, except for the stinging hairs, glabrous, and has staminate and pistillate flowers in the same panicle; and the Roman nettle (*U. pilulifera*), an annual with the pistillate flowers in rounded heads, which occurs in waste places in the east of England, chiefly near the sea—the most virulent British species.

In North America, where the small nettle has become naturalized across the continent and the great nettle, from Newfoundland to Colorado and southward, there are several native nettles. Among these are the tall nettle (*U. gracilis*), found across the continent northward; the weak nettle (*U. chamaedrioides*), of the south-eastern States; the hoary nettle (*U. holosericea*), found from Idaho and Washington to Lower California, and the California nettle (*U. californica*). Closely allied are the wood nettle (*Laportea canadensis*), of the eastern United States, and the western nettle (*Hesperocnide tenella*), of California.

NETTLERASH, the popular English name for urticaria (*q.v.*), a disorder of the skin resembling the effect produced by the sting of a nettle and attended with great irritation. It occurs either in acute or chronic form. In America the corresponding term is "hives."

NETTLESHIP, HENRY (1839–1893), English classical scholar, was born at Kettering on May 5, 1839. He was educated at Lancing, Durham and Charterhouse schools, and Corpus Christi college, Oxford. He was a master at Harrow and later professor of Latin at Oxford, where he died on July 10, 1893. He specialized in the study of Virgil. After Conington's death in 1869, he saw his edition of Virgil through the press, and revised and corrected subsequent editions. In 1887 he published some of the results of 12 years' labour on a Latin lexicon (never completed) in a volume entitled *Contributions to Latin Lexicography*. The second series of his *Lectures and Essays*, published in 1895, and edited by F. Haverfield, contains a memoir by Mrs. M. Nettleship, with full bibliography.

NETTLESHIP, RICHARD LEWIS (1846–1892), English philosopher, was born on Dec. 17, 1846, and educated at Uppingham and Balliol college, Oxford. He won the Hertford scholarship, the Ireland, the Gaisford Greek verse prize, a Craven scholarship and the Arnold prize, but took only a second class in Litterae Humaniores. He became fellow and tutor of his college and succeeded to the work of T. H. Green, whose writings he edited with a memoir (1880). His philosophy was idealistic and Hegelian. He died on Aug. 25, 1892, from the effects of exposure on Mont Blanc, and was buried at Chamonix.

Besides his edition of Green's works, Nettleship published *The Theory of Education in Plato's Republic* (1880). His *Philosophical Lectures and Remains* were edited by A. C. Bradley (1897, 2nd ed., 1901), the *Lectures on the Republic of Plato* being printed separately in 1898 (2nd ed., 1901).

NETTLE TREE, the name applied to certain trees of the genus *Celtis*, belonging to the elm family (Ulmaceae). The best-known species have usually obliquely ovate, or lanceolate leaves, serrate at the edge, and marked by three prominent nerves. The flowers are inconspicuous, with a 4- or 5-parted perianth, as many stamens, a hairy disk and a 1-celled ovary with a 2-parted style. The fruit is succulent, like a little drupe, a character which serves to separate the genus alike from the nettles and the elms, to both of which it is allied. *C. australis* is a common tree, both wild and planted, throughout the Mediterranean region extending to Afghanistan and the Himalayas; it is also cultivated in Great Britain. It is a rapidly growing tree, from 30 to 40 ft. high, with a remarkably sweet fruit, recalling a small black cherry, and was one of the plants to which the term "lotus" was applied

by Dioscorides and the older authors. The wood, which is compact and hard, is used for a variety of purposes. *C. occidentalis*, a North American species, is the hackberry (*q.v.*).

NEU-BRANDENBURG, a town of Germany, in the republic of Mecklenburg-Strelitz, on the lake called Tollense See, 58 m. W.N.W. of Stettin by rail. Pop. (1925) 13,826. Neu-Brandenburg was founded in 1248, and has belonged to Mecklenburg since 1292. It is partly surrounded with walls, and possesses four old Gothic gates, dating from about 1300. The principal buildings are the Marienkirche, a 13th century Gothic building, the former grand ducal palace, and the palace of Belvedere.

NEUBREISACH: *see* NEUF-BRISACH.

NEUBURG, a town in the republic of Bavaria, situated on the Danube 12 m. W. of Ingolstadt by rail. Pop. (1925) 7,564. Neuburg was originally an episcopal see. In the 10th century it passed to the counts of Scheyern, and through them to Bavaria, being ceded to the Rhenish Palatinate in 1507. From 1557 to 1742 it was the capital of a small principality ruled by a cadet branch of the family of the elector palatine of the Rhine. In 1742 it was united again with the Rhenish Palatinate, with which it passed in 1777 to Bavaria. Its most important building is the old residence of its princes, in 16th century Renaissance style.

NEUCHÂTEL (Ger. *Neuenburg*), one of the cantons of western Switzerland, on the frontier towards France. It is the only Swiss canton that is situated entirely in the Jura, of which it occupies the central portion (its loftiest summit is the Mont Racine, 4,731 ft. in the Tête de Rang range). The canton has a total area of 305 sq.m., of which more than three quarters are reckoned "productive." It consists, for the most part, of the longitudinal ridges and valleys characteristic of the Jura, while its drainage is very unequally divided between the Thièle or Zihl, and the Doubs, which forms part of the north-west boundary of the canton, and receives only the streams flowing from the Le Locle and La Chaux de Fonds valley. Three regions make up the territory. That stretching along the shore of the lake is called *Le Vignoble* (from its vineyards) and extends from about 1,500 ft. to 2,300 ft. above the sea-level. An intermediate region is named *Les Vallées*, for it consists of the two principal valleys of the canton (the Val de Ruz, watered by the Seyon, and the Val de Travers, watered by the Areuse) which lie to a height of about 2,300 ft. to 3,000 ft. above the sea-level. The highest region is known as *Les Montagnes*, and is mainly composed of the long valley in which stand the industrial centres of La Chaux de Fonds (*q.v.*), and Le Locle (*q.v.*) to which must be added those of La Sagne, Les Ponts and Les Verrières, the elevation of these upland valleys varying from 3,000 ft. to 3,445 ft. The canton is well supplied with railways, the direct line from Berne past Kerzers (Chiètres), Neuchâtel, the Val de Travers and Les Verrières to Pontarlier for Paris passing through it, while La Chaux de Fonds is connected by a line past Le Locle with Morteau in France. Other lines join the capital, Neuchâtel, to La Chaux de Fonds, as well as to Yverdon at the south-west extremity of the lake, and to St. Blaise at its north-east end.

In 1920 the population was 131,431 (estimated [1925] 126,560), of whom 111,199 were French-speaking, 16,064 German-speaking and 3,393 Italian-speaking, while 109,949 were Protestants, 18,623 Roman Catholics and 987 Jews. There are three "established and state-endowed" churches, the National Evangelical, the Roman Catholic and the Old Catholic (this sect in La Chaux de Fonds only), while the pastors of the Free Evangelical church and of the Jews (mostly in La Chaux de Fonds) receive special privileges.

Besides the capital, Neuchâtel (*q.v.*), the chief towns are La Chaux de Fonds, Le Locle and Fleurier, the principal village in the Val de Travers.

The most valuable mineral product is asphalt, of which there is a large and rich deposit in the Val de Travers. The wine of the Vignoble region is plentiful. Absinthe is manufactured in the Val de Travers. The most characteristic industry is that of watchmaking, which is chiefly carried on (since the early 18th century) in the highland valleys of La Chaux de Fonds and of Le Locle, as well as at Fleurier in the Val de Travers.

The canton is divided into 6 administrative districts, which comprise 63 communes. In 1927 the legislature or *Grand Conseil* consisted of members elected in the proportion of one to every 1,200 of the population and holds office for three years, while since 1906 the principles of proportional representation obtain in these elections. The executive or *Conseil d'État* is elected by the people by secret ballot to hold office for three years. Since 1882 there have been 5 members. The members of the federal *Conseil des États* are named by the *Grand Conseil* and hold office for one year.

History.—We first hear of the *novum castellum* (Neuchâtel) in the will (1011) of Rudolf III., the last king of Burgundy, on whose death (1032) that kingdom reverted to the empire. About 1034 the emperor Conrad II. gave this castle to the lord of several neighbouring fiefs, his successors establishing themselves permanently there in the 12th century and taking the title of "count." In 1288 the reigning count resigned his domains to the emperor Rudolf, who gave them to the lord of Châlon-sur-Saône, by whom they were restored to the count of Neuchâtel on his doing homage for them. This act decided the future history of Neuchâtel, for in 1393 the house of Châlon succeeded to the principality of Orange by virtue of a marriage contracted in 1388. The counts gradually increased their dominions, so that by 1373 they held practically all of the present canton, with the exception of the lordship of Valangin which was held by a cadet line of the house till bought in 1592. In 1532 the title of "prince" was taken by the reigning count, while by the treaty of Westphalia (1648) the principality became sovereign and independent of the empire. In 1707 the Longueville house of Neuchâtel also became extinct, and a great struggle arose as to the succession. Finally the parliament (states) of Neuchâtel decided in favour of Frederic I., the first king of Prussia. The nominal rule of the Prussian king (for the country enjoyed practical independence) lasted till 1857, with a brief interval from 1806 to 1814, when the principality was held by Marshal Berthier, by virtue of a grant from Napoleon. In 1814 its admission into the Swiss confederation was proposed and was effected in 1815, the new canton being the only non-republican member, just as the hereditary rulers of Neuchâtel were the last to maintain their position in Switzerland. This anomaly led in 1848 to the establishment (attempted in 1831) of a republican form of government, brought about by a peaceful revolution led by A. M. Piaget. A royalist attempt to regain power in 1856 was defeated, and finally, after long negotiations, the king of Prussia renounced his claims to sovereignty, though retaining the right to bear the title of "prince of Neuchâtel." Thus in 1857 Neuchâtel became a full republican member of the Swiss confederation.

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NEUCHÂTEL, capital of the above Swiss canton, situated near the north-east corner of the lake of Neuchâtel. In 1920 it had 23,152 inhabitants (in 1850 only 7,727 and in 1870, 12,683), 17,620 being French-speaking and 4,506 German-speaking; there were 19,204 Protestants, 3,515 Roman Catholics, and 95 Jews. It is the meeting-point of several important railway lines. The older portion of the town is built on the steep slope of the Chaumont (3,855 ft.), and originally the waters of the lake bathed the foot of the slope. But the gradual growth of alluvial deposits, and more recently the artificial embankment of the shore of the lake, have added much dry ground, and on this site the finest modern buildings have been erected. The 16th century castle and the 13th century collegiate church of Notre Dame (now Protestant) stand close together, and were founded in the 12th century when the counts took up their permanent residence in the town, to which they granted a charter of liberties in 1214. Among the buildings on the quays are the Musée des Beaux Arts (modern Swiss paintings and various historical collections, including that

of Desor relating to the Lake Dwellings), the Gymnase (in which are also the museum of natural history, with the fine collections of Agassiz, and the town library), the university and the École de Commerce. The town owes much to the gifts of citizens.

NEUCHÂTEL, LAKE OF. The lakes of Neuchâtel, Bienne and Morat, connected by canals, are survivors of a former great lake of the lower Aar valley. It is the largest lake wholly in Switzerland. Its total area is 92½ sq.m. (36½ sq.m. are in the Canton of Neuchâtel over 33 sq.m. in Vaud, 20¾ sq.m. in Fribourg and in Berne 2 sq.m.). It is about 23½ m. long, from 3¾ to 5 m. wide, its greatest depth is 502 ft., while its surface is 1,427 ft. above sea level. The Thièle or Zihl river enters at its south-western end and issues from it at its north-eastern end, but it also receives the Areuse (N.W.), Seyon (N.W.) and the Broye (N.E.). On the south-eastern shore the picturesque and historic little town of Estavayer is the chief place. At the south-western extremity of the lake is Yverdon (the *Eburodunum* of the Romans and the residence of Pestalozzi, 1806–1825). Far more populated is the north-western shore, where from south-west to north-east, we find Grandson, Cortaillod, Serrières and Neuchâtel itself. On the north shore is La Tène.

NEUENDORF: *see* NOWAWES.

NEUF-BRISACH or **NEUBREISACH,** a town of France in the department of Haut-Rhin on the Rhine-Rhone canal, 12 m. E. from Colmar by the railway to Freiburg. Pop. (1926) 1,775. Neuf-Brisach is a garrisoned fortress town founded by Louis XIV. in 1699 and fortified by Vauban. It was taken by the Germans on Nov. 10, 1870, and became French once more in 1918.

NEUFCHÂTEAU, a town of eastern France, in the department of Vosges at the confluence of the Meuse and the Mouzon, 49 m. W.N.W. of Épinal by rail. Pop. (1926) 3,845. The town, which is said to occupy the site of the Roman *Neomagus,* belonged in the middle ages to the dukes of Lorraine, ruins of whose château are still to be seen. In 1641 it passed to France. The churches are those of St. Christopher (13th and 15th centuries) and St. Nicholas, the latter combining the Romanesque and Gothic styles and built above a Romanesque crypt.

NEUHOF, THEODORE STEPHEN, BARON VON (*c.* 1690–1756), German adventurer and for a short time nominal king of Corsica, was a son of a Westphalian nobleman and was born at Cologne. Educated at the court of France, he served first in the French army and then in that of Sweden. Baron de Goertz, minister to Charles XII., realizing Neuhof's capacity for intrigue, sent him to England and Spain to negotiate with Cardinal Alberoni. He returned to Sweden and then went to Spain, where he was made colonel and married one of the queen's ladies-in-waiting. Deserting his wife soon afterwards he repaired to France and became mixed up in Law's financial affairs; then he wandered about Portugal, Holland and Italy, and at Genoa he made the acquaintance of some Corsican prisoners and exiles, whom he persuaded that he could free their country from Genoese tyranny if they made him king of the island. With their help and that of the bey of Tunis he landed in Corsica in March 1736, where the islanders, believing that he had the support of several of the Powers, proclaimed him king. He assumed the style of Theodore I., issued edicts, instituted an order of knighthood, and waged war on the Genoese, at first with some success. But he was eventually defeated, and civil broils soon broke out in the island; the Genoese having put a price on his head and published an account of his antecedents, he left Corsica in Nov. 1736, ostensibly for foreign assistance. He returned to the island in 1738, 1739 and 1743, but the combined Genoese and French forces drove him out. Arrested for debt in London he regained his freedom by mortgaging his "kingdom" of Corsica, and subsisted on the charity of Horace Walpole and other friends until his death in London on Dec. 11, 1756.

See *Mémoires pour servir à l'histoire de la Corse,* by his son Frederick, also an English translation, both published in London in 1768. In 1795 he published a new edition on *Description of Corsica with an account of its union to the crown of Great Britain. See* also Fitzgerald, *King Theodore of Corsica* (1890); and Le Glay, *Théodore de Corse* (1907).

NEUILLY, TREATY OF. The Bulgarian treaty was signed at Neuilly on Nov. 27 1919, and came into force on Aug. 9 1920. In the main it is the same as the Austrian treaty. But there were important differences in the military and naval clauses, and also in reference to reparation and finance.

The only serious territorial changes were to the west and south. The Serb-Croat-Slovene kingdom obtained several strategic ratifications. The two most important are that the Strumitsa salient in the extreme south-west has been flattened out, the western half being ceded to the Serbs; also, and more important, in the Nish-Pirot area the town of Tsaribrod has been taken from Bulgaria and a line drawn whereby an advance on Nish would be rendered more difficult. The frontier, however, confers no offensive advantage on the Serbs. A loss more serious in another sense is that to Greece of the district of Western Thrace, lying between Xanthi and the Maritsa river. This was ceded to Greece on her obtaining Eastern Thrace and Adrianople. Bulgaria, for ethnic reasons, received a slight extension of territory west of Adrianople. The expulsion of Greeks from Adrianople and East Thrace by the Turks did not, however, cause the Allies to change their minds about Western Thrace, which remains annexed to Greece and is denied to Bulgaria.

Bulgaria had always asserted claims to that part of Macedonia now in Serbian hands, and also to Eastern and Western Thrace. In the former area her ethnic pretensions are better founded than in the latter. But Serbian Macedonia is in the hands of a formidably armed and militarily strong nation. Greek Macedonia and Thrace are now populated by hundreds of thousands of Greek refugees from Asia, and contain over 80% of a purely Greek population. In population Bulgaria lost some 300,000 persons, of whom some are not Bulgars.

Part IV. The military, naval and air clauses have some special points. Bulgaria is allowed 20,000 regulars, 10,000 gendarmes and 3,000 frontier guards, or 33,000 in all. This number is insufficient to maintain order in a turbulent Balkan State, and the subsequent serious disturbances in Bulgaria are due directly to this fact. It is increased by the difficulty of applying the voluntary long-service system of 12 consecutive years to a nation of peasants. In an agricultural country it is practically impossible to get men to leave their farms for 12 years, and the army is always likely to be dangerously below strength, and the less regular formations dangerously above it. The naval clauses do not differ from those of the German or Austrian treaties. All Bulgaria's navy has now been destroyed, and she was left with four torpedo-boats, of which three were damaged, and six motor-boats, of which four were damaged.

Part V. (*Prisoners of War and Graves*) and *Part VI.* (*Penalties*) are the same as in the Austrian treaty (*see* ST. GERMAIN, TREATY OF).

Part VII. (*Reparation.*) This contains the most novel and interesting feature of the treaty, and is, in fact, the only serious attempt to get reparation on to a business basis. It contained three features of great interest.

(*a*) Contrary to the practice in the German, Austrian and Hungarian treaties, there was no attempt made to seize or distribute the Bulgarian commercial fleet on the "ton-for-ton" or "class-for-class" principle.

(*b*) It fixed the amount to be paid at the lump sum of £90,000,000.

(*c*) It created a Reparation Commission consisting of French, British and Italian representatives with power to reduce this amount by a simple majority vote (not by unanimity as is the systematic rule), on the suggestion of the inter-allied Commission.

The general scope and powers of the Reparation Commission are drawn in such a manner as to control the finances of the country sufficiently to obtain reparation, without offensive interference. In the end, the Reparation Commission, after examining the question on the spot, has practically remitted three-quarters of the total of £90,000,000. The annual sum now required to meet the charges on the 550,000,000 gold francs of the debt is well within the capacity of the new Bulgarian State, and is being punctually paid. None of the remaining clauses of the Bulgarian treaty have any special features of interest or importance.

(*See* BULGARIA; PARIS, CONFERENCE OF; REPARATION, etc.).

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NEUILLY-SUR-SEINE, a suburb of Paris, 8 kilometres north-west from Notre Dame, in the department of Seine. It is situated between the fortifications and the Seine. Pop. (1926) 50,528. A castle at Neuilly, built by the count of Argenson in the 18th century, ultimately became the property and favourite residence of the duke of Orleans (Louis Philippe), the

birthplace of nearly all his children, and the scene of the offer of the crown in 1830. The buildings were pillaged and burned by the mob in 1848. The park, which extended from the fortifications to the river, as well as the neighbouring park of Villiers (also belonging to the princes of Orleans), was broken up into building lots, and is occupied by many small middle-class houses and a few fine villas. The fine bridge, designed in the 18th century by Perronet, is noteworthy as the first level bridge constructed in France. The Galignani Institution, founded by the brothers Galignani for aged booksellers, printers and others, has accommodation for 100 residents. The manufactures include perfumery, chocolate, colours, varnish, automobiles, carpets; Neuilly is an engineering centre.

NEUMANN, FRANZ ERNST (1798–1895), German mineralogist, physicist and mathematician, was born at Joachimstal on Sept. 11, 1798. Neumann's earlier papers on crystallography led to his appointment as Privatdozent at Königsberg, where in 1828 he became extraordinary, and in 1829 ordinary professor of mineralogy and physics. In 1831, from a study of the specific heats of compounds, he formulated "Neumann's law" (that "the molecular heat of a compound is equal to the sum of the atomic heats of its constituents"). Devoting himself next to optics, he produced memoirs which entitle him to a high place among the early searchers after a dynamical theory of light. In 1832, by the aid of a particular hypothesis as to the constitution of the ether, he reached results agreeing with those obtained by A. L. Cauchy, and succeeded in deducing laws of double refraction resembling those of A. J. Fresnel. He made contributions to the mathematical theory of electrodynamics, and in papers published in 1845 and 1847 established mathematically the laws of the induction of electric currents. His last publication was on spherical harmonics (*Beiträge zur Theorie der Kugelfunctionen*, 1878). He died at Königsberg on May 23, 1895.

NEUMANN (originally BAMBERGER), **KARL FRIEDRICH** (1793–1870), German orientalist, was born at Reichsmannsdorf, near Bamberg, on Dec. 28, 1793. He studied philosophy and philology at Heidelberg, Munich and Göttingen. From 1822 to 1825 he was a teacher at Spires; then he learned Armenian in Venice and visited Paris and London. In 1829 he went to China, where he amassed a library of about 12,000 valuable books and manuscripts, which he presented to the royal library at Munich. In 1831 Neumann became professor of Armenian and Chinese at Munich. In 1852 he was removed from his chair on account of his revolutionary views. He died in Berlin on March 17, 1870.

Neumann wrote *Geschichte des englischen Reichs in Asien* (Leipzig, 1851); *Geschichte der Vereinigten Staaten von Amerika* (Berlin, 1863–1866); *Versuch einer Geschichte der armenischen Literatur* (Leipzig, 1836); *Die Völker des südlichen Russland* (1846, and again 1855); and several translations from the Chinese. The journal of the Royal Asiatic Society (London, 1871) contains a full list of his works.

NEUMES, the signs employed in Western musical notation before the introduction of the staff. (Gr. νεῦμα, a sign). They were, in the first instance, merely rough expression marks placed over the words, to guide the singers of the plainsong melodies, the melodies themselves being learned by ear, and hence they gave no indication as to the pitch or time-relations of the notes. Gradually, however, they became more and more elaborate and precise, then their positions on the paper were varied to indicate pitch, though at first without the employment of lines; subsequently lines were introduced, and so, step by step, the whole present-day system was evolved. (*See* MUSICAL NOTATION.)

NEUMÜNSTER, a town in the Prussian province of Schleswig-Holstein, lies on the small river Schwale, 40 m. N. of Altona-Hamburg by rail, and at the junction of lines to Kiel, Vamdrup (Denmark) and Tönning. Pop. (1925) 39,851. The name, which was originally Wipendorp, is derived from an Augustine monastery, founded in 1130, and is mentioned as *novum monasterium* in a document of 1136. Its industrial importance began in the 17th century, when the cloth-workers of Segeberg, a town to the south-east, migrated to it. It became a town in 1870. It is, after Altona, the most important industrial town in the province.

NEUNKIRCHEN or OBER-NEUNKIRCHEN, a town in the Prussian Rhine province, on the Blies, 12 m. N.E. of Saarbrücken by rail. Pop. (1925) 35,274, consisting almost equally of Protestants and Roman Catholics. The town is first mentioned in 1280, and became important industrially during the 18th century. The principal industrial establishment is an iron-foundry. Around the town are important coal mines. The castle built in 1570 was destroyed in 1797.

NEUQUÉN, an inland territory of Argentina on the Chilean frontier, between the Colorado and Limay rivers, with the province of Mendoza on the north and the territory of Río Negro on the east and south. Area, 40,530 sq.m. Pop. (1914) 28,866. The greater part of the territory is mountainous, with fertile, well-watered valleys and valuable forests. The eastern part, however, contains large plains, showing only stunted vegetation, and having numerous saline deposits. Long droughts prevail in this region and there is no inducement for settlement, the nomadic Indians visiting it only on their hunting expeditions. Guanacos and Argentine hares are found in abundance in Neuquén, and to a lesser degree the South American ostrich. The Neuquén, which unites with the Limay near the 68th meridian to form the Río Negro, is the principal river of the territory. The largest of a group of beautiful lakes in the higher Andean valleys is the celebrated Nahuel-Huapi (Lion Grass), which is nearly 50 m. long from east to west and about 20 m. from north to south at its widest part, and which lies partly in the south-west angle of the territory, partly in Río Negro, and partly in the Republic of Chile. It is the source of the Río Limay and receives the overflow from two smaller neighbouring lakes. The temperature of the Andean region is cold even in summer, but on the lower plains it is hot in summer. The territory is reached by a light-draught river steamer which ascends the Río Negro to Ft. Roca at the confluence of the Limay and Neuquén, and by a branch of the Great Southern railway from Bahía Blanca to the same point. The population is concentrated in a few small towns on the rivers and in some colonies, in the fertile districts of the Andes. The capital is Neuquén, a small town on the river of the same name, in the mountainous district in the northern part of the territory.

NEURALGIA, a term generally used to indicate pain affecting a particular nerve or its branches from any cause. The existence of neuralgia usually betokens a depressed or enfeebled state of health. It is often found to affect the hereditarily rheumatic or gouty. In weakened conditions from improper or insufficient food, in anaemia from any cause, and in syphilis or malaria, neuralgia is a frequent concomitant. The pain is often localized, but may come to extend beyond the area of its first occurrence. It is usually paroxysmal, not unfrequently periodic; occurring at a certain time of the day or night, varies in intensity, and may be agonizing or less severe and tingling. Perverted nerve function may co-exist with or following neuralgia. Thus there may be hyperaesthesia, anaesthesia, paralysis or alterations of nutrition, such as wasting of muscles, whitening of the hair, etc.

The commonest forms of neuralgia are facial neuralgia or tic douloureux, intercostal neuralgia and sciatica.

Facial Neuralgia (or *tic douloureux*) affects the great nerve of sensation of the face (fifth nerve), and may occur in one or more of its three divisions. It is usually confined to one side. When the ophthalmic division of the nerve is involved the pain is mostly felt in the forehead and side of the head. It is often intensely sharp, cutting or burning, either constant or with exacerbations, and often periodic. The skin over the affected part is often red and swollen, and, even after the attack has abated, feels stiff and tender to the touch. In this, as in all forms of neuralgia, at certain localities the pain is more intense, these "painful points" usually being where the branches of the nerves emerge from bony canals or pierce the fascia to ramify in the skin. Hence, in this form, the greater severity of the pain above the eyebrow and along the side of the nose. There is also pain in the eyelid, redness of the eye, and flow of tears. When the maxillary division of the nerve is affected the pain is chiefly in the cheek and upper jaw, the painful points being immediately below the lower eyelid, over the cheek bone and about the upper lip. When the mandibular division of the nerve suffers the pain affects the lower jaw, and the chief painful points are in front of the ear and about the chin.

Intercostal neuralgia is pain affecting the nerves which emerge from the spinal cord and run along the spaces between the ribs to the front of the body. It affects the left side more than the right, is much more common in women than in men, and occurs generally in enfeebled states of health. It might be mistaken for pleurisy or some inflammatory affection of the lungs; but the absence of chest symptoms, its occurrence independently of respiration and other considerations establish the distinction. The specially painful points are chiefly at the commencement of the nerve as it issues from the spinal canal, and at the extremities towards the front of the body, where it breaks up into filaments which ramify in the skin. This form of neuralgia occasionally precedes or follows an attack of shingles (*Herpes zoster*).

Sciatica is another common form of neuralgia. It affects the great sciatic nerve which emerges from the pelvis and runs down the leg to the foot. It is often traceable to cold or damp, to overuse of the limbs in walking, etc. Any source of pressure upon the nerve within the pelvis, *e.g.*, pregnancy, a tumour or even constipation, may excite an attack of sciatica. It is often connected with a rheumatic or gouty constitution. In general the nerve of one side only is affected. The pain which is felt at first a little behind the hip-joint steadily increases in severity and extends along the course of the nerve and its branches, perhaps, down to the toes. The specially painful points are about the knee and ankle joints; besides which a feeling of numbness is experienced throughout the whole limb. In severe cases all movement of the limb aggravates the pain, and the patient is obliged to remain in bed. In prolonged attacks the limb may waste and be drawn up and fixed in one position. Attacks of sciatica are often attended with great suffering, and are apt to be very intractable to treatment.

Treatment.—In the treatment of all forms of neuralgia it is of first importance to determine if possible any underlying cause. When the attack is periodic the administration of a large dose of quinine two or three hours previous to the usual time of the seizure will often mitigate, and may even prevent the paroxysm. Many topical applications are of great efficacy. Liniments containing opium, belladonna or aconite rubbed into the affected part will often soothe the most severe local pain. And antipyrin, phenacetin, aspirin and similar analgesics are commonly taken. The plan at one time resorted to of dividing or excising a portion of the affected nerve is now seldom employed, but the operation of nerve-stretching in some forms of neuralgia, notably sciatica, is sometimes successful. Such an operation is justifiable only in cases where other less severe measures have failed to give relief. Electricity proves serviceable in many instances. In the severest forms of tic douloureux complete relief has followed extirpation of the Gasserian ganglion. (F. W. Mo.)

NEURASTHENIA, a medical term for weakness of the nervous system. The symptoms may present themselves as follows: (1) general feeling of malaise, combined with a mixed state of excitement and depression; (2) headache, sometimes with the addition of vertigo, deafness and a transitory clouding of consciousness simulating *petit mal* or *migraine;* (3) disturbed and restless, unrefreshing sleep, often troubled with dreams; (4) weakness of memory, especially for recent events; (5) blurring of sight, noises or ringing in the ears; (6) variable disturbances of sensibility, especially scattered analgesia (partial and symmetrical) affecting the backs of the hands especially, and in women the breasts; (7) various troubles of sympathetic origin, notably localized coldness, particularly in the extremities, morbid heats, flushings and sweats; (8) various phenomena of nervous depression associated with functional disturbances of organs.

According to the complexity of symptoms, the neurasthenia is more particularly defined as cerebral, spinal, gastric and sexual. The cerebral form is sometimes termed *psychasthenia,* and is liable to present morbid fears or phobias, *e.g.,* agoraphobia (fright in crowds), monophobia (fright of being alone), claustrophobia (fright of being in a confined place), anthropophobia (fright of society), batophobia (fright of things falling), siderodromophobia (fright of railway travelling). There may also be mental ruminations, in which there is a continuous flow of connected ideas from which there is no breaking away, often most insistent at night and leading to insomnia. Sometimes there is arithmomania (an imperative idea to count). Such cases often exhibit a marked emotionalism and readily manifest joy or sorrow; they may be cynical, pessimistic, introspective and self-centred, only able to talk about themselves or matters of personal interest, yet they frequently possess great intellectual ability, and there is an absence of the insane ideas characteristic of melancholia.

Traumatic neurasthenia is the neurasthenia following shock from injury; it is sometimes termed "railway spine," "railway brain," from the frequency with which it occurs after railway accidents, especially in people of a nervous temperament. The physical injury at the time may be slight, so that the patient is able to resume work, but symptoms develop later which may simulate serious organic disease. As in all forms of neurasthenia, the subjective symptoms may be numerous and varied, whereas the objective signs are but few and slight. Many difficulties, therefore, present themselves in arriving at a sound opinion as to the future in such cases. "Shell-shock" (*q.v.*) is a modern variant of neurasthenia occasioned by war conditions. The treatment of neurasthenia is largely psychical and if carried out systematically is often very successful (*see* PSYCHOTHERAPY). (F. W. Mo.)

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NEURITIS, a term denoting inflammation of nerve fibres. Two varieties are known, the localized and the multiple. The localized form frequently follows exposure to cold and may attack a single nerve. Facial paralysis (Bell's palsy) is commonly seen following a neuritis of the facial nerve. Neuritis may follow blows and wounds, stretching or long-continued pressure, as in a dislocation of the elbow joint, or the nerve may be involved in a neighbouring inflammation. The first symptom of a localized neuritis is boring pain along the course of a nerve and its distribution, the part being sensitive to pressure.

Multiple neuritis or polyneuritis may affect many of the peripheral nerves symmetrically and at the same time. For the pathological changes *see* NEUROPATHOLOGY. The causes may be divided as follows: (1) The toxins of acute infective diseases, such as diphtheria, influenza, typhoid fever, malaria, scarlet fever and septicaemia. (2) Acute or chronic poisoning by lead, arsenic, mercury, copper and phosphorus. (3) General disorders: gout, rheumatism, tubercle, carcinoma. (4) The local action of leprosy and syphilis. (5) Endemic disease: beri-beri (*q.v.*). (6) Alcohol, the most common. Alcoholic neuritis is a result of constant steady drinking, particularly of beer. It begins with numbness of the feet and later of the hands, then painful cramps in the legs appear and there is pain on moving the limbs, and superficial tenderness is occasionally present. In other cases the earliest symptoms are weakness of the legs and extreme fatigue, leading to a characteristic "steppage gait," or marked inco-ordination of movement may occur and the gait become ataxic. Trophic changes soon appear, early and rapid muscular wasting occurs, the skin becomes dry and glossy, the nails brittle and the hair thin. In time contractures take place, the hip and knee-joints become flexed and the foot dropped at the ankle. Should the case progress the patient may become bedridden and powerless, and degenerative mental changes may take place, loss of memory, irritability of temper and emotional instability. Early cases may recover completely under treatment. The galvanic and faradaic currents combined with massage are useful in helping to restore the wasted muscles, and hot-air baths and warm applications are appreciated.

Arsenical neuritis mostly affects the lower extremities, as contrasted with lead, which mainly paralyses the fingers and wrists; recovery is even slower than in alcoholic neuritis, the treatment being on the same lines, with the removal of the cause of the disease. In the neuritis of chronic lead poisoning a fine tremor of the hands is an early symptom and sensory symptoms are usually

absent; the muscles affected are the extensors of the wrists, thumb and fingers (*see* LEAD POISONING). The course of the disease is long, and an attempt should be made to eliminate the lead from the system by purgatives and the administration of potassium iodide.

In diabetic neuritis paraesthesia is slight, and the legs are chiefly affected; weakness and ataxia may be present. Trophic sores on the feet are of frequent occurrence in this variety. The treatment is that of the disease.

Post-diphtheric neuritis occurs in about 10% of all cases of diphtheria. Paralysis of the soft palate is the earliest, and may be the only symptom. The limbs are affected much later, usually about the fifth or sixth week. Atrophy of the muscles is frequently rapid. If the respiratory muscles are unaffected the prognosis is good, but the paralysis of the limbs may last for several months. The treatment is complete rest, good food and the administration of strychnine.

Acute polyneuritis with numbness and motor weakness has been noted after influenza, together with slight muscular wasting and electrical degeneration. Later, there is loss of sensation in the peripheral portion of the limbs, and the motor weakness may affect the muscles of the trunk and face. Such cases tend towards complete recovery.

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NEUROPATHOLOGY, the general name for the science concerned with diseases of the nervous system. For the anatomy and physiology, *see* NERVE, NERVOUS SYSTEM, BRAIN, SPINAL CORD and SYMPATHETIC SYSTEM. The morbid processes affecting the nervous system are usually clinically divided into two great groups of (1) organic disease, (2) functional disturbance, depending on whether or not symptoms observed during life can be associated with recognizable changes after death. Knowledge of the first group is much more advanced than of the latter, for, given certain symptoms during life, we can, as a rule, predict not only the nature of the morbid process, but its particular locality.

The histological elements which make up the nervous system may also be divided into two groups: (1) the nervous units or neurones, (2) the supporting, protecting and nutrient tissues. Nervous diseases may start primarily in the neurones and cause their degeneration; such may bring about "diseases," or "syndromes" within the nervous system. The nervous units, however, may be affected secondarily by disease processes starting in the supporting, protecting and nutrient tissues within the nervous system; such include changes of the blood-vessels, lymphatics, membranes and the special nervous connective tissue, neuroglia (a residue of the embryonal structure from which the nervous system was developed). Tumours and new growths must also be included.

The causes of pathological processes occurring in the nervous units (neurones) may be divided into internal and external; in all cases except direct injury the two groups are generally more or less combined.

Internal Causes.—Of the factors involved in nervous disease *hereditary predisposition* may first be accented. In 70% of 150 cases of idiocy or imbecility in the London county asylums, Dr. Tredgold found a family history of insanity in some form or another. This predisposition may be convergent, paternal, maternal; from grandparents or even more remote ancestors. Moreover, no study of heredity is complete that does not take into consideration collaterals. Especially does this apply to functional neuroses, *e.g.*, epilepsy, migraine, hysteria and neurasthenia; and to psychoses, *e.g.*, delusional insanity, mania and melancholia, manic-depressive, recurrent or periodic insanity and dementia-praecox or adolescent insanity. Strictly speaking, it is the tendency to nervous disease rather than the disease itself that is inherited, and this is frequently spoken of as a neuropathic or psychopathic taint.

EXTERNAL CAUSES

The external causes producing morbid changes in the nervous elements are: I. Abnormal conditions of the blood and lymph. II. Excess or deficiency of normal stimulation, or existence of abnormal stimulation. III. Injury or diseases of supporting, enclosing or vascular tissues.

Abnormal Conditions of the Blood and Lymph.—The essential causes of change in environment of the nervous elements (neurones) are: (1) Deficiency or absence of blood-supply to the nervous system in general (as after severe haemorrhage), or to some particular portion, owing to local vascular disturbance or occlusion. (2) Alterations in the normal condition of the blood, due to (*a*) deficiency or absence of certain essential constituents, (*b*) excess of certain normal constituents, (*c*) the presence of certain abnormal constituents produced within the body, or entering it from without. All these act through the cerebro-spinal fluid, a special lymph secreted by the choroid plexus in the ventricles of the brain by which the neurones are bathed.

(1) *Quantity of Blood Supply.*—Syncope or fainting occurs when the blood supply suddenly fails to reach the higher centres of the brain; such may arise from sudden reflex arrest of the heart's action, or from localized spasms of the cerebral vessels. The effects of embolism and thrombosis are considered later.

(2) *Quality of Blood Supply.*—(*a*) Insufficiency of oxygen, as in anaemia, leads to functional depression, lassitude and mental fatigue. Impoverishment of the blood in women by frequent pregnancies and excessive lactation causes neuralgia, nervous exhaustion and may aid in the development of neurasthenic or hysterical reactions. The tendency of psychoneuroses and psychoses to occur and recur at menstrual and climacteric periods in women, indicates that these factors themselves are of periodic significance. These are connected with the reproduction function, rather than with the blood however. The most striking examples of the effect of absence or "sub-minimal" deficiency of a normal constituent of the blood upon the development and functions of the nervous system are afforded by cretinous idiots, who are born without thyroid glands, and whose brains never develop in consequence; and by those people who suffer from myxoedema (*q.v.*) occasioned by the absence of thyroxin or other products of the internal secretion of the thyroid gland. The proof of this is shown by the disappearance of the nervous phenomena, slowness of thought, slowness of speech, etc., after thyroxin or a preparation of the gland has been continuously administered. This is an excellent example of a reversible process.

(*b*) Excess of certain Normal Constituents in the Blood.—Excess of carbonic acid causes drowsiness, and probably in asphyxia is one of the causes of the convulsions. All the nitrogenous waste products are normal constituents of the blood; but should oxidation be incomplete, from disease of the liver, or should these substances accumulate in the blood, owing to inadequate function of the kidneys, uraemia may supervene, the manifestations of which are headache, drowsiness, unconsciousness or coma, epileptiform convulsions and sometimes symptoms of polyneuritis. Again, in Graves's disease (hyperthyroidism), nervous phenomena, in the form of exophthalmos, fine tremors, palpitation and mental excitement have by some authorities been explained by the excess of thyroid internal secretion, due to the enlargement and increased functional activity of the gland.

(*c*). The presence of abnormal constituents in the blood is a most important cause of disease of the nervous elements. These are: Poisons produced within the body (α) by perverted function of organs or tissues, auto-intoxication; (β) by the action of micro-organisms, protozoa and bacteria, upon the living fluids and tissues of the body; (γ) poisons introduced into the body from without.

(α) Poisons resulting from perverted Function of the Organs.—Nervous symptoms follow auto-intoxication by products of disordered digestion, fatigue products (*e.g.*, sarcolactic acid in prolonged muscular spasm), excess of uric acid, phosphates, oxalates, sugar, bile, hepatic products as in acute yellow atrophy. In pernicious and certain grave anaemias, the degenerative changes in

the spinal cord found in some cases is due, chiefly, to some neuro-toxin, which probably arises from imperfect metabolism or absorption from the alimentary canal. In auto-intoxication, disease of one organ or tissue is apt to establish a vicious circle which is constantly enlarging; therefore nervous symptoms manifesting themselves in the course of a disease add much to the gravity of the complaint.

(β). Poisons produced by infective Micro-organisms.—Some of these have a general devitalizing influence by altering the blood and producing fever. In acute infectious diseases, delirium is a frequent complication; in severe cases, stupor and coma may occur, and in this extreme stage the nerve cells undergo an acute morbid bio-chemical change. These particular poisons may have marked selective toxic action upon particular parts of the nervous system.

Poisons may have a *selective influence* upon some part of the nervous system. The syphilitic organism and its poisons are most important factors in the production of two progressive degenerations of the nervous system—one affecting especially the afferent conducting tracts of the spinal cord, namely, tabes dorsalis (locomotor ataxia), and the other affecting especially the frontal and central convolutions of the cerebral hemispheres, namely, general paresis (general paralysis of the insane). When syphilis attacks the supporting, enclosing and nutrient vascular tissues, a predilection to affect structures about the base of the brain occurs, and paralyses of the third nerve are frequent in this disease. Other examples occur in rabies, tetanus, diphtheria (*q.v.*).

Protozoa and Diseases of the Nervous System.—The relation of protozoa to the existence of widespread diseases affecting men and animals is becoming yearly of greater importance. Certain diseases in which the nervous system is profoundly affected are now explained by the invasion of the tissues of the body by these lowly organisms, for example, African sleeping sickness due to a special protozoan; Syphilis due to *Spirochaeta* or *Treponema pallida;* Malaria due to *Haematozoon malariae.*

The bacterial invasion of tissues is generally characterized by a migration of polymorpho-nuclear leucocytes, but protozoal invasion is characterized by a formative hyperplasia of the fixed cell tissues, endothelial, epithelial and conjunctival, and there is a close similarity in the defensive reaction of the tissues to all forms of protozoal invasion.

When the nervous system is affected a local or general chronic meningo-encephalitis is set up, characterized by a meningeal and perivascular infiltration with lymphocytes and plasma cells, occasioned by a chronic irritative process, presumably caused in the case of sleeping sickness for example by the presence of trypanosomes in the actual cerebro-spinal fluid. The same perivascular and meningeal infiltration with plasma cells and lymphocytes is found in syphilitic diseases of the nervous system.

Pathology of the Cerebro-spinal Fluid.—Pathological changes in the cerebro-spinal fluid are important in the diagnosis of nervous diseases. Normal cerebro-spinal fluid is clear like water; it has a specific gravity of 1·006 and resembles in its composition the blood *minus* its corpuscular and albuminous constituents. Being secreted by the choroid plexus, if any cause, such as tumour or meningitis, should interfere with its escape from the ventricles it gives rise by pressure to *internal hydrocephalus* and cerebral anaemia which may occasion epileptic convulsions and various degrees of drowsy stupor, lethargy, unconsciousness and even coma. Lumbar puncture has proved of some use in treatment, but is invaluable in the diagnosis of various diseases of the central nervous system. The fluid withdrawn should be centrifuged and the deposit examined microscopically if necessary after staining by suitable methods; the existence of cells indicates disease of the central nervous system. In general paresis, cerebro-spinal syphilis and tabes dorsalis even in early stages, the deposit consists almost entirely of lymphocytes. Some evidence of the progress of the disease and the effect of treatment may be obtained by counting the number of cells at different periods. In tuberculous meningitis there are also lymphocytes in abundance; tubercle bacilli cannot readily be found, but if the fluid be injected into a guinea pig, the animal will develop tubercle. In epidemic cerebro-spinal meningitis the cells in the deposit are polymorpho-nuclear leucocytes and in the leucocytes can be seen *Diplococcus intracellularis.* Septic, pneumonic and pyogenic organisms may also invade the central nervous system giving rise to meningitis, and in these cases the deposit will be polymorpho-nuclear leucocytes, and perhaps the specific organisms may be seen in stained preparations; but if not, they can be obtained by cultural methods.

Other formed elements which may be found are large cells, macrophages containing blood pigment; these cells indicate that haemorrhage has occurred. One of the most important uses of lumbar puncture has been the discovery of the cause of African sleeping sickness. The fluid withdrawn and centrifuged is found to contain large numbers of lymphocytes and plasma cells in addition to specimens of the actively moving organism *Trypanosoma gambiense*, a flagellate. In the forms of disease here described as containing cells in the centrifuged deposit, there is also in the fluid an appreciable amount of proteins. If pathological cerebro-spinal fluid be added to an equal quantity of saturated solution of sodium sulphate there will be a distinct turbidity indicating the presence of proteins in appreciable quantity. This appreciable quantity of proteins is especially significant in the case of fluid withdrawn from cases of general paralysis or tabes, for it goes *pari passu* in amount with the Wassermann *sero-diagnostic reaction for syphilis.*

African sleeping sickness is characterized by a progressive *lethargy*, paresis, tremors and the signs and symptoms of neural exhaustion without neural destruction; it comes on slowly and insidiously often years after infection and eventually terminates fatally by intercurrent disease or paralysis of the bulbar centres. Examination of the central nervous system explains the fatal lethargy; the perivascular and meningeal lymphatics are filled with lymphocytes and plasma cells and the neuroglia supporting cells have undergone a rapid proliferation. The effect of this morbid process is to deprive the neural elements of oxygen and nutrition; the neurones in consequence, although not destroyed, are nevertheless unable to function for more than a brief period.

Poisons Introduced into the Body.—The most widespread and potent cause of nervous and mental disease is the abuse of alcohol-containing liquids. At least 20 per cent of the inmates of the asylums of London are admitted with a history of alcoholism. Whether alcoholism is a cause or a result is still debatable. In not more than 10% is alcohol the efficient cause of the mental disease; in many it is only a contributory factor, and in not a few the lapse from moderation to intemperance is one sign of a mental disturbance. To people with unstable nervous systems a relatively small quantity of alcohol may act as a poison. Thus epileptics, imbeciles, criminals, potential lunatics, and the subjects of head injury are liable to become anti-social and dangerous to themselves and others by indulgence in quantities of alcohol which would have no harmful effect upon the mentally stable and sound individual. However, chronic alcoholics form a large proportion of those convicted for crimes of violence, homicide, suicide, and sexual offences. Another common effect of alcohol is *peripheral polyneuritis* (*see* NEURITIS), although frequently changes occur as well in the ganglion cells, from which the axis cylinders of the nerves have their origin. (*See* NERVOUS SYSTEM.) Alcoholic polyneuritic psychosis affecting women in many ways resembles delirium tremens (*see* DELIRIUM); the fact that neuritis occurs much more frequently in women is probably associated with the fact that when the female breaks through the resistance to her conflicts by the use of alcohol her regression is deeper and her indulgence greater. Many other poisons, notably lead and arsenic, the specific fevers before mentioned, syphilis and alterations of the blood due to imperfect metabolism, such as occur in diabetes and gout, may produce, or become important factors in producing, peripheral neuritis. The outbreak of arsenical neuritis from beer containing this poison in Manchester in 1900 (*see* ADULTERATION), is of interest from that fact that the symptoms closely resembled acute alcoholic neuritis. A distinctive feature, however, was the pigmentation of the skin and the severity of the nervous symptoms. A disease, common in the East, termed beri-beri (*q.v.*),

is a form of neuritis. Anaesthetic leprosy is an interstitial inflammation of the nerves due to the *Lepra bacillus*. Among the nervous diseases due to occupation may be cited lead-poisoning (*q.v.*). Lead also produces a chronic inflammation of the cerebral cortex, *Encephalitis saturnina*, causing a complex of symptoms, namely dementia, loss of memory, weakened intellect, paresis and epileptiform seizures, hallucinations of sight and hearing, and mental exaltation or depression. Mirror-makers suffer with characteristic fine tremors, from the slow absorption of mercury into the system. Workmen at indiarubber factories may suffer from severe mental symptoms, owing to the inhalation of the fumes of carbon bisulphide. Serious nervous symptoms have followed carbon monoxide poisoning. Cases which have recovered from the immediate effects have suffered with dementia and symptoms of disseminated sclerosis, the result of multiple haemorrhagic softenings.

Certain other poisons, besides alcohol, act upon the nervous system when continually entering the body as the result of a *habit*, namely, absinthe, ether, cocaine, opium, morphin, hashish and tobacco. Each of these has a selective influence upon certain parts of the nervous system. In illustration thereof may be mentioned impairment of central vision in tobacco amblyopia. Other diseases of like kind are under pellagra (*q.v.*), ergot (*q.v.*), botulism (*see* MEDICAL RESEARCH).

Adequate and Pathological Stimulation.—The nervous system in the form of systems, groups and communities of neurones, each with special functions, yet all woven together in one harmonious whole, develops in a particular way in consequence of the awakening influence of stimuli from without and from accumulated instinct stimuli from within. Consequently nervous structures which are not used at all, or badly used are liable to undergo regressive metamorphosis and atrophy; thus amputation of a limb in early life causes atrophy of the nervous structures which dealt with the sensations and movements of the part. This may be seen in the grey (synapses) and white matter (conducting pathways) of the spinal cord; there may also be found an atrophy of the psycho-motor neurones of the brain functionally related to the sensory and motor terminal areas of the involved limb. The converse is also true; the longer a perverted function exists, the more unlikely it is to disappear and ultimately to bring about irreversible structural changes.

Mental pain in the form of grief, worry, anxiety, fright, shock, violent emotions (pleasurable or painful), disappointed love, and excessive intellectual work, frequently precede and determine various types (*a*) of psychoses, *e.g.*, maniac-depressive, paranoid; (*b*) of neuroses, *e.g.*, compulsion neurosis, hysteria, epilepsy, hystero-epilepsy; (*c*) or gross brain disease, *e.g.*, apoplexy, thrombosis, arteriosclerotic degenerations.

Visceral reflex irritation affords many examples of organ neuroses, the symptoms of which may be set up by irritation of the viscera, *e.g.*, intestinal worms. Teething and indigestible food are often the exciting cause in infants and young children of convulsions and spasms of the glottis (spasmophilic). Some anomalies of the female reproductive organs act as exciting causes in the release of hysterical reactions. Paroxysmal exacerbations of emotional disturbances are liable to occur at the menstrual period or menopause. Here the stimulus proceeds from the reproductive instinct. The irritation of a carious tooth may produce spasmodic tic or trigeminal neuralgia. Wax in the ear may occasion vertigo and tinnitus; and grave errors of refraction in the eyes may be an accessory factor in the causation of attacks of migraine. Irritation of the receptors of the vagus in almost any part of its widespread visceral origin may lead to vomiting. The characteristic pain of angina pectoris, which radiates down the inner side of the left arm, is partly explained by the fact that the cardiac branches of the sympathetic follow the vascular supply of the arm, and the stimulus from the diseased aorta or coronary vessels radiates as pain in the vascular area. The entire explanation is extremely complex[1]. This is one example of a great number of *referred pains* studied so extensively by the English observers, Head and Mackenzie.

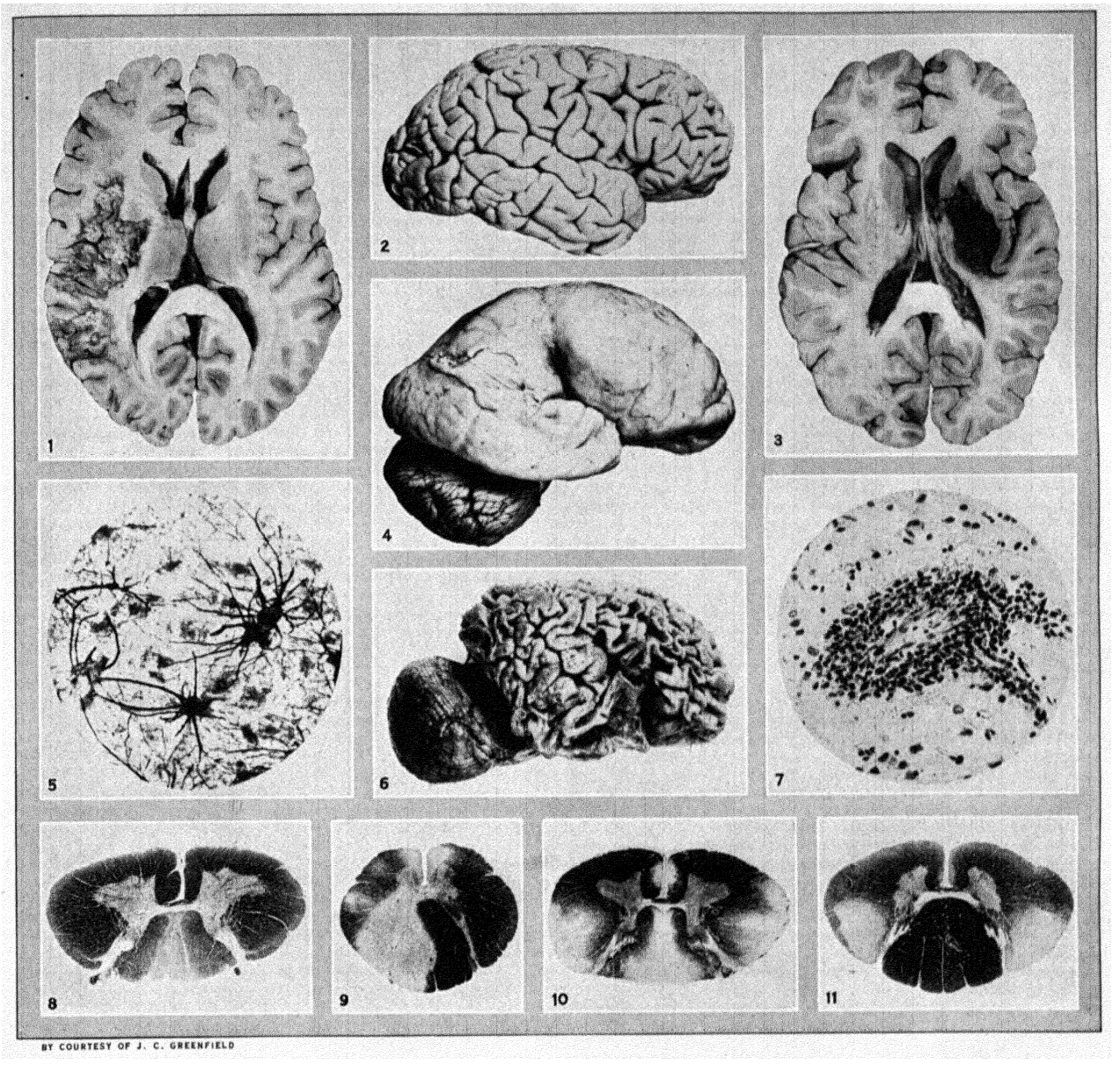
[1]Spiegel, Wien, Kl. Woch. 40, 1927, 853.

Injury or Disease of Enclosing or Supporting Structures may lead to paralytic or irritative lesions of the nervous system, or the two may be combined. Blows or wounds of the head and spine may damage or destroy the nervous structures by shock or direct injury. Concussion of the brain or spinal cord may occur, as a result of injury, without any recognizable damage of the enclosing structures or even the central nervous system. Shock, due to concussion, can thus be explained as resulting from molecular or bio-chemical changes in the nervous structures.

Direct injury may cause local destruction of the nervous tissue; but wounds and diseases of the enclosing and supporting structures, if non-infective, give rise only to such symptoms as accord with the nerve structure irritated or destroyed. Should, however, the wound or diseased structure become infected, the disease spreads and becomes generalized; likewise the symptoms. Of the many causes of infective inflammation of the brain itself, middle-ear disease is the most important. It is very liable, when neglected, to be followed by a septic meningitis, encephalitis and brain abscess, the most frequent seat of which is in the adjacent temporal lobe, but it may involve other parts of the brain as well, for example the cerebellum and frontal lobe. The peripheral nerves may be destroyed or irritated by direct injury, disease or new growth in adjacent tissues, or they may be involved in the callus thrown out round the seat of a fracture.

Diseases of the blood-vessels are among the most frequent causes of gross brain disease. Arteries or veins—more frequently the former—may become blocked or ruptured from various causes. The immediate effect is a disturbance or loss of consciousness, and the individual may be "struck down" (*see* APOPLEXY) and never regain consciousness (*see* COMA). Should consciousness return, more or less permanent loss or disturbance of function becomes obvious. Paralysis of some form, especially hemiplegia, is commonest.

The cerebral arteries, usually the left middle cerebral may be occluded by embolism (*q.v.*). The area of brain supplied by that artery undergoes softening in consequence, resulting in paralysis of the opposite half of the body (hemiplegia) associated with aphasia when the paralysis affects the right side in a right-handed person (*see* Plate, fig. 5). When the embolus is infective, as in ulcerative endocarditis, it not only blocks the vessel but leads to an infective inflammation and softening of its coats, with the formation of an aneurism. The aneurism may suddenly rupture into the substance of the brain and produce apoplexy. Most cases of apoplexy from cerebral haemorrhage in young people are due to this cause. Softening may also arise from coagulation of the blood (thrombosis) in the arteries or veins. Many causes generally combine to produce thrombosis, viz., a weak acting heart and altered conditions of the blood. It is sometimes met with in the cachexia of phthisis and cancer, in typhus and pneumonia, after parturition and in marasmus at all periods of life, but especially in the very young and very old. But thickening, roughening, and a degenerated condition of the cerebral arteries known as atheroma, when associated with a weak acting heart is especially liable to give rise to thrombosis and softening, and is a very common cause of apoplexy, paralysis and mental deterioration in people who have passed middle life. General disease of the arteries of the body, with chronic Bright's disease and high arterial pressure, is frequently associated with the formation of minute aneurisms upon the cerebral arteries, which may rupture and cause apoplexy. This is especially liable to occur in a vessel supplying the basal ganglia, the effused blood tearing through the motor efferent fibres (pyramidal tracts) lying between the optic thalamus and the corpus striatum (*see* Plate, fig. 4). The result is hemiplegia of the opposite side of the body. Disease of the arteries of the central nervous system, occurring in a person under 40, is generally due to syphilis, the virus of which produces an inflammation of the inner coats (*see* ARTERIES, DISEASES OF). The thickening and narrowing of the lumen with loss of elasticity of the arteries of the brain generally may suddenly or gradually set up cerebral anaemia and give rise to semi-comatose and comatose or even apoplectic states. Occlusion by the inflammatory proliferation or by the sudden clotting of blood in the diseased vessel may occur, the immedi-



BY COURTESY OF J. C. GREENFIELD

THE HUMAN BRAIN AND SPINAL CORD IN HEALTH AND DISEASE

1. Horizontal section across a brain showing a softening in the left hemisphere due to a blockage of a cerebral artery. This caused right sided hemiplegia and aphasia
2. Right cerebral hemisphere of an adult man; normal state of convolutions
3. Horizontal section across a brain in which a haemorrhage in the right hemisphere had damaged the motor path to the left arm and leg causing left hemiplegia
4. Right half of the brain of a microcephalic idiot. There is complete absence of any convolutional pattern in the cortex of the brain, which closely resembles that of the sheep. The cerebellum is normally developed
5. Microscopic section of a degenerated area of cerebral cortex overlying a tumour, showing enlarged neuroglia cells
6. Right half of the brain of a microcephalic idiot (walnut type). Here the convolutions have shrunk and a bag of fluid replaces the temporal pole. This is due to a vascular lesion before birth
7. Microscopic section of the cerebral cortex of a case of general paralysis showing inflammatory cells surrounding a small vessel
8–11. Sections across the spinal cord in different common forms of spinal paralysis (the undamaged nerve fibres are stained black): 8. "Locomotor ataxy" in which the ascending or sensory fibres in the posterior columns degenerate. 9. "Disseminated sclerosis," in which patches of degeneration (pale areas) are scattered haphazard, damaging both sensory and motor fibres. 10. "Subacute combined degeneration," usually associated with anaemia, in which both sensory and motor fibres are affected. 11. "Motor neuron disease," in which all the descending or motor fibres degenerate

ate effect of which may be an epileptic or apoplectic fit; the result is softening; and as any or all of the arteries of the brain may be affected successively, simultaneously, or at random, the symptoms may be manifold. They may be general or local, and are often associated with inflammation of the membranes. The disease, under treatment, may abate, and the paralytic or mental phenomena partially or completely disappear, indicating the restoration, or partial restoration, of the circulation in the diseased arteries; sometimes with the lapse of treatment, and sometimes without, new symptoms manifest themselves, showing that the disease has attacked a fresh set of arteries. *Disseminated sclerosis (insular)* is another progressive random, morbid process, the pathology of which is not fully understood, but is probably due to some toxic cause. Islands of nervous tissue undergo a morbid change, commencing in the myelin sheath and ending in an increase of the supporting neuroglia tissue at the expense of the true nervous tissue (*see* Plate, fig. 11).

Tumours and new growths in the central and peripheral nervous systems may be primary or secondary; the former arise in the supporting, enclosing or nutrient tissue elements; the latter are metastatic deposits from tumours originating elsewhere. Tumours may be single or multiple, the special symptoms occasioned depending upon the seat of the tumour and whether it destroys or only irritates the adjacent nervous tissue. Tumours situated within the cranial cavity cause general symptoms, namely, optic neuritis, severe headache and vomiting; these symptoms, which are caused by increased intracranial pressure, are more severe in rapidly growing vascular tumours, even though small, than in large slow-growing tumours. Some tumours are highly vascular and a large thin-walled vessel may suddenly rupture and cause an apoplectic fit. If the growth is situated in a portion of the cortex having some special localizing function, *e.g.*, the motor area, it is likely to give rise to epileptiform convulsions, starting in a limb or definite group of muscles; but the irritation usually spreads to the whole motor area of the same side, and even extends to the opposite hemisphere, by an overflow of the discharge through the corpus callosum. In such case there is loss of consciousness. If, however, the tumour destroys the cerebral cortex of a particular region, it may give rise to a paralytic lesion, *e.g.*, paralysis of the arm.

Diseases of the blood-vessels, or of supporting and enclosing tissues, produce secondary degenerations of the nervous system. The symptoms, like the lesion, are obtrusive; frequently arising suddenly, they may in a short time terminate fatally, or tend towards partial or complete recovery. Various forms of motor and sensory loss and disturbance of function may arise, indicating destruction or disturbance of particular regions of the central nervous system; and degenerations in certain tracts and systems of fibres arise, corresponding in histological character with those observed when a nerve fibre is separated from its cell of origin by section (secondary degeneration of Waller and Türck). This form of degeneration must be distinguished sharply from primary degeneration, which is due to an inherent nutritional defect of the nerve cell and all its processes (the neurone), in which a regressive metamorphosis occurs; it starts in the myelin sheath and the fine terminal twigs of the axis cylinder and dendrons, and proceeds back to the main branches and trunk, eventually destroying the trophic and genetic centre itself, the nerve cell. These *primary* degeneration processes are insidious in origin, progressive in character, and nearly always fatal; they, therefore, are associated with a progressive evolution of symptoms.

To cite some examples: (1) *Locomotor ataxy* (tabes dorsalis), is a primary degeneration affecting the *afferent* sensory system of neurones. (2) *Progressive spinal muscular atrophy* is a disease of the *efferent* motor system of neurones of the brain and spinal cord. Infantile paralysis (*Anterior poliomyelitis*), is an acute inflammation causing destruction chiefly of the spinal motor neurones of the ventral horn. It differs from the progressive spinal muscular atrophies in its sudden onset and non-progressive character; it resembles them in producing paralysis of muscles without sensory disturbance. (3) *General paralysis of the insane* (general paresis) is a degeneration which begins in the association system of neurones of the cerebral cortex, but frequently is associated with degeneration of the afferent or efferent systems.

The psychoneuroses and benign psychoses have not been satisfactorily explained by definite morphological changes in the actual brain substance. We know little or nothing accurately about the morbid histology of certain chronic psychoses, or defect states, except as regards the morphological changes met with in cases of amentia and dementia. The large and illy circumscribed groups, called idiocy and imbecility, are associated with arrest of development of the brain, the naked-eye evidence of which may be afforded by small size and simplicity of convolutions of the brain as a whole or in part (*see* Plate, figs. 1, 2 and 3); and the microscopical evidence by arrest, or imperfect development, of structures connected with the higher functions of the mind, namely, the association neurones in the more superficial layers of the cerebral cortex. Various degenerative processes, either primary or secondary, broadly termed dementics, are associated with progressive decay and atrophy of the superficial layers of the grey matter of the cortex, and naked-eye evidence thereof is afforded by partial or general wasting of the cerebral hemispheres, accompanied with thickening of the pia-arachnoid membrane, atrophy of the convolutions, and with deepening and widening of the intervening sulci. Since the modern studies on this subject of V. Economo, Jakob, the Vogt's Josephy, Fünfgeld, Spatz, Spielmeyer and others have given a definite architectonic and myelotectonic knowledge of the cortex as well as the striatum the older studies of a former generation are obsolete. A newer cortical and subcortical pathology is being written and is to be found in special articles in this edition. At the present time a generalized neuropathology cannot be written.

The cerebro-spinal fluid fills up the space in the cranial cavity caused by the atrophy of the brain; consequently there is a great excess of this fluid. This wasting so characteristic a finding in general paralysis is especially due to atrophy of the cells and fibres of the superficial grey matter of the cortex, sections of which, examined microscopically, after suitable staining, show great poverty, or complete loss, of three sets of delicate myelinated fibres, namely, tangential, super-radial and the inter-radial corresponding to the line of Baillarger. This degeneration of the superficial association fibres of the cerebral cortex affects especially the frontal and central convolutions, and is the earliest and most constant microscopical change in general paresis. It is accompanied usually by meningeal and vascular changes, atrophy of the nerve cells, the proliferation of the neuroglia (fig. 7); especially characteristic is the perivascular infiltration with lymphocytes and plasma cells (*see* Plate, fig. 6). It was, indeed, thought that this condition of the vessels was pathognomonic of general paresis; it certainly is not, for it is found throughout the central nervous system in cases of African sleeping sickness and the arterial types of neurosyphilis. It has sometimes been known to occur in the neighbourhood of cerebral tumours but it is not found in uraemia or lead encephalitis.

Microscopical Changes in Degeneration of the Neurone.—About 1850, Waller demonstrated that a nerve fibre undergoes degeneration to its termination when separated from its cell of origin; hence the term "Wallerian degeneration." Embryological researches by Prof. His showed that the axis-cylinder process (the essential conducting portion of the nerve fibre) is an outgrowth of the nerve cell. The cell, therefore, is the trophic and genetic centre of the nerve fibre. Acute alterations and death of the nerve cells may occur from toxic conditions of the blood; from high fever (107°–110° F); arrest of the blood supply, as in thrombosis and embolism; or actual destruction by injury, haemorrhage or inflammation. These morbid processes produce, as a general rule, bio-chemical as well as morphological changes in the nerve cell and its processes. When a nerve cell dies, the nerve fibre undergoes secondary degeneration and death; that is to say, the whole neurone dies, and regeneration, at any rate in the higher vertebrates, does not take place. Restoration, or partial restoration, of function is due to other structures taking on the function, and the more specialized that function is, the less likely is restoration to take place. If, however, a peripheral

nerve is divided, its component fibres are merely severed from their cells of origin. All that portion of the nerve which is in connection with the nerve cells of origin practically undergoes no change. The peripheral portion undergoes degeneration, but from the central end of the nerve new axis cylinders again grow out and a new nerve is formed. With this regeneration comes restoration of function, which may be hastened by suturing the ends of the cut nerve. A similar regeneration, however, does not occur after section of fibres of the white matter of the central nervous system, and this may be due to the fact that the nerve fibres of the white matter of the cerebro-spinal axis possess no nucleated sheath of Schwann, which plays an important part in regeneration; in the present writer's opinion, the neurilemmal sheath of the old fibre forms a new protoplasmic basis, into which the axis-cylinder from above grows, the passage of stimulus determining its function. The writer, working in conjunction with Prof. Halliburton, has shown that the characteristic microscopical changes in the myelin sheath which occur in the process of degeneration are due to a splitting up of the complex phosphoretted substance "protagon" into glycero-phosphoric acid, choline and oleic acid by a process of hydration. The Marchi reaction, so useful for demonstrating degeneration of the central and peripheral nervous systems, is dependent upon the fact that the myelin sheath, after hardening in a solution of bichromate of potash, does not turn black when acted upon by osmic acid, whereas the simpler non-phosphoretted fatty product of degeneration is stained black. When the Marchi reaction of degeneration is fully developed, it has been ascertained that the nerve yields no phosphorus. The degeneration resulting from section of a nerve is termed *secondary*, to distinguish it from another, *primary*, due to slow and progressive decay of the whole neurone, beginning usually at the terminal twigs and proceeding back towards the cell body with its contained nucleus. These primary degenerations involve systems of neurones, correlated by function rather than by anatomical situation. Examples have been given already. The cause of primary degenerations is probably a defect inherited or acquired in the "vita propria" of the neurones affected. They slowly atrophy and disappear, and their place is filled up by an overgrowth of the supporting neuroglia tissue (*see* Plate, fig. 7). This overgrowth of dense tissue is termed sclerosis and was erroneously considered to be the cause, instead of the effect, of the atrophy of the nervous tissue.

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(F. W. Mo.)

NEUROPTERA, the term used in zoological classification for that order of insects which includes the alder flies, snake flies, ant-lion flies, lace-wings and their allies. They comprise small to rather large soft-bodied insects with usually elongate feelers and two pairs of similar, net-veined, membranous wings: the wings are closed roof-like over the body when at rest and the hind pair are almost always without a plicated posterior lobe. The mouth-parts are for biting, the tarsi are five-jointed and there are no cerci or tail feelers. All Neuroptera undergo complete metamorphosis and the larvae are active and predatory with well developed antennae, sense organs and legs: they are mostly terrestrial but some are aquatic. The pupae have the appendages free and are generally enclosed in silken cocoons.

Rather more than 2,000 species of Neuroptera are known and of those only a little more than 60 occur in the British Isles while about 200 species are found in the United States.

Neuroptera are all insects of weak flight, they are rarely abundant in individuals and feed mostly upon soft-bodied insects or liquid matter such as honey-dew. Most of the species have beautiful net-veined wings which often exhibit a complex reticulation owing to the presence of numerous accessory veins. There are numerous veinlets arising from the costal vein and vein Rs is generally pectinately branched. In their larval stages they are exclusively predaceous. The order is divided into two sub-orders, viz., the Megaloptera and the Planipennia as given below.

SUB-ORDER I. MEGALOPTERA

Veins with little or no tendency to fork at the margins of the wings: vein Rs with but few extra branches. Larvae with biting mouth-parts: pupae not enclosed in a true cocoon.

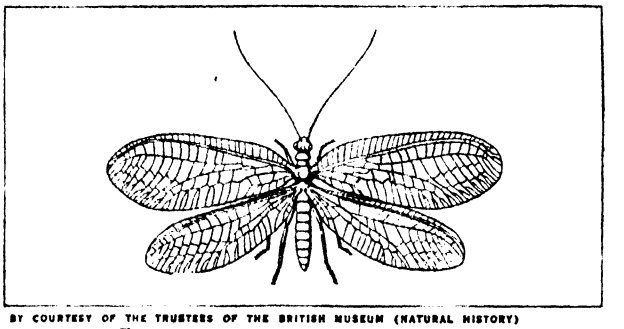
This group includes a small number of archaic insects separable into two well defined divisions comprising less than 200 species throughout the world. (1) The Sialidae include the alder flies (*q.v.*) so called because in England the adults often frequent alders along the banks of streams. Their larvae live in the water and respire by means of seven or eight pairs of slender, jointed, abdominal gills. The genus *Sialis* is widely distributed with two British and one North American species. The Dobson-flies *Corydalis*, found in America (North and South) and northern India, attain a great size with immense jaws in the males. The smaller allied forms (*Chauliodes*, etc.) are often known in America as fish-flies. (2) The Raphidiidae or snake flies (*q.v.*) are distinguished by the elongate prothorax and the very long ovipositor in the female. They are terrestrial insects whose larvae are found under the bark of trees. Nine species are found in North America and four species of the genus *Raphidia* occur in Britain.

SUB-ORDER II. PLANIPENNIA

Veins with evident forking at the margins of the wings: vein Rs usually with numerous branches. Larvae with piercing mouth-parts: pupae enclosed in a cocoon.

Included here are the major portion of the Neuroptera: they are nearly all terrestrial insects, only a small number being partially or truly aquatic in their larval stages. The Planipennia are divided into 16 families of which only the most important are mentioned.

The Ithonidae or moth-lacewings are confined to Australia: they are large, stoutly built, moth-like insects with primitive venation. Their larvae live in the soil where they prey upon those of chafer beetles, to which they bear a close general resemblance. The Hemerobiidae or brown lacewings are widely distributed and

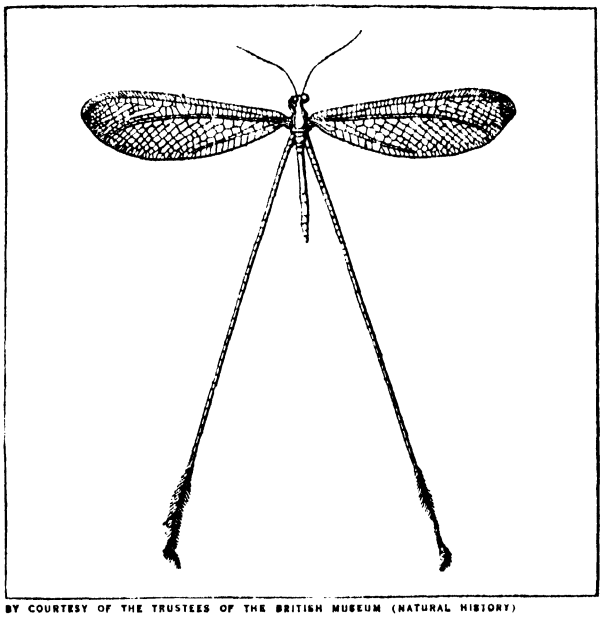


BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)

FIG. 1.—A GREEN LACEWING (CHRYSOPIDAE)

fairly numerous in species. Their larvae along with those of the Chrysopidae or green lacewings (fig. 1) roam about vegetation preying upon aphides, mites, thrips and other soft-bodied insects (*see* LACEWING-FLY). The Osmylidae and Sisyridae have aquatic larvae: the insects of the first mentioned family are medium to large-sized species which differ from the lacewings in certain venational characters. *Osmylus chrysops* is the largest British Neuropterous insect and occurs locally along the borders of streams where there is dense vegetation. The Sisyridae differ in having very few cross-veins to the wings besides being much smaller in size. They are brown or fuscous insects found along the borders of rivers which contain the fresh-water sponge upon

which their larvae feed and live. Three species of *Sisyra* occur in Britain and this genus, along with *Climacia*, is found in the United States. The Mantispidae or mantis flies (*q.v.*) are easily distinguished by the elongate thorax and the prehensile fore-legs which resemble in form those of the common mantis (*q.v.*) and are likewise used for seizing other insects which serve as their prey. The larvae of the European *Mantispa styriaca* are predacious upon



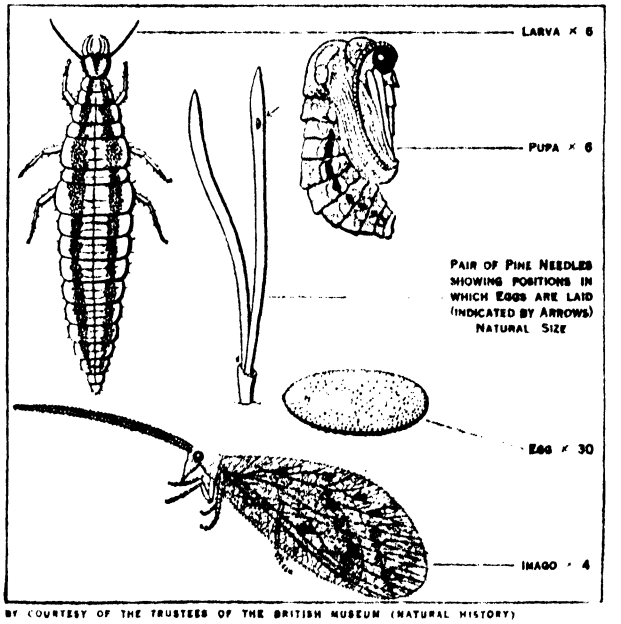
BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)
FIG. 2.—HALTER IMPERATRIX (NEMOPTERIDAE)

young *Lycosa* spiders and during development they undergo striking changes of form constituting hypermetamorphosis. The family is mainly tropical but ranges into southern Europe and a few rare species occur in the United States. The Psychopsidae have very broad, rounded wings supported by a stout "mid-rib" and with a densely reticulated venation. Many are insects of striking beauty and their larvae have been found beneath bark of trees. The family has a wide discontinuous range occurring in South Africa, Tibet, China and Australia. The Nemopteridae (fig. 2) differ from all other Neuroptera in having very long thread-like or ribbon-like hind wings. Their larvae occur in caves on the floors of buildings among debris, etc., where they prey upon smaller forms of insect life. The family occurs in many of the warmer parts of the world including southern Europe but is absent from North America. The Myrmelionidae or ant-lion flies (*q.v.*) bear a general resemblance to dragon-flies and have short knobbed feelers. Although most abundant in the warmer parts of the world, several species occur in Europe, one being found as far north as Sweden, but none are found in the British Isles: about 60 species inhabit the United States. Their larvae live on the ground where some make pit-like snares for entrapping their prey, while others hide away under stones or debris. The Ascalaphidae are closely related to the preceding family but can easily be separated by their much longer antennae as well as by venational differences. Their larvae either hide away on the ground or live concealed on the bark of trees. They are chiefly tropical insects only a few species occurring in southern Europe and North America. The Coniopterygidae, or mealywings, number about 50 species and are the smallest and most aberrant of all Neuroptera. They are covered with a white powdery secretion, their wings have comparatively few veins and the hind wings are much reduced in size. Their larvae roam about plants, preying upon aphides, scale-insects and mites. Rather more than half a dozen species are found in Britain and a similar number occur in the United States.

Natural History (fig. 3).—The eggs of Neuroptera are ovoid and in several families, including the green lacewings, the female exudes a sticky secretion which she draws out into a hair-like stalk upon which the egg is laid for safety. The larvae, with few exceptions, are terrestrial or arboreal and in the Planipennia they are all characterized by the greatly drawn out mandibles and maxillae which are used for seizing and perforating the prey. The mandibles are grooved along their ventral surface and the maxillae, which closely resemble them in form, fit one into each groove: in this way the two sets of appendages function as a pair of tubes through which the body-juices of their victims are sucked out. Larvae of the Planipennia are further remarkable for the fact that six out of their eight Malpighian tubes become transformed into silk glands, the silk being emitted through an anal spinneret. The larvae of all Neuroptera are carnivorous and mostly prey upon other forms of insect life. When fully fed those of the Planipennia construct silken cocoons and, prior to the emergence of the perfect insect, the pupa cuts open the cocoon with its mandibles and, being mobile, often travels some little distance before the imago emerges. Little is definitely known respecting the specific nature of the food of the perfect insects: many are nocturnal in habits and are attracted to lights, while most of the day-flying species are rarely seen on the wing.

Geographical Distribution.—Certain families of Neuroptera are nearly world-wide in their distribution, the Chrysopidae for example, being found in almost all extensive areas of land excepting New Zealand: the Sialidae have an almost world-wide though discontinuous range, while the Raphidiidae are apparently restricted to the northern hemisphere. Several families, on the other hand, are almost confined to Australia which has a more complete and diverse fauna of Planipennia than any other region of the globe, although the Megaloptera are only represented there by four species. Only seven families of Neuroptera occur in the British Isles and 13 families are found in the United States.

Geological Distribution.—The Megaloptera are evidently an archaic group but their fossil remains, unless very perfect, are difficult to identify. The earliest undoubted remains of this sub-order have been found in the Triassic rocks of Europe. The Planipennia



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)
LIFE CYCLE OF BROWN LACEWING (HEMEROBIS STIGMA)

first appear as fossils in the Upper Permian beds of Belmont, New South Wales, where they are represented by the genus *Permithone* which appears to be an ancestor of the existing Ithonidae and possibly of other families also. The sub-order is well represented in the Liassic and Upper Jurassic rocks of Europe.

Economic Importance.—Neuroptera as a whole are distinctly beneficial to man in their larval stages. Larvae of the Sialidae form food for trout and other fishes, while those of the Planipennia prey upon many soft-bodied noxious insects. In Europe and North America the most beneficial families are the Hemerobiidae,

Chrysopidae and Coniopterygidae and in Australia larvae of the Ithonidae destroy numbers of Scarabaeid grubs in the soil.

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NEUSALZ, a town in the Prussian province of Silesia, on the Oder, 20 m. by rail N.W. of Glogau. Pop. (1925) 14,212. Neusalz became a town in 1743. Its largest industry is, perhaps, the manufacture of thread; there are also in the town ironworks, breweries, shipbuilding yards and electrical works. Lignite is mined in the neighbourhood and chemicals manufactured. It is developing trade, especially towards the Polish frontier, because of its numerous rail and river connections.

NEUSS, a town in the Prussian Rhine province, lies 4 m. to the W. of Düsseldorf and 1½ m. from the west bank of the Rhine, with which it is connected by the Erft canal. It lies at the junction of lines to Cologne, Viersen, Zevenaar (Holland), Düsseldorf, Düren and Rheydt. Pop. (1925) 44,978, of whom the majority were Catholics. Neuss, the *Novaesium* of the Romans, mentioned by Tacitus, formerly lay close to the Rhine. Drusus, brother of the emperor Tiberius, threw a bridge across the Rhine here, and his name is preserved in the Drususstor, the lower half of which is of Roman masonry. In 1474–75 Charles the Bold besieged the town in vain for 11 months, but it was taken and sacked by Alexander Farnese in 1586. Extensive excavations have been made and many Roman treasures have been unearthed.

The church of St. Quirinus is a fine example of the transition from the Round to the Pointed style. The town hall was built in the 17th and altered in the 18th century.

NEUSTADT (Polish, *Prudnik*), a town in the Prussian province of Silesia, on the river Prudnik, 60 m. by rail S.E. of Breslau. Pop. (1925) 17,050.

NEUSTADT-AN-DER-HAARDT, a town of Germany, in the Bavarian Palatinate, situated under the eastern slope of the Haardt mountains and at the mouth of the valley of the Speyerbach, 14 m. W. of Speyer, and at the junction of railway lines to Worms, Weissenburg and Kaiserslautern. Pop. (1925) 20,726. Neustadt, which became a town in 1275, is one of the centres of the Rhenish "grape-cure." The Protestant abbey church, a Gothic edifice, dates from the 14th century.

NEU-STETTIN, a town in the Prussian province of Pomerania, on the small Streitzig lake, 90 m. by rail E.N.E. of Stettin, at the junction of railways to Belgard, Posen and Stolpmünde. Pop. (1925) 15,518. Neu-Stettin was founded in 1313 by Wratislaus, duke of Pomerania.

NEU-STRELITZ, a town of Germany, capital of the republic of Mecklenburg-Strelitz, situated between the Zierker See and the Glambecker See, 60 m. N. of Berlin, on the railway to Stralsund, at the junction of lines to Warnemünde and Wittstock. Pop. (1925) 12,100. Neu-Strelitz was not founded till 1726. The former ducal residence is a pseudo-classical edifice, with a library.

About 1½ m. to the south lies Alt-Strelitz (pop. 4,820), the former capital of the duchy.

NEUSTRIA, the old name of the western kingdom of the Franks, as opposed to the eastern kingdom, Austrasia (*q.v.*). The most ancient form of the word is *Niuster,* from *niust,* which would make the word signify the "most recent" conquests of the Franks. The word Neustria does not appear in Gregory of Tours, but is found for the first time in Fredegarius. Under the later Merovingian kings the princes reigning in the West were called kings of Neustria, and those reigning in the East, kings of Austrasia. Under the new Carolingian dynasty, the word Neustria was restricted to the district between the Loire and the Seine, together with part of the diocese of Rouen north of the Seine; while Austrasia comprised only the Frankish dominions beyond the Rhine, together, apparently, with Mainz, Worms and Spires on the left bank. The districts between Neustria and Austrasia were called *Media Francia* or simply *Francia.* In 843 Brittany took from Neustria the countships of Rennes and Nantes; and gradually the term Neustria came to be restricted to the district which was later called Normandy. By a similar usage, the term Neustria was applied in Italy in the 8th century to western Lombardy.

See F. Bourquelet, "Sens des mots France et Neustrie sous le régime mérovingien," in the *Bibliothèque de l'école des chartes,* xxvi. 566–574; Longnon, *Atlas historique de la France.*

NEUTRALITY has been defined as the legal status arising from the abstention of a state from all participation in a war between other states, the maintenance by it of an attitude of impartiality in its dealings with the belligerent states, and the recognition by the latter of this abstention and impartiality. From this legal status arise the rights and duties of neutral and belligerent states respectively. Under the conception of absolute sovereignty prevalent before the World War one state might go to war with another for a good or bad reason, or for no reason at all, and a violation of international law by one state was regarded as no concern of any other, except that immediately affected by such violation. With the creation of the League of Nations, however, a new conception arose. The League is based upon international solidarity, hence neutrality and a League of Nations are mutually exclusive. In the next war, said President Wilson, there will be no neutrals. But the League is not yet universal. The United States and Russia, to mention only the most important, are not members; and even among members the Covenant of the League fails to prohibit neutrality in all circumstances. Consequently the legal status of neutrality still retains an important place in international law.

Rights and Duties of Neutrals.—These may be subdivided into the rights and the duties of neutrals; and the rights and liabilities of trade. A neutral state is entitled to have the integrity of its territory and territorial waters respected by all the belligerents. By the Hague Convention of 1907 its territory is inviolable; it is entitled to notice of a state of war, unless it can be proved that it was aware of its existence, so that the date from which its liabilities commence may be ascertained (Hague Convention III., 1907). In the case of a civil war, its liabilities will commence only when a state of belligerency is established; for instance, Great Britain contended that the proclamation of a blockade of the coasts and ports of the seceding states by President Lincoln on April 19, 1861, was a recognition of such states as belligerents. That is to say, it is entitled to prevent and nullify, by force if necessary, war-like operations by any of the belligerents committed in violation of such integrity. It is also entitled to exact compliance by belligerents with its own municipal regulations, designed to maintain its neutrality and to perform its international obligations. If such regulations are enforced equally upon all the belligerents, they are not to be regarded as hostile or unfriendly. It is entitled to maintain its diplomatic intercourse with other neutral states and with the belligerents alike, except for such temporary interruptions as may be demanded by military necessity. It is entitled to offer its good offices or mediation to the belligerents with a view to the cessation of hostilities without the exercise of this right being regarded as an unfriendly act (Hague Convention I., 1907). Finally it is entitled to require belligerents not to interfere with the commercial intercourse of its subjects, unless such interference is warranted by International Law.

Armed Neutrality.—In his address to Congress on Feb. 26, 1917 President Wilson, after recounting the failure of diplomatic methods to protect the neutral rights of the United States from their violation by Germany, declared that "there may be no recourse but to armed neutrality, which we shall know how to maintain and for which there is abundant American precedent." There were also European precedents for armed neutrality.

In 1780 Russia issued a declaration of neutral rights, to which Sweden and Denmark adhered, which became known as the First Armed Neutrality. Spain, France, Holland and the United States—

all in a state of war with Great Britain—Prussia, Austria, Portugal and the two Sicilies, subsequently joined the league. The object of this declaration was to limit the list of contraband commodities. In 1800 Russia with Denmark, Prussia and Sweden formed the Second Armed Neutrality, the object of which was to exempt from visit and search neutral merchantmen under convoy.

Duties of Neutral States.—The primary duty of a neutral state is strict impartiality in its relations with both belligerents, whether such impartial conduct is obligatory or discretionary. There must not be any discrimination or preference. Even a favour granted to one must be extended to the other. A neutral state must not allow a belligerent to move troops, munitions of war or supplies across its territory or to erect or use therein wireless or other telegraphic apparatus for military purposes. It must intern belligerent forces which have taken refuge in its territory, but may leave at liberty escaped prisoners of war and permit the passage of the sick and wounded belonging to the belligerent forces (*Hague Convention* V., 1907). It must not allow any act of war, including the exercise of visit and search or capture, to be committed by a belligerent within its territorial waters. It must release a prize so captured with its officers and crew and intern the prize crew. It must not allow a prize court to be established on its territory nor on a vessel within its territorial waters. It must not allow either belligerent to use territory or territorial waters as a base of military operations against its adversary, nor may it furnish either belligerent with troops, ships, munitions of war, money or with commodities of direct or indirect use in the war. It must use due diligence in preventing the fitting out or arming of vessels within its jurisdiction and the departure of vessels intended to engage in hostile operations; the issue of commissions by either belligerent or the enlistment of men (*Hague Convention,* XIII., 1907, the Neutrality Act, 1818 U.S.A. and the Foreign Enlistment Act, 1870, 33–34 Vict. C. 90).

Rights and Liabilities of Neutral Trade.—Restraint on neutral trade with belligerents rests upon a compromise between two conflicting principles. On the one hand the subjects of a neutral state contend that they are entitled to carry on their normal trade with either belligerent, provided such trade is not directly calculated to prejudice the military operations of one belligerent, nor to promote those of the other. On the other hand a belligerent state claims that the subjects of a neutral state are not entitled to supply his enemy with commodities which are of direct and indirect use to his enemy in the conduct of the war. Between these two contentions there have been great divergencies both in theory and practice. A state is apt to take a different view when belligerent from that which it maintained as a neutral. But upon one matter there is no difference of opinion. It is generally recognized that it is for the belligerent and not for the neutral state to enforce the restraints on neutral trade; that it is the duty of the neutral state to acquiesce in such restraints in so far as they are not unwarrantable; and that the violation of such restraints by the subjects of a neutral state are not criminal and only involve the perpetrators in the seizure and loss of their property. The most important restraints on neutral trade are those imposed by the rules relating to blockade (*q.v.*); pacific blockade (*q.v.*); contraband (*q.v.*); continuous voyage; convoy (*q.v.*); unneutral service; and visit and search (*q.v.*).

Continuous Voyage.—The doctrine of continuous voyage has been referred to under CONTRABAND (*q.v.*). It was first applied by Lord Stowell to the engagement of neutrals in a trade closed to them in time of peace (*The Immanuel,* 2 C. Rob. 186 [1799]). In this case a neutral vessel sailing from Hamburg was condemned for carrying food, during the war between Great Britain and France, from Bordeaux to St. Domingo, a French colony. The doctrine was also applied by Lord Stowell in *The Yonge Pietor,* 4 C. Rob. 79 (1801), under the rule prohibiting trade with the enemy. In this case the goods were consigned to a neutral port with an ultimate destination by land to an enemy port. This gave rise to the doctrine of "continuous transport." Secondly the doctrine was applied during the American Civil War both to blockade and contraband.

At the Naval Conference (1908–9) it was found impossible to reach agreement upon the question of the engagement of neutrals in a trade closed to them in time of peace, but the Declaration of London did deal with the application of the doctrine of continuous voyage to blockade and contraband. By Art. 19 whatever might be the ulterior destination of a vessel or her cargo, she was not liable to capture if at the moment she was on her way to a non-blockaded port, although it was still open to the captor to prove that the alleged destination to a neutral port or open port was merely simulated. But such capture was permissible only within the area of operations or on a pursuit commenced therefrom. Art. 39 provided that absolute contraband should be liable to capture if shown to be destined to territory belonging to or occupied by the enemy or to his armed forces.

During the World War the doctrine of continuous voyage and continuous transport was applied by the Allied and Associated Powers to conditional as well as to absolute contraband, and was fully examined by Sir Samuel Evans in the *Kim* (1918) I.B. and C.P.C. 405. For the French practice, *see* the *Karimata,* Fanchille, *Jurisprudence Française en Matière de Prises Maritimes,* 62, 92; for the Italian see *S. S. Kyzicos,* Fanchille, *Jurisprudence Italienne en Matière de Prises Maritimes,* 57.

Destruction of Neutral Prizes.—By the law of nations merchantmen must always be brought in for adjudication and consequently must never be destroyed by their captors (the *Actaeon* [1818] 2 Dods: 48, the *Felicity* [1819] 2 Dods: 381, and *Maisonnaire* v. *Keating* [1815] 2 Gall: 325). The old rule, however, that neutral vessels must never be destroyed, was rejected by Russia in her naval instructions in 1868, 1895 and 1901; by France in 1870; by the United States in 1812 and 1898; by Japan in 1904 and by Germany in 1908. Art. 48 of the Declaration of London provided that "a neutral vessel which has been captured may not be destroyed by the captor but she must be taken into such port as is proper for the determination there of all questions concerning the validity of the prize." But this provision is qualified by Art. 49 which declares: "As an exception a neutral vessel which has been captured and which would be liable to condemnation, may be destroyed if the observance of Art. 48 would involve danger to the safety of the warship or to the success of the operations in which she is engaged at the time." By Art. 50, before destruction, all persons must be placed in safety and the ship's papers taken on board the warship, and by Art. 51 the captor must prove that the destruction was demanded "in the face of exceptional necessity."

Upon failure to prove this, the captor was bound to make full compensation, whether the capture was valid or not. It was contended at the time by some Powers that these guarantees virtually amounted to the renunciation to the right of destruction, but the present writer declared that Art. 49 would lead to piracy. And so it proved in the World War. Under the plea of "danger to the safety of the warship" and of "exceptional necessity," the German Government ordered the officers of submarines to sink enemy and neutral merchantmen alike at sight and without leaving a trace (*spurlos versenken*). It is estimated that 1,720 neutral vessels were thus destroyed by Germany and her allies, and over 2,000 neutral sailors killed or drowned.

By the Treaty of Washington, 1922, between the United States, Great Britain, France, Italy and Japan, a merchantman must not be destroyed unless the crew and passengers have been first placed in safety, and if the submarine cannot capture a merchantman in conformity with the rules applicable to other war vessels, it must permit the merchantman to proceed unmolested. Violation of these rules will be deemed an act of piracy and the plea of superior orders will be no defence. These provisions have not been ratified by France.

Unneutral Service.—A neutral individual is of course guilty of unneutral service who breaks blockade or carries contraband. But there are certain acts of a particularly distinctive service to which the term unneutral service is usually applied. These are divided into two classes by the Declaration of London according to the gravity of the act. In the first is included service which is only partial. By Art. 45 when a neutral vessel is engaged to

carry military persons or despatches, concurrently with employment of an innocent character, she is liable to be treated in the same manner as a neutral vessel engaged in the carriage of contraband. The vessel may be condemned and the cargo if it belongs to the owner of the vessel. These are sometimes described as analogues of contraband, and so she will be treated throughout as a neutral vessel. But a neutral vessel which identifies herself with the enemy falls into the second class: she is definitely guilty of "hostile service."

By Art. 46, a neutral vessel is liable to be treated as an enemy merchantman (1) if she takes a direct part in the hostilities; (2) if she is under the orders or control of an agent placed on board by the enemy Government; (3) if she is in the exclusive employment of the enemy Government; (4) if she is exclusively engaged at the time either in the transport of enemy troops or in the transmission of intelligence in the interests of the enemy. In these cases goods belonging to the owner of the vessel are liable to condemnation with the vessel. By Art. 47, an individual liable to military service found on board a neutral vessel may be made a prisoner of war; and by Art. 12 of The Hague Convention X., 1907, enemy sick or wounded found on board neutral hospital or merchant ships may be removed.

During the World War the German Government having removed all persons liable to military service from the occupied territories of Belgium and France, Great Britain in Dec. 1914 declared they would no longer be bound by Art. 47 of the Declaration, and that they would arrest all reservists found on board neutral vessels. This action was avowedly by way of reprisal. Nevertheless neutral states protested that such persons were not actually incorporated in the armed forces of the enemy and so not within Art. 47. This is probably true, but apart from the Declaration, persons of military age returning to their country of origin for the purpose of military service are really "noxious persons," who, if found on board neutral ships bound to an enemy port or even to a contiguous neutral port, may be seized.

Inviolability of Postal Correspondence.—By The Hague Convention XI. of 1907 the postal correspondence of both neutrals and belligerents, whatever its official or private character may be, found on board a neutral or enemy ship is inviolable. If the ship is detained the correspondence must be forwarded by the captor at once. These provisions do not apply to correspondence destined for, or proceeding from a blockaded port. This right to inviolability does not exempt a neutral mail ship from the laws and customs of maritime war. The ship, however, may not be searched except when absolutely necessary, and then only with as much consideration and expedition as possible. Apart from the Convention neutral mail ships and other vessels carrying mails, even though the property of a neutral Government, are not by international law exempt from the ordinary process of the tribunals of a belligerent, unless expressly exempted by treaty. Thus, such vessels are still subject to visit and search.

During the World War, Hague Convention XI. did not apply since it had not been ratified by some of the belligerents. Nevertheless in the first year of the war the Allied Powers did not interfere with the mails found on neutral vessels. But when it was discovered that the Germans were sending contraband through the post and more particularly by means of the parcels post, they insisted upon the right of search and seizure. In their protest against this policy the United States admitted that there was a distinction between such articles as bonds and other securities which might be regarded as merchandise, and shipping documents and money-order lists which should be regarded as genuine correspondence. By such a distinction a right of censorship was obviously implied, but such a censorship on the high seas, owing to German submarine methods, was impracticable.

Neutral vessels were therefore either induced by the Allied Powers to enter allied ports voluntarily for the purpose of search and censorship, or were brought in involuntarily. In their protest against this practice the United States did not complain so much that the exercise of jurisdiction over such vessels was abused, as that the Allied Powers, by sheer naval force, compelled neutral steamship lines to cause their mail steamers to put into allied ports, and thus subject them to the control of the territorial sovereign. The Allied Powers justified this practice on the ground of necessity.

Reprisals.—Even neutrals may suffer by measures of reprisal taken by one belligerent without having any legal ground of complaint. The British Order in Council, Feb. 16, 1917, was issued as a measure of retaliation for the German declaration of Feb. 1, 1917, of unrestricted submarine warfare in certain designated zones. The Order provided that a vessel encountered at sea on her way to or from a port in a neutral territory affording means of access to the enemy territory without calling at a port in British or Allied territory should be deemed to be carrying goods with an enemy destination, or of enemy origin and should be liable to capture and condemnation. *The Leonora*, 3 B. & C.P.C. 181, 385 [1919] A.C. 974, was a Dutch vessel, with coal laden at Rotterdam for Stockholm. The coal was produced in Belgian collieries under the control of the German Government and sold by it to a Swedish company. In condemning the ship and cargo, Evans P. held that the Order did not entail unreasonable inconvenience upon neutrals, having regard to all the circumstances. Upon appeal Lord Sumner gave the following opinion: "There are certain rights, which a belligerent enjoys by the law of nations in virtue of belligerency, which may be enforced even against neutral subjects and to the prejudice of their perfect freedom of action, and this because without those rights maritime war would be frustrated and the appeal to the arbitrament of war would be made of none effect."

This and the previous case of *The Stigstad*, 2 B. & C.P.C. 179; 3 *ib.*, 347 [1919] A.C. 279, decided that retaliation is a belligerent right and that retaliatory measures may be enforced against neutrals. If, said Sir Erle Richards, retaliation be a legal right, neutrals can have no cause of complaint.

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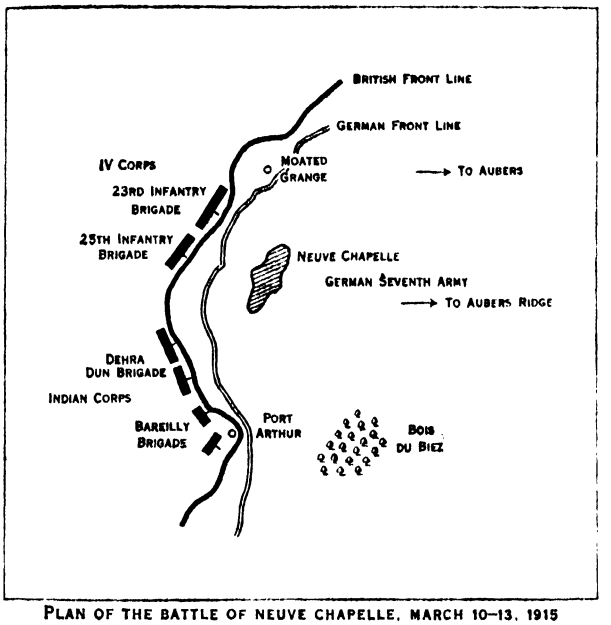
NEU-ULM, a town in Bavaria. Pop. 11,919 (1925). The town is situated on the Danube, opposite Ulm, and is a railway centre. It was incorporated as a town in 1857.

NEUVE CHAPELLE, BATTLE OF (March 10–13, 1915). Neuve Chapelle is a village in Pas de Calais west of Lille. Pop. 319 (1921). To understand the tactical idea upon which the battle of Neuve Chapelle was founded (the first of the siege warfare battles undertaken by the British army in France) it must be clearly kept in view that the British higher command had not grasped the fact that the war which now confronted them was an engineer-artillery war, and not a cavalry-infantry one. They considered that infantry could "open a door for an inroad of horsemen against the enemy's rear," and in spite of the failure of Neuve Chapelle, this quite impossible idea governed the tactics of Sir John French and Sir Douglas Haig up to the end of the war.

Plan of Attack.—On Feb. 12, General Haig recommended an offensive towards the Aubers ridge on a frontage of 2,000 yards between Port Arthur and the Moated Grange. Neuve Chapelle was to be the first objective, then a line east of the village, and finally the Aubers ridge, the occupation of which would threaten the enemy's communications between La Bassée and Lille. Sir John French, the commander-in-chief, approved of this plan, and fixed its date as soon after March 9 as weather would permit. The attack, or rather assault, was to be carried out by two corps, the Indian corps on the right and the IV. corps on the left. It was to be made after an intense artillery bombardment of 35 minutes' duration. Having broken the enemy's front, it was proposed to extend the attack to five miles in width, and so make room for the cavalry corps to pass through and pursue. The bombardment was to be carried out by 530 guns and howitzers, and the ammunition available was approximately 216,380 rounds.

Operations of March 10.—At 4.30 A.M. the assaulting battalions were in position. The morning was cold and misty, and visibility was bad. Sunrise was at 6.30 A.M., and exactly one hour

later the general bombardment was opened. At 8.5 A.M. the attack was launched, and its first phase was carried out with considerable success. At 8.50 A.M. Neuve Chapelle was entered, but here the advance of the right was brought to a standstill by the British artillery barrage which had lifted, and was now falling between the village and the Bois de Biez. The first real trouble was experienced on the two flanks, on the right from the Bois de Biez, and on the



PLAN OF THE BATTLE OF NEUVE CHAPELLE, MARCH 10–13, 1915

left from Manquissart, from both of which a heavy fire was directed on the attackers rendering it impossible for them to extend their front rapidly. By 1 P.M. the whole of the first objective, except part of the Port Arthur salient, was in British hands. Then came a delay. Sir Douglas Haig proposed to advance on the Aubers ridge at 2 P.M., but this attack had to be postponed. This enabled the Germans to push forward reserves to their second line position east of the village, which was only partially dug. From this line an effective cross fire was brought to bear on the north of Neuve Chapelle.

Operations of March 11.—During the night the Germans strengthened their new front line. The main attack was carried out by the IV. corps, and was directed on Aubers, the Indian Corps supporting it on the right. It was launched at 7 A.M., but was at once crushed by heavy machine gun fire opened from the concave position now held by the enemy. A little after noon the attack had to be abandoned. It was then clear that until the infantry assault could be prepared by an effective bombardment, to continue the action would lead to unprofitable slaughter.

Operations of March 12.—At 5 A.M. on the 12th the Germans made a strong counter-attack which, however, failed in its object. This was followed by an order from Sir Douglas Haig to continue the attack. It was ordered and then postponed with the inevitable confusion resulting. The IV. Corps was instructed to "push through the barrage of fire regardless of loss." The Bois de Biez was to be taken "at all costs." The 7th and 8th Divisions were to push on "regardless of the enemy's fire," with the inevitable result that hundreds of men were at once shot down. By nightfall it became obvious that the battle could not be continued, and early on the 13th Sir John French, having lost 12,892 officers and men, wired to Lord Kitchener: "Cessation of the forward movement is necessitated . . . above all by want of ammunition."

Comments.—The true reason for the failure was lack of understanding. An attempt was made to attack a fortress as if it were a deployed army in the field. The conception of surprise was admirable, but it was useless to expect to capture the Aubers ridge from a frontage of 2,000 yards. To do so the frontage should have been at least 12,000 yards, because the ridge was some 6,000 yards distant, and because in siege-warfare the normal depth of penetration is half the length of the initial base. Nevertheless, in this battle, the first of the British grand attacks, and the first in which the "barrage" was used, more common sense was shown in restricting the artillery bombardment to the shortest possible time than in any subsequent battle up to that of Cambrai in November 1917. The German defences were but half a mile deep, and it was possible to fracture them by artillery fire if the bombardment were rapid, for rapidity carried with it surprise.

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NEUVILLE, ALPHONSE MARIE DE (1836–1885), French painter, was born at Saint-Omer, France, on May 31, 1836. From school he went to college, where he took his degree of *bachelier ès lettres*. He first took up painting in 1856, after passing through the Naval College at Lorient. For a time he worked in Picot's studio, but was painting independently when he produced his first picture, "The Fifth Battalion of Chasseurs at the Gervais Battery (Malakoff)." In 1861 he exhibited "The Light Horse Guards in the Trenches of the Mamelon Vert," at the Salon. His pictures of military life showed peculiar insight, but his full power was not reached till after the war of 1870, episodes in which he depicted in a famous series, including the "Bivouac before Le Bourget" (1872), "The Last Cartridges" (1873), the "Surprise at Daybreak" (1878), and a considerable number of drawings. He also exhibited in London some episodes of the Zulu War. In 1881 he was made an officer of the Legion of Honour for "The Cemetery of Saint-Privat" and "The Despatch-bearer." He also collaborated with Detaille in "The Panorama of Rézonville." De Neuville died on May 18, 1885.

See Montrosier, *Les Peintres militaires* (1881), and "De Neuville" in *Gazette des beaux arts* (1885).

NEUWIED, a town in the Prussian Rhine province, on the Rhine, 8 m. below Coblenz, on the railway from Frankfort-on-Main to Cologne. Pop. (1925) 20,432. Neuwied was founded by Count Frederick of Wied in 1662, on the site of the village of Langendorf. Among those who sought refuge here was a colony of Moravian Brethren; they still occupy a separate quarter of the town, where they carry on manufactures of porcelain stoves. Near Neuwied one of the largest Roman *castra* on the Rhine has been excavated. The principal building is the château, which contains a collection of Roman antiquities.

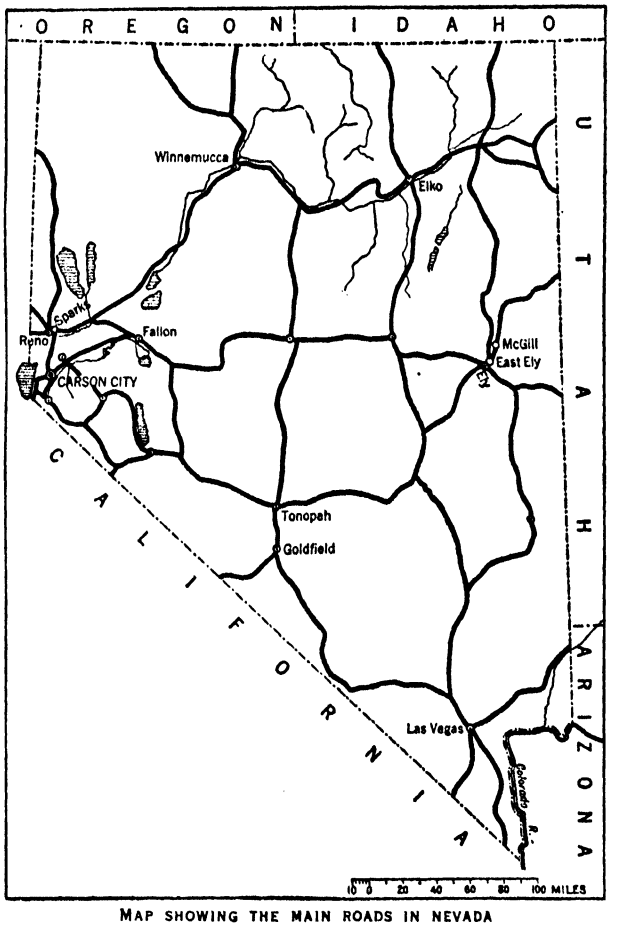
NEVA, a river of Russia, which carries off into the Gulf of Finland the waters of Lakes Ladoga, Onega, Ilmen and many smaller basins. It issues from the south-west corner of Lake Ladoga in two channels, which are obstructed by sandstone reefs, so that the better of the two has a depth of only 7 to 16 feet. A little farther down it becomes completely navigable, and attains a breadth of 4,200 ft.; but between the village of Ostrovki and that of Ust-Tosna it passes over a limestone bed, which produces a series of rapids, and reduces the width of the river from 1,050 to 840 and that of the navigable passage from 350 to 175 feet. Nine or ten miles before reaching its outfall the river enters Leningrad, and 5 or 6 m. lower down breaks up into the Great Neva (850 to 1,700 ft. wide), the Little Neva (945 to 1,365), and the Great Nevka (280 to 1,205), this last, 2 m. farther on, sending off the Little Nevka (370 to 1,130 ft.). Its total length is only 40 miles. In front of the delta are sandbanks and rocks which prevent the passage of vessels except by a canal, 18 m. long, 124 to 226 ft. wide, and admitting vessels with a draught of 18½ ft., from Kronstadt to Leningrad. When Lake Ladoga sends down its vast accumulations of block-ice, inundations of a dangerous kind occur, as in 1777, 1824, 1879, 1903, and especially in 1924.

According to observations extending from 1706 to 1899, the mean day of the freezing of the Neva is Nov. 25, the earliest Oct. 28, the latest Jan. 9, and the next latest Dec. 26. The mean day of opening is April 21, the earliest March 18, the latest May 12.

NEVADA, popularly known as the "Sagebrush" State, is one of the far western States of the American Union. It lies between 35° and 42° N. and 114° 2′ and 120° W., and is

bounded north by Oregon and Idaho, east by Utah and Arizona, south and west by California. The Colorado river separating it in part from Arizona is the only natural boundary the State possesses, the others being arbitrary lines of geodetic measurement. Nevada ranks sixth among the States in size, having an area of 110,690 sq.m., 869 sq.m. of which are water surface. Its extreme length north and south is 484 m., and its extreme width east and west is 321 miles. Its name, a Spanish word meaning "snow-clad," was originally applied to the snow-capped Sierra Nevada range on the Pacific slope.

Physical Features.—With the exception of its north-east and south-east corners, the State lies wholly within the Great Basin, the floor of which is really a vast tableland between 4,000 and 5,000 ft. above the sea. This plateau, however, is not a plain, but contains many buttes, mesas and isolated mountain ranges, the latter running generally in a north and south direction and rising 1,000 to 7,000 ft. above the level of the plain. These ranges are from 5 to 20 m. wide at their bases, and the valleys between are about the same width as the bases. The total area of the valleys is about equal to that of mountainous land. In the north-east an unnamed range of highlands, broken and ill-defined, with a general east and west trend, forms the water-parting be-



MAP SHOWING THE MAIN ROADS IN NEVADA

tween tributaries of the Humboldt river in the Great Basin region and those rivers that flow to the Snake river in Idaho and Oregon and thence via the Columbia river to the Pacific ocean. This drainage area of the Snake amounts to about 5,000 sq.m., the Owyhee, Little Owyhee, Salmon and Bruneau rivers being the principal streams. In the south-east corner is the third drainage system. Here the Virgin river from Utah, after crossing the north-west corner of Arizona, enters the State and flows south-west for 60 m. until it joins the Colorado river. The latter stream flows for 150 m. along the south-east boundary towards the Gulf of California. The Colorado leaves Nevada at an altitude of but 470 ft. above sea-level, the lowest point in the State. The mean elevation of the State is 5,500 ft. and, with the exception of the dip to the Colorado in the south-east, the entire State lies above the 2,000 ft. line.

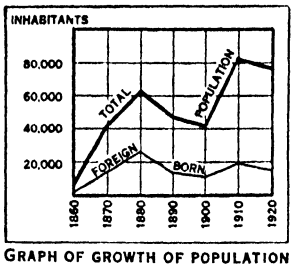
The Sierra Nevada range, which forms the western rim of the basin, sends into the State a single lofty spur, the Washoe mountains. At the foot of this range there is, relatively speaking, a depression, with an altitude of about 3,850 ft. above the sea, which receives the drainage of the eastern slopes of the Sierra, and what little drainage there is in the northern half of Nevada. From this depression eastward the general level of the plateau rises to an elevation of 6,000 ft. near the eastern borders of the State. The mountain ranges also increase in height and importance as far as the East Humboldt range, a lofty mass about 60 m. west of the Utah boundary. This range is the water-parting for nearly all the westward-flowing streams of the State, and is by far the steepest and most rugged within Nevada, a number of its peaks attaining a height of 11,000 or 12,000 feet. On its eastern slope the waters soon disappear within the bed of narrow canyons, but break out again at the foot in ice-cold springs that form the source of the Ruby and Franklin lakes; on its western side the descent is more gentle, and the waters form the south fork of the Humboldt river. The Humboldt is the most important of the basin streams. Rising in the north-east it flows in a tortuous channel in a general south-west direction for 300 m. and drains 7,000 or 8,000 sq. miles. It empties into Humboldt lake, the overflow from which goes into the so-called Carson sink. At no part of its course is it a large river and near its mouth its waters are subalkaline. The Truckee, Carson and Walker rivers flow with more vigour, receiving their waters from the eastern slopes of the Sierra Nevada range and discharging them into alkaline lakes. Of these lakes Pyramid is the largest, being about 33 m. long and 14 m. wide. Walker lake is as long but only six or seven miles in width. These larger lakes always contain water, varying only in area and depth, but the smaller lakes usually evaporate in the course of the summer. The latter are formed by waters that fall on barren mountain-sides and rush down in torrents, forming in the valleys shallow bodies of water yellow with mud held in suspension. Excepting the "alkali flats" no portion of the desert is devoid of vegetation, even in the driest seasons. In the Washoe mountains there is a heavy growth of conifers extending down into the valleys; but in many places these mountains have been almost deforested to provide timber for the mines. In other places these areas have been incorporated into national forests, in the endeavour to protect and foster the growth of timber and vegetation so as to regulate the drainage of the State. On all but the lowest ranges of the basin the piñon and juniper are found, but these rarely grow to a height over 15 ft.; and on the principal ranges above 6,800 ft. is the stunted mountain mahogany. But except for these infrequent wooded areas, the mountains are even more bare than the valleys, because their shrubs are dwarfed from exposure. The valleys are covered with typical desert shrubs, greasewood, creosote bushes and sagebrush, and with bunch grass, which is valuable for grazing. The skies of Nevada are clear nearly every day in the year. The mean annual precipitation varies from 3 in. in the south-west (Esmeralda county) to 12 in. in the east (White Pine county), and varies also according to altitude. Snow rarely lies on the ground in the valleys.

Government.—Nevada is governed under its original Constitution, adopted in 1864, and since amended in important respects. Proposed amendments must be passed by a majority in both houses of two consecutive legislatures before they can be submitted to the people.

The legislature, composed of a senate and assembly, meets regularly in January of every odd-numbered year, its sessions being limited to 60 days. The Constitution requires that the number of senators shall be not less than one-third nor more than one-half the number of members in the assembly, and that the membership of both houses shall not exceed 75. In 1925 there were 18 senators and 37 representatives. Senators are

elected for four years—one-half the membership retiring every two years; representatives are elected biennially. The initiative and referendum were adopted by amendment in 1904.

The principal administrative officers are the governor, lieutenant governor, secretary of State, attorney general, controller, treasurer, inspector of mines, surveyor general and superintendent of public instruction, all elected for a four year term. The governor does not possess the usual sole pardoning power but serves together with the justices of the supreme court, the clerk of the supreme court and the attorney general on a board of pardons. There are many administrative boards and commissions, the most important of them being the board of finance, board of agriculture, board of stock commissioners, board of education, board of health, board of irrigation, board of examiners, Nevada tax commission, industrial commission and department of highways.



GRAPH OF GROWTH OF POPULATION IN NEVADA, WITH FOREIGN PERCENTAGE

The judicial department consists of a supreme court with a chief justice and two associate justices, chosen for six years, and ten district courts, each with a district judge elected for four years. Each township has a justice of the peace chosen biennially by its voters. The Constitution provides that only three-fourths of the jurors may be required to agree to a verdict in civil cases, though the legislature has the power to require by statute a unanimous agreement. For divorce a residence in the State of three months is necessary.

The county is the principal unit of local government. There were (1928) 17 counties in the State, some as large as several eastern States put together.

Population.—In 1860 Nevada's population was 6,857. The mining rush increased it to 42,491 by 1870 and 62,266 by 1880. The years of depression following showed their effect in the decrease to 45,761 by 1890 and 42,335 by 1900, the latter year registering the lowest ebb in the State's fortunes. The new mineral discoveries and new prosperity again raised the population to 81,875 in 1910. In 1920 it registered 77,407. Nevada not only has the smallest population of all States in the Union, but is the most sparsely settled, with only 0·7 person per sq. mile.

Whites numbered 70,699 or 91·3% of the population in 1920. There were 4,907 Indians, 754 Japanese, 689 Chinese and 346 negroes. Of the white population 14,802 (20·9%) were foreign born. Italy and the United Kingdom plus Ireland furnished about 2,500 each, while Scandinavia, Germany, Spain, Canada and Mexico each contributed about 1,200. The urban population increased from 16·3% in 1910 to 19·7% in 1920, amounting in the latter year to 15,254 persons. The leading city, the commercial and financial centre of the State, is Reno with a population in 1925 estimated at 12,665. Carson City with a population of 1,685 in 1920 is the capital.

Finance.—The State legislature authorizes all expenditures, and in turn fixes a tax levy which shall produce revenue enough to meet these expenditures. The supervision of the assessment and collection of taxes is in the hands of the Nevada tax commission consisting of the governor, acting as chairman, and six commissioners appointed by him.

The receipts of the State in 1926 amounted to $4,284,929, the expenditures to $4,180,147. There was a treasury balance Jan. 1, 1927, of $1,193,558. As in most States, a large share of the receipts is derived from general taxation, the amount from this source in 1926 being $1,388,238.

The State had bonds outstanding Jan. 1, 1927, to the amount of $1,812,000, incurred mostly for State building and highway purposes. This amount was more than offset by bonds and securities held by the State amounting at par value to $3,049,807.

In 1926 there were 34 banking institutions in the State—10 of them national banks—with total resources and liabilities of $45,209,000 and capital, surplus and undivided profits amounting to $4,894,000. Their deposits totalled $36,110,000, of which $19,365,000 were time deposits. The latter figure may be compared with savings deposits of $13,316,000 in 1921.

The value of all tangible property in the State was estimated in 1922 at $542,000,000 as compared with $454,000,000 in 1912. The 1926 assessment for tax purposes amounted to $204,000,000.

Education.—The governor, superintendent of public instruction and president of the University of Nevada compose the State board of education. There were, in 1926, 319 elementary schools, 32 district high schools and 20 county high schools. Isolation and districts of small population make first-class results difficult. Of the elementary schools 217 were housed in one-room buildings. There were ten consolidated and 11 joint district schools. In the grade schools 12,359 pupils were enrolled and in the high schools 2,810. There were 833 teachers, of whom 709 were women. The expenditure for each child of school age in 1925 was greater in Nevada ($121.65) than in any other State except California.

The only institution of learning of college rank is the University of Nevada located on an eminence overlooking the city of Reno. Its enrolment during the regular session 1927–28 was 1,000. The new Clark Memorial library, completed in 1927, contains about 47,000 volumes. The Mackay School of Mines, founded and endowed by the family of John W. Mackay, one of the "bonanza kings" of the Comstock Lode, is an excellent and well-equipped department. A meteorological observatory is maintained at the top of Mount Rose.

Charities and Corrections.—A State orphans' home is located at Carson City, a State hospital for mental diseases at Reno, and a home for male juvenile delinquents at Elko. The State penitentiary is at Carson City.

Agriculture and Live Stock.—Nevada is the most arid State of the United States because the high Sierra Nevada range interrupts the moisture-laden clouds from the Pacific. East of these mountains, the valleys, however rich their soils, are covered with sagebrush and appear like monotonous desert wastes, except where some stream annually overflows its banks to create natural meadows, or where the land has been cleared of sagebrush and artificially watered. Agriculture is dependent almost entirely upon irrigation; how much so is shown by the fact that of approximately 594,000 ac. of improved farm land contained in the State in 1919, 561,447 were under irrigation. In 1920, 1,382,036 ac. were included in all the irrigation enterprises of the State which up to that time had cost a total of $14,754,280. Of these 561,447 ac. were irrigated in 1919 and 331,177 ac. cropped. The value of the crops produced was $12,390,593 or $37.41 per acre. The cost per acre for operation and maintenance was $0.79.

The pioneer farmers of the State settled in the valleys where fertile bottom lands grew an abundance of wild hay for their stock, which ranged far and wide over the public domain. Gradually they supplemented the natural crop with tame hay, principally alfalfa. The hay crop in 1926 was still of first importance, amounting to 680,000 tons valued at $6,900,000, while the estimated value of all Nevada's crops in 1926 was but $9,000,000. In southern Nevada, figs, pomegranates and cotton are raised. Vineyards are to be found here and on the Truckee-Carson project. About 8,000 bu. of peaches and 6,000 bu. of pears were grown in 1926.

The total number of cattle decreased from 419,000 in 1925 to 366,000 in 1927, but their value in these years increased from $10,760,000 to $14,331,000. Most of these were raised for beef purposes, the number of milch cows numbering but 20,000 in 1927. The sheep of the State, valued in 1920 at $13,834,000, dropped in value in 1922 to $5,736,000, but increased to $9,529,000 in 1924 and in 1926 were valued at $13,721,000. In 1927 there were 1,250,000 sheep in the State. The 1926 wool clip amounted to 8,730,000 lb. or 7·9 lb. per fleece.

The farm population of Nevada, contrary to the trend in most of the mountain States, increased from 16,164 in 1920 to 17,034 in 1925, amounting in the latter year to 22% of the total population. The number of farms increased from 3,163 to 3,883 and the acreage of farm land from 2,357,000 to 4,091,000. The latter figure represents but 5·8% of the total land of Nevada, a smaller proportion than is to be found in any other State. The average

size per farm in 1925 was 1,053 ac. and the average value per farm $25,260.

Mining.—From 1907 metal production steadily increased until it reached its peak in 1917, in which year gold, silver, copper, lead and zinc were produced to the value of $54,424,580. The years 1918–21 were years of swift decline, the production in 1919 being less than one-half that of 1918, and that of 1921 but 50% of that of 1919. The industry in 1921 was everywhere in stagnant condition, several of the larger producers having closed down entirely. The whole mineral output of the State in 1921 was but $14,038,071. The upward turn came in 1923 when the gross production of all minerals rose to $28,598,627. In 1924 their value was $26,225,943; in 1925, $23,309,352; and in 1926, $26,084,500.

During the period of depression silver was in the best condition because of the Government guaranteed price of $1.00 per ounce under the Pittman Silver Purchase act. This expired in June, 1923, when the price of silver fell immediately to 63 cents. In 1926 it averaged approximately 51 cents per ounce in value. Production of this metal fell in consequence from 10,614,564 oz. in 1923 to 6,462,000 oz. in 1926, the lowest in many years.

Gold production also decreased from 1923–26, though slightly, its value in the former year being $4,223,109 and in the latter $3,707,885. The leading gold producing mine, the Comstock Merger Company, was closed in Dec. 1926.

The production of lead increased from 18,156,000 lb. in 1923 to 24,470,452 lb. in 1925 and 23,700,000 lb. in 1926. The value the latter year was $1,967,000. Mines at Pioche and Eureka were the largest producers. Zinc production, which amounted to 14,166,000 lb. in 1923, decreased to 9,500,000 lb. in 1926, the decrease being due to the closing in the latter year of the Yellow Pine mill, long the largest zinc producer in the State. This mill has since resumed operations, using a lower grade ore.

The general increase of 12% in the metal production of Nevada for 1926 over that of 1925 was due entirely to copper, since all the other metals registered a decrease. Its output saw a phenomenal rise from 23,000,000 lb. in 1922 to 67,000,000 in 1923, 79,000,000 in 1925 and 113,616,000 lb. in 1926. The value had increased from $3,122,967 in 1922 to $15,679,000 in 1926. By far the larger share of the output comes from the property of the Nevada Consolidated Copper Company at Ely, which registered an average of 6,500,000 lb. a month for the first three months of 1926 and increased considerably thereafter.

Other metals commercially developed in the State are quicksilver, antimony, manganese, arsenic and tungsten.

The production of non-metals such as gypsum, borax, lime, filter clay, etc., has showed a substantial increase from 1923 to 1926. In 1923 the gypsum production was valued at $1,952,007. Opals and turquoises of value are mined, a flawless opal, reported the largest in the world, weighing 2,566 carats and valued at $250,000, being found in 1924.

Manufactures.—The manufacturing interests of Nevada are unimportant. There were in 1925 but 102 establishments employing 2,670 workers, paying $4,474,000 in wages and manufacturing goods to the value of $21,626,000, the latter an amount less than that of any State except New Mexico. In the summer of 1928 work was begun on the $1,000,000 naval arsenal and munition plant near Hawthorne.

Transportation.—Nevada is crossed east and west by three main lines of railway, the Southern Pacific and the Western Pacific in the northern part of the State and the Los Angeles and Salt Lake (Union Pacific system) in the southern. All three are parts of great transcontinental systems. Branch lines connect the more important mining towns with these lines. Railway mileage in the State reached its peak in 1915 when it amounted to 2,332 miles. By 1925 it had decreased to 2,137 m. but the building of a new line in that year from the Idaho line to Wells, where it connects with the Southern Pacific and Western Pacific brought the 1926 mileage up to 2,201. The general decrease was due to the inroad of motor transportation. In the State highway system were 2,996 m. of road, of which 1,025 m. were surfaced.

History.—The first recorded person of European descent to enter the limits of Nevada was Francisco Garcés of the Order of St. Francis, who set out from Sonora in 1775 and passed through what is now the extreme southern corner of the State on his way to California. Half a century later trappers of the Hudson's Bay Company led by Peter Skene Ogden entered Nevada from the north and discovered the Humboldt river. In 1827 Jedediah S. Smith, an American trader from St. Louis, crossed the State from west to east on his return from California after the first recorded journey from the Mississippi to the Pacific by the central route. In 1833 Capt. Bonneville's men were on the Humboldt, and during 1843–45 John C. Fremont made a series of explorations in the region. The first recorded emigrant train to California crossed the State in 1841. By the treaty of Guadalupe Hidalgo, negotiated in 1848 at the close of the war with Mexico, Nevada became U.S. territory. It was then a part of California known as the Washoe Country, and so remained until 1850, when most of the present State was included in the newly organized Territory of Utah. One of the first settlements was made in 1849 by Mormons at Genoa in the valley of the Carson river. Here in 1851 the earliest recorded public meeting in the State was held to frame a government for the settlers since the seat of the Territorial Government of Utah was considered too remote to afford protection to life and property. But the Utah authorities intervened and in 1854 the Utah legislature created the county of Carson to include all settlements in western Utah. In 1858 Carson City was laid out, and in the following year the people of Carson county chose delegates to a Constitutional Convention which met at Genoa and drafted a Constitution. It was adopted by vote of the people, but this attempt to create a new State Government proved abortive, and it was not until the mineral wealth of the Washoe Country became generally known that Congress took action. In 1861 the Territory of Utah was divided at 39° W. (of Washington) and the western portion was called Nevada. The Comstock Lode, one of the richest deposits of precious metal known in the world, was discovered in 1859, and Nevada ceased to be merely a highway for gold-seekers on the way to California and became a stopping-place. Virginia City became the most famous of all the mining camps of the Far West.

An attempt to win Statehood in 1863 was defeated, but in 1864 when it became evident that two more Republican votes were needed in the U.S. Senate for reconstruction purposes, party leaders at Washington urged the people of Nevada to adopt a Constitution and enter the Union as a patriotic duty. The third Constitutional Convention in its history met at Carson City and drew up a Constitution which was duly ratified, and in October of that year, President Lincoln proclaimed the new State. The eastern boundary was pushed eastward to its present location on the 37th meridian (W. of Washington) in 1866, and the southern boundary was also fixed in that year. Being "battle-born," Nevada was loyal to the Union throughout the Civil War, and furnished a company of troops in 1861 which was joined to a California regiment. In 1863 the Territory raised six companies of infantry and six of cavalry (about 1,000 men), which saw no actual service against the Confederates but were useful in subduing hostile Indians.

The history of the State since its organization has been largely a history of its mines. From 1864 to 1868 there was a general reaction in the industry due to unwarranted speculation and inflated values. After 1868 there came a period of consolidation, of more systematic workings, and of deeper development. In 1873 came the discovery of the "big bonanza" by Mackay, Fair, O'Brien and Flood, who became the four "bonanza kings" of Nevada. In 1873, $21,000,000 was taken from the Comstock and production increased until the maximum of $36,000,000 was reached in 1878. The Sutro Tunnel intersected the lode in the latter year, and drained the mines. But the richer workings soon proved below the tunnel level and the shafts were sent deeper. In 1882 an immense flow of hot water was struck which flooded the principal mines up to the Sutro Tunnel level. The miners were forced to return to the upper levels and work the lower grade ores. Production decreased and with the end in sight the market slumped. Also, the National Government had abandoned its artificial maintenance of the price of silver. The period of depression lasted until

about 1900 when the discovery of a new mineral belt in southern Nevada brought renewed prosperity. Tonopah, 60 m. from the railroad, became the new Mecca, and fast upon the heels of its discovery came that at Goldfield. A railway was completed to the new camps in 1904 and Tonopah has since been one of the largest and steadiest producing districts of the State. Copper ores of vast extent were discovered at Ely at about the same time and the Nevada Northern railway was completed to this camp in 1907.

The depression immediately before 1900 served a good purpose in turning attention to the agricultural and live stock possibilities of the State. The river valleys under irrigation proved most fertile and these were soon settled by large-scale ranchers. On the river bottoms the ranchers raised their hay, and controlled a still larger acreage of the upland grazing ground. Private irrigation systems were supplemented by Federal undertakings the most notable being the Truckee-Carson project. Many beautiful valley towns now have their prosperity founded on the permanent basis of agriculture rather than the uncertain one of mining.

Until the silver agitation of the '90s Nevada was safely Republican. State politics in the early period were replete with corruption, mining interests buying influence with a lavish hand. Nevada also earned the name of the "Rotten Borough" in the U.S. Senate because so many of its rich mine-owners were accused of purchasing their seats in that body. An exception must be made in the case of William M. Stewart, elected as one of the first senators in 1864, who served, except for 12 years' intermission, until 1907, a span of 42 years. John P. Jones, his colleague, and perhaps an even abler man, served for 30 years, becoming one of the great leaders in the Silver movement. For four State elections the Silver Party swept the State and controlled the Administration. After the issue subsided the old parties reappeared and since have been about equal in their strength and their control of the State Government.

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NEVADA, a city of south-western Missouri, U.S.A., 90 m. S. by E. of Kansas City, at an altitude of 860 ft.; the county seat of Vernon county. It is on Federal highways 54 and 71, and is served by the Missouri-Kansas-Texas and the Missouri Pacific railways. Pop. 7,139 in 1920 (97% native white); estimated locally at over 9,000 in 1928. It is the seat of a State hospital for the insane, and of Cottey college for girls (1884). The National Guard of Missouri has a camping ground near by. There are chalybeate and sulphur springs in one of the city's parks. Coal is mined in the vicinity, and the city has flour and planing mills, galvanized iron works, and other manufacturing industries. Nevada was platted in 1855, incorporated as a town in 1869 and chartered as a city in 1880. During the Civil War it was burned to the ground (1863).

NEVADA CITY, a city of eastern California, U.S.A., on Deer creek, at an altitude of 2,580 ft., 60 m. N.N.E. of Sacramento; the county seat of Nevada county. It is served by the Nevada County Narrow Gauge railroad and motor-bus lines. Pop. (1920) 1,782; 1928 estimate, 3,500. It is a summer resort and a supply centre for the neighbouring mining camps. The county is still an important producer of gold, with an annual output of over $1,000,000. Gold was discovered here in the summer of 1849 by James W. Marshall, who in the preceding year had picked up the first nugget in California, near Coloma. The gold output was at its peak in 1850–51. Nevada City was incorporated in 1851 under a special act of the legislature (repealed in 1852). It was reincorporated in 1856 and again in 1878.

NÉVÉ or **FIRN,** masses of compacted snow formed from the accumulated snow in the catchment area of a glacier, by processes of alternate thawing and freezing. The névé is the feeding ground for the valley-glaciers. (*See* GLACIER.)

NEVERS, a town of France, capital of the department of Nièvre, 159 m. S.S.E. of Paris by the P.L.M. railway to Nimes. Pop. (1926) 27,328. *Noviodunum*, the early name of Nevers, was later altered to *Nebirnum*. Many medals and Roman antiquities found there show its importance when Caesar chose it as a military depôt. In 52 B.C. it was the first place seized by the revolting Aedui. It became the seat of a bishopric at the end of the 5th century.

Having formed part of the duchy of Burgundy, the county of Nevers (Nivernais) was given by Duke Henry I. in 987 to his stepson, Otto William, afterwards count of Mâcon, from whom it passed to his son-in-law Landri. The first house of the hereditary counts of Nevers originated in Landri, and was brought to an end in 1192 by the death of Agnes, countess of Nevers, wife of Pierre de Courtenay (d. 1217). The county subsequently passed into the houses of Donzy, Châtillon and Bourbon. Nevers is on the Loire where it joins the Nièvre. Narrow winding streets lead from the quay through the town, with many old houses (14th to the 17th centuries). The cathedral of St. Cyr is a combination of two churches, one Romanesque (11th century), the other Gothic (14th century). There is a fine square (16th century) tower on the south side. The church of St. Étienne is 11th century Romanesque. The ducal palace at Nevers (now occupied by the courts of justice and an important ceramic museum) was built in the 15th and 16th centuries and is one of the chief feudal buildings in central France. An octagonal middle tower contains the great staircase, and its windows are adorned by sculptures relating to the history of the house of Clèves. The Porte du Croux, a square tower, with corner turrets (14th century), is among the remnants of the old fortifications. Nevers is the seat of a bishopric under the archbishop of Sens, of tribunals of first instance and of commerce and of a court of assizes and has a chamber of commerce.

NEVILLE or NEVILL, the family name of a famous English noble house, descended from Dolfin son of Uchtred, who had a grant from the prior of Durham in 1131 of "Staindropshire," co. Durham, a territory which remained in the hands of his descendants for over four centuries, and in which stood Raby castle, their chief seat. His grandson, Robert, son of Meldred, married the heiress of Geoffrey de Neville (d. 1192–1193), who inherited from her mother the Bulmer lordship of Brancepeth near Durham. Henceforth Brancepeth castle became the other seat of the house, of which the bull's head crest commemorates the Bulmers; but it adopted the Norman surname of Neville (*Neuville*). Robert's grandson, another Robert (d. 1282), held high position in Northumbria, and sided with Henry III. in the Barons' War, as did his younger brother Geoffrey (d. 1285), ancestor of the Nevills of Hornby. This Robert's son Robert (d. 1271) extended the possessions of the family into Yorkshire by his marriage with the heiress of Middleham. The summons of their son Ranulf (d. 1331) to parliament as a baron (1294) did but recognize the position of the Nevills as mighty in the north country. Ralph (d. 1367) the second baron—whose elder brother "the Peacock of the North" was slain by the Douglas in 1318—was employed by Edward III. as a commander against the Scots and had a leading part in the victory of Nevill's Cross (1346), where David Bruce was captured, and by which Durham was saved. His active career as head of his house (1331–1367) made the name of Nevill a power on the Scottish march. Of his younger sons, Alexander became archbishop of York (1374–1388) and was a supporter of Richard II., attending him closely and encouraging his absolutist policy; he was one of those "appealed of treason" by the opposition in 1388, and was outlawed. He died abroad in 1392. His younger brother William, a naval commander, was a leading Lollard and a friend of Wiclif, and in 1388–1389 acted with the lords appellant.

John, the 3rd baron (d. 1388), a warden of the Scottish marches

and lieutenant of Aquitaine, a follower of John of Gaunt and a famous soldier in the French wars of Edward III., continued the policy of strengthening the family's position by marriage; his sisters and daughters became the wives of great northern lords; his first wife was a Percy, and his second Lord Latimer's heiress; and his younger son, Thomas, became Lord Furnival in right of his wife, while his son by his second wife became Lord Latimer. His eldest son Ralph (1364–1425), 1st earl of Westmorland (*see* WESTMORLAND, EARLS OF), married as his second wife a daughter of John of Gaunt and secured heiresses for five of his sons, four of the younger ones becoming peers, while a fifth, Robert, was made bishop of Durham (1438–1457). Among his daughters were the duchesses of Norfolk, Buckingham and York (mother of Edward IV. and Richard III.) and an abbess of Barking. The Nevills were thus closely connected with the houses of Lancaster and York, and had themselves become the most important family in the realm. Of the earl's sons by his second marriage, Richard, earl of Salisbury (and three of his sons) and William, earl of Kent, are the subjects of separate notices.

The greatness of the Nevills centred in the "kingmaker" (Richard's son) and the heads of his house, after the 1st earl, were of small account in history, till Charles, the 6th earl, at the instigation of his wife, Surrey's daughter, joined Northumberland in the fatal northern rising of 1569 to the ruin of his house. His estates, with the noble castles of Brancepeth and Raby, were forfeited; Middleham, with the Yorkshire lands, had been settled by the 1st earl on the heirs of his second marriage.

Although the senior line became extinct on the earl's death abroad (1601), there were male descendants of the 1st earl remaining, sprung from George and Edward, sons of his second marriage. George, who was Lord Latimer, was father of Sir Henry, slain at Edgcote fight, and grandfather of Richard, 2nd lord (1469–1530), a soldier who distinguished himself in the north, especially at Flodden Field. His grandson (d. 1577) was the last lord, but there were male descendants of his younger sons, one of whom, Edmund, claimed the barony, and after 1601 the earldom of Westmorland, but vainly, owing to its attainder.

The heirs male of Edward, Lord "Bergavenny" (now "Abergavenny" co. Monmouth), who died in 1476, have retained their place in the peerage under that style to the present day. In 1784 the then Lord Abergavenny received an earldom, and the next lord erected at Eridge, Sussex, the present seat of the family, on which the marquisate of Abergavenny and earldom of Lewes were conferred in 1876. Its Sussex estates are derived through the Beauchamps, from the Fitz Alans, heirs of the Warennes.

See Rowland's *Historical and Genealogical Account of the Family of Nevill* (1830); Drummond's *Noble British Families* (1846); Swallow's *De Nova Villa* (1885); and Barron's sketch in *The Ancestor*, No. 6 (1903). Also Dugdale's *Baronage;* G. E. C[okayne]'s *Complete Peerage;* J. H. Round's *Feudal England;* and for the Nevill castles Mackenzie's *Castles of England*. For the Kingmaker, *see* Oman's monograph (1891).

NEVILLE'S CROSS, BATTLE OF. This battle of Oct. 17, 1346, took place after Crécy (*q.v.*) and while Edward III. was still abroad, besieging Calais. It foiled the opportunist Scottish invasion, and assured Edward's freedom to continue his French projects. But its main interest in military history is that it affords an example of the offensive power of the new tactical combination of archers and spearmen, in contrast to Dupplin, Halidon Hill, Crécy, Poitiers and Agincourt, which were all won by awaiting the enemy's onslaught. After crossing the border, King David Bruce was surprised by the quickness with which the English, under William de la Zouch, archbishop of York, concentrated to meet him. Driven to accept battle near Durham, the Scottish king took up his position to resist attack, his pikemen formed in three great "schiltrons." The English advanced, with their left leading, and the archers on this wing overlapped and swarmed round the Scottish right flank "schiltron." When this broke under the arrow-storm, they closed on the centre "schiltron" —already attacked in front. Its collapse, in turn, under the converging pressure, led to the capture of the king and the hurried retreat of the remaining left division of pikemen. Thus the archers proved their power against an immobile foe to pave the way for a successful assault by knights and men-at-arms.

NEVIN, ETHELBERT (1862–1901), American composer, was born at Edgeworth, Pa., Nov. 25, 1862. His musical talent displayed itself in childhood. He studied in Boston, 1884, before going to Berlin to continue work under Klindworth and Von Buelow, who encouraged his ability as composer. After teaching in Boston (1887–93), he returned to Europe residing for a time in Paris, Berlin, Florence and Venice as well as in Algiers. In 1900 he went back to the United States, becoming associated with Horatio Parker in the department of music at Yale university. He died at New Haven, Conn., Feb. 17, 1901. Ranked with the foremost of American song-writers, he was also the composer of many instrumental pieces, mostly in miniature form, marked by a delicate, melodious originality. Among his compositions were *Water Scenes* for the piano, including the favourite *Narcissus;* a piano suite, *In Tuscany;* the song cycles, *In Arcady* and *The Quest of the Heart's Desire,* the latter posthumously published as was also *Tempo di Valse;* a *Sketch Book* of songs and piano music; and *The Rosary,* the song that became instantly popular at a concert at Madison Square Garden, New York, Feb. 15, 1898, and has been a universal favourite ever since.

NEVIS, an island in the British West Indies, forming with St. Kitts one of the five presidencies in the colony of the Leeward Islands. Pop. (1901) 12,774. It lies in 17° 14′ N. and 62° 33′ W., and is separated from St. Kitts by a shallow channel 2 m. wide at its narrowest point. The island is almost circular, and from the sea has the appearance of a perfect cone, rising gradually to the height of 3,200 ft. Total area 50 sq.m. The climate is healthy, the average temperature 82° F. Sugar, molasses, cotton and cocoanuts are exported, and corn, yams, coffee and fruit are grown. There are medicinal springs and large deposits of sulphur. The chief town, Charlestown, lies on a wide bay on the S.W. The legislative council of St. Kitts-Nevis meets at Basseterre, in St. Kitts. Nevis was discovered by Columbus in 1498 and first colonized in 1628 by English from St. Kitts.

NEW ACADEMY. Plato's school is known as the Academy, or the older Academy. For some time after Plato's death the school continued true to his teaching. But in the third century B.C., when Arcesilaus (316–241 B.C.), was head of the Academy, there came a great change. Arcesilaus developed a sceptical philosophy in opposition mainly to the Stoics. To mark this change in the trend of its teaching the school became known as the New Academy. *See* PLATO; ACADEMY, GREEK.

NEW ALBANY, a city of southern Indiana, U.S.A., on the Ohio river, opposite Louisville, Kentucky; county seat of Floyd county. It is on Federal highways 31 and 150, and is served by the Baltimore and Ohio, the Chicago, Indianapolis and Louisville, the Pennsylvania, the Southern, electric railways and river steamers. Pop. (1920) 22,992 (91% native white), estimated locally at over 32,000 in 1928. The city lies on a plateau above the river, in beautiful scenery. Four coalfields are close at hand, and hydro-electric current is available. Its 46 manufacturing industries had an output in 1926 valued at $19,500,000; the combined business of its 22 wholesale houses was $20,000,000; and bank deposits aggregated $14,431,472. The leading products are ply-wood, furniture, iron and steel, edge tools, engines and boilers, woollen and cotton goods, leather, fertilizer and flour. New Albany was settled early in the 19th century, plotted in 1813, and chartered as a city in 1839.

NEW AMSTERDAM, a town of British Guiana, situated in 6° 20′ N. and 59° 15′ W. on the east bank of the Berbice river, about 4 m. from the mouth. Formerly the capital of the colony of Berbice, it is now the capital of the county of that name. It is composed almost entirely of wooden houses, having a population in 1921 of 8,000. Colony House, standing in handsome grounds beside the botanical gardens, formerly the residence of the governor and seat of the legislature, now contains the treasury and supreme courts. New Amsterdam is connected by ferry, rail and a bi-weekly steamer service with Georgetown.

NEWARK, DAVID LESLIE, LORD (1601–1682), Scottish general, fifth son of Sir Patrick Leslie of Pitcairly, Fifeshire, commendator of Lindores, and Lady Jean Stuart, daughter of the

1st earl of Orkney. In his early life he served in the army of Gustavus Adolphus, where he rose to the rank of colonel of cavalry. In 1640 he returned to Scotland. He was major-general under Alexander Leslie, earl of Leven, at Marston Moor. He was then sent into the north-western counties, and besieged and took Carlisle. When, after the battle of Kilsyth, Scotland was at the mercy of Montrose and his army, Leslie was recalled from England in 1645, and made lieutenant-general of horse. In September he surprised and routed Montrose at Philiphaugh near Selkirk. He was then declared lieutenant-general of the forces. After a short period of service in England he returned to Scotland, and reduced several of the Highland clans.

In 1650 Newark was sent against Montrose, who was defeated and captured by Major Strachan, Leslie's advance guard commander; and later in the year, all parties having for the moment combined to support Charles II., Leslie was appointed to the chief command of the new army levied on behalf of Charles II. The result, though disastrous, abundantly demonstrated Leslie's capacity as a soldier, and it might be claimed for him that Cromwell and the English regulars proved no match for him until his movements were interfered with and his army reduced to indiscipline by the representatives of the Kirk party that accompanied his headquarters. After Dunbar Leslie fought a stubborn defensive campaign up to the crossing of the Forth by Cromwell, and then accompanied Charles to Worcester, where he was lieutenant-general under the king. On the defeat of the royal army Leslie was committed to the Tower, where he remained till the Restoration in 1660. In 1661 he was created Lord Newark, and received a pension of £500 per annum. He died in 1682. The title became extinct in 1790.

NEWARK, a town and municipal borough of Nottinghamshire, England. Pop. (1921) 16,958. It lies on the Devon near its junction with the Trent, and is connected with the Trent navigation by a canal 1½ m. in length. It is 120 m. N.N.W. from London by the L.N.E.R. Newark owed its origin, possibly in Roman times, to its position on the great road called the Fosse Way, in the Trent valley. In a 7th century document it is mentioned as having been granted to the abbey of Peterborough by Wulfhere. Granted to the monastery of Stow by Godiva, it remained in the hands of the bishops of Lincoln until the reign of Edward VI. The castle was erected by Bishop Alexander in 1123, and the bridge about the same time. It was incorporated in 1549, and the charter was confirmed and extended by Elizabeth. A weekly market on Wednesdays, and a fair on the eve, day and morrow of the Invention of the Holy Cross, are still held; another fair at St. Mary Magdalene and the four preceding days was granted by Henry III., and is probably represented by the fair now held on May 14. A market for corn and cattle is still held on Wednesdays, and another on Tuesdays for fat stock has been added. The church of St. Mary Magdalene is notable for its tower and octagonal spire (223 ft. high). Its central piers, dating from the 11th or 12th century, remain, and the lower part of the tower is Early English. The upper parts of the tower and spire are Decorated, completed about 1350; the nave dates from between 1384 and 1393, and the chancel from 1489. There are a few old monuments, and a 14th century brass. The castle is supposed to have been founded by Egbert, king of the West Saxons. It was known as the "key of the North." The Norman stronghold still shows a gate-house, a crypt and the lofty tower. The building seems to have been reconstructed in the early part of the 13th century. During the Great Rebellion it was garrisoned for Charles I., and endured three sieges. A late 15th century cross (the "Beaumond" cross) is preserved in the town. A grammar and song school was founded in the reign of Henry VIII. The town trades in malt, coal, corn and cattle. There are iron and brass foundries, boiler-works, agricultural implement manufactories and breweries. Gypsum and limestone are obtained in the neighbourhood.

NEWARK, the largest city of New Jersey, U.S.A., and the 15th in size in the United States (1920), a port of entry and the county seat of Essex county; on the Passaic river and Newark bay, 8 m. W. of lower Manhattan (New York city). It is served by the Baltimore and Ohio, the Central of New Jersey, the Erie, the Lackawanna, the Lehigh Valley and the Pennsylvania railways and an industrial belt line; steamships operating to Atlantic, Gulf and Pacific ports, and Hudson river landings; interurban trolleys, motor-bus and truck lines in all directions; and the Hudson and Manhattan railroad, which provides 176 trains daily to and from New York city via the Hudson tubes. A State highway runs direct (across Jersey City) to the Holland vehicular tunnel. Newark Metropolitan airport (350 ac. at Port Newark) was opened in 1928 for commercial aviation, and is to be used by the post-office department as the concentration and distributing base for air mail for the metropolitan district and eastern points. Pop. (1920) 414,524 (68% native white, 28% foreign-born white and 4% negroes); 1928 local estimate 474,154. This is practically doubled by the adjacent cities and suburbs, including Elizabeth, Bayonne, Harrison, the Oranges, Belleville, Nutley, Bloomfield and Montclair.

The city has an area of 23·78 sq.m., 10·5 m. of water front, 365 m. of streets (320 m. paved), 51,138 buildings (Dec. 1927) and an assessed valuation for 1928 of $845,831,123. The site, bordered on the east by a double S-shaped curve of the Passaic river, is generally level, but rises toward the west. Port Newark faces Newark bay at the mouth of the river. The city is laid out in an irregular pattern. It is closely built up in the business sections, largely with tall structures of modern type. Many of the older buildings are of a native brown sandstone. Broad street (120 ft. wide) and Market street (90 ft.) are the principal thoroughfares, and their intersection (the "Four Corners") is one of the busiest traffic spots in the world. Near by is Military park (an irregular plaza used in colonial days as a drill ground), surrounded by public and semi-public buildings (including the Public Service terminal, completed in 1916) and containing a magnificent bronze group of 48 figures on a gigantic scale by Gutzon Borglum, "The Wars of America." Facing Washington park, also near the heart of the city, are the public library and the Newark Museum of Industry, Art and Science (opened 1926). Conspicuous among the city's business structures are the buildings of the Prudential and various other insurance companies. The county court house, designed by Cass Gilbert, has mural decorations by well known American artists, and in front of it is Gutzon Borglum's seated statue of Lincoln (in bronze). The hall of records, opposite the court house, was completed in 1928. Center market (1923) is one of the best equipped municipal markets in the country. Contracts have been made (1928) for the construction of a new union railway and trolley station. Among the noteworthy old buildings are the Trinity Episcopal cathedral, near Military park, built in 1743 and used as a hospital during the Revolution, and the House of Prayer with its stone rectory. There are 38 playgrounds, with a combined area of 110 ac., and the parks within the city limits cover 734 ac., of which 704 ac. are part of the Essex county park system aggregating 3,484 acres.

Since 1917 the city has operated under a commission form of government. Five commissioners, elected at large every four years, constitute the governing body. Each commissioner is the director of one of the five departments of the city's business (public affairs, public works, finance, public safety, parks and public property) and the director of the department of public affairs serves as mayor. The public schools are administered by a non-partisan appointed board. On the initiative of the chamber of commerce, the council-manager form of government has been under discussion among the citizens since 1924. The city's water-supply from the Pequannock river (55,000,000 gal. daily) has been increased by the development of the Wanaque watershed (a joint undertaking by several municipalities of northern New Jersey) which will supply a total of 100,000,000 gal. a day, of which 40,500,000 gal. has been allotted to Newark. The sewage from Newark, Paterson and 13 other municipalities on the Passaic river is collected by a large intercepting sewer (completed 1924), carried down to a disposal plant on the Newark meadows, where it is treated for the removal of solids, and thence carried under Newark bay and Jersey City to a point in New York bay 2 m. from the shore, where the effluent is discharged at a depth of

40 ft. into strong tidal currents.

The public-school system comprises 68 elementary, 3 junior and 5 senior high, 2 vocational, 2 continuation and 17 evening schools. There are 27 parochial schools and several private academies, including Newark academy, founded in 1792. The public library and the museum (under the direction of John Cotton Dana) have been pioneers in developing unconventional methods of serving the people of an industrial community. The library has about 350,000 volumes and an annual circulation of 1,500,000. The museum has exhibits valued at over $800,000. There are several special libraries in the city, including the Prudential Insurance Company's valuable collection on vital statistics. The Newark Institute of Arts and Sciences (1910) is an extension centre of New York university. Newark is the seat of a State normal school (1913); the Newark College of Technology (1885), which co-ordinates theoretical instruction with practical training in industrial plants; the New Jersey College of Pharmacy (1891), now affiliated with Rutgers university; and the New Jersey Law school (1908). There are 114 churches and Newark is the see of both a Roman Catholic and a Protestant Episcopal bishop. The philanthropic institutions and agencies are united in a welfare federation, and over 50 of them are financed by a single annual "community chest" campaign. The daily newspapers are the *Star-Eagle* (1796), the *News* (1883), the *Ledger* (1914) and the *Freie Zeitung* (1857). Among the weeklies are one in Polish and one in Yiddish.

Newark has long been one of the leading manufacturing cities of the country. In 1925, with 1,668 establishments, employing together an average of 66,854 workers, and producing goods valued at $490,046,599, it ranked 14th among the cities of the United States in value of output. Over 400 new plants were established in the Newark district in 1926 and 1927. The industries are highly diversified. Among the principal products (measured by value in 1925) are electrical machinery, apparatus and supplies ($51,564,446), paints and varnishes ($23,271,662), leather ($22,945,072), jewellery ($22,301,802), chemicals ($18,053,917) and meat products ($17,682,863). As an insurance centre also it has long been important. The 16 large life, fire and casualty companies which have their home offices here employ some 9,000 persons in Newark and have assets aggregating $2,100,000,000. It is an important transportation centre, by rail, highway, air and sea. Development as a seaport is comparatively recent. In 1914 the city began the creation of Port Newark (on Newark bay, south-east of the city, a part of New York harbour) as a shipping terminal and industrial centre. On the entrance of the United States into the World War in 1917 the War Department leased 133 ac. of the newly filled land for one of its largest supply bases, spending $12,000,000 on docks, warehouses and freight-handling equipment; and the U.S. Shipping Board established a $30,000,000 ship-yard, employing 17,000 persons, where 150 steel cargo vessels were constructed by the Submarine Boat Corporation. At the close of the war the city acquired the army base (including 9 warehouses with 2,000,000 ft. of floor space) and resumed its programme. With aid from the Federal Government the channel has been deepened to 31 ft. and widened to 400 feet. Additional land has been reclaimed for industrial sites, and by 1928 six public and 139 private docks and piers had been built. Water-borne commerce in 1927 amounted to 7,115,323 tons. Freight received and despatched by rail totalled 5,892,011 tons and express shipments 1,992,483 parcels. There are nearly 500 building and loan associations, with total assets of over $350,000,000. The institutions for saving have deposits of about $90,000,000. Bank debits for 1927 aggregated $4,770,562,079.

In 1666 (following the union of the towns of the New Haven Jurisdiction with Connecticut in 1664, and the consequent secularization of the franchise) a band of about 30 Puritans from Milford, Conn., led by Robert Treat, settled at "Four Corners," and the next year they were joined by an equal number from Branford and Guilford. They bought practically all of what is now Essex county from the Indians for "fifty double hands of powder, one hundred bars of lead, twenty axes, twenty coats, ten guns, twenty pistols, ten kettles, ten swords, four blankets, four barrels of beer, ten pairs of breeches, fifty knives, twenty horses, 1850 fathoms of wampum, six ankers of liquor (or something equivalent), and three troopers' coats." The name was chosen in honour of their pastor, the Rev. Abraham Pierson (1608–78), who came from Newark-on-Trent. For 50 years or more the town remained essentially Puritan and was governed largely according to the Mosaic Law. About 1730 Presbyterianism superseded Congregationalism, and in 1734 Col. Josiah Ogden (who had caused a schism by saving his wheat one dry Sunday in a wet season) led in founding the first Episcopal church (Trinity). Newark was incorporated as a township in 1693 and was chartered as a city in 1836. The townships of Orange and Bloomfield were set off from it in 1806 and 1812 respectively. From 1747 to 1756 the College of New Jersey (now Princeton university) was carried on here, under the presidency after the first few months of the Rev. Aaron Burr, who published in 1752 his famous textbook, the *Newark Grammar*. The manufacture of leather (especially patent leather) and shoes early became an important industry. There was a tannery here in 1770 and by 1837 there were 155 curriers and patent-leather makers. The jewellery industry dates from about 1830. Until the passage of the Volstead Act the manufacture of malt liquors was one of the leading industries. Newark was the home of Seth Boyden (1788–1870), called by Edison "one of America's greatest inventors," who invented the processes for making patent leather (1818) and malleable cast iron (1826), besides many new machines and many improvements on older apparatus; and of the Rev. Hannibal Goodwin, who in 1887, in the attic of the rectory of the House of Prayer, invented the flexible film which made the motion picture possible. After the European revolutions of 1848 Newark received an influx of foreign-born, notably Germans. The city's population was 38,894 in 1850; 71,941 in 1860; 136,508 in 1880; and 246,070 in 1900. Between 1900 and 1910 it increased 41%; between 1910 and 1920, 19%. There has been no important annexation of territory (except at Port Newark) since 1905.

NEWARK, a village of Wayne county, New York, U.S.A., 30 m. E. of Rochester, on the State Barge canal, and served by the Marion, the New York Central, the Pennsylvania, the West Shore and electric railways. Pop. (1920) 6,964 (87% native white). Twenty miles north are the summer resorts on Sodus bay (Lake Ontario), and Lakes Seneca and Canandaigua lie 15 m. and 18 m. respectively to the south. Newark has extensive nurseries and a great variety of manufacturing industries, with a combined pay-roll estimated at $1,750,000 annually, and an aggregate business of $15,000,000. It is the seat of a State school for mental defectives. The village was founded about the time of the opening of the Erie canal (1825) and was incorporated in 1839.

NEWARK, a city of central Ohio, U.S.A., 33 m. E. by N. of Columbus, at the confluence of the north and south forks of the Licking river; the county seat of Licking county. It is served by the Baltimore and Ohio, the Pennsylvania and electric railways. Pop. 26,718 in 1920 (92% native white); estimated locally at over 30,000 in 1928. The city lies 820 ft. above sea-level, in a broad, fertile valley, surrounded on three sides by low hills. It is a division point of the Baltimore and Ohio, which employs 2,000 persons in its offices, shops and freight-yards; and has important and diversified manufacturing industries, with an output in 1925 valued at $26,392,153. Stoves, glass, freight-cars and automobiles are leading products. At Heath, 2 m. S.W., there is a large oil refinery. Granville, 6 m. west, is the seat of Denison university (Baptist, 1831). In Newark and its immediate vicinity are some of the most extensive remaining earthworks of the mound builders, occupying 4 sq.m. when first noticed (about 1800) by the white settlers, at which time they were covered with dense forests containing trees over 500 years old. They are of great variety, including a circular enclosure of 50 ac., connected by parallel banks with an octagonal mound (20 ac.), and a *bas relief* 6 ft. high in the form of a spread eagle measuring 240 by 210 feet. Newark was laid out about 1801 and was incorporated in 1813.

NEWARK WORKS. An elaborate and complicated group of prehistoric works at the junction of two branches of Licking river, near Newark, Licking county, Ohio. Situated on a plain

30 to 50 ft. above the bottom land, the works consist of a series of square, circular, and octagonal enclosures, with mounds, ditches and connecting avenues spreading over nearly four sq. miles. They are composed of two groups, nearly two m. apart, connected by two walled avenues averaging 200 ft. wide. The western group consists of a large circle, 3 to 14 ft. high and with a mean diameter of 1,054 ft., connected with a symmetrical octagon by an avenue 300 ft. long and 80 ft. wide. Outside the octagon are two small circles, and at each corner of the octagon is a gateway, opposite which and 60 ft. within is a small mound 3 to 6 ft. in height. The length of the walls between the centres of the gateways averages 621 ft., from which the greatest variation is only four ft., except in one wall that falls 8 ft. short of the average. From the S. side of the octagon a walled avenue stretches southward two m. or more, and from near its E. side two similar avenues extend eastward with a low wall on each side, one connecting with the square of the eastern group, the other running E. to the descent to the lowland north of the square. Disposed along these avenues are circles. The eastern group of the works consists of a large circle connected with the square mentioned by a broad avenue and several adjoining lines of walls. The wall of the circle is accompanied with an inside ditch 28 to 40 ft. wide and 8 to 13 ft. deep, while the wall itself is 35 to 55 ft. wide at the base and from 5 to 14 ft. high. There is a gateway at the N.E. with flanking extensions of the wall into the walled avenue leading to the square, the sides of which are 926 to 951 ft., yet the angles at the corners do not vary from the right angle more than one degree.

NEW BEDFORD, a city of Massachusetts, U.S.A., 56 m S. of Boston at the mouth of the Acushnet river, on an arm of Buzzard's bay; a port of entry and one of the county seats of Bristol county. It is on Federal highway 6, and is served by the New York, New Haven and Hartford railroad, interurban trolley and motor-bus lines, and steamboats. Pop. (1920) 121,217 (40% foreign-born white, including the largest colonies in the country from the Atlantic Islands and Portugal, and large numbers also of French-Canadians and English). The city occupies about 20 sq.m. along the west side of the river and harbour, opposite Fairhaven, with which it is connected by two highway bridges. It is in the heart of the summer-resort region of southern New England, and is the port of sailing for the islands of Nantucket and Martha's Vineyard. The harbour is a tidal estuary, with a 25 ft. channel 300 ft. wide and a 14 ac. turning basin. The State pier, completed in 1917, is a modern steamship terminal, 670 ft. long, with large storage space, built by the Commonwealth of Massachusetts. Boulevards almost encircle the city, including a broad drive along the shore of the harbour to Clark's point, where Ft. Rodman (erected during the Civil War) guards the entrance. There are some handsome modern buildings, including the post office, the municipal building, the library and the high school. The library, established by a private society in 1802 and taken over by the city in 1853, was one of the first free public libraries in America. It has a fine collection of whaling prints and other material relating to the industry, and much material relating to the Quakers. The Bourne Whaling museum contains, among other exhibits, a full-rigged whaleship completely equipped; and in the Seamen's Bethel (1831) just across the street are the memorial tablets described by Melville in *Moby Dick*. The last of the full-rigged whalers, the "Charles W. Morgan," set in a concrete basin on the estate of Col. E. H. R. Green at South Dartmouth (9 m. S.W. of New Bedford), is kept as a museum. Free educational opportunities, in addition to those provided by the public-school system, are offered by a State Textile school, the New Bedford Vocational school and the Swain Free School of Design. The morning newspaper, the *Mercury*, was established in 1807. Daily papers are published in French and in Portuguese.

New Bedford has long been one of the principal centres for the manufacture of fine cotton goods. It ranks second only to Washington in the proportion of women employed in gainful occupations (42% in 1920) and second only to Fall River in the proportion of children 10 to 14 years of age so employed (17% in 1920). Its aggregate factory output in 1925 was valued at $143,551,349, of which $100,589,496 represented cotton goods. It is the spot cotton market of the North, and its warehouses have a storage capacity for 300,000 bales. The traffic of the harbour in 1925 (including Fairhaven) amounted to 1,033,829 tons, valued at $129,622,261, almost all domestic commerce. In addition, there are large shipments of fish. The city's assessed valuation for 1927 was $216,197,725. Bank debits for 1927 aggregated $364,352,000.

The site of New Bedford was visited in 1602 by Gosnold, who traded with the Indians at the mouth of the Acushnet. It was originally part of the town of Dartmouth, settled in 1652 by colonists from Plymouth, who purchased the land from Massasoit. About 1665 there was a considerable influx of Quakers, who have ever since been an important and influential element in the population. There was no village on the site of the present city until 1760. In 1787 New Bedford was set off from Dartmouth and incorporated as a town, and in 1847 it was chartered as a city. Fairhaven was separated from it in 1812. The town was at first called Bedford (the family name of Joseph Russell, one of the founders), and later New was prefixed to distinguish it from Bedford in Middlesex county. On May 14, 1775, a local ship captured two armed British sloops just outside the New Bedford harbour. During the Revolution the harbour was a rendezvous of American privateers, and this led to an attack (Sept. 5, 1778) by a fleet and armed force under Earl Grey, which burned 70 ships and almost destroyed the town. The whaling industry became established here after Joseph Rotch, a Nantucket merchant, in 1765 built wharves and warehouses on the west side of the harbour, and New Bedford was long the principal whaling port of the world. For more than a century the industry flourished, with interruptions due to the Revolution, the Embargo, the War of 1812 and the Civil War, reaching its peak in 1857, when 329 whaling ships were registered, representing an investment of $12,000,000 and employing 10,000 men ashore and afloat. The hunting grounds shifted after 1791 from off the Virginia and Carolina coast to the Pacific, and after 1848 to the Arctic waters. The first cotton-mill was built in 1847 by Joseph Grinnell (1789–1885) and his associates, and began operation in 1848 with 15,000 spindles and 200 looms. In 1928 the 66 mills making cotton yarn and cotton goods were equipped with 3,382,500 spindles (about 10% of the total in the United States) and 58,000 looms, and they produce from 35 to 40% of all the fine cotton fabrics made in the country. Because of the character of the goods made, New Bedford has suffered less than other New England cities from the competition of the new textile centres in the South.

NEW BERN, a city of eastern North Carolina, U.S.A., at the mouth of the Trent river, on the Neuse river estuary; a port of entry and the county seat of Craven county. It is on the Atlantic Coastal highway; is connected by a 12 ft. channel with the inland waterway from Boston to Beaufort; and is served by the Atlantic Coast Line and the Norfolk Southern railways and coastwise steamers. Pop. 12,198 in 1920 (55% negroes); estimated locally at 14,000 (40% negroes) in 1928. The Neuse river is 1¼ m. wide here, and it widens gradually to 7 m. at its entrance into Pamlico sound, 30 m. east. New Bern is a picturesque old city, on the peninsula formed by the two rivers, surrounded by forests of cypress and pines. It is the supply depot and commercial centre of the rich surrounding farm lands, and of the numerous fishing and hunting resorts of the region (Ocracoke, Morehead, Beaufort, Jacksonville, Havelock, Nags Head and Cape Lookout). Traffic on the Neuse in 1925 amounted to 258,003 tons, valued at $9,596,720. The city's manufacturing industries include the largest lumber-mill in the South-east.

New Bern was founded in 1710 by a company of Germans and Bernese Swiss in search of religious freedom, under the leadership of Baron Christopher de Graffenried, and was incorporated as a city in 1723. The general assembly met here in 1738. In 1749 a printing press (the first in North Carolina) was set up, and the first academy in the province was established. For some years the city was the capital of the province, and it was the leading seaport until the Revolution. Many beautiful old buildings still stand, including one wing of "Tryon's Palace" (the residence of the royal governor, built in 1767–70, and reputed the finest structure in America at the time), the Presbyterian church (1822),

and Christ church, which has a communion service presented by George II. in 1752. The city was strongly fortified early in the Civil War, but was captured by Federal troops on March 14, 1862, and subsequent attempts by the Confederates to retake it (March 14, 1863, and Feb. 1 and 5, 1864) were unsuccessful.

NEWBERRY, JOHN STRONG (1822–1892), American geologist, was born at Windsor, Conn., on Dec. 22, 1822. He graduated from Western Reserve in 1846 and from Cleveland Medical college in 1848, and completed his medical studies in Paris. In 1851 he began the practice of medicine in Cleveland, but abandoned it to accept an appointment as surgeon and geologist with an exploring party in northern California and Oregon. His reports on the geology, botany and zoology of the expedition were published in 1857. For the next four years he was employed on similar work in the region of the Colorado river, his researches extending over a large area in Utah, Arizona and New Mexico. In 1866 he was appointed professor of geology and palaeontology at the Columbia School of Mines, New York, where he commenced the formation of a magnificent collection of specimens. In 1869 he was made State geologist of Ohio and director of the (second) geological survey of that State, and in 1884 palaeontologist to the U.S. Geological Survey. He devoted much study to Triassic, Cretaceous and Tertiary plants, and in particular to those of the Larami stage. He also carried on researches among the Palaeozoic and Triassic fishes of North America. Among his other publications may be mentioned *The Origin and Classification of Ore Deposits* (1880). He died at New Haven, Conn., on Dec. 7, 1892.

A bibliography of his publications is given in *Bulletin of Geol. Soc. of America*, vol. iv. p. 393. "Memoir" (with portrait) by J. J. Stevenson in *American Geologist* (July 1893).

NEWBERRY, a town of South Carolina, U.S.A., the county seat of Newberry county; on Federal highways 76 and 176, 43 m. N.W. of Columbia. It is served by the Columbia, Newberry and Laurens and the Southern railways. Pop. 5,894 in 1920 (35% negroes); estimated locally at 8,000 in 1928. It is an important cotton market and cotton-manufacturing centre, with over 195,000 spindles in its mills in 1928; and is the seat of Newberry college (founded 1859). The town was settled about 1830 and was incorporated in 1894.

NEWBOLT, SIR HENRY JOHN (1862–), English author and poet, was born on June 6, 1862, the son of H. F. Newbolt, vicar of St. Mary's, Bilston. He was educated at Clifton college, and at Corpus Christi college, Oxford. He was called to the bar at Lincoln's Inn in 1887 and practised until 1899. His first book was a story, *Taken from the Enemy* (1892), and in 1895 he published a tragedy, *Mordred;* but the publication of his ballads, *Admirals All* (1897), created his literary reputation. These were followed by other volumes of stirring verse, *The Island Race* (1898), *The Sailing of the Long-ships* (1902), *Songs of the Sea* (1904). From 1900 to 1905 he was editor of the *Monthly Review.* His novels *The Old Country* (1916) and *The New June* (1909), attracted attention. During the World War he was controller of wireless and cables. He was knighted in 1915. In 1914 appeared *Drake's Drum and other Sea Songs,* and *Aladore;* his chief contribution to war poetry was *St. George's Day and Other Poems* (1918). In 1920 he published his *Naval History of the Great War.*

His other works include:—*Tales of the Great War* (1916), *The Book of the Happy Warrior* (1917), and *Submarine and Anti-Submarine* (1918), written primarily for the young; *A New Study of English Poetry* (1917); *Poetry and Time* (1919); *An English Anthology* (1921); *Studies Green and Gray* (1926); and *New Paths on Helicon* (1927).

NEW BRIGHTON, formerly a village (coextensive with the town of Castleton) of Richmond county, New York, U.S.A., but since Jan. 1, 1898 a part of the borough of Richmond, New York city. It is at the north-eastern end of Staten Island, about 6 m. S.W. of the borough of Manhattan. At New Brighton is the Sailors' Snug Harbour, founded under the will of Robert Richard Randall (*c.* 1740–1801), who in 1771 became a member of the Marine Society of New York (an organization for the relief of indigent masters of vessels and their families), and in 1790 bought from Baron Poelnitz the "Minto farm," about 21 ac. of land in what is now the Borough of Manhattan. This tract, with four lots, also in what is now Manhattan, and cash and stocks to the value of about $10,000 Randall bequeathed to a board of trustees, directing that the income should be used "for the purpose of maintaining and supporting aged, decrepit and worn-out sailors," who had served at least five years under the American flag, and that the institution established for this purpose should be called "the Sailors' Snug Harbour." The Sailors' Snug Harbour was incorporated in 1806, and its charter was amended in 1828 to permit the building of the institution on Staten Island rather than on the Randall estate, which had already greatly increased in value. In 1833 the institution, with lands covering 160 ac., was opened in New Brighton with about 50 inmates. Randall's body was removed to the grounds in 1834, and in 1884 a life-size bronze statue of him, by Augustus Saint Gaudens, was placed in front of the main building. At New Brighton are also a Home for Destitute Children of Seamen, founded in 1846 at Stapleton, Staten Island, removed to a new building on the Snug Harbour property in 1852, and the Samuel R. Smith Infirmary, founded in 1861.

See G. A. Ward, *Description of New Brighton on Staten Island* (1836); I. K. Morris, *Memorial History of Staten Island* (1900); and C. G. Kolff, *A Short History of Staten Island* (1926).

NEW BRITAIN, an island of the Bismarck Archipelago, lying east of New Guinea, in the Pacific ocean, between 5° and 6° S., and 150° E. (German, *Neu Pommern;* native, *Birara*). It formed part of the colony of German New Guinea from 1884 (when the German protectorate was declared), until 1914, when it was occupied by Australian troops, and in 1919 it was mandated by the League of Nations, to the Commonwealth of Australia, by which country it is now being administered. It is the largest and most important island of the archipelago, with a total area of 10,000 sq. miles. It is long and very narrow, almost crescent-shaped, with a mean breadth of 28 miles. Despite its small width, in 1928 it had not been crossed by a white man, except at its northern extremity, due to the fact that a high and very rugged range of mountains runs from one end to the other. Volcanic action is very evident throughout the island, especially in the north, where, close to Rabaul, are the Matupi sulphur springs. The highest peak in the island, the Father (7,500 ft.) on the north-west coast, is an active volcano, and near it are two mountains the North Son and the South Son, and not far from Rabaul are three mountains, the Mother, the North Daughter and the South Daughter, the first-named being an extinct volcano. Vulcan Island, with an area of several acres, on the south side of Blanche Bay, made its appearance in a single night, in 1870, during an eruption of Mt. Mother when violent earthquakes were experienced: earth tremors are of frequent occurrence. The coast is precipitous in some places, in others flat and fringed with coral reefs; but there are several good harbours, the best being Simpson Haven, the inlying portion of Blanche Bay; others are Jacquinot Bay, Arawe, Linden haven and Powell haven. There are no rivers of any importance, only a few short, rapid-flowing streams. The chief town and centre of administration is Rabaul, situated on Simpson haven, which is also a good port with a safe and spacious anchorage for shipping. The bulk of the white population of New Britain is settled in or near Rabaul, where sanitary conditions have improved greatly, and which has a fairly healthy climate, with a rainfall of more than 100 inches. White-owned coco-nut plantations are scattered about the island. Copra is the chief product, shipments of which from Rabaul in 1919 amounted to a value of £345,927, and there is a considerable shell fishing industry. Roads are being constructed where possible, and between Rabaul and the various islands and ports on the mainland and in Australia there is regular steamship communication. There is also telegraphic and wireless communication. The island is divided into four districts for administrative purposes, Rabaul, Kokopo (formerly Herbertshöhe, the former seat of the governor of German New Guinea), Gasmatta and Talasea, administered by district officers appointed by the administrator of the mandated territories of New Guinea.

The people are Melanesians, of good physique, akin to the aborigines of the mainland. They are considered to be very

treacherous, and cannibalism exists amongst them; but this is being stamped out as the island is opened up with roads. They are amenable to discipline, and some display considerable intelligence when trained. Pidjin English is used by European settlers in dealing with the natives, who have clean and well kept villages, and though not craftsmen in carving and pottery, are good hunters and fishermen. (*See* NEW GUINEA.)

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NEW BRITAIN, a city of Hartford county, Connecticut, U.S.A., 9 m. S.W. of Hartford; served by the New York, New Haven and Hartford railroad. Pop. (1920) 59,316 (36% foreign-born white, including 7,804 Poles, 3,177 Italians and 2,102 Swedes); 1928 local estimate 80,000. The city has an area of 13·77 sq.m.; its parks cover 350 ac.; and it is the seat of a State normal school (established 1851) and a State trade school. It is an important manufacturing centre, with an output in 1925 valued at $72,676,424. Hardware, cutlery and edge tools (valued at $39,046,986 in 1925) and foundry and machine-shop products are the leading manufactures. The city's assessed valuation in 1927 was $114,788,798. A weekly newspaper in Swedish has been published here since 1896. Settlement within the territory now occupied by New Britain began in 1687. The town of New Britain was incorporated in 1850; the city in 1871; and in 1905 the two were consolidated.

NEW BRUNSWICK, a province of the Dominion of Canada, lying between 45° 2′ and 48° 3′ N. and 63° 46′ and 69° 3′ W. Its length from north to south is 230 m., its greatest breadth 190 m., and it has a seaboard of about 550 miles.

Geological and Physical Features.—New Brunswick is characterized most of all by the transgression of strata of Carboniferous age over the worn edges of folds which may be Carboniferous or pre-Carboniferous, or both. The areas of these mainly horizontal Carboniferous beds are mostly well under 500 ft. above sea-level. The remnants of mountain axes running north-east to south-west, north of St. John, reveal Archaean and folded early Palaeozoic rocks, and a good deal of land is well above the 1,000 ft. contour. Between the fold lines run remarkable lake-river feeders of the St. John river, which skirts around the south-western end of these folds. This river is remarkable for its fine scenery and is navigable for 88 m. up to Fredericton, but small boats go 65 m. further, to Woodstock, not far from the border of Maine. North of this the frontier for the most part skirts the west side of the valley up to Grand Falls, which can be reached by boats when the river is high. Above Grand Falls the river forms the boundary between New Brunswick on the north and Maine on the south, up to St. Francis, the uppermost section of the river being in Maine. The total length of this river is about 450 miles. The eastern lowland, with its horizontal layers, including some thin beds of coal, is continued eastwards into Nova Scotia. The overlying Red Permian beds attain considerable importance northwards, in Prince Edward island, across Northumberland strait. The whole of the south coast of the Gulf of St. Lawrence, from Miscou point, bounding Chaleur bay, to Sydney on the Atlantic coast of Cape Poreton island, is thus bordered by coal-bearing rocks. The main north-eastward drainage of the lowland is effected by the Miramichi river (220 m. long), flowing into a large estuary and generally navigable up to Nelson, opposite Newcastle. West of this lowland area comes a fold axis which undulates about a north-north-east to south-south-west direction, and has been thought to be related to the chains on the east side of the Hudson-Champlain depression. The fold axis forms a broad highland which reaches a 2,000 ft. level at a good many places in its northern section. The northern boundary of the province is the great Chaleur bay, stretching 90 m. inland and possessing a number of harbours. Into it flows the Restigouche river, which curves around the north-west edge of the western highland, and for some distance bounds New Brunswick against Quebec.

The coast-line of New Brunswick is indented with numerous fine bays and harbours. The Bay of Fundy is an arm of the sea separating New Brunswick from Nova Scotia and terminating in two smaller bays, Chignecto Bay and the Basin of Minas. Its length up to Chignecto Bay is 140 m. and its extreme breadth 45 m. It is noted for its high tides, which rise about 30 ft. at St. John and over 50 ft. at the head of Chignecto Bay. At Bay Verte, 14 m. distant, on the opposite side of the Isthmus of Chignecto, the tide rises little more than 4 or 5 ft. The Bay of Chaleur, which has several excellent harbours, is over 90 m. in length and from 20 to 25 m. in breadth. The other inlets of consequence on the east coast are Miramichi, Richibucto, Buctouche, Cocagne and Shediac Bays; on the south coast are Passamaquoddy Bay, St. John Harbour and Chignecto Bay. At the mouths of the rivers are in nearly every case excellent harbours. To the province belong the islands of Campobello and Grand Manan, at the entrance of the Bay of Fundy, from both of which important fisheries are carried on.

The geological features are mantled by glacio-marine deposits, including a basal clay with *Leda Arctica*, and sands containing *Saxicava* shells. There is evidence of coastal sinking, so that many rivers flow into estuaries often bounded by cliffs on the Bay of Fundy, whereas the east coast is, for the most part low, with mosses and marshes.

Climate.—The cold air of the northern interior frequently flows over the province in winter. The average rainfall is about 40 to 45 inches. The snowfall is very heavy in the north of the province, where it exceeds 100 inches. The harbour of St. John is open throughout the year. The autumn is the best season of the year, especially during the "Indian summer," after the first frost, but before the weather has broken.

Area and Population.—Not including the territorial sea, the area of the province is 27,985 sq.m., of which 74 are water. It thus occupies an area rather larger than that of the mainland of Scotland. The population in 1921 was 387,876; in 1881 it was 321,233. There was a marked increase (10·23%) during the decade 1911–1921. The number of males slightly exceeds that of females. The bulk of the people are of English descent, the remainder Irish and French. The Scots, so prominent in nearly all the other provinces of the Dominion, are here less conspicuous. Of the original Indian inhabitants of the province, who were of Algonquin stock and divided into two tribes, the Micmacs and the Malicites, few remain, many of whom have a greater or less proportion of white blood. The principal towns are St. John (pop. 1921) 47,166, Moncton (17,488), and Fredericton, the capital of the province, with a population of 8,114.

Administration and Education.—The province sends ten senators and eleven (1926) members of the House of Commons to the Federal parliament. Since the abolition of the legislative council in 1892 the provincial legislature has consisted of a lieutenant-governor and a legislative assembly. Both city and county districts have an elective municipal system. Primary education is free and undenominational, with a compromise (1875) by which practical, though not theoretical, satisfaction is given to the Roman Catholic Church. At Fredericton there is a teachers' college and a school for the deaf and dumb. The lazaretto for lepers, at Tracadie, and the marine hospital, at St. John, are supported by the Dominion. At Fredericton is a small provincial university, founded in 1800 and re-established in 1859; at Sackville is the university of Mount Allison college, under Methodist control, and at Memramcook one, working chiefly among the French, is owned by the Roman Catholics. Their interests are more in arts than in science.

Either owing to the beauty of its scenery or to the excellence of its education New Brunswick has produced a school of poetry, headed by Charles Roberts, which is unique in the Dominion.

Agriculture.—The great predominance of the lumber industry has tended to keep agriculture in the background. The total area under field crops in 1926 was 891,631 acres. Of these, 10,916 ac. were wheat lands, 204,686 ac. oats, and 6,558 ac. barley. These, together with potatoes (42,744) and roots (12,235), formed the main crops. There were 559,019 ac. under hay and

clover. In all the river valleys, and especially on the fertile diked lands along the head of the Bay of Fundy, many rich and prosperous farms are found, varying in size from 100 to 240 acres. The raising of sheep and cattle, and the production of cheese and butter, are industries of importance.

Forests.—The State owns about 10,000 sq.m. of forest, and in 1925 the Crown and granted lands produced 405,203,000 ft. board measure. The most valuable and most widely-spread tree is the black spruce (*Abies nigra*), from which is made a yearly increasing quantity of wood-pulp for paper-making. The hemlock (*Abies Canadensis*), the cedar, birch, beech, oak, ash and many other valuable trees, are also widely spread. The chief ports for shipping are St. John, at the mouth of the St. John river, and Chatham, at the mouth of the Miramichi.

The great forests, through which flow numerous rivers with excellent harbours at or near their mouths, have long made New Brunswick a centre of lumbering. This industry has affected the whole development of the province, and the wilder and more unsettled line of its woodsmen contrasts with that of the farmer of Ontario or of the west.

In 1902 the Provincial Government set aside a large area of the highlands at the sources of the Tobique, Nipisiquit and Miramichi rivers for a national park and game preserve. Moose, caribou and deer may be shot in limited numbers during two autumn months in other parts of the province.

The game laws are being made increasingly strict, and the province draws a large revenue from the sale of licences.

Mines and Fisheries.—The mineral wealth of the province is small, though gold, iron, copper, lead, zinc and plumbago have been worked on a small scale at various times. Coal and gypsum are actively mined. Natural gas with oil is obtained near Moncton.

The fisheries, on the other hand, are extensive, though less so than those of Nova Scotia. This industry centres in the counties of Charlotte and Gloucester, herring, salmon, lobsters, sardines and cod forming the chief catch. The Restigouche, and other rivers near the northern border, are much frequented by anglers in search of trout and salmon. A large number of persons are employed (2,401 in 1925) in the fish canneries and freezing establishments.

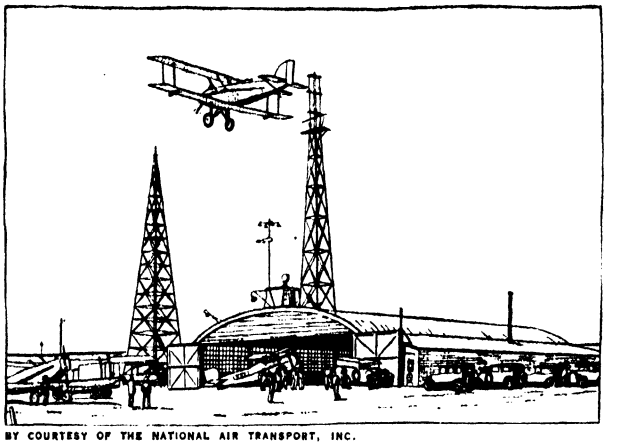
Manufactures.—The chief manufactures, apart from the shipping of St. John, are connected with lumbering and with agriculture. The making of paper pulp and of furniture is important. Co-operation in the manufacture of butter and cheese has produced excellent results, and numerous cheese and butter factories are scattered through the province.

Communications.—The railway system links the province to Nova Scotia on the east, and to the rest of Canada on the west. In all there are some 1,941 m. of railway. The roads and rivers are also arteries of communication. There are Government owned and commercial radio stations at Red Head and St. John, with a direction-finding station at the latter as well.

History.—Until 1784 New Brunswick formed part, first of the French province of Acadia, later of the British province of Nova Scotia. The first settlement within its borders was made in 1604 by Pierre de Guast, sieur de Monts, with whom was Samuel de Champlain. Their colony at the mouth of the St. Croix river was soon abandoned, but throughout the French régime the district was frequented by bands of fur-traders. In 1762 the first English settlement was made at Maugerville, on the St. John river, and in 1764 a body of Scottish farmers and labourers took up land along the Miramichi. On May 18, 1783, a band of American loyalists settled at the mouth of the St. John. Thousands more followed, and in 1784 New Brunswick was declared a separate province. At first governed by a representative assembly and an irresponsible council, it obtained responsible government in 1847–48, after a constitutional struggle in which no little ability was shown. In 1867 it entered, without reluctance, but without enthusiasm, into the Canadian Federation.

BIBLIOGRAPHY.—Sir J. W. Dawson, *Acadian Geology* (ed. of 1891), is the most easily accessible work on the geology of the province. Numerous studies have been published, chiefly by the Geological Survey of Canada, by L. W. Bailey, R. W. Ells, A. P. Low and G. F. Matthew. Valuable papers on various provincial subjects have been published in the *Transactions* of the Royal Society of Canada by W. F. Ganong. The Provincial Government issues a yearly volume of sessional papers; *Acadiensis*, a magazine published in St. John, should also be consulted. The earliest account of New Brunswick is given by Nicholas Denys, *Description géographique* (published Paris, 1672; republished by W. F. Ganong, with notes and introduction, 1908); R. Montgomery Martin, *History of New Brunswick* (1837); G. E. Fenety, *Political Notes* (1867); James Hannay, *History of Acadia* (1879); and *Lives of Wilmot and Tilley* (1907); N. Denys, *Description géographique* (1672; republished, 1908); Sir J. W. Dawson, *Acadian Geology* (1891); *Canada and its Provinces* (23 vols., Toronto, 1914); *Chronicles of Canada* (32 vols., Toronto, 1914); *New Brunswick: Its Natural Resources* (Ottawa, 1921); *Canada Year Books;* Publications of the Geological Society of Canada; *Transactions* of the Royal Society of Canada.

NEW BRUNSWICK, a city of New Jersey, U.S.A., the county seat of Middlesex county; on the Raritan river, the Lincoln highway and the Delaware and Raritan canal, 30 m. S.W. of New



BY COURTESY OF THE NATIONAL AIR TRANSPORT, INC.

HADLEY FIELD, AT NEW BRUNSWICK, SHOWING A HANGAR AND AERIALS

York city and 60 m. N.E. of Philadelphia. It is served by the Pennsylvania and the Raritan River railways, motor-bus lines and freight steamers and barges. Pop. (1920) 32,779 (27% foreign-born white); 1928 local estimate 45,000. The city rises from the river to high bluffs on the east and the west, commanding wide and picturesque views. It is the seat of Rutgers university (*q.v.*) and the Theological seminary of the Reformed Church in America, the oldest theological school in the United States, founded in New York city in 1784 and situated in New Brunswick since 1810. New Brunswick is one of the oldest cities of New Jersey, and has many buildings dating from the 18th century. The Buccleuch mansion, in a 60 ac. park, presented to the city by Anthony Dey, is one of the best preserved colonial houses in the State. On York street still stands the house occupied by Gen. Howe in 1776–77. There is a fine modern stone bridge across the Raritan. The city has large manufacturing industries, employing about 15,000 persons and making a variety of products, ranging in size from motor trucks to knitting needles and valued in 1925 at $43,453,878. Surgical and medical supplies, motor buses and trucks and fire apparatus are among its leading manufactures. The assessed valuation for 1927 was $40,130,029. Since 1906 the city has had a commission form of government. A settlement was established here in 1681. It was at first called Prigmore's Swamp, later Inian's Ferry, until the present name was adopted in honour of the House of Brunswick. A city charter was granted by the royal governor in 1730 and by the State legislature in 1784. Washington entered New Brunswick on Nov. 28, 1776, but evacuated it on the approach of the enemy, and from Dec. 3 to April 13, 1777, it was occupied by the British under Lord Howe.

NEWBURGH, a royal burgh, Fifeshire, Scotland, on the Firth of Tay, 7 m. N.W. of Ladybank junction by L.N.E.R. Pop. (1921), 2,178. Its industries chiefly consist of the making of linen and floorcloth and quarrying; there are fisheries, especially of salmon, and a considerable trade in corn, fruit and potatoes. About 1 m. S.W. of the town stand the remains of Macduff's Cross, which marks the spot where the clan Macduff was granted rights

and sanctuary and composition for murder done in hot blood. Lindores abbey on the Tay is close to Newburgh. Of the Benedictine abbey, founded in 1178 by David, earl of Huntingdon, brother of William the Lion, there only remain the groined arch of the principal entrance, a portion of the west tower and other fragments. At Blackearnside, a forest of alders, to the east of the village, Wallace defeated the earl of Pembroke in 1298.

NEWBURGH, a city of Orange county, New York, U.S.A., on the west bank of the Hudson river, opposite Beacon, 60 m. N. of New York city. It is on Federal highway 9W; is served by the Erie and the West Shore railways, motor-bus and truck lines; and is connected by ferry with the New York Central at Beacon. Pop. (1920) 30,366 (82% native white); 1928 local estimate over 34,000. The Hudson widens at this point into Newburgh bay. The city has 2 m. of water front, with a channel deep enough for ocean-going vessels. It occupies a commanding position on terraces rising abruptly from the river, and from the higher points the view embraces many miles of the Hudson and reaches to the Catskill mountains on the north-west. Newburgh has a retail trade amounting to $11,000,000 annually; a large shipping trade in orchard, farm and dairy products; and a variety of manufacturing industries, with an output in 1925 valued at $24,095,960. The assessed valuation for 1927 was $38,387,945. Since 1916 the city has operated under a commission-manager form of government. Newburgh was settled in 1709 by 53 Germans from the Rhenish Palatinate, led by their minister, Joshua Kockethal. Toward the middle of the century many of the Germans moved to Pennsylvania, and their lands were taken up by Scottish and English settlers, who in 1752 named the town after Newburgh, Scotland, from which some of them had come. Washington made his headquarters here from the spring of 1782 until Aug. 1783, in the Dutch farmhouse built by Jonathan Hasbrouck in 1750 (still standing in Washington park). Here he wrote his letter of May 27, 1782, rebuking Col. Nicola for the suggestion that he assume the title of king; here he made his reply to the "Newburgh Addresses" calling for action by the army to force Congress to redress its grievances; and here the arrangements were completed for demobilizing the Continental army. Newburgh was incorporated as a village in 1800 and as a city in 1865.

NEWBURN, urban district, Wansbeck parliamentary division, Northumberland, England, on the Tyne, 5½ m. W. of Newcastle by a branch of the N.E. railway. Pop. (1921) 18,830. It has collieries, and iron, steel, engineering, tool and fire-clay works, and there is a large industrial population. Newburn is of considerable antiquity. Roman remains have been discovered in proximity to Hadrian's Wall. The name of Scotswood, one of the manufacturing villages between Newburn and the city, commemorates the occupation of the town by the Scottish Covenanters in 1640.

NEWBURY, a town and municipal borough of Berkshire, England, 53 m. W. by S. of Reading by G.W.R. Pop. (1921) 12,295.

The name Newbury (new town or borough) is first mentioned by Odericus Vitalis; it is probable, however, that the manor of Uluritone, entered in Domesday as held by Ernulph de Hesdain, covered a large part of the site. The manor subsequently passed to the crown and was held by Elizabeth before her accession. In 1627 it was granted by Charles I. at a fee-farm to the corporation. Newbury was a borough by prescription; in 1187 its inhabitants are called "burgesses" and a document of the time of Edward I. speaks of it as *burgus*. It was incorporated by a charter of Elizabeth (1596), confirmed by Charles I. and Charles II. Newbury sent two representatives to the parliament of 1302.

The woollen industry declined early in the 17th century. The Weavers' Company, which still exists, was incorporated in 1601. Newbury castle, of which traces remained until the 17th century, is said to have been besieged by Stephen in 1152. An important woollen market, established in 1862, is held annually.

Newbury is situated on the Kennet, which is followed by the Kennet and Avon canal. The church of St. Nicholas is an early 16th century Perpendicular building. It is said to have been built mainly at the charge of John Winchcombe or Smalwoode (Jack of Newbury), an eminent clothier. A part of John Winchcombe's (Jack of Newbury's) house and the Jacobean cloth hall, now a public museum, still exist. The almshouses called King John's Court are supported by a foundation known as St. Bartholomew's Hospital, to which in 1215 King John granted by charter the profits of a fair on St. Bartholomew's day. Shaw House, on the outskirts, is an Elizabethan mansion; to the north is Donnington castle, retaining a Perpendicular gateway and other fragments. The suburb of Speenhamland was formerly an important posting station on the Bath road. At Sandleford Priory, to the south of Newbury, the site and part of the buildings of an Augustinian priory (*c.* 1200) were utilized in the erection of a mansion in 1781. The householders of Newbury have the right to elect boys and girls to the educational foundation of Christ's Hospital. Trade is agricultural and there are breweries and flour mills.

Battles of Newbury (1643 and 1644).—These two important battles during the English Civil War, more commonly called the *Great Rebellion*, are described under the latter heading. The first, on Sept. 20, 1643, arose out of the attempt of the Royal army to bar the path of the Parliamentary forces under the Earl of Essex, which was returning to its base at Reading after raising the siege of Gloucester. Although Essex's army failed to break the Royalist line, they had made so strong a moral and material impression that the Royalists opened the road to them. The situation was reversed in the second battle, Oct. 26, 1644, when the Parliamentary army had headed off Charles I. on his way back to Oxford from Basingstoke. This was the first great manoeuvre-battle of the war.

NEWBURYPORT, a city of north-eastern Massachusetts, U.S.A., one of the county seats of Essex county; 38 m. N.N.E. of Boston, on the southern bank of the Merrimack river, 3 m. from the ocean. It is on Federal highway 1 and is served by the Boston and Maine railroad and coasting steamers. Pop. (1920) 15,618 (20% foreign-born white). It is an important manufacturing city, with a very diversified output, valued in 1925 at $11,877,397. The commerce of its port in 1925 amounted to 41,943 tons, consisting entirely of receipts of coal, gasolene, fuel oil and lumber. There are statues of George Washington and William Lloyd Garrison (by J. Q. A. Ward and Daniel Chester French respectively) and many houses dating back to the 17th century, among them the stone "garrison" house in the form of a cross, with walls 4 ft. thick. Other houses of interest are the birthplace of William Lloyd Garrison, the homes of "Lord" Timothy Dexter and Caleb Cushing, and the Tracy mansion (1771), now part of the public library building. Indian Hill farm, birthplace of the journalist Ben Perley Poore, is 3 m. W. of the city. The Putnam Free school, now part of the public-school system, was founded early in the 19th century by an endowment from Oliver Putnam. The high school for girls (opened in 1843) was a pioneer institution. Newbury, including the site of Newburyport, was settled in 1635 under the leadership of the Rev. Thomas Parker (1595–1677) who had lived in Newbury, England. In 1764 a tract of 647 ac. was set off and incorporated as the town of Newburyport, which (with enlarged boundaries) was chartered as a city in 1851. In the early part of the 19th century Newburyport was one of the most flourishing commercial centres of New England. Fishing, whaling and ship-building were the principal interests until the Civil War, and its clipper ships were among the fastest and the best known on the seas. During the Revolution and the War of 1812 it sent out many privateers.

NEW CALEDONIA: *see* PACIFIC ISLANDS.

NEWCASTLE, DUKES OF. Within the space of a century there were no less than four successive creations of dukes of Newcastle in the British peerage. William Cavendish (*see* p. 280), nephew of the 1st earl of Devonshire, was raised to the dignity of duke of Newcastle-upon-Tyne in 1665. His son and successor Henry (1630–1691) died leaving daughters only, and one of these married John Holles (1662–1711), earl of Clare, who was created duke in 1694. This duke died also without male issue, leaving his estates to his sister's son, Thomas Pelham (*see* p. 280), who, with other dignities, had the title of duke of Newcastle-upon-Tyne conferred on him in 1715, and a second and similar ducal title (that of Newcastle-under-Lyme) in 1756. The first dukedom became

extinct at his death, but the second title was granted him with remainder to Henry Fiennes Clinton, earl of Lincoln, at once his nephew and nephew-in-law. From that time the dukedom has remained in the Clinton family. The two principal dukes are more fully noticed below.

1. WILLIAM CAVENDISH, duke of Newcastle (1592–1676), eldest surviving son of Sir Charles Cavendish and of Catherine, daughter of Cuthbert, Lord Ogle, and grandson of Sir William Cavendish and "Bess of Hardwick," was born in 1592 and educated at St. John's College, Cambridge. On the occasion of the creation of Prince Henry as prince of Wales in 1610 he was made a knight of the Bath, subsequently travelled with Sir Henry Wotton, then ambassador to the duke of Savoy, and on his return married his first wife, Elizabeth, daughter of William Basset of Blore, Staffordshire, and widow of Henry Howard, 3rd son of the earl of Suffolk. His fortune was immense, and he several times entertained James I. and Charles I. with great magnificence at Welbeck and Bolsover. In 1620 he was created Viscount Mansfield, in 1628 earl of Newcastle, and in 1629 the barony of Ogle was restored to his mother, this title, together with an estate of £3,000 per annum, descending to him. In 1638 he was made governor of the prince of Wales, and in 1639 a privy councillor. When the Scottish war broke out he assisted the king with a loan of £10,000 and a troop of volunteer horse, consisting of 120 knights and gentlemen. In 1641 he was implicated in the Army Plot, and in consequence withdrew for a time from the court. He was sent by Charles on Jan. 11, 1642 to seize Hull, but was refused admittance. When the king declared open war, Newcastle was given the command of the four northern counties, and had the power conferred on him of making knights. He maintained troops at his own expense, and having occupied Newcastle kept open communications with the queen, and despatched to the king his foreign supplies. In Nov. 1642 he advanced into Yorkshire, raised the siege of York, and compelled Fairfax to retire after attacking him at Tadcaster. Subsequently his plans were checked by the latter's recapture of Leeds in Jan. 1643, and he retired to York. He escorted the queen, who returned from abroad in February, to York, and subsequently captured Wakefield, Rotherham and Sheffield, though failing at Leeds, but his successes were once more ravished from him by Fairfax. In June he advanced again, defeated the Fairfaxes at Adwalton Moor on June 30, and obtained possession of all Yorkshire except Hull and Wressel Castle. He might now have joined the king against Essex, but continued his campaign in the north, advancing into Lincolnshire to attack the eastern association, and taking Gainsborough and Lincoln.

Thence he returned to besiege Hull, and in his absence the force which he had left in Lincolnshire was defeated at Winceby by Cromwell on Oct. 11, 1643, which caused the loss of the whole county. On Oct. 27, 1643 he was created a marquis. Next year his position was further threatened by the advance of the Scots. Against prevailing numbers he could do little but harass and cut off supplies. He retreated to York, where the three armies of the Scots, Fairfax and Manchester surrounded him. On July 1, Rupert raised the siege, but on the next day threw away his success by engaging the three armies in battle, contrary to Newcastle's desire, at Marston Moor. After this disaster, notwithstanding the entreaties of the king and the remonstrances of Rupert, Newcastle immediately announced his intention of abandoning the cause and of quitting England. He sailed from Scarborough accompanied by a considerable following, including his two sons and his brother, resided at Hamburg from July 1644 to Feb. 1645, and removed in April to Paris, where he lived for three years. There he married as his second wife Margaret (*see* below), daughter of Sir Thomas Lucas of St. John's, Colchester. He left in 1648 for Rotterdam with the intention of joining the prince of Wales in command of the revolted navy, and finally took up his abode at Antwerp, where he remained till the Restoration. In April 1650 he was appointed a member of Charles II.'s privy council, and in opposition to Hyde advocated the agreement with the Scots. In Antwerp he established his famous riding-school, exercised "the art of manage," and published his first work on horsemanship, *Méthode et invention nouvelle de dresser les chevaux* (1658, 2nd ed., 1747; translated as *A General System of Horsemanship*, 1743).

At the Restoration Newcastle returned to England, and succeeded in regaining the greater part of his estates, though burdened with debts, his wife estimating his total losses in the war at £941,303. He was reinstated in the offices he had filled under Charles I.; was invested in 1661 with the Garter which had been bestowed upon him in 1650, and was advanced to a dukedom on March 16, 1665. He retired, however, from public life and occupied himself with his estate and with his favourite pursuit of training horses. He established a racecourse near Welbeck, and published another work on horsemanship, *A New Method and Extraordinary Invention to Dress Horses and Work them according to Nature . . .* (1667). He wrote also several comedies, *The Country Captain and The Varietie* (1649), *The Humorous Lovers* and *The Triumphant Widow* (1677). With Dryden's assistance he translated Molière's *L'Étourdi* as *Sir Martin Mar-All* (1688). He contributed scenes to his wife's plays, and poems of his composition are to be found among her works; and he was the patron of Jonson, Shirley, Davenant, Dryden, Shadwell and Flecknoe, and of Hobbes, Gassendi and Descartes. He died on Dec. 25, 1676, and was buried in Westminster Abbey. By his first wife he had ten children, of whom one son, Henry, survived him, and became 2nd duke of Newcastle, dying in 1691 without male issue; the title then became extinct.

His second wife, Margaret, duchess of Newcastle (*c.* 1625–73), had been maid of honour to Henrietta Maria. The duchess cultivated literary composition with exuberant fervour, and kept a bevy of maids of honour obliged to be ready at all hours "to register her Grace's conceptions." Walpole speaks of her as a "fertile pedant." She published *Philosophical Fancies* (1653); *Poems and Fancies* (1653); *The World's Olio* (1655); *Nature's Picture drawn by Fancie's Pencil to the Life*, which includes an autobiography (1656); *Philosophical and Physical Opinions* (1655); Orations (1662); Plays (1662); Sociable Letters (1664); *Observations upon Experimental Philosophy* (1666); *Letters and Poems* (1676).

The Life of William Cavendish, Duke of Newcastle, by Margaret, duchess of Newcastle, has been edited by C. H. Firth (1886); it was criticized by Pepys as "the ridiculous history of my Lord Newcastle writ by his wife, which shows her to be a mad, conceited, ridiculous woman, and he an ass to suffer her to write what she writes to him and of him," but on the other hand eulogized by Charles Lamb as a work for which "no casket is rich enough, no case sufficiently durable to honour and keep soft such a jewel." *See* also *La Duchesse et le Duc de Newcastle*, by Émile Montégut (1895). The duchess's *Select Poems* were edited by Brydges in 1813, and her *Autobiography* in 1814. The latter, edited by Lower, was published with her *Life of the Duke of Newcastle* in 1872.

2. THOMAS PELHAM HOLLES, duke of Newcastle (1693–1768), whose official life extended throughout the Whig supremacy of the 18th century, was the elder son of Thomas, first Lord Pelham, by his second wife Lady Grace Holles, younger sister of John Holles, duke of Newcastle-on-Tyne, who died in 1711, and left the whole of his vast estates to him. In 1712 he also succeeded his father in his peerage and estates, and in 1714, when he came of age, was one of the greatest landowners in the kingdom. He vigorously sustained the Whig party at Queen Anne's death, and had much influence in making the Londoners accept King George. His services were too great to be neglected, and in 1714 he was created earl of Clare, and in 1715 duke of Newcastle-on-Tyne. He also became lord-lieutenant of the counties of Middlesex and Nottingham and a knight of the Garter in 1718, in which year he increased his Whig connection by marrying Lady Henrietta Godolphin, granddaughter of the great duke of Marlborough. In 1717 he first held political office as lord chamberlain of the household, and in 1724 was chosen by Sir Robert Walpole to be secretary of state in place of Lord Carteret. This office he held continuously for 30 years (1724–54), and only changed it for the premiership on his brother's death. His long tenure of office was mainly due to his great Whig connections and his wealth, but praise must also be given to his inexhaustible activity and great powers of debate. He continued in office on Walpole's fall in

1742, and became more powerful on his younger brother Henry becoming prime minister in 1743. On Henry Pelham's death in March 1754, Newcastle succeeded him as premier; but people who had been accustomed to him as secretary of state would not stand him as premier, and in Nov. 1756 he gave place to the duke of Devonshire. For his long services he was created duke of Newcastle-under-Lyme, with remainder to Henry Fiennes Clinton, 9th earl of Lincoln, who had married his niece Catherine Pelham. In July 1757 he again became prime minister—for Pitt, though a great statesman, was a bad party leader—on the understanding, according to Horace Walpole, that "Mr. Pitt does everything, the duke gives everything." Under this ministry England became famous abroad, but it gradually fell before the young king's affection for Lord Bute, who, after supplanting Pitt, became prime minister in the room of Newcastle in May 1762. The duke went into strong opposition, and lost his two lord-lieutenancies for opposing the peace of 1763. In 1765 he became lord privy seal for a few months, but his health was fast giving way, and he died in Nov. 1768. The duke was not a great man, but he was industrious and energetic. He worked tirelessly, though vainly, to hold the Whig Party together in the face of the determination of George III. to destroy it. In this if in nothing else Newcastle was statesmanlike: for it seems as though he alone clearly foresaw that calamity to the Party which only union and organization could have averted.

See *Memoirs of the Administration of the Right Hon. H. Pelham*, by W. Coxe (1829).

NEWCASTLE, a city and port of New South Wales, Australia, situated on the southern shore of the estuary of the Hunter River (*q.v.*), about 22 miles from its outlet, and 104 miles, by rail, from Sydney. It is built at the foot of, and up, a steeply-rising hill which backs the harbour (Av. ann. temps.: 72°–55° F; av. ann. rainfall: 42 in.). With a large and fertile hinterland (Hunter Valley, Northern Tablelands and Liverpool Plains) and abundant coal resources at its doors (reserves within area 15 miles W. and 7 miles S. amount to about 270,000,000 tons; reserves of total area: *c.* 9,000,000,000 tons), Newcastle was early a notable centre for the export of coal and primary produce. By 1922 it had exported some 186,000,000 tons (*c.* £111,000,000), but since about 1900 its mines have been steadily superseded by those of the Maitland field (*q.v.*) and, at the present time, owing mainly to social and economic causes, the coal industry is severely depressed. The possession of fuel, water, food-supply, and a good commercial position, and access to raw materials have, however, steadily attracted manufacturing industries and Newcastle is now one of the leading industrial areas in the southern hemisphere. The Broken Hill Proprietary Co. (*see* BROKEN HILL; AUSTRALIA: *Metallurgical Industries*) established in 1915 at Port Waratah large-scale steel-works and these have brought in their train numerous associated industries. Newcastle's industries may be roughly classified as metallurgical and metal-working; constructional engineering and ship-building; coke and chemical industries; the making of fertilisers, cement, fire-bricks, pottery; wood-working; flour-milling and food-making; besides numerous miscellaneous types. These are conducted in Newcastle itself or in one or other of the numerous centres (*e.g.*, Port Waratah, Walsh Island, Cockle Creek, Merewether, etc.) within easy reach of the port. The harbour (comprising North Harbour, the Basin and Port Waratah) has ample accommodation, is well sheltered and has modern installation for handling cargo and especially for loading coal. The entrance is by a channel (width 500–450 yd.; av. depth 23½ ft.) between breakwaters, within which a fairway (width 500 ft., depth 32 ft.) is being cut. The port, which for hinterland trade (*e.g.*, wool) tends to be overshadowed by Sydney, has lost much owing to the shallowness of its entrance and suffers from the necessity of continuous dredging both at the entrance and alongside the wharves. In respect of trade Newcastle is the third port of Australia and the second of New South Wales. Its normal trade is of the order of £3,500,000 per ann. Exports (coal, coke, tar, etc.; frozen meat; butter, eggs; timber; pig iron, steel rails and plates, etc.; fertilisers) usually exceed imports. Some 4½–5 million tons of shipping use the port annually, of which about 2,000,000 tons are "overseas" vessels (*i.e.*, other than interstate or coastwise). Newcastle has excellent railway connections, along the coastal lowlands, with Sydney and also northwards (Grafton, Lismore, *q.v.*). A series of (privately owned) lines serves the coal-fields and an important line taps the Hunter valley and may possibly be linked with the western system (*e.g.*, Merriwa-Tallawang). Pop. 1926/7: 100,000.

NEWCASTLE, a seaside resort of Co. Down, Ireland, on the western shore of Dundrum bay, at the foot of Slieve Donard. Pop. (1926), 2,687. It is the terminus of the Belfast and County Down railway, being 36 m. S. of Belfast. A fort guarded the passage of the river Shimna here in early times.

NEW CASTLE, a city of New Castle county, Delaware, U.S.A., at the head of Delaware bay, 6 m. S. of Wilmington. It is on Federal highway 11 and is served by the Pennsylvania railroad and steamship lines. Pop. 3,854 in 1920. It has a good harbour, important shad-fisheries and various manufacturing industries. New Castle played an important part in the territorial disputes of the Swedes, the Dutch and the English, from 1651, when Peter Stuyvesant built Ft. Casimir in the vicinity; and it was the capital of Delaware until 1777. The old courthouse may have been built by the Swedes, the Immanuel Protestant Episcopal church dates from 1689; and there are several Dutch and English colonial dwellings still standing. The city was chartered in 1875.

NEW CASTLE, a city of eastern Indiana, U.S.A., 45 m. E. by N. of Indianapolis; county seat of Henry county. It is served by the Big Four, the Nickel Plate, the Pennsylvania, and electric railways. Pop. (1920) 14,458 (96% native white), estimated locally at over 22,000 in 1928. It is the trade centre of a rich farming area; has large rose nurseries and important manufacturing industries (with an output in 1925 valued at $17,494,962); and is the seat of the Indiana Village for Epileptics. The city was founded in 1819 and incorporated in 1839.

NEW CASTLE, a city of western Pennsylvania, U.S.A., the county seat of Lawrence county; 50 m. N.N.W. of Pittsburgh and 20 m. S.E. of Youngstown (Ohio), on the Shenango river and Federal highway 422. It is served by the Baltimore and Ohio, the Buffalo, Rochester and Pittsburgh, the Erie, the Pennsylvania and the Pittsburgh and Lake Erie railways. Pop. 44,938 in 1920 (19% foreign-born white); estimated locally at 55,000 in 1928. New Castle is an important commercial and industrial centre, with a trade population of over 100,000, and manufactures (notably tin plate and steel) valued at $100,000,000 annually. New Castle was founded in 1802. It was incorporated as a borough in 1869 and as a city in 1875.

NEWCASTLE-UNDER-LYME, market town, municipal and parliamentary borough, Staffordshire, England, 2 m. W. of Stoke-on-Trent by the L.M.S. railway. Pop. (1921) 20,410. The parish church of St. Giles was rebuilt (1876) by Sir Gilbert Scott, with the exception of the tower, which dates from the 12th century. The free grammar school (1602), richly endowed, is now amalgamated with the Orme's school for girls. There is also a school of art. The manufacture of hats was once the staple trade. There are cotton and paper mills; and tanning, brewing, malting and the manufacture of army clothing are carried on. Partly included in the parliamentary borough is the populous parish of Wolstanton, of which the fine church has good details of the 13th century, with a massive tower and spire. The mining town of Audley lies 4 m. N.W., with a fine early Decorated church.

Newcastle-under-Lyme (Neofchastell-sur-Lyme, Newcastle-under-Lyme) is not mentioned in Domesday, but a charter was given to the town by Henry II. The town owes its name to a castle built here in the 12th century to supersede an older fortress at Chesterton about 2 m. to the north, and to the fact that it was situated under the forest of Lyme. Henry III. (1235) constituted it a free borough and other charters were granted in 1251, 1590, 1664, and 1835. Newcastle, which was originally held by the crown, was granted (1265) to Simon de Montfort, and subsequently to Edmund Crouchback, through whom it passed to Henry IV. In Leland's time the castle had disappeared "save one great Toure"; in the 17th and 18th centuries the town was flourish-

ing and had a manufacture of hats. Grants of fairs were given by Edward I., Edward III. and Henry VI.

NEWCASTLE-UPON-TYNE, city and county of a city, borough and port, Northumberland, England, 272 m. N. of London, on the L.N.E. railway. Pop. (1921) 275,009. It stands on the Tyne. The mouth of the river is 8 m. below Newcastle and its banks are lined with docks and industrial towns.

Though Newcastle owes its origin to a Roman station, its modern growth has largely destroyed traces of antiquity. Of the old walls there are slight remains. The castle, from which the town takes its name, was erected by Henry II. between 1172 and 1177 on the site of an older structure. It was originally the strongest fortress in the north of England, and its keep is now one of the finest specimens of a Norman stronghold remaining in the country. Fragments of its walls, with the principal entrance or Black Gate and the Watergate or southern postern remain. The keep, with walls 14 ft. thick, is in a state of good preservation, as is also the Norman chapel. The castle was purchased by the corporation in 1809, and a portion of it is used as an antiquarian museum. Near the castle is St. Nicholas church, forming the cathedral of the diocese of Newcastle, instituted in 1882. The diocese covers practically the whole of Northumberland, with a small portion of Cumberland. The church, which is principally Decorated, consists of nave, aisles, chancel and transepts, and the principal feature is the lantern tower, a fine specimen of early Perpendicular. Among other interesting old churches is St. Andrew's (11th century). St. John's is 14th century with an ancient front. A few fragments of the monastery of the Black Friars remain, and the chapel of the hospital of St. Mary at Jesmond is a ruin.

Some of the modern streets are spacious and handsome. Richard Grainger (1798–1861), a wealthy local architect, devoted himself to beautifying his city. The guildhall was re-erected in 1658.

Among educational establishments are the College of medicine and the Armstrong University college, both constituent colleges of the University of Durham. The royal free grammar school, founded in 1525, occupies modern buildings in Jesmond. There are also Allan's endowed schools, founded in 1705; Rutherford college and the Commercial institute; and the Laing Art Gallery, opened in 1904. The benevolent institutions include the dispensary (1777), fever house (1803), Royal Victoria Infirmary (1906), Princess Mary Maternity hospital (1923), eye infirmary (1822), children's hospital, Trinity almshouses (1492), hospital of the Holy Jesus (1682), hospital (1701) for keelmen, *i.e.*, coal-bargemen.

Newcastle is well supplied with public parks and recreation grounds. Jesmond is the chief residential suburb.

Both the Northumberland and Durham banks of the river are lined with manufacturing towns or suburbs. Of these the most important is Gateshead (*q.v.*) immediately opposite Newcastle; while those adjacent to Newcastle on the same bank are Benwell, Fenham and Walker. Newcastle is connected with Gateshead by five bridges: (1) the Old High Level bridge (1849), a toll bridge, carries L.N.E. railway with a road and footway beneath it; (2) the King Edward High Level bridge (1906), carries the L.N.E. railway only; (3) the New High Level bridge (opened Oct. 10, 1928), takes the bulk of the traffic and trams to the Great North road; (4) the Hydraulic Swing bridge (1876), the lowest bridge, takes foot and vehicular traffic; (5) the Redheugh Suspension bridge (1871), a toll bridge, takes foot and general traffic. The Roman bridge, the Pons Aelii, is said to have spanned the river where the hydraulic swing bridge now is. The suburban line to Jesmond, Gosforth and Benton was the first standard line to carry passengers by electric traction (1904).

Industries.—Newcastle owed its prosperity to its situation on a tidal river, and to its immense stores of coal, which, besides being exported, stimulated many industries. The quay in front of the town forms a thoroughfare about a mile long, and by dredging a depth of water has been obtained permitting vessels of large tonnage to approach, although the berths of the ocean steamers are farther down the river. There is a large grain warehouse at the east end of the quay. There was severe depression in the Newcastle area in 1928.

Exports include coal, chemicals, pig-iron, iron-work, steel, iron bars, plates and castings, machinery, fire-clay goods and copper. The chief imports are fruits, wheat, maize, oats, barley, iron and steel, petroleum, sulphur ore, timber and wood hoops, iron ore and potatoes. Passenger steamers serve the principal English ports; also Baltic ports and New York; while Newcastle is one of the chief ports for the Norwegian tourist traffic.

To the industries indicated by the exports may be added glass, lead and shot, brick and tile, earthenware, tool, rope and ships'-fitting manufactures, and most important of all, shipbuilding. The Elswick works, founded by Messrs. Armstrong in 1847, and amalgamated with those of Mitchell and Co., are among the most important in the world. The construction of ships of all sorts is carried on.

History.—Newcastle owes its origin to its position on the great Roman wall and on the estuary of the Tyne. The most important Roman remains are the foundations of a bridge, attributed to the emperor Hadrian. Before the Conquest it was called Monkchester, and was destroyed (9th century) by the Danes. It was again destroyed by William the Conqueror, but Robert of Normandy raised a castle there in 1080, and from that time the town was called Newcastle. Shortly afterwards it was fortified by Robert de Mowbray, but it was taken by William Rufus in 1095. In the reign of Stephen it was seized by David, king of Scotland, and after its restoration in 1157 Henry II. rebuilt the castle and established a mint. The walls of the town are attributed to Edward I. During the 14th century Newcastle was three times defended successfully against the Scots, but in 1640 it was occupied for a year by the Scottish Covenanters under Leslie. It was then garrisoned by royalists, but again surrendered to the Scots in 1644 and Charles I. was taken there in 1646 when he had yielded himself to the Scottish army. Charters were granted by William Rufus, Henry III., Henry IV. (1400), Mary (1556), Elizabeth (1589) and James I. (1604).

The coal trade began in the 13th century, but, partly owing to the act of parliament passed in the reign of Edward I. forbidding the use of coal in London, did not become important until the 17th century. Glassmaking was a considerable trade in the 17th century, and in 1823 George Stephenson established iron works at Newcastle, where the first engines used on the Stockton and Darlington, and Manchester and Liverpool lines were made. Newcastle was represented in parliament by two members from 1295 to 1918, and since then it has had four members.

NEWCHWANG, a Chinese port city in the province of Fengtien, Manchuria (40° 41′ N.; 122° 15′ E.), some 30 miles above the mouth of the Liao river which enters the Gulf of Liao Tung. At the Treaty of Tientsin (1858), Newchwang was chosen as one of the ports to be opened to foreign trade, but it was Yingtze (or Yinkow) near the mouth of the Liao river which actually became the centre of foreign settlements and was opened to trade in 1864. In recent years there has been a tendency to designate the port correctly as Yinkow, but Newchwang remains the official name of the Treaty port. The town was in 1895 occupied by and later ceded to Japan, only to be retroceded to China under foreign pressure. During the Russo-Japanese War, it was first in Russian and later in Japanese hands, but was finally restored to China at the end of the war. The outlet of the Liao River is obstructed by a bar and the port is closed by ice for three or four winter months. It has railway connection with Peking and with the main Mukden-Dairen line of the South Manchuria Railway by means of a short branch. Until 1907 Newchwang was the only Treaty port of Manchuria and it shared in the rising prosperity of South Manchuria; but in more recent years its development has been checked owing to the remarkable rise of Dairen, the southern terminus of the South Manchuria Railway.

The trade of Newchwang in 1926 was: net foreign imports, 19,324,000 Hk. Taels; net Chinese imports, 32,296,443 Hk. Taels; exports, 26,967,606 Hk. Taels; total 78,588,049 Hk. Taels.

The chief imports are foreign cotton piece goods, cotton yarn, native cottons, aniline dyes; exports mainly beans, bean-oil, bean-

cake, maize, cotton-seed and coal. Until 1908 Newchwang was the centre of the bean-oil and bean-cake industry of Manchuria and of the export trade in these and other Manchurian products, but it has since been supplanted by Dairen. It has still, however, a large number of Chinese mills manufacturing bean cake, which is mainly exported to South China, and bean oil for the Shanghai market. The product of the cotton-weaving industry of Newchwang is very cheap and durable and exceptionally popular among the peasants of South Manchuria. There are a large number of cotton-cloth weaving factories, some of which employ electric power, as well as many hosiery, ribbon and towel factories. Other industries include match-making, soap-works, glass-ware, knitting-needle factories, brick and dye-works. The sea-fisheries of the neighbourhood are very important and employ about 3,000 fishermen and 550 boats; the annual yield of fishery products being worth more than half a million yen. The Chinese population of Newchwang is 65,000 (1926) and there are also some 2,300 Japanese in the Japanese Concession.

NEWCOMB, SIMON (1835–1909), American astronomer, was born in Wallace, Nova Scotia, on March 12, 1835. He became a resident of the United States in 1853, and graduated at the Lawrence scientific school of Harvard university in 1858. He was an assistant in the American *Nautical Almanac* office 1857–61. In 1861 he became professor of mathematics in the United States navy, and was assigned to duty at the United States Naval Observatory. For more than ten years he worked with the various meridian instruments, and when the 26in. equatorial was erected in 1873 he was put in charge of that instrument. In 1877 he was assigned to duty in charge of the American *Nautical Almanac* office, a post which he held until March 1897. In 1884 he became professor of mathematics and astronomy at the Johns Hopkins university, continuing, however, to reside at Washington. He was also editor of the *American Journal of Mathematics* for many years. In view of the wide extent and importance of his labours, the variety of subjects of which he treats, and the unity of purpose which guided him throughout, Simon Newcomb must be considered one of the most distinguished astronomers of his time. A study of his works reveals an unusual combination of skill and originality in the mathematical treatment of many of the most difficult problems of astronomy, an unfailing patience and sagacity in dealing with immense masses of numerical results, and a talent for observation of the highest order. On taking charge of the *Nautical Almanac* office, he became very strongly impressed with the diversity existing in the values of the elements and constants of astronomy adopted by different astronomers, and the injurious effect which it exercised on the precision and symmetry of much astronomical work. Accordingly he resolved to "devote all the force which he could spare to the work of deriving improved values of the fundamental elements and embodying them in new tables of the celestial motions." The formation of the tables of a planet has been described by Cayley as "the culminating achievement of astronomy," but the gigantic task which Newcomb laid out for himself, and which he carried on for more than 20 years, was the building up, on an absolutely homogeneous basis, of the theory and tables of the whole planetary system. The results of these investigations have, for the most part, appeared in the *Astronomical Papers of the American Ephemeris,* and have been more or less completely adopted for use in the nautical almanacs of all countries. A valuable summary of a considerable part of this work was published in 1895, as *The Elements of the Four Inner Planets and the Fundamental Constants of Astronomy.* In 1866 Newcomb had published an important memoir on the orbit of Neptune, which was followed in 1873 by a similar investigation of the orbit of Uranus (*Smithsonian Contributions to Knowledge,* vols. xv. and xix.). About 25 years later new tables of these planets were issued by him (*Astronomical Papers of the American Ephemeris,* vol. vii., pts. 3 and 4) based on unpublished investigations in which the elements were determined from the best available observations up to that time. In the meantime the theory of Jupiter and Saturn had been thoroughly worked out by G. W. Hill, Newcomb's distinguished collaborator in the *Nautical Almanac* office, and thus was completed one important section of the work projected by Newcomb in 1877.

NOTABLE ACHIEVEMENTS

Among Newcomb's most notable achievements are his researches in connection with the theory of the moon's motion. His first work on this abstruse subject, entitled *Théorie des perturbations de la lune, qui sont dues à l'action des planètes,* is remarkable for the boldness of its conception, and constitutes an important addition to celestial dynamics. For some years after the publication of Hansen's tables of the moon in 1857 it was generally believed that the theory of that body was at last complete, and that its motion could be predicted as accurately as that of the other heavenly bodies. Newcomb showed that this belief was unfounded, and that as a matter of fact the moon was falling rapidly behind the tabular positions. With the view of examining this question, he undertook the reduction of every observation made before 1750 which appeared to be worthy of confidence. The results of this work were published in 1878. The discussion of the observations made after 1750 was interrupted by his work on the planetary tables carried on during his connection with the *Nautical Almanac* office. After his retirement from active service in the navy he was enabled, due to a grant from the Carnegie Institution of Washington, to secure the necessary assistance from 1903 to 1909 to bring to completion the work of his great programme on the motion of the moon. This was finished less than a month before his death. The observations used in his work covered an extreme range in time of about 2,600 years and seemed, as he himself said, "to prove beyond serious doubt the actuality of the large unexplained fluctuations in the moon's mean motion."

On taking charge of the 26in. equatorial at the United States Naval Observatory, Newcomb devoted it almost exclusively for the first two years to observations of the satellites of Uranus and Neptune. The results of these skilfully conducted observations were published in a memoir on *The Uranian and Neptunian Systems.*

As early as 1860 Newcomb communicated an important memoir to the American Academy, *On the Secular Variations and Mutual Relation of the Orbits of the Asteroids,* in which he discussed the two principal hypotheses to account for the origin of these bodies—one, that they are the shattered fragments of a single planet (Olbers's hypothesis), the other, that they have been formed by the breaking up of a revolving ring of nebulous matter.

In the *Astronomical Papers of the American Ephemeris* will be found a large number of contributions from Newcomb's pen on some fundamental and most important questions of astronomy. Among these are papers on *The Recurrence of Solar Eclipses, A Transformation of Hansen's Lunar Theory, Development of the Perturbative Function and its Derivatives.* His memoir *On the Motion of Hyperion, a New Case in Celestial Mechanics,* is in some respects one of his most original researches. He discussed the transits of Venus of 1761 and 1769, and those of Mercury from 1677 to 1881. At the international conference, which met at Paris in 1896 for the purpose of elaborating a common system of constants and fundamental stars to be employed in the various national ephemerides, Newcomb took a leading part, and at its suggestion undertook the task of determining a definite value of the constant of precession, and of compiling a new catalogue of standard stars. The results of these investigations were published in 1899, and were in general use for a quarter of a century. In the intervals of these immense labours, on which his reputation as an astronomer rests, he found leisure for works of a lighter character; *e.g.,* his *Popular Astronomy* (1878), his *Astronomy for Schools and Colleges* (1880), written in conjunction with E. S. Holden, and *Astronomy for Everybody* (1903). After his retirement from official life he published an excellent popular treatise on *The Stars* (1901). Several of these books have been translated into one or more of seven different foreign languages. A more recondite work is his *Compendium of Spherical Astronomy* (1906). He also wrote on questions of finance and economics, as well as in the field of fiction.

He received honorary degrees from ten European and seven American universities. He was a member of 45 foreign societies. He was awarded the gold medal of the Royal Astronomical Society in 1874, the Huyghens gold medal of the Holland Society of Science in 1878, the Copley medal of the Royal Society in 1890, the Bruce gold medal of the Astronomical Society of the Pacific in 1897, the Schubert prize of the Imperial Academy of Sciences, St. Petersburg, in 1897, and the Sylvester prize of Johns Hopkins university in 1901. He died at Washington on July 11, 1909, and was given a military funeral befitting his rank as a rear admiral in the United States Navy.

An autobiography, *Reminiscences of an Astronomer,* appeared in 1903; and a bibliography of his life and works containing 541 titles, is given by R. C. Archibald in *Memoirs of the National Academy of Sciences,* xvii., "First Memoir," pp. 19–69. This also contains, pp. 1–18, "Biographical Memoir" by W. W. Campbell. (W. S. E.)

NEWCOMEN, THOMAS (1663–1729), English engineer, one of the inventors of the steam-engine, was born at Dartmouth. While employed as ironmonger in his native town, he corresponded with Robert Hooke about the possibility of obtaining motive power by exhausting the air from a cylinder provided with a piston, Denis Papin and the marquis of Worcester having already made investigations on this subject. In 1698 he entered into partnership with Thomas Savery (*c.* 1650–1715), who had patented a method for raising water from mines. Newcomen's improvements on Savery's invention were so successful that they produced together a pumping-engine which served as a model for nearly three-quarters of a century. For a description of the "atmospheric steam-engine," then known as a "fire-engine," which they constructed in 1705, *see* STEAM-ENGINE. John Cawley (or Calley), was also associated with them in this invention. Newcomen died in 1729, probably in London.

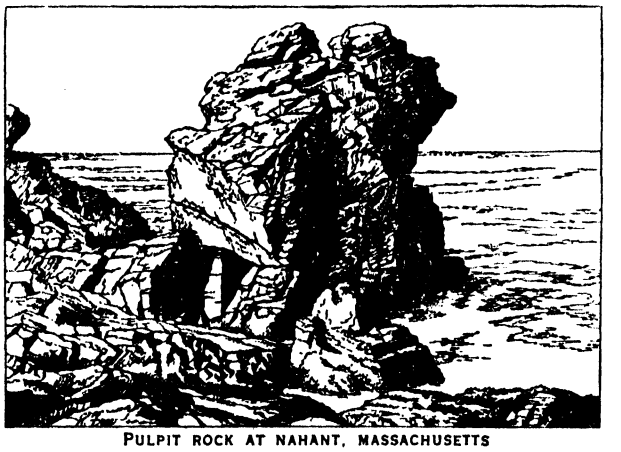
NEWDIGATE, SIR ROGER (1719–1806), English antiquary, was born on May 30, 1719. He was the 5th baronet of Harefield (in Middlesex) and Arbury (in Warwickshire), and grandson of Sir Richard Newdigate, an English chief justice during the time of Richard Cromwell's protectorate. He had an active political career, but is chiefly remembered for his collection of antiquities including marbles, casts of statues and vases. Two marble candelabra found in Hadrian's villa at Rome he purchased for £1,800 and presented them to the Radcliffe Library at Oxford. Among his other generosities to the university were a chimney piece, for the hall of University College, and the sum of £2,000 for the removal by Flaxman of the Arundel collection of marbles to the Radcliffe Library. The "Newdigate" prize of twenty-one guineas for English verse, which is open for competition each year to the undergraduates of Oxford University, was founded by him and was first awarded in the year of his death. He died at Arbury on Nov. 23, 1806.

NEWEL, in architecture, originally the central shaft around which a spiral or semi-circular staircase winds. Now more commonly any post at the intersection of a stair with a landing, in which case it is a vertical post which receives the rail and is framed into the supporting strings or beams of the stair construction. By extension, the term is also applied to any post in the railing larger than the other posts or balusters.

NEW ENGLAND. That portion of the eastern coast of North America lying between the 41st and 45th degrees of North Latitude received its name of New England in 1614 from Capt. John Smith who explored those shores on behalf of the Virginia Company of English merchants.

Physiographically, New England possesses great variety and also a unity derived from isolation. Such physical isolation and unity is, however, deceptive, for New England faces on three fronts. The long and deeply indented coast line from its easternmost point on the Bay of Fundy to the tip of Cape Cod, turns New England toward the maritime provinces of Canada, toward the fishing grounds of the Newfoundland banks and toward the ports of northern Europe from which it is some hundreds of miles less distant than are its rival ports in the middle States. New England's southern shore from Cape Cod to the Hudson river invites close relations with the States to the south, that part lying west of the Connecticut river, especially falling within the area of the metropolitan influence of New York rather than any New England centre. The north-western region, on the other hand, turns its back on the rest of New England and finds its outside connection through Lake Champlain and the Richelieu river or through Lake Memphramagog with the Canadian province of Quebec.

The very characteristics of location, climate, topography and soil conditions and lack of natural products of a highly prized



PULPIT ROCK AT NAHANT, MASSACHUSETTS

sort, which discouraged the exploitation of New England in the early years of American colonial development, were admirably calculated to make it an attractive seat for political and religious refugees whose primary consideration was living conditions and freedom from external molestation. While substantial financial resources assured the success of the Puritan colony of the Massachusetts Bay company, the survival of the feeble and ill-supported settlement of the Pilgrims at Plymouth proved that a living could be won from the wilderness by extraordinary effort and self-discipline. Both examples prompted other undertakings. Roger Williams, Ann Hutchinson and Wheelwright, refugees from the strict theocratic government of Boston, with no backing from the home government, set up tiny political States at spots just beyond the boundaries set by the Crown to the jurisdiction of Massachusetts Bay Company. On the other hand, new immigrant groups enlarged by malcontents from Massachusetts established strong settlements on the southern coast and secured royal recognition as the colony of Connecticut in 1661. In four directions colonial attempts of a distinctly different type were attempted. Based on Champlain's discovery in 1609 of the lake which bears his name, the French Government in Canada attempted to establish *seigneuries* on the slopes of the Green mountains bordering that lake. On the coast of Maine, Sieur de Mont in 1604 and a band of Jesuits in 1613 tried to found colonies. North of the Merrimac river Capt. John Mason received a grant from the Crown and sent settlers to the mouth of the Piscataqua (Portsmouth). His plans for an aristocratic domain modelled on the mediaeval County Palatine as well as his appointment as royal governor-general of all New England came to naught with his death in 1637. His settlers fell under the rule of the Massachusetts Bay company until created into a royal province in 1679. Further north-east another royal proprietor, Gorges, planned to colonize but failed in competition with the Puritan settlers. His heirs sold their claims to Massachusetts in 1674 and the region under the name of the District of Maine remained a part of Massachusetts until erected into an independent State in 1820.

The New England colonies had attracted little attention from the restored Stuarts until complaints of the independent attitude of the Massachusetts authorities in the persecution and exclusion of Quakers and Anglicans and a disregard of the Navigation acts drew down the royal displeasure. James II. attempted to systematize his northern colonies by consolidating all the New England

colonies with New York and New Jersey under a single royal governor. From an administrative point of view the scheme was sound. This new "Dominion of New England" would also have enabled the English to oppose the threatened aggressions of the French more effectively, but the methods of James's agent, Randolph, and his governor, Andros, roused bitter opposition in New England. The cancellation of their charters the colonists regarded as a destruction of their constitutional rights. When the news of the glorious revolution in England reached Boston, Andros was overthrown, Connecticut and Rhode Island quietly resumed their old charter governments and Massachusetts obtained at the court of the new sovereigns, William and Mary, a restoration of many of her old rights under a new "province" charter (1691). The qualities and characteristics which have distinguished the New Englanders and the institutions which New England has given to America were developed in the colonial period. At first, the most pronounced characteristic was the capacity for co-operative action. From this sprang the public school system, the town government, the Congregational Church organization. By the Revolution, however, the individualism which appeared sporadically in the early years came to be general and reached its height in the political philosophy of the Adamses, in the transcendentalism of Emerson, in the educational theories of Charles William Eliot. Much has been said of the spiritual heritage of the Puritans and Pilgrims, and ideals with which they came to New England; there seems to be ample grounds for explaining the peculiar features of New England life with reference to the economic situation. Unquestionably the New England colonists suffered from lack of division of labour. The nature of the soil, the lack of easily accessible markets, the difficulty of securing a surplus of any great staple to exchange for other necessities forced each family to provide for its own wants. This produced a people of singular ingenuity and resourcefulness but without specialized skills. It offered no premium for systematic development of agriculture or industries except the few in which New England had a natural advantage both in production and in marketing. Of these the greatest was ship-building. This industry began almost at once with Winthrop's "Blessing of the Bay" launched on the Mystic river in 1631. On nearly every navigable stream in close proximity to the supply of timber arose small ship-yards where the neighbouring farmers, trappers or fishermen employed their time in off-seasons in turning out vessels for which they found a ready sale, because the English Navigation acts admitted colonial-built vessels to the status of English ships in the monopoly of the carrying trade of the expanding empire.

As compared to the other English colonies in North America, however, New England colonies were not keeping pace either in the matter of supplying the mother country with the desired staples or in offering an outlet for population. The so-called Great Puritan Exodus of the years 1629–1640 has been shown by recent historians to have been directed more to the West Indies than to New England. The strength of New England relative to other sections of the continental colonies fell from 52% in 1650 to 25% in 1790. The beginning of this relative decline was already manifest in 1700. During the Restoration period the Puritan emigration, dormant during the Civil War, revived slightly but was never again the chief source of immigration to America. Of the great streams of migration of the next century, the Scotch-Irish and the Palatinate Germans, New England got but a small share as compared to the Middle or even the Southern colonies. The New England colonies had been singularly free during their early years from interference by the natives on account of a severe plague which had swept away approximately half of the population just before the arrival of the first settlers. In addition to this the authorities had been fortunate in maintaining friendly relations while extinguishing Indian titles to lands allotted to new townships. The war with the Pequots (1637) was the exception.

The French and the Indian wars ultimately benefitted New England by the entire removal of the menace to expansion toward the Canadian border, but they were even more important as an effective, though costly training of the colonists in self-government in war time. The colonial legislatures were obliged to raise and equip troops and supply ships and sailors to convey them on expeditions. Of these the most noteworthy were those against Quebec and Louisburg. The obvious advantage here of joint action brought home again the need of some form of political co-operation such as had been tried in the New England Confederation (1643). New Englanders were, therefore, interested in Franklin's so-called "Albany Plan" of union in 1754.

New England played her chief part in the Revolution during the years 1765–77 in defining the issues and in precipitating actual hostilities. Though these centred in Boston, sentiment for and against rebellion and independence was fairly evenly distributed throughout New England, the line of cleavage being one of class and occupation rather than of locality. After the British evacuated Boston on March 17, 1776, New England saw little of active hostilities, except for the part played by her militia in checking Burgoyne's advance at Bennington, Vt., and in the struggles over the possession of Newport, R.I. Her irreconcilable temper convinced the British that attempts at conciliation or subjugation had greater chance of success elsewhere.

The period of disorganization which followed the cessation of hostilities brought great suffering to many communities and certain classes in New England. The utter disruption of the old courses of commerce within the British Empire no longer supplemented by privateering and war-time trade with other countries caused a lack of specie. Every State fell a prey to a greater or less degree to the paper money craze. Rhode Island, in particular, suffered so heavily that civil war threatened. The refusal of the Massachusetts legislature to relieve the pressure of debts and taxes by stay laws and further issues of paper money, led to a rebellion under the leadership of Daniel Shays. Although the mercantile classes were convinced of the necessity of forming a stronger central government capable of securing favorable commercial treaties with foreign countries, and although New England leaders played prominent parts in the Federal Convention, the actual ratification of the new constitution proved a difficult matter in Massachusetts and in New Hampshire and was rejected in Rhode Island until 1790.

For nearly a decade after the inauguration of the new government under Washington the superior organization of the dominant commercial interests committed New England as a whole to the Federalist party, but Jefferson gradually organized the latent anti-Federalist and Democratic elements until in the election of 1800 he was able to carry several representative districts.

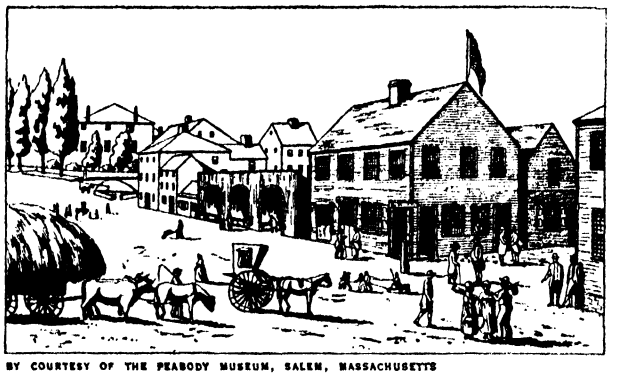
The basis of New England's prosperity in the Federalist period seems to lie in the application of Yankee energy and resourcefulness to the exploitation of the peculiar advantages of New England in foreign trade. Her ships, restricted in their enterprises in the older fields under control of the British Crown, turned to the Mediterranean, Pacific and Indian oceans. In 1786 Samuel Shaw established in Canton the first American mercantile house in China. In 1787 the "Grand Turk" brought to Salem the first of the many oriental cargoes which made that port famous. In 1792 Capt. Gray's "Columbia" carried the Stars and Stripes around the world for the first time and laid the foundations not only for the American claim to Oregon but also the very profitable trade with the north-west coast where furs were obtained which could be exchanged in China for silks and tea. Salem became for a time the tea market of America and Europe and the third city in the Union. The heyday of New England's mercantile success, was shared to a considerable extent by all classes. There was speculation in timber-lands and a rapid shift of population into the frontier States—Maine, New Hampshire, Vermont, western New York and Ohio. The Napoleonic wars shattered this prosperity. Although equipped to compensate the loss inflicted on her commerce by English and French war time restriction through the enormous profits made in privateering and in blockade running, the New England shipper could not survive the devastating effect of the Republican embargo policy. The war of 1812 was regarded in New England as Mr. Madison's war, forced upon him by the *Warhawks* of the West and was viewed as another and convincing demonstration that the annexation of Louisiana and the development of the Western States was ruinous

to the interests of the old commercial States of the north-east and justified that group in seceding from a Union in which they would clearly form a hopeless minority. Convinced of the injustice done to their section, New Englanders disregarded the embargoes, carried on illicit trade with the English in Canada and West Indian ports, discouraged recruiting and subscriptions to war loans and refused to celebrate victories gained by the French over the common enemy, the British.

In one respect only did New England enter the war. She supplied men and ships to the navy and was especially active in fitting out privateers. A threatened secession movement in 1804 was headed off by the wiser Federalist leaders like George Cabot and Hamilton, but by 1814 the sentiment had got beyond the control of the moderates and resulted in the convention at Hartford, which demanded an amendment of the Constitution to protect New England interests. The termination of the war left this movement high and dry; it brought its sponsors—the Federalist Party and New England generally—into disrepute among the nationalistically-minded rising generation of statesmen from the South and West. The interference with her commerce wrought by the embargo together with the interruption of the usual flow of manufactured merchandise from England and the Continent caused some New England capitalists to transfer their money from shipping to the new textile plants which had been introduced during the last decade of the 18th century. At Beverly and Waltham in Massachusetts, at Pawtucket and Woonsocket in Rhode Island, the new spinning and weaving machines had been set up. Saved by the war from immediate competition of English textiles these factories gained a start. The termination of the war saw a great importation of English goods. Faced with ruin, the mill owners of New England joined with the infant woollen manufacturers of Pennsylvania to secure a protective tariff in 1816. As part of a general burst of nationalism the policy of protection and creation of a home market as advocated in Hamilton's famous report on manufactures was adopted. Increased rates were sought after the depression of 1819 and by 1824 New England politicians of all parties were faced by the presence of a new sectional issue. Manufacturing as a New England occupation grew steadily through the next generation bringing with it the social, economic and political problems of concentration of population and constant demand for cheap labour and widening markets. In the same period, 1816–50, the rapid expansion of the agricultural regions of the South and West brought into the eastern markets the cheaper cotton as well as the cheaper food-stuffs. The former stimulated more textile activity—the latter drove the less well-situated farmers to abandon their farms.

Several of the shibboleths, such as "Manifest Destiny" which swept the national Government in the first half of the 19th century left New England cold. Her own frontier, the northern and eastern regions of New Hampshire, Vermont and Maine were losing that character. The northern boundary, long subject to dispute even to the extent of an armed clash known as the Aroostook war of 1838, was finally determined by the Webster-Ashburton treaty in 1842. While hostile to Western expansion, and to the policy of cheap public lands which went with it, New England had contributed mightily to people the new areas. Miss Lois K. Mathews's *Expansion of New England* admirably relates the direction, quantity and peculiar quality of the migration from the New England States. Through this transplantation of her population to the new States of the old North-west and later to Iowa, Kansas and Oregon, New England continued to exert the peculiar influence of her Puritan traditions. In the great problem which confronted the inhabitants of the great areas of the Mississippi valley and the Western plains—transportation—New England took little interest until railroad building came into the class of capitalistic enterprises. Her location excluded her from the competition in canal, highway and railroad building which engrossed the attention of Virginia, Maryland, Pennsylvania and New York. Yet New England had locally been a pioneer in railroad experimentation. One of the first railroads in America was built in 1826 to carry granite blocks from the Quincy quarries to tide water. In the '40s short lines were built connecting Boston with Providence, Lowell, Portsmouth, Worcester, Springfield, New Haven and New York. In 1850 Massachusetts ranked third to New York and Pennsylvania in railroad mileage.

The humanitarian movements of the '30s produced lively response in New England. Not only were the social problems incident to concentration of population in her mill-towns provoca-



BY COURTESY OF THE PEABODY MUSEUM, SALEM, MASSACHUSETTS

NEW BEDFORD IN THE EARLY 19TH CENTURY. FROM AN ENGRAVING AFTER A PAINTING BY W. A. WALL

tive of controversy over questions such as the length of a working day and conditions of labour, the right to strike and the association of workers, but the assembling of people within easy reach of such potent agencies for education and enlightenment as schools, colleges and lyceum lectures, had a stimulating effect on the popular interest in all sorts of questions. In this soil flourished many new ideas—advocates of liberal movements in religion, like William Ellery Channing, Theodore Parker and Horace Bushnell, crusaders for temperance like Neil Dow, who in Maine secured the first prohibition law in the United States, or for abolition of slavery like William Lloyd Garrison, for public high schools like Horace Mann; the Concord group—Ralph Waldo Emerson, Henry D. Thoreau, Bronson Alcott and Margaret Fuller gave New England an international reputation for "transcendental philosophy"—and with Longfellow, Holmes and Lowell made this section the literary centre of America. The colleges and the academies that had survived the Revolution largely as sectarian institutions or theological schools now took on more liberal aims and methods and sent their graduates all over the country. At Litchfield, Conn., the first real law school in America flourished, under the guidance of Chancellor Kent, and produced such men as John C. Calhoun. Harvard college, where the triumph of liberalism over the more orthodox Puritan Party in Boston in the early 18th century had led to the founding of Yale by conservatives, carried its liberalism still further and in the 19th century, under the guidance of Unitarians, borrowed largely from the German universities, gradually widened its curriculum on an elective basis, developed graduate schools of law, medicine, arts and science. In Providence the Baptists had founded Brown; at Middletown, Conn., the Methodists established Wesleyan; in the Connecticut valley arose Amherst; in the Berkshires Williams college, and in Maine appeared Bowdoin, Bates, and Colby. In Vermont a State university was established through the benevolence of Ira Allen.

The position of New England in the Civil War accords with the double character of that struggle—the abolition of slavery and the preservation of the Union. The same men who gave their lives for the latter issue had heaped abuse upon the men like Garrison who had agitated for 20 years in favour of the former issue. On the other hand, Wendell Phillips had denounced the clergy and the Cotton Whigs for their willingness to compromise with the slave owners, and a great convention at Worcester advocated New England's secession from a Union which required its members to enforce the Fugitive Slave law and to recognize slaveholders' property rights in human flesh. Once war began, New Englanders supported the Administration steadfastly although the persistent demands of Charles Sumner and other abolitionists for immediate emancipation frequently caused embarrassment to

President Lincoln. During the Reconstruction period New England remained consistently Republican.

New England commerce suffered severely during the Civil War. The whaling fleet, once the pride of New Bedford and Nantucket, was broken up by Confederate raiders and its monopoly of the illuminating oil market was destroyed by introduction of kerosene oil, gas and electricity. By the change from wooden to iron, and then to steel ships, and by the rising costs of operation under the American flag, all the natural advantages in the construction and operation of ships which New England formerly possessed, were lost.

Again as in 1812, New England's answer has been to shift her capital from shipping to manufacturing. Again as in the '30s and '40s she succeeded, but toward the close of the century was faced with competition from new centres in the South and West, equally well equipped with power sites, with capital and within easier reach of the source of raw products and of the markets.

New England is now a highly industrialized section, yet she retains a good deal of the diversification of occupation which gave the Yankee his reputation for being a jack-of-all-trades and has produced many inventors.

Apart from the decline in her relative position in commerce, the chief respect in which New England has altered in comparison with other sections of the Union has been in the character of her population. Far from being the most homogeneous section of the colonies, New England has become one of the most cosmopolitan areas. The development of industries on a factory basis was effected by drawing the "native" New England stock from farms to factories without reliance on the recent immigrants. It was not till after 1830 that the number of non-English immigrants began seriously to affect her political or social structure. The great immigration of Irish after the famine in the '40s produced in the neighbourhood of Boston some serious disturbances, and New England shared the anti-foreign sentiment which took political shape in the Know-Nothing party. The immigration of large groups of other nationalities and religions between 1890 and 1914 altered the situation rapidly. Although the number of native-born of English ancestry still forms a minority in New England as a whole, and is almost negligible in the industrial centres, the *blocs* of foreign-born or those of non-English ancestry tend largely to offset each other for political and social or economic purposes. Of the "foreigners" the Irish Catholics took the most active part in politics. Except for a short period in 1912 during strikes in the textile centres, the influence of radical leaders has been slight among the working classes. Trade unionism existing in most industries is generally directed in conformity to the conservative policy of the American Federation of Labor. That there has been no general attack on the principles of capitalism is due to the fact that the New England States have been leaders in legislation favourable to labour as respects conditions and hours of work.

New England won the name of the Switzerland of America because of the independent spirit of her people in the colonial and revolutionary periods. She has kept the title in virtue of her natural scenery, stimulating climate and the wisdom of her people in conserving her natural attractions for a vacation resort and playground. No other of the old sections of the Union has set aside so many beautiful areas for parks or reservations. The White mountains of New Hampshire, the Green mountains of Vermont, the lake regions and rugged coast of Maine, the wooded Berkshire hills and sandy stretches of Cape Cod have become nationally famous. They attract a visiting population of summer residents, tourists and children's summer camp colonies which doubles the normal population of many regions during every summer. Of late years a similar movement to enjoy winter sports in the northern States has been inaugurated. From colonial days down to the present, a constant emigration of New England born or trained leaders in literature, art, science and engineering has extended her influence in the nation out of all proportion to her population or her area or to the capitalization of the industries situated within her borders. (P. P. C.)

NEW FOREST, one of the few woodland regions left in England, covering 92,365 acres in the south-west of Hampshire, between the Solent, Southampton Water and the river Avon. The Crown has the right to keep enclosed and planted 16,000 acres.

The New Forest is one of the five forests mentioned in Domesday. It was a hunting-ground of the West Saxon kings, but derives its name from the afforestation schemes carried out by William I. in 1079. One of the chief sources of the wealth of the forest in early times was the herds of pigs fed there. The New Forest being under the forest laws, was affected by the forest clauses of Magna Carta and by the Forest Charter (1217), which mitigated their severity. The chief officer was the justice in eyre who held the justice seat, the highest forest court. The lower courts were the Swainmote and Wodemote, the former of which is still held, in a modified form, in the Verderers' Hall of the King's House at Lyndhurst. The circuit of the justices in eyre, or their deputies, continued down to 1635; they were virtually ended by the Act for the Limitation of Forests (1640), though Charles II. attempted to revive them, and they were not legally abolished until 1817. The lower officers of the forest, who held merely local appointments, were the verderers, the regarders, the foresters, the woodwards and the agisters. There was also a lord warden, who was usually a nobleman and performed no judicial functions. The Deer Removal Act (1851) resulted in the almost total extinction of the forest deer. Under the act of 1877 the forest is administered as a national park. About one-fourth of the area is under cultivation by private owners and tenants, and the remainder is open woodland, bog and heath. The principal village within the forest is Lyndhurst (pop. [1921], 2,562), with the verderers' court, in charge of the Crown portion of the forest. On the western outskirts lies the town of Ringwood (*q.v.*). Beaulieu village on the estuary of the Beaulieu river, has ruins of Beaulieu Abbey, founded by King John for Cistercians. The gatehouse is restored as a residence, and the Early English refectory as a church. There are considerable remains of the cloisters, chapter house and domestic buildings.

NEWFOUNDLAND. Newfoundland is said to be the tenth largest island in the world, forming a separate country. It is one-sixth larger than Ireland, one-fifth smaller than England. It is approximately 317 m. in its widest place, and 317 m. long from north to south. Its area is 42,734 sq.m. Pop. (1925) 258,425. It is a country of great potential wealth.

Material wealth has been more easily and rapidly accumulated farther west, and the current of immigration from Europe has hurried past her shores only staying to profit by her more easily gathered raw products. New methods of using the resources of nature, new methods of controlling her powers, new methods of transportation and communication are beginning already to turn new attention to this oldest colony of the greatest empire in the world.

Position.—Newfoundland lies more to the south than England, and her position at the gateway of the St. Lawrence has given her a strategic position that is alone sufficient to raise her to a position of first importance to the federated nations of the British Empire, while the fact that her capital lies almost exactly half-way between New York and London made her the link that enabled the two great English-speaking countries to be first united together by the message-carrying transatlantic cables, decades before it would have been possible in any other way. Nor as a pioneer in uniting the two countries through the conquest of the air has Newfoundland played a mean part.

Newfoundland is part of the American continent, broken off. Her southern point, Cape Race, lies as far south as 46° 39′ N. in the latitude of Bordeaux, France, and her northern point, Cape Norman, is in 51° 38′ N., the same as that of Brighton on the English south coast, while she falls in longitude between 52° 36′ W., and 59° 30′ W. She is separated on the north from Labrador by the Strait of Belle Isle, fifty miles long, which ranges from nine miles wide at its narrowest place at the western end to forty miles wide at its eastern entrance. This is a shallow, mostly sandy bottomed strait, through which the ocean current, coming from the Polar sea runs into the Gulf of St. Lawrence, and through which the great river of Canada, as it now is called, partly dis-

charges her waters (the rest flowing through Cabot Strait, a piece of water ninety miles wide at its narrowest place, between Cape Breton on the Canadian side, and Port au Basques, opposite it in Newfoundland). Belle Isle, or the Isle of Demons, lies in the centre of the eastern entrance. Its lofty cliffs are well lighted at both ends by fine lighthouses, and it is one of the best cod fishing stations in the world.

Minerals.—The story of mines in Newfoundland is very different in 1928 from what it was in 1925. Then, excluding the great Wabana iron deposit at Belle Isle in Conception Bay, minerals gave little return to the country. In 1928, with the lead, zinc and copper of Buchan's mine on the Exploits, and the Red Indian Lake deposit, the new day had dawned. The huge deposit of titaniferous magnetite at St. George's, called Steel Mountain, the widely distributed deposits of copper in Notre Dame Bay, now that low grade ores can be so much more profitably worked, the silver lead zinc area of Placentia Bay, especially the La Manche lead mine, the vast deposits of coal in St. George's neighbourhood, all promise a real future in this third line of native wealth. As a copper producing country, experts say that the future is absolutely assured. Gypsum for cement, fine slate, oil shale, and the annual output of oil on the north-west coast, need further work, but again the experts estimate them as a potential of great value. The final settlement of the "Labrador Question" by the Privy Council in 1927 entirely in favour of Newfoundland, has given the Colony an area twice as large as her own, with waterfalls that are, for potential power, now unequalled in the world, and all the timber, minerals, fisheries and wealth of one hundred thousand square miles of virgin territory. Its value to her is estimated at anywhere between $300,000,000 and $500,000,000 on a conservative estimate. Yet a few years ago, she offered the whole of it to Canada for $30,000,000, and the offer was declined.

Physical Character.—The coast of Newfoundland is rugged and rocky, and deep water runs right up to the cliffs. These rise high and perpendicular in most places, but beautiful bays intersect this outer face, and wind away mile after mile, in many cases among numerous islands, giving a coast line of over four thousand miles. Conception Bay, Trinity Bay, Bonavista Bay, St. Mary's Bay, Placentia Bay, Green Bay, White Bay, and Bay of Islands are the chief large inlets, and through them find outlet to the sea beautiful winding rivers of which the Gander, the Humber, and the Exploits are the largest, the latter being a mile across at its mouth. There are innumerable lakes, some many miles in length, Grand Lake and Red Indian Lake being among the largest, with areas of one hundred and ninety-two square miles, and sixty-four square miles respectively. The bottom of Grand Lake is three hundred feet below sea level. One-third of the surface of the Island is said to be water-covered. These lakes fill the deep gulches between rocky mountains, are very deep and mostly well stocked with trout. The highest and most beautiful mountains are on the north-west coast. They extend north from Cape Ray about 200 m., and rise to over 2,200 ft.; as they rise almost directly from the water line they have a very impressive effect on the passer-by. The "tundra" nature of the land near the Coast affords excellent pasture for caribou. The half dozen moose imported by the Government have multiplied steadily.

Climate.—The total annual rainfall of Newfoundland is not large. Its sunshine is above the average. The heavy fogs, even of the south, seldom surmount the immediate ramparts of her shore line, while farther north, as the Gulf Current gets farther and farther from the land, except in the Straits of Belle Isle, where the warmer waters of the Gulf of St. Lawrence meet the cold incoming tides from the Polar Current, the fogs, so far as navigation goes, are not a more serious factor than elsewhere. The climate is somewhat that of England, except that it is colder, and possibly a little damper, except in the North, where the narrow peninsula is completely sub-Arctic, being steeped on both sides in the Arctic waters.

Population.—Of the original inhabitants, a sturdy, brown race of peaceful and clever little people, called Beothucks, perhaps the less said, the better. They were wilfully destroyed, being hunted down like wild animals.

Newfoundlanders are open air men. They do not take kindly to mining, or even to the lumber woods. On the other hand, they are born mechanics, and as carpenters, builders, plumbers, painters and skilled workmen of all kinds, they are greatly in demand—so much so that it is truly said that there are more Newfoundlanders in Boston today where a "Newfoundland Gazette" is regularly published for their benefit than there are in St. John's. Once, however, her mineral wealth is seriously tapped, and her pulp and other potentials scientifically exploited and conserved, the population will probably increase.

The population of St. John's, like many other things, is recorded only according to religious affiliation, and there are said to be, in 1927:—8,374 Church of England, 7,623 Methodists, 980 Salvationists, 1,047 Presbyterians, 348 Congregationalists, 326 other denominations; that is, 18,698 Protestants, and 17,746 Roman Catholics, almost entirely of Irish extraction.

In the whole Colony:—The church of England numbers 84,665, Methodists 74,205, Salvationists 13,023, Presbyterians 1,876, Congregationalists 1,018, Other Denominations 1,670. Total Protestants 176.457. Roman Catholics 86,576. There is an archbishop of the Roman Catholic Church, and two bishops, and one bishop of the Anglican Church.

Education.—The people of Newfoundland are of English stock largely from England's western seaports, while mixed with these are the inevitable Scots, and not a few Irish. Only a few French remain. Comparatively, they are a poor people, and at times in outposts there is considerable shortage of the necessities of life, as the deficiency diseases only too forcibly testify, and even still there is, in the outposts, a great deal of illiteracy. For if the political system can be classed as successful, the denominational system of education has little, if anything, to recommend it, so far as results go, and overlapping sectarian schools paid for by the Government are one of the greatest handicaps of the Colony. One or two interdenominational schools have been founded by outsiders, under Government permission. In the capital itself, good schools exist, but Newfoundland has no university of its own, and its students still go to England, Canada, or the United States for degrees and for higher education.

Economics.—Almost of necessity the Newfoundland fisheries have been carried on a credit basis, since the time when the lower hands on the vessels were treated little better than serfs. But the credit system here has been exceptional in that in so many cases very little money was paid. This led to a peonage system in which the poorer people lived on what supplies their particular merchant cared to give them, and many, even fathers of families, never owned money. On the other hand, merchant and planter (*i.e.*, fisherman with an outfit) in a sense stood together, and as long as the industry repaid generously both capital and labour, there was no lack for either of plenty or happiness. Trouble began when fish became scarce, when prices dropped, and when capital claimed all repayment first, and failed to recognize that labour also was the equivalent of money invested. Thus, in bad seasons, labour always accumulated debts, and no wages being credited for the outlay of all his time, the fishermen often lived and died in debt, and even handed his "red letter" debts on to his children, so much so that a law had to be passed that debts contracted at the cod fishery to one supplier might not be charged by another against any credits he might establish on account of the seal fishery. Of late years, cash has been regularly paid for balances due, and a truck act is in force. To understand the peculiar conditions of the social life of the fishermen of the island, these facts have to be understood. It was in an honest endeavour to remedy the conditions that about 1900 the Fishermen's Protective Union was formed, becoming a co-operative, productive, and distributive society. The members flew their own flags, created a new centre for the collection and sale of the proceeds of their voyages in a new harbour away altogether from the capital, and all around the island, in the outposts where fishermen lived, they established the Fishermen's Union Cash Co-operative stores. The idea spread like wild fire, and if possible to carry it out efficiently, the system is unquestionably ideal, for it really offers the men, whose hard work and dangerous calling produce the wealth, at least a major part of the resulting

profits. At first it went splendidly, though against great opposition, for it, like every reform, tended to upset all the conventions of commerce as well as all the traditions of this particular trade. It had no revolutionary side, it sought peace, not war, in business. But it could only get human agents, and many of them were not equipped fully for their responsibilities. Politics, alas, were also allowed to enter, and played no small part when troubles began. Though the humble founder was honoured by the King, at the request of the Newfoundland Government, with a knighthood, and became the Minister of Fisheries, the success that was merited and anticipated for this most interesting venture has been disappointing, though this Union still functions and has many firm and loyal friends; but the bulk of fishermen do not have the same active connection with it as before.

Fishing.—Newfoundland has exported on an average fifteen million quintals or seventy thousand tons of dried codfish every year at a value of about $6,000,000 reaching even $12,000,000. This is only one-third the weight of fish when first caught before being split and dried. There are three fisheries, the Grand Banks, the "Shore" or home coast, and the Labrador. The banks are probably the top of an old submerged mountain range, three hundred miles long, running south-east towards the centre of the Atlantic Ocean, over which 80 up to 100 fathoms of water washes. They are covered with sand and fine mud, and the two currents that meet over them bring endless small diatoms and algae, on which are fattening endless invertebrates of the crustacean and mollusc types, that in turn fatten the hosts of codfish that resort there. The cod swim in to the coast from the deeper water in May and June, heralded by sardine-like fish called caplin, which, in enormous hordes, land on the actual sandy beaches to spawn.

The number of fishermen varies, but approximately one-fifth of the population now engage in catching and curing codfish. About 1,000 schooners are used, the numbers having fallen from over 1,500. The bankers use long lines or trawls with many hundreds of hooks on each. The "Shore" and Labrador men use mostly submerged nets, called traps, which cost about four hundred dollars apiece. They also use hand lines and flaxen gill nets set on the bottom, and ordinary twine mesh nets, called "cod-nets." Squid follow the caplin and on these also the cod feed greedily; they make excellent bait and also are good eating.

In spite of the decline of late years in the number of men and boats employed in the Colony's fisheries, the actual statistics are enlightening:—

	Actual quantity of Codfish caught in qtl.	*Value in dollars*
1885	1,284,719	4,061,600
1905	1,196,814	5,108,614
1927	1,589,841	12,057,414

The advent of the Hudson's Bay Company in 1927 into the codfish trade of Newfoundland is a very happy augury for her.

Exports of cod oil unrefined, 1921, value	$474,304
Exports of cod oil unrefined, 1928, value	751,734

The new knowledge of the enormous value to the human body of refined cod liver oil, has advanced its price all the world over, exactly as it has that of calf's liver. The Newfoundland cod liver oil has been repeatedly stated by the chemical biological experts of the United States to be the richest in vitamines in the world.

In 1921, 45,956 gallons were exported, valued at	$ 79,982
In 1926, 169,645 gallons were exported, valued at	197,244

The lobster fishery has been necessarily closed down, owing to the great depletion of that esculent crustacean, and whereas the export value of cases in 1921 was $304,954, in 1927 it was nothing at all. In the 'eighties, a fine fish and lobster culture laboratory, and fish protection centre, were established at Dildo, in Trinity Bay, under a Norwegian scientific expert. This introduced laws protecting lobsters, and gave out simple floating hatcheries for saving the spawn, and replenishing the stock. But political opposition closed this soon after.

The salmon fishery has at last begun to come to itself. The putting up of salmon in salt or brine never made an article of food that was much appreciated in the market, except in limited quantities that could be washed out, smoked, and sold chiefly for hors d'oeuvres. In 1926, however, largely due to the enterprise of the Hudson's Bay Company, fresh salmon was satisfactorily put on the London market, in such excellent condition that a company of expert tasters gathered in London for a sample testing at the greatest fish restaurant in the world, were unable to distinguish it from fish just taken from the rivers. This industry is just beginning, and so far the capacity of the Newfoundland salmon fishery has only been touched. With its long coast line, and its innumerable rivers, there is no reason why, if the breeding rivers are themselves adequately protected, the fresh salmon trade of Newfoundland should not compete even with British Columbia in value, for the coast is so close to Montreal, New York, and London, as to throw their large trade almost wholly into her hands. New methods of collecting, catching and preserving, are all the while improving, and there are no salmon in the sea like the crisp fat fish of the Labrador current, all of which are caught in salt water in gill nets, before they enter the rivers, where they would be knocked about, and where they do not feed. In 1920, pickled salmon fetched $85,563. In 1926, it fetched $130,825, while fresh salmon fetched in 1926, $144,896.

The seal fishery varies in value, but already shows that these mammals, which have only one young per year, are unable to stand against the modern inventions used to destroy them when they are helpless at the time of motherhood. The mothers bring forth their young at the end of February or early part of March on the level floe ice, called "whelping ice," that comes south along the east and west coasts of the Colony. They are there attacked by large ice-protected steamers, with wireless communications with the land, and with one another, with airplane service to direct the vessels where possible, and with modern repeating rifles and expanding bullets. There is, moreover, every year great loss from thousands of seals being killed, and their bodies lost upon the ice pans, as it is still legal to kill many more than can be taken straight to the safe storage of the ship, and they are left floating about on the loose ice, with flags indicating the owners, hoping that they may be picked up later. In 1927, only nine steamers, with crews amounting to 1,634 men, pursued this fishery, and brought home 180,459 seals, as against 211,531 taken in 1926, a very large decrease on what used to be taken half a century ago. There are those who defend this fishery, especially the old sealing captains and steamer owners, but the man-in-the-street sees nothing but obliteration for the herds, like those of the hood seals of East Greenland, if this annual slaughter continues. The poor settlers of the Labrador and North Newfoundland coast suffer severely from the diminution of these seals, for they depend on them for both meat and boot leather in the long winter, while the oil was to them an essential winter industry. For 1928 the total value to the Colony of all the fisheries was estimated at $36,000,000.

Another future for the abundant cod lies in the distribution of it in cold storage; no doubt this will be greatly developed in the future. Hundreds of tons were thus sent to Europe during the war.

Whales.—The whale fishery, which declined and almost disappeared a few years ago, except for the station at Hawk's Harbour in Labrador, has practically been taken over by Norwegians. A very large factory has been opened in Gready Islands, and the managers propose to put yet another about 200 m. further north. The law only allows two killing steamers to a station. The average number of whales to make such a factory pay well is two to three a day. There is a large patch of ground off the south Labrador coast, greatly frequented by sperm whales, once supposed to be the doyen of the huge cetaceans. In 1927, however, orders were given not to bother with sperms, but to bring in only sulphur bottoms or blue noses, humps or finbacks. The value of sperm oil, and the difficulty of getting it out of the whale made it practically unremunerative.

Finance.—The coinage is decimal. The measures and weights are as in England. The banks are Canadian. When the local banks went into liquidation, the Bank of Montreal, the Royal Bank of Canada, the Bank of Nova Scotia, and the Bank of Commerce at once stepped in, and have ever since rendered yeoman

service. American, Canadian or Newfoundland Government notes are all accepted in the Colony, and there is no demur or worrying even over accepting silver or gold coins of all those countries in Newfoundland. The catholicity of a seafaring people happily pervades all their activities. All the Government finances, even their savings banks' business, is done through the great Bank of Montreal. The economic disadvantage to the country of this is apparent, where the power of every dollar is so much needed locally. The habit of saving in actual gold by fishermen became almost universal after failures of Newfoundland banks in 1895. Deposits in all the banks have increased considerably. The figures are:—

	1922	1926
	$	$
Bank of Montreal	6,034,863	8,158,286
Bank of Commerce	701,760	990,066
Royal Bank	3,766,933	4,079,537
Bank of Nova Scotia	7,676,776	8,664,691
Government Savings Bank	1,984,542	2,011,262

The trade, revenue, expenditure, loans and public debt statistics, are equally illuminating:—

	Imports	Exports	Current revenue	Current expenditure	Funded pub. debt
1910	..	..	3,527,126	3,354,746	27,176,380
1917-18	26,892,946	30,153,217	6,540,083	5,369,455	34,489,955
1926-27	25,813,871	30,839,859	8,932,436	10,533,409	72,017,932

There are approximately five million dollars in loans and in a sinking fund, reducing the liabilities of the public debt to approximately sixty-seven and a half million dollars. This makes the public debt per caput of the population about $260, half of which was due to the World War. This is double that of any provinces of the Dominion of Canada. The steady borrowing of money is easy, and still goes on, and almost every year a new loan is contracted. It is, however, hoped that the new industries now developing may make this unnecessary.

Public Debt.—At the end of the nineteenth century, the public debt of the Colony was small, approximately $9,000,000, and her population about 250,000. But Newfoundland, which has been described, not altogether unjustly, as a land of a repetition of misfortunes, was suffering from a fresh series of disasters. In 1892, for the third time, the capital of the country, St. John's, was wiped out by fire, and in 1895 all the banks in the country failed, and many people all over the island lost the savings of their lifetimes. This, capped by some bad fisheries, had greatly discouraged even the politicians in St. John's, and overtures were made to Canada to enter the federation on condition that their public debt be taken over by the Dominion. Sir Mackenzie Bowell, however, Prime Minister of Canada at that period, with his Cabinet, decided that the price was too great, a decision which many Canadians have bitterly criticized in later years. Since that time, Newfoundland's public debt has doubled several times, and stands in 1928, at some $67,500,000, with still only a population of 260,000. This has involved heavy taxation, and a greatly increased cost of living. Unfortunately, concurrent with this increase there has been a decrease in the value of Newfoundland's main production, salt codfish, and consequently a gradual decline in the number of vessels and men employed. Whereas, 90% of the people were once living out of the fisheries, less than 50% now are able to do so, though the greatly increased level of living partly accounts for this. The great war undoubtedly had much to do with this, but however that may be, even with the new labour opportunities that have arisen to supplement the incomes derivable from the season of open water, the fishery no longer supports the country, and a very large number of her yeoman families have left for the United States and Canada.

The details of the revenue for the year help to an understanding of the country's problems, and are as follows, for the current year 1927:—

Income		Expenditure	
	$		$
Customs	7,321,512	Int. on pub. debt	3,538,785
Posts	354,676	Civil government	546,311
Telegraphs	170,040	Civil pensions	89,426
Crown lands	107,602	Military pensions	618,835
Int. revenue stamps	48,762	Old age pensions	114,425
Fines	4,613	Admins. of justice	481,008
Interest on loans	87,155	Legislation	93,678
Brooms from penitentiary	2,893	Education	914,958
Fees of pub. institutions	43,512	Pub. charities	1,135,752
Taxes and assts.	140,183	Ag. and mines	79,659
Estate duties	89,803	Marine and fish.	408,272
Liquor sales	350,000	Roads and budgets	458,541
Bus. profits, tax on cars	61,364	Customs	628,220
Income tax arrears	34,391	Posts and tel.	1,142,949
Man. sales arrears	691	Elections	21,977
Misc.	115,132	Audit	180,327
	8,932,329		10,533,458

Trade.—Newfoundland imports much she might well produce, much land for cattle being undeveloped, and unused, and thousands more pigs might well be raised, than are at present. Duroc Jerseys and Berkshires flourish well in the North, and the pigs fatten well on codheads, berries, roots and offal. Coal exists in good quality and great plenty and might well be exported. Hay can be grown of perfectly satisfactory quality in unlimited quantities in return for labour. Hides should be exported instead of imported. Eggs also can be raised in abundance. It is true, bacon and eggs, and everything fed on fish foods are apt to taste fishy, but clean feeding for a while before slaughtering, and good cooking do much, and it is better to have quantity of essential food constituents than to haggle over flavours.

In 1926-27, Newfoundland imported: beef, salted, 46,879 barrels, valued at $851,681; butter, 612,195 lb., valued at $219,884; coal, 334,034 tons, valued at $1,745,451; flour, 368,240 barrels, at $2,927,236; cotton, wool, silk and clothing, $3,036,192; leather in 1924, $623,554, 1925 $492,901, 1926 $280,162; hardware in 1924, $936,517, 1925 $1,461,283, 1926 $1,014,532; molasses, in gallons, in 1924, $686,368, 1925 $572,534, 1926 $589,889; sugar, in cwt., 1924, $135,509, 1925 $139,926, 1926 $130,752; pork, 1926, 23,990 barrels, valued at $626,876; salt, tons, 1924 61,968, 1925 61,668, 1926 50,319; tea, 1926, 1,492,699 lb., valued at $562,811; tobacco, 1926, 675,403 lb., valued at $263,463.

In 1917 Prohibition became law in Newfoundland by 24,950 votes against 5,362, but was annulled by the Government in 1924. Since that year imports of wines and spirits were:—

In 1924-25, 68,354 gallons at a cost of $123,761.
In 1925-26, 102,311 gallons at a cost of $175,627.
In 1926-27, 203,028 gallons at a cost of $719,903.

—a very rapid increase, but it is claimed by the anti-prohibitionists "with excellent results to both revenue and morality." These figures do not include beer, nor is the making of home brew, which is cheaper, and in a poor country therefore still certain to be manufactured in the outports as before, any more specially guarded against. The present law prohibits a great many things which those interested in the sale of intoxicants pretend are more enforceable than prohibiting and sale, but which in practice are just as difficult, and many absolutely impossible, to carry out. The fact that there have been no convictions under any of them is suggestive. Thus, Government liquor sellers may not sell to those convicted of drunkenness, nor to habitual drunkards, nor to inmates of public institutions, nor to policemen on duty, nor to the Indians, or Eskimo, nor to any minors, nor to owners or inmates of disorderly houses. Bottles must have a label on which the Government endorsement is plainly marked. Those who sell liquor must not engage in other remunerative occupations. The Government sells eight brands of rum, which is the intoxicant most consumed in the Island. Its brandy is expensive, and so are its liqueurs, of which it sells twelve varieties. The law only allows each adult to purchase one bottle of intoxicating liquor per day

three hundred and twelve days per year. The Government may not establish a sales depot in a community without a two-thirds majority vote for it and so far not a single town or outport has asked for this blessing. Moreover, St. Pierre and Miquelon still are on the map, and it has not yet been shown that the new law has caused any change of heart in their liquor traders. The experience of the Seamen's Institute was that prohibition was much better than the present arrangement.

The imports and exports are as follows for 1926–27:—

	Imports	Exports
	$	$
Canada	11,635,110	2,087,496
U.S.	8,553,567	9,429,038
United Kingdom	4,527,533	6,273,344
Ceylon	305,058	..
British West Indies	221,926	1,188,340
Spain	144,698	2,799,587
Norway	70,458	..
Holland	68,799	819,133
Germany	51,569*	76,117†
France	32,424‡	300
Greece	28,478	444,358
Belgium	47,674	25
and a few other imports, making in all	25,813,871	..
Brazil	..	2,620,813
China	..	3,734
French West Indies	..	598,038
Italy	..	1,346,653
Madeira	..	114,327
Portugal	..	2,664,398
Exports in all	..	30,839,859

*Steadily increasing.
†Steadily decreasing.
‡Increasing since prohibition closed.

Newfoundland's greatest new financial developments have, however, been in the exports of paper and pulp, and the opening of new mines. For the first time in her history, the value of any other industry has equalled that of the island's codfish—that being her export of paper:—1927, $12,057,440 codfish against $12,517,665 paper, and this latter promises to grow rapidly.

The history of this is interesting. Lord Northcliffe opened the first undertaking in 1909, with far more extensive and better timbered areas than he could have obtained in Canada or America, with cheaper labour, far more favourable legislative grants to the industry, with better wood (as its black spruce has proved), and cheaper and quicker manufacturing facilities. The fir, at first difficult to use, has been also most successfully handled; it might be all used for artificial silk instead of newspaper sheets. A splendid remunerative business has been built up, which, with new adaptations such as using a southern harbour, called Heart's Content for shipping, makes only a short storage during winter necessary for material produced, and even that, if essential, could be avoided by carrying it to St. John's, an all-the-year-open harbour. The whole management of the business has been admirable as far as Newfoundland is concerned, and every kind of progressive method has been introduced to improve the scale of living and to carry high standards in every department at their capital at Grand Falls. The possession of two fine falls, the Grand Falls and Bishop's Falls, has completely solved their power problems. To Sir Mayson Beeton, as well as to Lord Northcliffe, the island owes a very big debt.

A larger and more ambitious paper mill has been that of the Whitworth Armstrong Company at Corner Brook, on the west coast, at the mouth of the Humber River. The amount of money invested has been variously estimated, but considerably over $50,000,000. The result has been a stupendous plant, with every modern improvement for the industry. The hydro-electric power alone of Deer Lake gives sixty-five thousand horse power. This gives employment to many thousands of men in logging in winter—an invaluable help to the summer cod fishing. The total output goes to America, chiefly, to two big newspapers. It takes forty years to grow one tree in Newfoundland of sufficient size for profitable pulping, with ten inches across at the lower end. Ninety-seven thousand tons of paper were put out last year from Newfoundland. To pay, Corner Brook must put out one hundred and eighty thousand cords. The splendid harbour, steamers, hotel, machinery, and village that has been built up promise, so long as the forests are conserved, to be an enormous asset for the finances of the country. But the great outlay proved too much for the original company, and in 1927, the whole concern was handed over at a very greatly reduced cost to the International Paper Company of America.

Communications.—Except for the immediate neighbourhood of St. John's, and the little peninsula of Avalon, roads have been characterized chiefly by their absence, the whole of the north being treated as if it were another world. There scarcely a yard of good road exists, and progress has been proportionately retarded. In the year 1925 the government of Mr. Walter Monroe decided to borrow money for better roads, and generally to make a serious bid for the tourist traffic.

The railways of Newfoundland, which are a little over 900 m. in length, and especially the 500 m. from St. John's to the west coast, have done a great deal to foster trade and travel to Canada and the United States. Owing to the difficulty in winters of crossing the high land, over which the rails were carried, owing to the scattered nature of the small settlements, through which the line passes, and the little amount of inter-town traffic, the railway has been run at an increasing loss annually. The line, as far as Harbour Grace, was finished in 1884, and to Placentia in 1888. In 1893, Mr. R. G. Reid of Montreal was granted a contract to build the rest of the road, which in 1898 was altered to a grant of the whole railway to the contractor at the end of 50 years, provided he operated it free of expense to the Colony, for that period of time. It gave him also, beyond 5,000 ac. in fee simple granted before, 2,500,000 ac. along the route. Mr. Reid was also to build and ply seven steamers for coastal service, including one for Labrador, he was to provide an electric street railway for St. John's, pave part of the capital, and he became owner of the dock, built an electric lighting system for the city, and acquired the Government telegraph system. He was also to pay a million dollars in cash to the Government.

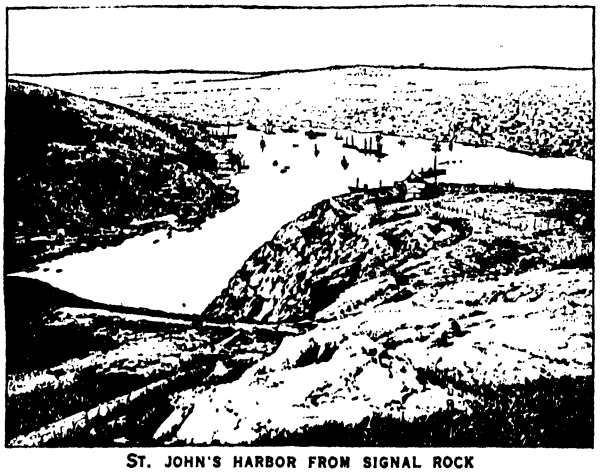
In 1923 the Government bought out the Reid interests for $2,000,000. They also took over the railroad, and steamers and docks. They had previously taken back their own telegraphs. The line, which is only a narrow gauge one, had fallen into great disrepair, and another million and a half dollars at once had to be spent on the track, and over $600,000 on the rolling stock, ties, bridges, and the buildings. The narrow gauge, and light carriages, have led to delays and troubles from weather and the railway has not been financially successful. Total receipts of the dock and steamship service and railways are:—in 1927, $3,009,190, and for the same period the expenditure was $3,753,087—a deficit of $743,897. In 1924–25 Earnings were $3,371,200, Expenditure, $3,729 710, Deficit, $358,509. These figures include the returns from the freight and passenger service and traffic. Mails, Pullman cars, express, steamers, dock shop and dry dock and miscellaneous are included. The steamers and dock actually showed a small profit.

The newspapers of the country are in St. John's, the Royal Gazette, the Daily News, the Evening Telegram, the Fishermen's Advocate, the Free Press, The Newfoundland Quarterly, and there are half a dozen other papers in various outposts. There are 21 foreign consuls in St. John's.

Good tugs and pilots offer every facility for entering the port. The country now maintains over 200 lighthouses around her shores. Owing to a dangerous current in the neighbourhood of St. Mary's Bay and Cape Race, and also to the frequent heavy fogs that bank often in that vicinity, while icebergs reach as far as there on the Polar Current, that region has not been inappropriately called the "Graveyard of the North Atlantic," so many wrecks having occurred there. It is studiously avoided by mariners, but has, through the years, claimed many notable victims, and has been the scene of many romances and tragedies. Hotels in the Island for accommodation of tourists are slowly increasing.

St. John's has a large, modern repairing dry dock, a museum, two cathedrals, and the usual quota of public buildings, of which the Government House is the finest and most interesting, are also in the capital.

Sport.—All details regarding sport can be obtained simply by writing to the Secretary of the Game and Island Fisheries Board at St. John's. The rules are not burdensome, and the expense not



ST. JOHN'S HARBOR FROM SIGNAL ROCK

great. Good guides, who must be licensed, can be obtained without difficulty, and often tents and canoes can be hired in the district selected. It is well, however, to make certain of this. All apparatus and outfit introduced into the country is liable to customs' duty, and sportsmen may have to deposit at the port of entry money to the value of the duty charged, but this will be returned upon leaving the country. Any necessary supplies can always be obtained in the excellent large stores in the capital. Caribou hunting is undergoing a closed season. The willow grouse shooting is excellent, and attainable in any part of the island. The close season is Jan. 1. to Sept. 20. Capercailzie and black game, both of which have been introduced, have no open season. The moose also are protected. Carrying of firearms, except to a genuine traveller, is forbidden on Sundays, and in close seasons. No license is required.

Salmon or trout fishing can be obtained everywhere, the kind depending only on the size of the river. The close season is Sept. 15 to Jan. 15. Every river is preserved by the Government, and none are closed to the public. Many kinds of fur-bearing animals are indigenous. Foxes of various colours, lynx, martin, muskrat, otter, beaver, hares and rabbits, are numerous.

Postal Service.—The Colony issues its own stamps of many denominations. They are beautifully and variously engraved, and are frequently changed, with some advantage to the revenue. It costs three cents to the United States, Canada, or in the Colony, whereas postage from the United States to Newfoundland is only two cents. Parcels up to 22 lb. weight are accepted from England by post, and up to 11 lb. from Canada and the United States. The Government owns 5,000 m. of telegraph lines all round the country, and 2,000 m. of telephone wires, besides a string of wireless telegraph stations as far North as Makkovik islands in North Labrador. The British news despatch from Rugby, England is picked up daily, and published. During the summer months, mails are carried largely by steamers to the North, and in winter from Bay of Islands North around the bottom of White Bay, including Labrador, the mails are carried by couriers and dog sledges. The Furness-Withy steamers from Halifax to Liverpool call at St. John's, completing the voyage from St. John's in six days. The Red Cross steamers from New York take five days.

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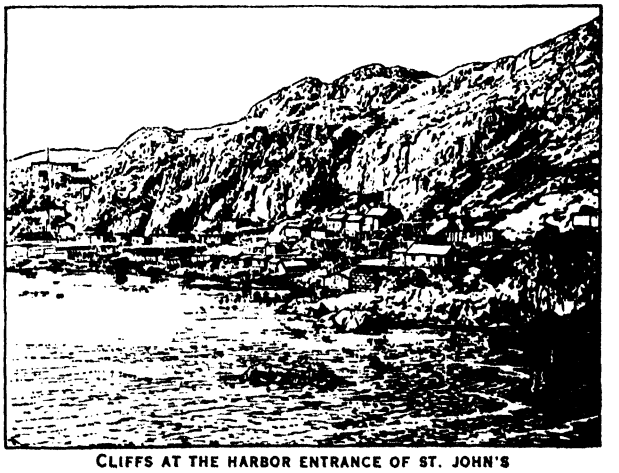
(W. GL.)

HISTORY

DISCOVERY AND COLONIZATION

Newfoundland, commonly termed the "senior colony" of Great Britain, antedates in discovery (though not in continuous settlement) any other British over-sea dominion. John Cabot, sailing from Bristol in 1497, appears to have made landfall at Bonavista and claimed the whole country for Henry VII. Three years later Gaspar Corte-Real, ranging the North American coasts, discovered and named Conception bay and Portugal cove, and was appointed Portuguese governor of Terra Nova. The long series of annual trans-Atlantic expeditions followed upon the voyages of Cabot and Corte-Real, and their reports in England, Portugal and France concerning the multitude of fish in Newfoundland. The belief that English fishermen did not avail themselves to any extent of these advantages until the middle of the 16th century is now shown to be erroneous. In 1527 the little Devon fishing ships were unable to carry home their large catch, so "sack ships" (large merchant vessels) were employed to carry the salt cod to Spain and Portugal. An act of 1541 classes the Newfoundland trade with the Irish, Shetland and Iceland fisheries. Hakluyt, writing in 1578, mentions that the number of vessels employed in the fishery was 400, of which only one-quarter were English, the rest being French and Spanish Basque. But in the same year, according to Anthony Parkhurst, "the English are commonly lords of the harbours where they fish and use all help in fishing if need require." Shortly thereafter England awoke to the importance of Cabot's great discovery, and an attempt was made to plant a colony on the shores of the island.



CLIFFS AT THE HARBOR ENTRANCE OF ST. JOHN'S

Sir Humphry Gilbert, provided with letters patent from Queen Elizabeth, landed in St. John's in Aug. 1583, and formally took possession of the country in the queen's name. The first attempt at colonizing was frustrated by the loss of Gilbert soon afterwards at sea. In 1610 James I. granted a patent to John Guy, an enterprising Bristol merchant, for a "plantation" in Newfoundland; but no marked success attended his efforts to found settlements. In 1615 Captain Richard Whitbourne of Exmouth in Devon was despatched to Newfoundland by the British admiralty to establish order and correct abuses which had grown up among

the fishermen. On his return in 1622 he wrote a "Discourse and Discovery of Newfoundland Trade" which King James, by an order in council, caused to be distributed among the parishes of the kingdom "for the encouragement of adventures unto plantation there." A year after the departure of Whitbourne, Sir George Calvert, afterwards the first Lord Baltimore, obtained a patent conveying to him the lordship of the whole southern peninsula of Newfoundland, and the right of fishing in the surrounding waters. He planted a colony at Ferryland, 40m. north of Cape Race, where he built a handsome mansion and resided with his family for many years. The French so harassed his settlement by incessant attacks that he at length abandoned it.

In 1650, or about a century and a half after its discovery, Newfoundland contained only 350 families, or less than 2,000 individuals, distributed in fifteen small settlements, chiefly along the eastern shore. These constituted the resident population; but in addition there was a floating population of several thousands who frequented the shores during the summer for the sake of the fisheries, which had now attained very large dimensions. So early as 1626, 150 vessels were annually despatched from Devon alone. The fish caught were salted and dried on the shore; and on the approach of winter the fishermen re-embarked for England, carrying with them the products of their labour. Hence it became the interest of these traders and shipowners to discourage the settlement of the country, in order to retain the exclusive use of the harbours and fishing coves for their servants, and also a monopoly of the fisheries. They were able to procure the support of the English government of the day for this system, and stringent laws were passed prohibiting settlement within 6m. of the shore, forbidding fishermen to remain behind at the close of the fishing season, and rendering it illegal to build or repair a house without a special licence. The object of this short-sighted policy, which was persisted in for more than a century, was to preserve the island as a fishing station and the fisheries as a nursery for the English fleet.

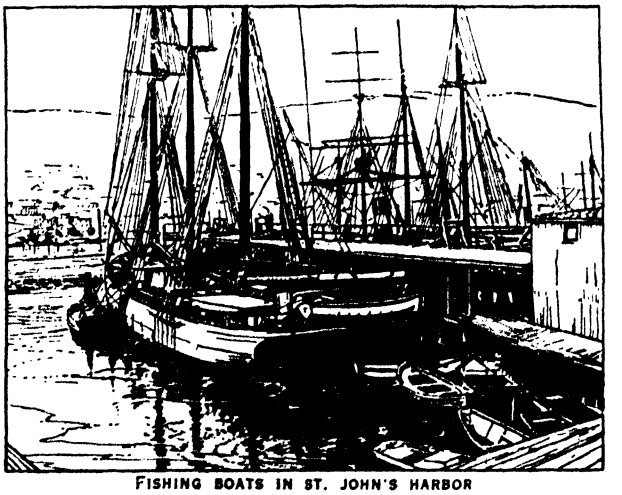
There was, however, another element which retarded the prosperity of the country. The French had early realized the immense value of the fisheries, and strove long and desperately to obtain possession of the island. Their constant attacks and encroachments harassed the few settlers, and rendered life and property insecure during the long wars between England and France. When at length, in 1713, the treaty of Utrecht ended hostilities, it did not deliver Newfoundland wholly from the grasp of France, as it gave the latter the right of catching and drying fish on the western and northern sides of the island. Though no territorial rights were conferred on the French, and the sovereignty was secured to England, the practical effect was to exclude the inhabitants from the fairest half of the island.

In spite of the restrictive regulations, the number of the resident population continued to increase. The sturdy settlers clung to the soil, and combatted the "adventurers" as the merchants were called. The latter strenuously opposed the appointment of a governor; but at length, in 1728, the British government appointed Captain Henry Osborne first governor of Newfoundland, with a commission to establish a form of civil government. This constituted a new era in the history of the colony. In 1763 the fixed inhabitants had increased to 8,000, while 5,000 more were summer residents who returned home each winter. In 1763 the coast of Labrador, from Hudson's Strait to the river St. John opposite the west end of the island of Anticosti, was attached to the governorship of Newfoundland. The population in 1785 had increased to 10,000. During the wars between England and France which followed the French Revolution, Newfoundland attained great prosperity, as all competitors in the fisheries were swept from the seas, and the markets of Europe were exclusively in the hands of the merchants of the island. The value of fish trebled, wages rose to a high figure, and in 1814 no less than 7,000 emigrants arrived. The population now numbered 80,000. In 1832 representative government was granted to the colony, and provision was made for education. In 1846 a terrible fire destroyed three-fourths of St. John's and with it an enormous amount of property; but the city rose from its ashes improved and beautified. In 1855 the system of responsible government was inaugurated. In 1858 the first Atlantic cable was landed at Bull Arm, Trinity Bay.

Unproductive fisheries, causing a widespread destitution among the working classes, marked the first eight years of the decade between 1860 and 1870. A system of able-bodied pauper relief was initiated to meet the necessities of the case but was attended with the usual demoralizing results. The necessity of extending the cultivation of the soil in order to meet the wants of the growing population was felt more and more as the pressure arising from the failure of the fisheries evinced more clearly their precarious nature. In 1864 copper ore was discovered in the north, and mining operations were successfully initiated. In 1869 a series of successful fisheries began which enabled the government to terminate the injurious system of able-bodied pauper relief. In 1871 the revenue rose to $831,160. In 1873 direct steam communication with England and America was established.

THE FISHERIES

French Claims.—By the treaty of Utrecht of 1713 a right was reserved to French subjects to catch fish and to dry them on that part of Newfoundland which stretches from Cape Bonavista to the northern part of the island and from thence coming down by the western side reaches as far as Pt. Riche. By the treaty of Versailles of 1783 France renounced the fishery from Bonavista to Cape St. John on the east coast, receiving in return extended rights upon the west coast as far as Cape Ray. Neither treaty purported to grant exclusive right, but there was annexed to the treaty of Versailles a declaration to the effect that "His Britannic Majesty will take the most positive measures for preventing his subjects from interrupting in any manner by their competition the fishery of the French during the temporary exercise of it which is granted to them upon the coasts of the island of Newfoundland, and he will for this purpose cause the fixed settlements which shall be formed there to be removed." Upon this declaration the French founded a claim to exclusive fishing rights within the limits named. A convention was entered into with a view to defining these rights in 1854, but it remained inoperative, the consent of the Newfoundland legislature, to which it was made subject, having been refused. Meanwhile the French government



FISHING BOATS IN ST. JOHN'S HARBOR

granted a bounty to the French fishermen which enabled them to undersell the colonists.

Twice, in 1884 and in 1885, a convention arranged between the British and French governments was submitted to the colonial legislature which, however, absolutely refused to ratify the arrangement unless the French government would consent either to annul or to amend the system of bounties paid upon French-caught fish in Newfoundland waters. To counteract the effect of these bounties, which pressed very hardly upon the British competition, a Bait Act was passed in 1886, empowering the executive to pro-

hibit the capture in Newfoundland waters for exportation or sale of bait fishes, except under special licence to be issued by the colonial government. The consequence of this measure, had its provisions been properly enforced, would have been to place an embargo upon the local supply of bait requisite to the French fishermen—the so-called "metropolitan fleet"—on the Grand Banks. The French government immediately demanded that Great Britain should deny its sanction to the Newfoundland Bait Act, and pressed their objections with such persistence as to induce Lord Salisbury to disallow the measure. Nevertheless, the despatch of the governor, Sir William des Voeux, to the colonial secretary, Sir H. Holland, was entirely in favour of the principle of the bill. In 1887, at the conference of Colonial Premiers attending Queen Victoria's Jubilee the subject was argued at considerable length. The claim of the senior colony "to control and legislate for her own fisheries" met with general approval, the single dissentient being the representative of Canada, who feared that Canadian fishermen would suffer under the bill. When an assurance was tendered that Canada's fishermen would be placed upon the same footing with those of Newfoundland, the British government somewhat reluctantly sanctioned the Bait Act. In the meantime the chagrin of the French Foreign Office at the failure of negotiations, and the hostile attitude taken up by the Newfoundlanders induced de Freycinet to devise retaliatory measures. Instructions were issued "to seize and confiscate all instruments of fishing belonging to foreigners resident or otherwise, who shall fish on that part of the coast which is reserved to our use." Lord Rosebery, then foreign secretary, protested to the French ambassador against the spirit of these instructions, which he insisted were in direct contravention of the treaty, inasmuch as they ignored the concurrent as well as those sovereign rights of Great Britain which France solemnly undertook by the treaties never to question or dispute. About 1874 a Nova Scotian named Rumkey had established the first factory for the canning of lobsters on the west coast. This concern proved profitable, and others sprang up, until, at the close of the season of 1887, Captain Campbell, R.N., reported that 26 factories were at work, employing about 1100 hands. The year of the Bait Act's first successful application was marked by the stoppage, by order of the French government, of one of the largest factories, and by their contention that the lobster-canning industry formed a part of the exclusive privileges conceded under the treaties to the French. "France," it was then declared, "preserved the exclusive right of fishing she always possessed. This right of France to the coast of Newfoundland reserved to her fishermen is only a part of her ancient sovereignty over the island which she retained in ceding the soil to England, and which she has never weakened or alienated." The French government then voted (1888) a special bounty for the establishment of lobster factories by their subjects on the treaty coast. Acting under a statute passed in the reign of George III., empowering British naval officers to interpret and enforce the treaties, Sir Baldwin Walker and others proceeded to destroy or remove a number of British factories at the request of the French agents. In 1890 the unexpected discovery was made that the act empowering British naval officers to enforce the provisions of the treaties with France had expired in 1832 and had never been renewed. Consequently all the proceedings of which the colonists had been the victims were illegal. One of them, James Baird, immediately took proceedings against Sir Baldwin Walker in the supreme court, which decided in his favour, mulcting the admiral in £1,000.

On an appeal to the privy council the decision was upheld. But before this incident had taken place, the controversy between London and Paris culminated in the *modus vivendi* of 1890, by which the lobster factories, both British and French, which were in existence on July 1, 1889, were to continue for the present. Instantly the colony took alarm, and a deputation consisting of the island's leading men was sent to England to protest against both the principle and practice of such an arrangement. On their return they learnt that it was the intention of the imperial government to re-enact *verbatim et literatim* the act for the enforcement of the treaties which had expired 59 years previously To prevent such an occurrence, delegates from both parties in Newfoundland visited London in April 1891, and, appearing at the bar of the House of Lords, promised that if the measure which was then on the eve of being introduced into that body were withdrawn, a temporary measure would be passed by the Newfoundland legislature which would answer the same purpose of enabling Great Britain to carry out her treaty obligations with France. For a number of years the Modus Vivendi Act was annually passed by the legislature, each year under protest.

In 1898 the secretary of state, Joseph Chamberlain, yielding to the urgent request of the senior colony, despatched a royal commission of investigation to the "French shore," and three years later a new conference was held in London. Later in the same year negotiations were begun between the British and French governments for a general treaty.

On April 8, 1904 the Lansdowne-Cambon Convention was signed, which, *inter alia*, effected a final settlement of the French shore question. Territorial concessions were made consisting of a modification of the Anglo-French boundary line in the Niger and Lake Chad district, and a re-arrangement of the Gambia-Senegambia frontier, giving Yarbatenda to Senegambia. The Los Islands opposite Konakry Island were likewise ceded to France. Individual claims for indemnity were duly submitted to an arbitral tribunal, composed of an officer of each nation; and at length what is known as the Lyttelton Award, was made as follows:—

General award for French rights	$255,750
Loss of occupation	226,813
Effects left by the French on treaty coast	28,936

Thus, so far as concerned the French, was an end put to a situation on the treaty shore, which for nearly 200 years had given rise to difficulties and anxieties.

American Claims.—Scarcely, however, had a year elapsed from the signing of the convention, when another international disagreement connected with the fisheries assumed grave importance. There had long been intense dissatisfaction in the Colony over the attitude of the American government and American fishermen towards the colony. The action of the American Senate in rejecting the Bond-Hay treaty negotiated in 1902 stirred the colonial government to retaliatory measures. By virtue of the treaty of 1818 American fishermen enjoyed the right, in common with British fishermen, to prosecute their industry within certain defined areas. But America then formally renounced for ever "any liberty heretofore enjoyed or claimed . . . to take, dry or cure fish on or within three marine miles of any of the coasts, bays, creeks or harbours of His Britannic Majesty's dominions in America" not included in the stated limits, with one qualification: "that American fishermen shall be permitted to enter such bays or harbours for the purpose of shelter and of repairing damages therein, of purchasing wood, and of obtaining water and for no other purpose whatever." In 1905 an act was passed by the colonial legislature imposing certain restrictions on American vessels, and a further more stringent act in 1906, preventing Newfoundlanders from joining American vessels. These acts were resented by the American government, which, through Secretary Root, called upon the British government to disallow such interferences on the part of the Newfoundland legislature. Lord Elgin's reply was to suggest a *modus vivendi* pending further discussion of the questions at issue. In spite of the colony's energetic protest, a *modus vivendi* was agreed to in Oct. 1906, whereby the Foreign Fishing Vessels Act of 1906 was held in abeyance, and the act of 1905 was held not to apply to American fishing vessels, and light dues were waived, while on the other hand American vessels were to report at the custom house on entry for clearance, and their fishermen were to comply with colonial fishery regulations. The American government consented to waive Sunday fishing by the Americans, which was an important colonial grievance, if the use of purse seines by American fishermen were allowed. Lord Elgin's action was considered to be an interference with the internal affairs of the colony and great public indignation was aroused. Retaliatory measures were resolved upon, Newfoundland fishermen being declared liable to fine and imprisonment for selling bait to the Americans or for joining

American vessels. The legislature voted an address to the imperial government, protesting against the *modus vivendi*, and this was carried to England in 1907 by Sir Robert Bond, the premier of the colony. Finally the matter was referred to The Hague tribunal for arbitration, which gave its award in Sept. 1910, the two main points at issue being decided as follows: (*a*) Great Britain had the right to make regulations for the fisheries without the consent of the United States, subject to the provisions of the treaty of 1818. (*b*) The "three-mile limit" in bays (subject to special judgment in individual cases) was to be taken from a line across the bay at the point, nearest the entrance, where a width of ten miles is not exceeded. Among other provisions it was decided that American vessels might employ foreign hands (but these received no benefit under the treaty); also that they might be required to report to custom houses if facilities to do so existed

THE LABRADOR JUDGMENT

In the opening decades of the century the question of Newfoundland's claim to Labrador became an urgent one. It had indeed been raised about 1888 and was a subject of discussion at the Halifax Conference of 1892. But not until 1903 did the Government of Canada, learning that the Newfoundland Government had issued a timber licence in the Hamilton river region, seriously challenge the island's ownership. In the succeeding years the rival claims of Canada (or to be more precise, the Province of Quebec) and Newfoundland were subjected to close and skilled investigation, especially since, in 1920, it was agreed to accept an adjudication by the Judicial Committee of the Privy Council. The case was heard in 1926 before the Lord Chancellor, and Lords Haldane, Finlay, Sumner and Warrington, the arguments lasting for fourteen days. In March, 1927, a decision was rendered, in which Newfoundland's claim was upheld. The Judicial Committee found "the boundary between Canada and Newfoundland in the Labrador peninsula to be a line drawn due north from the eastern boundary of the bay or harbour of Ance Sablon as far as 52° N. and from thence westward along that parallel until it reaches the Romain river, and then northward along the left or east bank of that river and its headwaters to their source, and from thence due north to the crest of the watershed or height of land there, and from thence westward and northward along the crest of the watershed of the rivers flowing into the Atlantic Ocean until it reaches Cape Chidley." This important judgment which first formally established the island Dominion's claim to territory nearly three times its own extent, caused great rejoicing in Newfoundland. It enabled the varied natural resources of the disputed region to be accessible at last to those desiring a valid title. The taking of the watershed as the boundary was held to remove the danger of any further dispute. The territory awarded is estimated (1928) to contain spruce forests valued at $50,000,000.

1912–28.—The inauguration in 1912 of the Fishermen's Union, which established large trading stores in all the principal outposts and had as its political object the safeguarding of the interests of the fishermen by means of representation in the Legislature, was the outstanding political event of the immediate pre-war period. In the elections of Nov. 1913, although the Government of Sir Edward Morris was re-elected, the candidates of the Fishermen's Protective Union (F.P.U.) won all the constituencies in the north and northeast. On the outbreak of the World War a Newfoundland regiment was formed and served overseas in Gallipoli, Egypt and France. Altogether some 6,500 men joined up for service. In 1917 the Morris Government was enlarged into a National Government by the inclusion of the Opposition, in order to expedite measures dealing with war requirements. At the end of 1917 Sir Edward Morris resigned, and was succeeded by Mr. (Sir) William Lloyd, the former leader of the Opposition.

In 1919 Sir William Lloyd attended the Peace Conference as the representative of the Colony. During his absence his Government was destroyed by internal dissensions, and Mr. (Sir) Michael Cashin became Premier. The elections of Nov. 1919 were marked by extreme bitterness, religious feeling being introduced to a great extent. A considerable turnover of votes resulted, and the Government was defeated by a party led by Mr. (Sir) Richard Squires, whose Government was re-elected in 1923. Shortly afterwards Sir Richard Squires resigned as a result of grave charges preferred against him in the Legislature, including, amongst others, the receipt of money from private corporations and the diversion of government funds to persons occupying high official posts. The Attorney-General, William Warren, had assumed the leadership, but on the opening day of the legislative session of 1924 his ministry was defeated. It was reconstructed, but without avail and the election of 1924 resulted in a victory for the party led by Walter Monroe.

Among the measures passed in 1925 was one abolishing Prohibition, which had proved unworkable and the substitution of government control of liquor, on the pattern of the Quebec law. The Monroe ministry was pledged to economy and reform, but its difficulties were many, there being much opposition to nearly all its measures of retrenchment. Although revenue was declining and expenditure increasing, a considerable party clamoured for still further loans, to provide bounties on fish and new roads. Only by a steady resistance to these demands was the Government able during the years 1925–28 to balance its revenue.

Projects for Union with Canada.—In 1900 the British admiralty, acting upon the repeated suggestions of Sir Charles Dilke and others interested in the manning of the navy, decided to initiate a branch of the imperial naval reserve in the Colony. In 1901 a difficulty arose about paying the men, owing to the lack of any provision for that purpose in the Imperial Reserves Act under which they were enlisted. The Colony was asked to bear the cost; its refusal was followed (1902) by the enactment of special legislation rendering the enrolment and maintenance of the reserves in Newfoundland a special imperial undertaking. Several efforts had been made to induce Newfoundland to confederate with the Dominion of Canada, but the project never met with any degree of favour with the electorate. After the insolvency of the colony in 1894–95, a delegation was sent to Ottawa to ascertain if it were possible to arrange terms of confederation; but Sir Mackenzie Bowell's government objected to the assumption by the Dominion of the entire amount of Newfoundland's debt (then only $16,000,000), and the negotiations were abandoned. The Labrador decision of 1927 revived the project in Canada; but Newfoundland would appear to be satisfied with its separate Dominion status.

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NEW GLARUS, a town and a village of Green county, Wisconsin, U.S.A., about 22 m. S.W. of Madison, on the Little Sugar river, a branch of the Rock river. Pop. town (1920) 554; village, which was separated from the town in 1901 (1920) 981. New Glarus is served by a branch of the Chicago, Milwaukee and St. Paul railway. It has agricultural and dairying industries, but little or no manufacturing interests. It had its origin in a colonizing experiment made by the canton of Glarus, Switzerland, in 1845. Agents sent by the canton chose the site of New Glarus largely because the rocky slopes of the valley suggested their Alpine home. The settlers brought with them a "form of government" drawn up by the Cantonal Council of Glarus and providing in great detail for a system of schools, for what was practically a State church (Reformed Lutheran) supported by tithes, for a system of poor relief, for a system of courts and for a set of town officers elected on a limited property franchise. The original plan provided also for an equitable distribution of land to each head of a family. With such adjustments as were found necessary for co-ordination with the town and county Governments of Wis-

consin, it remains practically the same to this day. The village and town still have an Old World aspect.

NEW GLASGOW, a manufacturing and mining town of Pictou county, Nova Scotia, Canada, on the East river, near its entrance into Pictou harbour, and the Canadian National railway, 104 m. N.E. of Halifax. Pop. (1921) 8,974. Extensive coal mines are in the vicinity, and there are manufactures of iron and steel, mill machinery, door and sash factories, as well as several ship-building yards.

NEW GRANADA (Span. *Nueva Granada*), the title under Spanish colonial administration of that part of South America now known as the republic of Colombia, which at one time was extended to include Venezuela and Ecuador. It also was for a time the title of the united territories of Panama and Colombia under republican auspices. The Bogotà plateau was invaded from the Caribbean coast and conquered in 1537 by Gonzalo Jiménez de Quesada, who, in honour of his native province, called it the "Nuevo Reino de Granada." In 1550 an *audiencia real* under the viceroyalty of Peru was established at Santa Fé (Bogotà), but in 1564 this isolated group of Spanish settlements was transformed into a presidency. In 1718, owing to the unmanageable size of the viceroyalty of Peru, it was divided and a new viceroyalty was created from the various provinces lying in the north-western angle of the continent, extending from Tumbez northward to the northern limits of Panama, and eastward to the Orinoco, to which the name of Nueva Granada was given. The new viceroyalty included the provinces of Tierra Firma (now the republic of Panama); Maracaibo, Caracas, Cumana and Guyana (now included in Venezuela); Cartagena, Santa Marta, Rio Hacha, Antioquia, Pamplona, Socorro, Tunja, Santa Fé, Neiva, Mariquita, Popayan and Pasto (now included in Colombia); and Quito, Cuenca and Guayaquil (now included in Ecuador). In 1777 the provinces of Maracaibo, Caracas, Cumana and Guyana were detached from the viceroyalty to form the captaincy-general of Caracas; otherwise it remained as above until the termination of Spanish rule in South America.

For the republic of Colombia (1819–30), the republic of New Granada (1831–61), the United States of Colombia (1861–86) and the republic of Colombia (1886 to date), *see* COLOMBIA.

NEW GUINEA, island, of estimated area 312,329 sq.m., stretching from the equator in the north-west to 12° 5′ S. in the south-east and from 130° 50′ E. to 151° 30′ E.; separated from Australia by the shallow Torres strait and Arafura sea. On its eastern side lies the Bismarck archipelago.

STRUCTURE AND PHYSICAL GEOGRAPHY

The island consists of a long central mountain chain of complex formation, a northern coastal range, and a small planed down hill country on the south coast, west of the mouth of the Fly river, together with the alluvial surfaces formed mainly by the rivers under the influence of equatorial rains. The structure shows, in the west, the influences of great earth movements ranging from the Banda sea. These give arcs (1) Banda islands, (2) Buru, Ceram, West Timorlaut, (3) East Timorlaut, Kei islands, coastal mountains of south-west New Guinea from the Baik mountains to Cape Fatingar, thence Misol island, Obi island, and then north on the west side of Halmahera. This curve is separated, in West New Guinea, from the central chain by the deep McCluer inlet. The central chain stretches from north-west to south-east. In the west the ranges of the central chain are called Charles Louis Mts. and then for a while, still in Dutch New Guinea, the name Nassau Mts. is used. Here the snow line is approximately at 14,600 ft. and Mt. Idenburg (15,150 ft.) and Mt. Carstens (16,400 ft.) have glaciers. The next section is the Orange Mts. with Mt. Wilhelmina (15,312 ft.). There seems to be a more or less parallel range 25–45 m. to the north of this succession of ranges, and in it a height of 12,500 ft. has been observed in the Weijland mountains. The composite nature of the great chain is maintained eastwards and it is believed that the main watershed lies in the Mandated and not in the British Territory. In the former a height of 13,700 ft. has been found in the Otto Mts.; on the south flank the chain grades into a complex of mountains of lesser height. The south-eastern part of the chain called the Owen Stanley range (Mt. Albert Edward, 13,220 ft.) declines gradually to the end of the long peninsula.

Towards the west the central chain is formed principally of palaeozoic sandstones and slates on which much younger rocks, nummulitic sandstone and limestone are laid. In Dutch New Guinea, the lower mountain country is of Miocene rock. Towards the south-eastern peninsula there are again old rocks, some with gold-bearing quartz, especially along the axis, as well as granite and folded Tertiary limestone on both coasts of the peninsula; here also, and in the d'Entrecasteaux islands is much evidence of volcanic activity (Miocene, Pliocene, Pleistocene and recent).

The northern coastal range in Dutch New Guinea is said to reach a height of about 6,900 ft.; it declines towards the mouth of the Sepik, beyond which it rises again to a height of about 10,500 ft. and ends at King William's cape. It is formed of ancient elements with diorites, gabbro, andesites, etc., mostly covered with Tertiary and even possibly younger sediments, and is probably still in process of uplift; recent coral reefs adorn some cliff sides and may reach a level of some 5,500 feet. There is abundant evidence in New Guinea of large earth movements from Miocene times onwards, with a probable maximum in the Pliocene or Pleistocene. The southern hills between the mouths of Digul and Fly rivers are an extension of Australia structurally. Between these lines of hills there run lowlands, floored near the Idenburg river by Pliocene sandstones.

The most important rivers are the Mamberamo, reaching the sea north of the Nassau range; the Sepik, also on the north, navigable by seagoing steamers for 180 m.; the Fly river flowing into the Gulf of Papua, navigable by a whale boat for 600 miles; and the Digul in the south-west. Many of the rivers have gold, but it is important in few places save the Louisiade archipelago beyond the south-east extremity and Woodlark island. Murua (Woodlark island) beyond the d'Entrecasteaux islands has banded quartzite much valued by the people for the making of stone adzes. Petroleum occurs near the coast of the Gulf of Papua.

Climate.—In the northern summer the south-east trades dominate New Guinea; they bring rain to the south-east peninsula but the rain diminishes farther west on the south side as the wind is affected more and more by the passage across the corner of Australia. Northward on the east coast the rain at this season appears to be very heavy where the land faces south-east. Farther west there is little rain while the south-east trades blow. In the southern summer, New Guinea is on the wind-path from Asia, round to the very marked Australian low pressure centre. The wind is swinging round from the north-west to north-easterly direction and it brings heavy rain to northern New Guinea and to the southern part of the Dutch Territory. In one place in the rain shadow of the northerly mountains an annual rainfall of 96 in. has been measured, but on the exposed heights, especially between 3,000 and 6,500 ft., it must be enormously greater. In the lowlands the convection currents rule all the year round, but the amount of rain varies. The temperature remains near the average of about 81° declining to about 72° and rising to about 92° as rough monthly averages. 72° is not far from the average morning, and 92° not much above the average noon, temperatures.

Flora and Fauna.—The general vegetation is that of the rain-forest, but under the conditions of great heat the rain-forest cannot grow where there is a long dry season. The tree limit is more than 10,500 ft. above sea-level. Towards the mountain tops one finds European (*Rubus, Ranunculus, Leontodon, Aspidium*), Himalayan, New Zealand (*Veronica*), South American (*Drymus, Libocedrus*) and even Antarctic species. From 6,000 ft. upwards fine Agapetes (*Ericaceae*), pines (*Araucaria, Libocedrus*) and palms adapted to hill-life abound. In the lower lands palms are very abundant, and along the tidal courses of rivers those of the genus *Nipa* are common; sago palms are numerous in the seasonal swamps while grass and cane swamps occur where the land remains long under water. On the Alang steppe is the tall, tough grass, *Imperata arundinacea.*

New Guinea was probably united to Australia as recently as Pleistocene times, whereas its last effective connections farther

west are much older. It thus belongs in the main to the Australian region with nine species of Echidna (*Monotremata*) and 84 of marsupials among which are two genera peculiar to the island (*Distoechurus* and *Dorcopsis*). Small kangaroos live on the borders of steppe and forest in the higher lands. Bats abound and there is a pig (*Sus papuensis*), a dingo and 50 indigenous species of rats and mice chiefly on the steppe, and a few squirrels. The bird fauna includes well over 500 species and at least 50 genera are peculiar to the island. Birds of prey hover over the steppe and catch rats and mice, but apparently they avoid the great forests and here flourish the famed birds of paradise, which are absent from all the islands east of New Guinea. The Bismarck islands have birds allied to those of New Guinea but 74 species are peculiar to them. Turtles and tortoises are plentiful on the coast and have curious relationships with South American forms; many lizard species are peculiar to the island but comparatively few snakes. Amphibia are abundant and of Australian affinities. Insects are very numerous and the butterflies are gorgeous. Land molluscs are related to those of India and Malaya.

POLITICAL DIVISIONS

British New Guinea (TERRITORY OF PAPUA).—Area about 90,540 sq.m., European population 1,452. Natives variously estimated 114,000 to 275,000. A British protectorate was declared in 1884 after the Government of Queensland had annexed the land in 1883, and after various changes it became (1906) the Territory of Papua under the governor-general of Australia, with a lieutenant-governor of its own. An executive council of one unofficial and eight official nominees helps the lieutenant-governor and also forms part of the legislative council, which has five additional unofficial nominees. There are eight magisterial districts and a central court at Port Moresby, and an appeal thence to the high court of the commonwealth. There are now two government anthropologists. Some simple regulations of native government are administered with the help of (in 1926) 1,024 village constables. About 190,000 ac. of land have been leased, chiefly by planters, and over 62,000 are cultivated, chiefly for coconuts, rubber and sisal. Land may not be bought freehold. Natives may establish communal plantations of food plants in lieu of paying a tax in money, and they do this under European instructors. The expenditure for 1926 was £157,202 and the revenue £172,395; both are increasing fast, especially the latter. The ports are Port Moresby, Samarai, Kulumadau, Daru and the imports are worth nearly £500,000, the exports nearly £700,000; the latter are rising very rapidly. Copper has been worked for some time near Port Moresby and the export of this in 1926 was worth £155,305 while rubber amounted to £194,849 and copra to £204,097. (A. C. H.)

Mandated Territory of New Guinea.—The northern section of south-east New Guinea (formerly called Kaiser Wilhelmsland) was mandated in 1919 by the League of Nations to the Government of the Commonwealth of Australia, together with the Bismarck archipelago (New Britain, New Ireland, and adjacent islands), the Admiralty islands and several outlying groups, and the northern Solomon islands (Bougainville and Buka). North-eastern New Guinea lies between 2° 15′ and 8° S., and 141° 30′ and 148° E. It had been declared a German protectorate in 1884 when not a single white man lived there. Plantations arose in the islands and on the mainland, and three German mission societies soon formed settlements in New Guinea. There are now eight mission societies working in 603 stations in 18 districts. Under the mandate, the system of indirect rule through native chiefs has been continued. The administrator advises the governor-general of Australia who can legislate by ordinance. There are ten district officers, six of whom are in the islands. The headquarters is at Rabaul. No slavery or forced labour is permitted, but natives are not allowed to leave the territory, and labour indentures are made. No one may supply natives with firearms, ammunition, alcoholic liquor, opium or derivatives of opium. A native police force has 464 constables and 42 N.C.O.s.

The total native population is estimated at 378,701, excluding territories not yet under control and also excluding 23,421 indentured labourers. Of the above population 187,011 are on the mainland. The non-native elements number 3,045 including 1,303 Chinese, 944 British and 310 Germans. The area of the mainland mandated territory is 68,500 square miles. The area under cultivation includes 113,481 ac. of coconuts, often with cacao between the trees, and 2,478 ac. of rubber under the control of the Expropriation Board. Independently managed are 55,490 ac. of coconuts and small plantations of rubber, cotton and cacao. The exports for 1925 were valued at £858,990, the imports at £537,940.

Dutch New Guinea.—Dutch New Guinea, which lies between 10° S. and the equator, comprises practically half of the entire island of New Guinea. The boundary line between it and British New Guinea starts from the south coast and follows the line 141° E. up to the Fly river, which river then forms the boundary until 141° E., is reached, when the meridian becomes the boundary again, right up to the north coast. The area is 151,789 sq.m., and the population is estimated at 195,460, of whom 237 are Europeans or Eurasians. The territory is practically undeveloped, save for the extreme western coastal portion opposite Ceram, and parts of the northern coast, its coasts are imperfectly charted, and there has been little systematic exploration. The northern half is mainly hilly, with a very high range of mountains traversing it east by west, though along the northern coast and on either side of the Mamberamo river, which flows into the sea at Cape d'Urville, are great alluvial tracts of land; the extreme west is almost wholly hilly; the south very flat, with vast swamps near the coast, especially in the south-west, where Prince Frederick Henry island, separated from the mainland by the narrow and tortuous Princess Marianne strait, is perfectly flat and marshy, and covered with dense forest. Into McCluer gulf, which divides the western portion of Dutch New Guinea almost into two, flow several rivers, including the Seljar and Ketero, the former navigable, for small vessels, for 34 and the latter for 23 miles. Along the south-western coast stretch, in succession, from north to south, the Mimika, Utakwa, North-West river, Lorentz, Utumbuwe, Eilanden, Digul and Merauke. Some of these are situated so close to each other that they are connected by channels navigable for small, light-draught boats, several are navigable for distances of from 25 to 50 m. for steamers of 12 ft. draught, and the Digul the largest, is 6 m. wide at its mouth and has been ascended for nearly 400 m. by a steamer of 6 ft. draught. The south-western coast is flat and fairly even, until the Charles Louis Mts. are reached, where it becomes high and much indented, Nautilus strait running far inland, between hills. Flat tracts alternate with high ground along the western coast, very much indented after McCluer Gulf, and the north coast, from Cape Sorong along Little Geelvink bay, to the middle of the coastline of Great Geelvink bay, is generally high, especially where, near Manokwari, the Arfak Mts. come very near to the sea. The remaining shores of Geelvink bay, to Cape d'Urville, and beyond, as far as Sarmi point, are low, flat and alluvial, but from here to Humboldt bay it is mostly high, rugged and rocky. The entrance to Great Geelvink bay is blocked by several islands, the northernmost being the Schouten group, Suk, or Supiori, to the west, and Biak, or Wiak, to the east. The former is 17 m. long and has hills reaching 1,600 ft.; the latter is 45 m. long and 23 m. wide, with a hill 800 ft. high at the southern end, otherwise it is only 50 ft., above sea-level. Farther within the bay is the important island of Jobi, or Jappen, 110 m. long and 15 wide, with a ridge of mountains 2,500 ft. high running along the centre, the south coast being indented with deep creeks, fronted by wooded islets and reefs. Between Ceram and the north-west coast of Dutch New Guinea lies Misol, 50 m. long and 23 broad (narrow in the west, wide in the east), with numbers of very small islands to the north and south of it. It is flat in the north and hilly in the south, no point being over 1,800 ft., the coast is rocky, but swampy in places, and there are three rivers, navigable for a few miles. Separated from the north-west coast by the narrow Galewo straits is Salwatti, a round island, 30 m. across, with regular coasts, and limestone hills on the north coast, 1,000 ft. high, but low and swampy in the east, and no rivers of note: east of Salwatti is the small island of Popa. North of Salwatti, separated by Pitt strait, is Batanta, 40 m. long and only

from 4 to 8 m. wide, densely wooded and mountainous (highest point 3,676 ft.). Due north of Batanta is the large island of Waigiou, 28 m. wide, nearly 80 in length, and separated from New Guinea by Dampier strait, 30 m. in width. It is covered with dense forest.

Commerce and industry in Dutch New Guinea are almost unknown. The people generally live in a very wild state, head-hunting and cannibalism are all too prevalent; some are semi-nomadic, others entirely, and as they live largely on sago, and this is obtainable almost everywhere, in large quantities, with a minimum amount of labour, whilst the coconut abounds, and the sweet potato, sugar-cane, plaintain, papaya and tobacco are grown with little trouble, there is no incentive to work, apart from hunting the cassowary, pig and kangaroo, for their flesh, and fishing, the only lucrative employments followed being those of hunting the bird of paradise, collecting the wild nutmeg, the mace of which is much esteemed and marketed specially in Macassar, and the preparation of copra. Men and women go about almost entirely naked, the men armed with bow and arrow, axes of polished stone, and daggers of the jaw-bone of a crocodile or the thigh-bone of a cassowary. There are head men of villages, but they have little power, the people of the coast are often at war with those of the scrub lands of the interior, and there is enmity between these and the mountain folk: language varies considerably. There are no roads, save in the immediate neighbourhood of Dutch official settlements.

In the whole of South New Guinea there is only one settlement, Merauke, a few miles inland up the Merauke river. A Dutch *Gezaghebber* resides here, there is a small garrison, a hospital, Catholic mission church, and settlement, and a few shops, mostly run by Chinese traders, a wireless station, and a small wharf, where vessels of the Dutch Royal Packet Company land passengers and collect copra and other cargo. Merauke was established in 1902, as the result of a military expedition. The nearest Dutch settlement to Merauke is at Kaimana, on the McCluer gulf, 500 m. distant. Here, and at Kokas and Fak Fak (headquarters for West New Guinea, where there is a *Gezaghebber*), there are small trading stations with Malay, Chinese and Arab settlers; Fak Fak is the most important, where proximity to Ceram and generations of outside influence have resulted in settled and semi-civilized conditions amongst some of the Papuans. All three places are ports of call for vessels of the Dutch Royal Packet Company, also Sorong, on the north-west coast, opposite Salwatti, and Manokwari (Doreh), on the north-east coast, which is the seat of an assistant resident and the headquarters of administration for North New Guinea. Waslor, on Little Geelvink bay, is another port of call, also Sarmi, Demta and Humboldts bay, and here, too, are Chinese and Malay traders, dealing mostly in copra and bird of paradise plumes, and there is some exploitation of the hinterland. The development of Dutch New Guinea will probably be more rapid than that of North New Guinea, for there is good land available and more chance of being able to utilize imported labour, when this can be procured. Trade is being developed with Jappen island, where Dutch Royal Packet vessels call at two ports, Seroei and Wooibaai; and with Biak, of the Schouten islands, the port of which is Bosnik.

A treaty dated 1660 between the Dutch East India Company and the three States of Ternate, Tidore and Bachian, acknowledged the company to be "lord of the Papuans or all their islands which are subject to the king of Tidore." This gave the Dutch a nominal sovereignty over the Tidorese fiefs on the islands of Waigiou, Salwatti and Misol, and as on the latter two islands there were kingdoms possessing a vague sovereignty over parts of the mainland of New Guinea, whilst the suzerainty of Tidore was acknowledged in the neighbourhood of McCluer gulf, eventually the Dutch succeeded to these somewhat shadowy rights. Their first establishment was in 1828, when Fort de Bus was erected, but before this, in 1814, Dutch sovereignty in North-West New Guinea had been admitted, practically, by Great Britain by the convention of 1814, which restored to the Dutch their colonies as they had existed prior to 1803. In 1828 the Dutch Government declared North-West New Guinea, as a dependency of Tidore, a part of the Dutch East Indian colonies, which claim was confirmed in 1848, the frontier then being stated to run straight from Cape Bonpland to the north coast. In 1884, when South-East New Guinea was declared a British Protectorate, the meridian of 141° E. was acknowledged as the frontier between British and Dutch territory, and later, in 1885, the same meridian was accepted by the Dutch as defining the frontier of German New Guinea. A convention entered into by Holland and Great Britain in 1895 made a slight alteration in the boundary (the Fly river) and made the navigation of the Fly river free to subjects of both Powers, except for the carriage of munitions of war. In 1898 Tidorese territory was assigned to the Ternate Residency, in 1911 West New Guinea was attached to the Residency of Amboyna (the chiefs having subscribed to the "short declaration" in 1909), and the present division of territory is North New Guinea, West New Guinea, and South-West New Guinea, the former province being under Ternate, the two latter under Amboyna. (E. E. L.)

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ANTHROPOLOGY

The island of New Guinea and its island-clusters, together with those adjacent island-groups, of which the principal are the Louisiades and the Torres Straits islands, is a region of considerable racial and cultural diversity. The territory of New Guinea, the north-eastern quarter of the island, is, however, still very incompletely surveyed ethnologically, and of the inhabitants of Dutch New Guinea, our knowledge is comparatively slight.

Racial History.—Although there is considerable variety of racial type, the inhabitants of New Guinea belong almost entirely to the ulotrichous (frizzy-haired) branch of mankind. The principal varieties are the Negritoes, the Papuans and the Melanesians. The only typical Negritoes that have been found in New Guinea are the Tapiro at the source of the Mimika river in the Snow mountains of Dutch New Guinea, and the Pesechem. The Mafulu, the Kai and some others have probably a Negrito element.

The Papuan, the dominant stock in New Guinea, is dark, of short stature and generally long-headed. Evidently, Papuan man occupied not only New Guinea, but also Melanesia in very early times (*see* OCEANIA; *Racial History*), later migrations from Indonesia having on the whole less racial than cultural effects. The Melanesian element in New Guinea is certainly comparatively recent, and appears to be a mixture of Papuan with Indonesian and proto-Malay, a mixture which may in part have taken place in Indonesia. The Melanesian influence is strongest in the north and north-eastern coastal regions; and on the south-east coast of Papua the immigrant nature of this Melanesian type is clear.

Principal Groups.—Taking the whole New Guinea area, and

working from west to east, some of the principal culture-areas (or tribes where these exist) may be enumerated. Belonging to New Guinea rather than Australia we have the islands of Torres Straits with a well-developed and distinctive culture. Two groups on the mainland between the Fly and the Dutch boundary may be mentioned, the Tugeri, partly in British but mainly in Dutch territory where they are known as Marind-Anim (their name for themselves) and the Kiwais. A culture of which little is known occurs in the neighbourhood of Lake Murray, between the Strickland and the Fly; and between the Fly and the Aramia, we have a tribe, the Gogodara, containing many distinctive characters. In the Gulf of Papua, from a little west of the Kikori river to Cape Possession, four main groups are distinguished by Dr. Haddon, Kerewa, Urama, Namau and Elema, and far from the coast on the upper waters of the St. Joseph river the Mafulu show distinctive characters, physically and culturally. To the east of these Papuan districts we meet the farthest westward extension of Melanesian-speaking peoples. There are two main groups of these Papuo-Melanesians, the Western Papuo-Melanesians, the Roro, Mekeo, Motu and others, and the eastern Papuo-Melanesians or Massim, inhabiting the eastern extremity of New Guinea and the islands beyond, including the whole of the Louisiades, except possibly the island of Rossel, the inhabitants of which speak a non-Melanesian language. Passing westward along the north coast, Melanesian-speaking peoples give way for a while to Papuan-speaking peoples, such as the Orokaiva.

In the territory of New Guinea (excluding the Bismarck Archipelago, *q.v.*), the Bukaua, Huon gulf and the adjoining Jabim are Melanesian in culture, while the Tami of the neighbouring islands seem to be fairly pure Melanesian. Farther north the Kai, who inhabit the Rawlinson and Sattelberg ranges, are Papuan with Pygmy admixture. Both Papuan-speaking and Melanesian-speaking peoples occur along the coast farther north and west. Flourishing cultures occur on the Sepik river, and something is known of the Banaro on the Keran river.

In Dutch New Guinea something is known of the Geelwink bay district, where Melanesian-speaking peoples occur. On the west coast we find Papuans on the Mimika river, and at the headwaters of this river are the Tapiro pygmies.

Mode of Life.—With very few exceptions the inhabitants of New Guinea are horticulturists, cultivating coconuts, yams, taro, bananas and a number of other food plants. Sago is also an important food in some parts, constituting the main article of diet in the swampy region of western Papua. Fish are caught by net and spear, and occasionally by hook; and the harpooning of the dugong is an important feature amongst certain of the coastal peoples. The pig, domesticated and wild, is the only important flesh-food, though the wallaby and many birds are caught by various devices. Betel-nut is chewed with lime and pepper-plant, and the use of tobacco is now universal. Kava, the Polynesian drug, is limited to one or two places. Family houses are usually small, and are often built on piles. They may be scattered, as amongst the Massim, or grouped in big villages, as amongst the Motu and Gulf peoples. Club-houses in which initiated males live most of their lives occur in many parts and may be of considerable size; structures of this kind which entail enormous labour occur on the Sepik and in the Papuan gulf. Canoes are simple dugouts, or provided with an outrigger. Double canoes occur amongst the western Papuo-Melanesians. The Motu, joining several canoes together, make vessels of considerable size. For clothing the men usually wear some sort of girdle, and the women a petticoat of shredded palm; the Papuans of the north-west coast of Papua clothe the waist with tapa-cloth. Armlets of cane or of shell are common; necklaces of shell, dogs' teeth or seeds. The septum of the nose is commonly pierced to admit a nose-stick, usually of clam-shell, and the lobes of the ear are pierced and decorated in the east with turtle-shell rings and sapi-sapi beads. Tattooing has an irregular distribution, being confined to women in the case of the Massim, who are tattooed from forehead to thighs. Considerable artistic skill is shown, particularly by the Melanesian-speaking inhabitants, the carved and fretted woodwork of the Massim being of unusual excellence. Pottery is in general use among the Melanesian-speaking peoples. The drum is the commonest musical instrument, though absent from Rossel island in the Louisiades. Slit wooden gongs, with a most limited distribution, are found north of Huon gulf, in the territory of New Guinea, and in Dutch New Guinea. With these gongs are associated sacred flutes, which, however, are also found in the northern division of Papua.

Social Organization.—Although the family (*q.v.*) is an important unit in the social structure of all New Guinea peoples, a wider group, the clan (*q.v.*), seems in general to be more fundamental. Moreover, family relationships are not usually distinguished by name from many more remote relationships, and relationship terms used between persons who can trace genealogical relationship are also used in a systematic way between persons who are unable to trace any genealogical connection. This system, known as the classificatory system, takes a variety of forms in New Guinea, and social organization is unintelligible without an understanding of this system. Within the clan the classificatory system establishes a comparatively small number of relationships, and in general members of the same generation within a clan address one another as brothers and sisters, and the tie uniting members of one clan will be found to be similar to that uniting brothers and sisters by one father or mother. Both matrilineal clans (membership of which is determined by descent through the mother), and patrilineal clans (membership of which is determined by descent through the father), are found in New Guinea. The principal matrilineal area is the Massim district of Papua, and in this area the clans are totemic. (*See* TOTEMISM.) Each clan is associated with four linked totems, bird, plant, fish and snake, and the bird-totem is not eaten by members of the clan. A person will also avoid the bird-totem of his father's clan, the totems of which are necessarily different, since the rule of clan-exogamy (marrying out of the clan) is strictly observed. Amongst the patrilineal Papuans of the west, the clan seems to become of rather less importance, and totemism occurs only in an attenuated form in the Gulf region.

In the east the clan figures as the important unit in the rituals of marriage and death, and the series of feasts more or less connected with these events, which play a dominant part in the life of the Massim. Reciprocal exchanges of pigs and objects of value between persons more or less representative of clans is an important part of all such activities, as in the Big Feast which extends from the Massim as far as the Mafulu. This reciprocity between clans was also shown in warfare, cannibalism being a ceremonial act of revenge on the part of one clan for the death of one of its members by another clan.

In the social organization of the Papuans of the west, as well as the Papuans of the northern division, and the Jabim, Bukaua, Tami islanders and others in the territory of New Guinea, the outstanding feature is the existence of tribal initiation-ceremonies. The Elema tribes commence this initiation of the males at about the age of eight, when the boy is first taken into the club-house of the village and shown the bullroarer, the noise of which has previously been a mystery to him. Only after two or three years is his initiation complete, and the process involves not only various ordeals and instruction for the initiates, but a great deal of ceremonial in which the whole of the village, and maybe other villages, are involved. In other initiation rites the swallowing of novices by a monster and subsequent resurrection is prominent, this occurring both amongst the extreme western tribes of Papua and in the Huon peninsular district of the territory of New Guinea.

Religion.—A cult of the dead occurs throughout New Guinea, and only rarely is a cult of gods associated with it. The Big Feast of eastern Papua is to a large extent a collective celebration of the dead, though in the Soi feast of the Massim a being is continually addressed, who is not strictly an ancestor, and is supposed to have performed supernatural feats in olden times, and to have introduced the pig into New Guinea. This being is related to a number of other superhuman beings who lived in the past, but they can hardly be regarded as objects of a religious cult. On Rossel island, on the other hand, at the extreme east of the Massim area, we find an elaborate god-cult and constant care of the gods, who control the processes of nature by a priesthood.

The religion of the Elema tribes in the west of Papua may be described as an ancestor-cult, the name for ancestor being the same as that for all sacred objects; but some of these ancestors are regarded as deities who temporarily assumed a human form, giving birth to various tribes.

That death results from sorcery or is brought about by ghosts is probably a universal belief in New Guinea. The magic employed by sorcerers for this end is usually of the sympathetic type, some part of the victim being utilized by the sorcerer, or some imitative action being made to the accompaniment of a spell. Divination is also common, and where it is believed that ghosts may cause sickness divination is used to discover whether a ghost or sorcerer is responsible. On Rossel island an alternative cause of death is the desecration of the sacred ground of a god. (W. E. A.)

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HISTORY

Exploration.—Although New Guinea may have been seen by Antonio d'Abreu in 1511, its first visitor was apparently Dom Jorge de Menceses, who in 1526 took shelter at "Isla de Versija," either Warsia on the north coast, or Waigiu Island. Two years later Alvaro de Saavedra discovered "Isla de Oro," probably one of the Schouten Islands, and sailed along the north coast. The name "Nova Guinea" is due to Ynigo Ortiz de Retez (or Rotha) who landed on the north coast in 1546, and thought the natives resembled those of West Africa. The chart of Ortelius (1580) shows "Nova Guinea" as an island seventeen years before the fact was proved by Luis Vas de Torres sailing through the straits now bearing his name.

Dutch navigators, Willem Jansz (1605), Jacques le Maire and Willem Schouten (1616), Jan Carstensz (1623), Gerrit Pool (1636), Abel Tasman and others, appeared after the conquest of the Moluccas. In 1700 William Dampier sailed along the northern coast, and Philip Carteret (1767) and L. A. de Bougainville explored the islands. James Cook re-discovered Torres Straits, and landed in New Guinea near Prince Frederick Henry Island (1770). Thomas Forrest (1774) wrote an interesting account of the island (*Voyage*, 1780). Although parts of the coast were surveyed by La Perouse (1788), John MacCluer (1790), D'Entrecasteaux (1793, *Voyage* by Rossel), and also by Duperrey (1823), D. H. Kolff (1826), and Dumont d'Urville (1828), very little knowledge was gained of the country or people.

The Papuan Gulf and shores eastward were visited by F. P. Blackwood (1842–6, *Voyage of the Fly*, by J. B. Jukes), Owen Stanley (1846–50, *Voyage of the Rattlesnake*, by J. Macgillivray), Charles B. Yule (1864) and J. Moresby (1874). In 1875 Schleinitz explored the north coast and islands. During this period scientific observers visited the islands, notably A. R. Wallace (1858), Odoardo Beccari (1871–76), Maria d'Albertis (1871–78), C. B. H. Rosenberg (1869–70, *Bijdragen*, 1875), and Nicholas von Miklucho-Maclay (1871–81). Expeditions were made for the Netherlands India Government by P. van der Crab, E. Teysmann, J. G. Coorengel, A. J. Langeveldt van Hemert and P. Swaan (*Bijdragen*, 1879). Missionaries of the Utrecht Missionary Society were at Port Dorey in 1858, and English missionaries have resided in the south-east since 1871. Of these, Samuel Macfarlane (1875), James Chalmers (1877–1901), and George Brown (1875–1897) have described both country and people. Otto Finsch (1882), and Theodore Bevan (1884–87) explored the southern rivers.

Since the annexations, explorers and observers have been constantly at work. During and since the administration of Sir William MacGregor (1888–98), large areas of British territory were surveyed, and the natives pacified by a system of patrols (*Annual Reports*). The island was first crossed in 1897. James Chalmers was murdered in 1901. The anthropology has been made known by C. G. Seligman, V. M. Egidi, W. Mersh Strong, R. W. Williamson, B. Malinowski, W. J. Saville, E. B. Riley, G. Landtman, J. H. Holmes, A. C. Haddon and others. In 1922 Leo Austen ascended the Fly River to the Netherlands Boundary.

In German territory the Sepik (Kaiserin Augusta) river was visited by Otto Finsch (1885) and the Ramu river by Schleinitz (1887). In 1893 O. Ehlers and N. Piering lost their lives in crossing the island from Huon Gulf. Other explorations were carried out by C. Lauterbach (1896), Poch (1904), Heine (1908), Full and Friederici (1908).

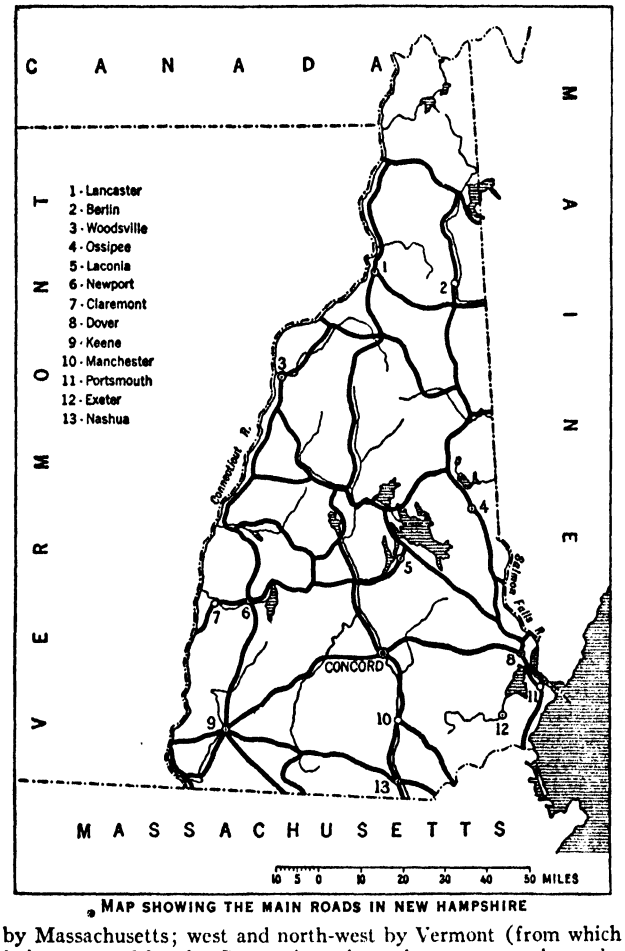
The northern part of Netherlands territory was explored by C. E. A. Wichman, G. A. J. van de Sande, and H. A. Lorentz (1903) and the south by Lorentz (1909—*Nova Guinea* by A. Wichman). South-west New Guinea has been explored (*Netherlands Geographical Society* 1908) and Central New Guinea in 1920 (H. J. T. Bijlers, 1923).

Annexations.—In 1793 New Guinea was annexed by the (English) East India Company, who placed a garrison for some time on Manuswari Island in Geelvink Bay. As Suzerain of the Sultan of Tidore the Dutch (after 1848), claimed control over the northern coast as far as Humboldt Bay. In 1828 they established a fort in Triton Bay and took possession of the south-west coast as far as the 141st meridian. Their claim to the western half of the island was admitted by Britain and Germany in 1885. In 1905 the Sultan of Tidore ceded his rights to the Government.

In 1864 Yule annexed the south coast for the British crown, and Moresby in 1873 took possession of the islands of Eastern New Guinea. The possible dangers to the commerce of Queensland and Australia generally, should the island come into the possession of a foreign power, led to a demand for annexation. The Germans in 1882 having advised their Government to annex, the Queensland Government in 1883 actually annexed all the mainland opposite their shores and east of the 141st meridian, but, as with the annexations of Yule and Moresby, this action was disavowed by the Home Government. In 1884 Germany annexed the north-east coast and adjacent islands, and Commodore Erskine proclaimed a British Protectorate over the region east of the 141st meridian as far as East Cape and the islands to Kosmann Island. In 1885 the German New Guinea Company was chartered to acquire and occupy those portions of the island not under British or Dutch sovereignty, the mainland being styled Kaiser Wilhelmsland, and the islands the Bismarck Archipel. A boundary agreement was made in the same year, the British territory being named British New Guinea. In 1888 the Protectorate became a dependency controlled by Queensland and in 1906 was renamed the Territory of Papua. In 1889 the German New Guinea Company surrendered their charter and the Imperial Government assumed direct administration. After the capitulations in 1914, the German territory was occupied by an Australian administration. Now, as the Territory of New Guinea, it is held by Australia under Mandate from the League of Nations.

BIBLIOGRAPHY.—Accounts of voyages published under the explorers' names are not noted here. A few others are mentioned in the text. Many Dutch expeditions are described in the *Bijdragen tot de taal-land-en-volken-Kunde- van Nederl. Indië*, especially for 1875 and 1879. German explorations are recorded in *Nachrichten über Kaiser Wilhelmsland*. English surveys will be found in *Annual Reports on British New Guinea (and Papua)*. Others works are: A. Dalrymple, *Historical Collection* (1770–71); Burney, *Chronological History* (1803); Meyners d' Estree, *La Papouasie* (Paris, 1881).

NEW HAMPSHIRE, popularly known as the "Granite State," is one of the New England group of the United States of America and one of the original thirteen. The State lies between 42° 40′ and 45° 18′ 23″ N., and between 70° 37′ and 72° 37′ W. It is bounded north by the Canadian province of Quebec; east by Maine, by the Salmon Falls river, which separates it in part from Maine and by the Atlantic ocean; south-east and south



MAP SHOWING THE MAIN ROADS IN NEW HAMPSHIRE

by Massachusetts; west and north-west by Vermont (from which it is separated by the Connecticut river—low water mark on the west bank of the Connecticut is New Hampshire's west boundary), and by Halls Stream which separates it from Quebec. The State has an area of 9,341 sq.m., of which 310 sq.m. are water surface.

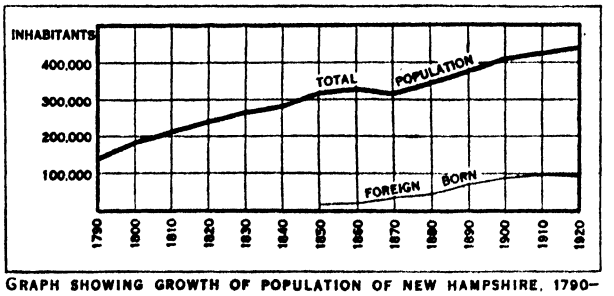
Physical Features.—In the north central portion of the State, the White mountains, a continuation of the Appalachian system, rise abruptly in several short ranges and in outlying mountain masses from a base level of 700 to 1,500 ft. The highest, Mount Washington, attains an elevation of 6,293 feet. The principal ranges, the Presidential, the Franconia and the Carter-Moriah, have a north-eastern and south-western trend. The Presidential, in the north-eastern part of the region, is separated from the Franconia on the south-west by the Crawford or White Mountain Notch, about 2,000 ft. in depth, in which the Ammonoosuc and Saco rivers find a passage, and from the Carter-Moriah, parallel to it on the east, by the Glen-Ellis and Peabody rivers, the former noted for its beautiful falls. On the Presidential range, which is about 20 m. in length, are Mount Washington and nine other peaks exceeding 5,000 ft. in height. On the Franconia, a much shorter range, are Mount Lafayette, 5,269 ft.; Mount Lincoln, 5,098 ft.; and four others exceeding 4,000 feet. The highest peak on the Carter-Moriah range is Carter Dome, 4,860 ft.; but seven others exceed 4,000 feet. Separating Franconia and Pemigewasset ranges is the romantic Franconia Notch, overlooking which from the upper cliffs of Profile mountain is The Great Stone Face, immortalized by Nathaniel Hawthorne.

The part of the State which lies north of the White mountains is occupied by ridges and wide rolling valleys, the ridges rising occasionally to heights of 2,000 ft. or more. South of the mountains a plateau-like surface—a part of the New England uplands—extends from the intervales of the Connecticut river to the eastern border of the Merrimac valley. Between the Merrimac valley and the sea is the only low surface in the State; a considerable portion of this region is less than 500 ft. above the sea. The seashore, about 18 m. in length, is mainly a low sandy beach. The only harbour is at Portsmouth near the mouth of the Piscataqua. About 9 m. from the shore are the bleak and nearly barren Isles of Shoals, divided between New Hampshire and Maine.

The lakes and ponds, numbering several hundred, were formed by glacial action and the scenery of many of them is scarcely less attractive than that of the mountains. The largest and most widely known is Lake Winnepesaukee, 20 m. long and from 1 to 8 m. wide is dotted by 274 islands, mostly verdant, and has clear water and a rather level shore, behind which hills or mountains rise on all sides. The rivers with their numerous falls and the lakes with their high altitudes furnish a vast amount of water-power for manufacturing,—the Merrimac, in particular, into which many of the larger lakes, including Winnepesaukee, find an outlet.

Fertile soil in New Hampshire is confined largely to the bottomlands of the Merrimac and Connecticut rivers. In the south-eastern section is also a moderately productive soil derived largely from the disintegration of slate. Elsewhere south of the mountains, the surface soil is mostly *hard pan* or *till*, this being deepest on the drumlins. In the mountain region the soil is mostly a sandy loam composed of disintegrated granite gneiss and organic matter; on the lower and more gentle slopes as well as in the valleys this is generally deep enough for a luxuriant vegetable growth but on the steeper slopes it is thin or the rocks are bare.

Climate.—The winters are usually long and severe, and the summers cool and fine. The mean annual temperature ranges from about 42° at only moderate elevations in the White mountain region and farther north to 47° at low altitudes in the south-east. The greatest extremes of temperature occur in the deep mountain valleys where it sometimes rises to 102° or above, in summer, and falls to −38° or below in winter; higher up on the mountains it is never so warm and along the sea-coast both extremes are considerably less. The mean precipitation for the entire State is about 40 inches. The distribution is even throughout the year, but summer and autumn are slightly more wet than winter and spring. Among the mountains and in the northern part of the State the annual fall of snow is from 7 to 8 ft., but in the south-east corner it is little more than one-half that amount. The prevailing winds



GRAPH SHOWING GROWTH OF POPULATION OF NEW HAMPSHIRE, 1790–1920

are generally north-west, but in the vicinity of the sea they are south-east during summer.

Population.—The population of New Hampshire on July 1, 1927 was 455,000, as estimated by the U.S. census bureau. The population of the State at certain of the decennial censuses was as follows: 141,885 (1790); 183,858 (1800); 269,328 (1830); 326,073 (1860); 376,530 (1890); 411,588 (1900); 430,572 (1910); and 443,083 (1920); the percentage of increase was 4·6 from 1900 to 1910 and 2·9 from 1910 to 1920. New Hampshire, in population, then ranked 41st among the States of the Union.

Of the total in 1920, 20·6% were foreign-born, 18·3% were of foreign-born parentage, 10·1% were of mixed parentage, and 51% were of native parentage. Of the total foreign-born population (91,233), 52,274 or 57·2% were natives of Canada (38,277 French and 13,997 others); 7,908 of Ireland; 5,280 of Greece; 4,367 of England; 3,997 of Poland; 3,467 of Russia; and 2,074 of Italy. The density of population in 1920 was 49·1 per square mile. The population of the principal cities was estimated in 1925 as follows: Berlin, 18,552; Concord, the capital, 22,546; Dover, 13,029 (1920 population); Keene, 11,855; Laconia, 11,300; Manchester, 83,097; Nashua, 29,723; and Portsmouth, 14,871.

Government.—New Hampshire was the first of the original States to establish a Government wholly independent of Great Britain. This was designed to be only temporary, but was in operation from Jan. 5, 1776 to June 2, 1784. The constitution provided for a general court consisting of a senate and a house of representatives and made the council a body advisory to the State president; the 1784 instrument was amended in 1792; with the amendments adopted in that year it is in large measure the Constitution of to-day. For 60 years there was no change whatever, and only three amendments, those of 1852 (removing the property qualifications of representatives, senators and the governor), were adopted until 1877, when 12 amendments were adopted,—the most important being those providing for biennial (instead of annual) State elections in November (instead of March), and those doing away with the previous requirement that representatives, senators and the governor "be of the Protestant religion." Five amendments were ratified in 1880, four in 1902 and four in 1912. The most important of those adopted in 1912 was one providing for the election of the governor and members of the council by a plurality instead of a majority vote. New Hampshire is the only State in which amendments to the Constitution may be proposed only by a Constitutional convention, and once in seven years at the general election a popular vote is taken on the necessity of a revision of the Constitution. By an act approved on April 9, 1909 provision was made for direct nominations of candidates at primaries.

There is a governor's council of five members, one from each councillor district, which has advisory duties and shares with the governor most of his powers. There is no lieutenant-governor. The governor and the councillors are elected for a term of two years. The governor and the council appoint all judicial officers, the attorney-general, auditor, important administrative boards, coroners and certain naval and military officers; they have power to pardon offences; and they may exercise some control over expenditure through the Constitutional requirement of the governor's warrant for drawing money from the treasury. The governor may veto within five days, besides Sunday, after it has been presented to him, any bill or resolution of which he disapproves, and a two-thirds vote of the members of both houses is required to pass over his veto. A senate and a house of representatives, which together constitute the general court, meet at Concord on the first Wednesday in January of every odd-numbered year, and at such other times as the governor may appoint for a special session, principally for the making of laws and for the election of the secretary of State, the State treasurer, and the commissary general. The senate is composed of 24 members, one from each senatorial district. In the house of representatives, which had the larger membership of 421 (1924), representation is on the basis of population, but favours the rural districts. Senators and representatives are elected for a term of two years. Although money bills may originate only in the house of representatives the senate may propose amendments.

For the administration of justice the State has a supreme court and a superior court, each county has a probate court, and some towns as well as the cities have a municipal court. The supreme court consists of a chief justice and four associate justices; the superior court, of a chief justice and five associate justices. The supreme court holds one general term each year at Concord and on the first Tuesday of every month except July and August sits to hear arguments, make orders and render decisions; the superior court holds one or two sessions a year in every county. Both of these courts have extensive jurisdiction. Each probate court, consisting of a single judge, has jurisdiction within its county of the probate of wills, of the granting of administration, in insolvency proceedings, in relation to the adoption of children, and other similar judicial functions. The court of a justice of the peace has jurisdiction in criminal cases only where the punishment is by fine not exceeding $20, or by imprisonment not exceeding six months or by both, and in minor civil cases. A municipal court has the same jurisdiction as that of a justice of the peace, and, in addition, concurrent jurisdiction with the superior court in certain cases where the title to real estate is not involved and the damage demanded does not exceed $100. Justices of the peace are appointed for a term of 5 years only, but they may be reappointed. Local affairs are administered by counties (ten in number), towns (townships), village districts and cities. In each county a convention, composed of representatives from the towns, meets every two years to levy taxes and to authorize expenditures for grounds and buildings whenever more than $1,000 are required. For the discharge of other county functions the qualified electors of each county elect every two years three commissioners, a sheriff, a solicitor, a treasurer, a register of deeds and a register of probate; two auditors also are appointed annually by the supreme court. The county commissioners have the care of all county property, as well as of county paupers; and once every four years they are required to visit each town of their county, inspect the taxable property therein, determine whether it is incorrectly assessed and report to the State board of equalization. In each town a regular annual meeting of the qualified electors is called on the second Tuesday in March for the transaction of miscellaneous business and the election of town officers.

Finances.—The total valuation of property for the purposes of taxation in 1926 was $673,250,335; the State levy $3,064,587 or $6.77 per caput. The chief sources of the income of the State for the year ending June 30, 1926 were the general property tax, motor vehicle licence fees, the gasolene (petrol) tax, railroad taxes, interest from sinking fund securities, legacy taxes, tax on foreign insurance companies and a tax on telephone companies. The principal disbursements were for highways ($2,651,215), refunds to towns ($1,507,437), public schools ($1,308,029), State institutions ($1,155,895), sinking fund ($800,566) and the University of New Hampshire ($545,575). The total receipts and disbursements for the year ending June 30, 1926 were $9,451,378.58 and $10,434,506.69, respectively. The cash and cash items on hand July 1, 1926 was $939,796 as compared with $1,922,924 a year before.

Education.—New Hampshire formed a part of Massachusetts when, in 1647, the general court of that province passed the famous act requiring every town in which there were 50 householders to maintain a school for teaching reading and writing, and every town in which there were 100 householders to maintain a grammar school. During the 19th and early part of the 20th century various experiments for improving the public school system were tried. The public school system, as now constituted, has at its head a State board of education composed of the governor and five other persons, one selected annually, appointed by the governor and council. The actual administrative work is carried on by a commissioner of education, appointed by the board of education for an indefinite term, and two deputy commissioners. Each town is constituted a school district, and some special districts are organized under special acts of the legislature. For the purpose of inspecting and supervising all institutions in which State money is spent, the several school districts in the State are combined into supervision unions consisting of one or more school districts. The schools are maintained chiefly out of the proceeds of a district school tax, which must not be less than $3.50 on each $1,000 of assessed property. To this is added a "Literary Fund" (designed originally for founding a college) from various sources. All children between the ages of 8 and 16 are required to attend either a public or an approved private school for the full term unless they are more than 14 years old and have completed the studies prescribed for the elementary schools, or have been excused by the school board on account of physical or

mental infirmity. The school enrolment, for the year ending June 30, 1926 showed 74,735 attending public schools and 26,231 attending parochial and private schools. Of the total public school enrolment 59,671 were in the elementary grades, 12,114 in high schools and 2,950 in evening schools. The one-room schools of the State had an attendance of 12,039 pupils. The total expended on public education in 1926 was $7,933,669.

The only State institutions of higher education are the Plymouth Normal school (1870) at Plymouth, the Keene Normal school

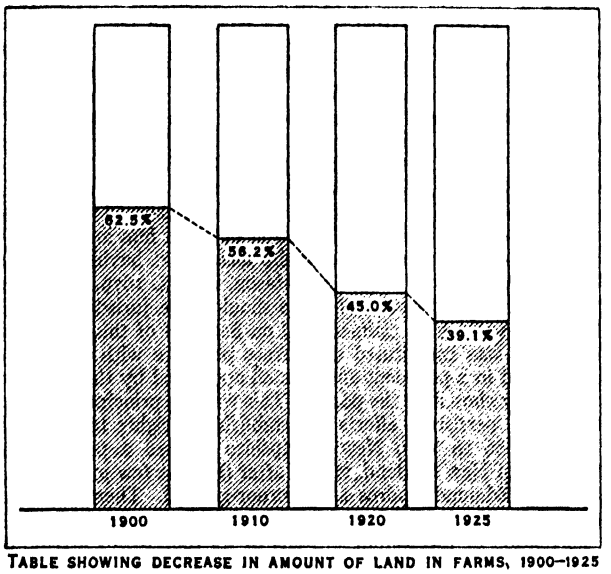


TABLE SHOWING DECREASE IN AMOUNT OF LAND IN FARMS, 1900–1925

(1909) at Keene, and the University of New Hampshire, organized as a department of Dartmouth college in 1866, but reorganized as the New Hampshire College of Agriculture and Mechanical Arts and removed to Durham as a separate institution in 1891. It was given its present name in 1923 by an act of the legislature. Other institutions of higher learning in the State are Dartmouth college (non-sectarian, 1769), at Hanover, and Saint Anselm's college (Roman Catholic, 1893), at Manchester.

Charities and Corrections.—The State charitable and correctional institutions include the New Hampshire School for feeble-minded children, at Laconia; the New Hampshire Soldiers' Home, at Tilton; the New Hampshire Industrial School, at Manchester; the New Hampshire Hospital for the Insane, and the State prison, at Concord; and the New Hampshire sanatorium for tuberculars, at Glencliff in the town of Warren. The State also makes annual appropriations for the care and education of blind and deaf and dumb persons in institutions outside of the State. Each county has an almshouse and house of correction.

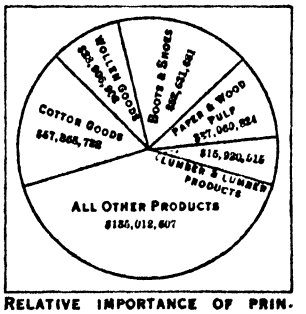
Agriculture.—Agriculture on the farms of New Hampshire still working has been greatly modified, the production of vegetables, fruits, dairy products, poultry and eggs largely supplanting the production of cereals. The total acreage in farms decreased from 3,249,458 in 1910 to 2,262,064 in 1925. The farm acreage was then 39·1% of the total land area. During the same period the number of farms decreased from 27,053 to 21,065, and average acreage per farm from 120·1% to 107·4%. The value of all farm property, however, had increased from $103,704,196 to $107,084,055. Of the total number of farms in 1925 (21,065), 19,895 or 94·4% were worked by owners or part owners, 1,014 by tenants and 156 by managers. The total value of all farm crops in 1926 was $19,608,000. Hay was the principal crop; in 1926 the acreage was 486,000 and the yield was 549,000 tons, valued at $10,311,000. Potatoes was the crop second in importance, valued at $3,086,000. The yield of fruit in 1924 included 1,327,820 bu. of apples and 3,116 bu. of peaches. Dairying has long been an important industry in New Hampshire. In 1924, the milk production was 38,149,067 gal. and the value of all dairy products was $7,791,159. The value of the poultry and egg product of 1924 was $6,456,790. The live stock on the farms of the State on Jan. 1, 1927 included 29,000 horses, 20,000 sheep, 20,000 swine and 117,000 cattle. Potatoes are grown in large quantities north and west of the White mountains; and this district leads in the number of cattle and sheep.

Forests and Fisheries.—Except on the summits of the higher mountains New Hampshire was originally an unbroken forest of which the principal trees were the white pine, hemlock, sugar maple, yellow birch, beech, red oak and white oak in the south, red spruce, balsam and white birch on the upper mountain slopes, and red spruce, white pine, sugar maple, white spruce and white cedar in the other parts of the north. In the year 1925 the State forestry commission reported a timberland acreage of 4,434,793, of which 1,012,753 ac. were in merchantable timber, 1,698,465 ac. in young growth and 1,723,575 ac. in which the timber stands were thin. Of this total 417,744 ac. or 9·42% were owned by the Federal Government and 20,538 ac. or ·46%, by the State. The forests of the State produced, in 1925, 261,000,000 board feet of lumber and 217,489 tons of wood pulp.

New Hampshire, with only one coastal county (Rockingham), was in 1924, the least important of the New England States with respect to her fisheries. The total yield of the fisheries amounted to 447,450 lb. valued at $56,029. Lobsters contributed $40,000, or over 70% of the value of this yield. Next in importance were haddock ($4,275), cod ($3,785) and soft clams ($3,600).

Minerals.—The most important of the mineral products of New Hampshire, which has long been known as "the Granite State," is granite, which is quarried in the southern part of the State in the area of Lake Winnepesaukee; gneiss, near Concord, Merrimac county, near Milford, Hillsboro county and east of Manchester in Rockingham county; in Sullivan county, near Sunapee; and in the east central region in Carroll county, near Conway and Madison. The value of stone quarried in New Hampshire in 1925 was $1,712,138, or approximately one-half of the total value of all mineral products of the State. Of this total ($3,464,837) the only other large items were clay products (valued at $828,541), sand and gravel ($316,248), crude feldspar ($278,736) and mica ($246,383). Mica, first mined at Grafton, Grafton county, in 1803, was later found in other parts of the State in such quantities that for 60 years New Hampshire was the largest producer of mica in the United States.

Manufactures.—The value of the products for all manufacturing industries of New Hampshire combined for 1919, 1924 and 1925 were $407,205,000; $333,124,503; and $327,400,651, respectively. The number of industries (1,499; 1,078; and 1,038) and the number of wage-earners (83,074; 75,310; and 66,658) showed a corresponding decrease. Textiles, and boots and shoes, which represented in 1923 more than one-half the total value, represented in 1925 approximately one-third the total. Cotton goods, the manufacture of which was introduced in 1804, was in 1925 the chief manufactured product. The 17 mills engaged in this industry employed 14,745 wage-earners and had an output valued at $57,868,732. The manufacture of boots and shoes, the industry second in importance, was carried on in 59 factories, gave employment to 12,275 wage-earners and had a product valued at $52,631,681. Other industries with a product exceeding $5,000,000 were: paper and wood pulp ($37,060,824), woollen goods ($28,906,292), lumber and timber ($12,621,867), knit goods ($9,789,550), foundry and machine shop products ($9,617,685), textile machines and parts ($6,934,488), and wooden boxes ($5,768,412). Most of the manufacturing centres of the State are south of Lake Winnepesaukee. An exception is Berlin, the chief manufacturing centre north of the White mountains, important for its manufacture of paper and wood pulp.



RELATIVE IMPORTANCE OF PRINCIPAL MANUFACTURES, 1925

Transportation.—With the exception of the Grand Trunk line in the northern part of the State the several steam railways are owned or leased by the Boston and Maine. This company was the first to operate a railway within the State, service being maintained between Boston, Mass., and Dover, N.H., as early as 1842. The steam railway mileage decreased from 1,256 to 1,234 during the decade 1915–25. The electric railway mileage in 1925 was 259. Since the first State highway aid law was passed in 1903, the amount spent by the highway department has increased annually. A total of $4,027,000 was expended by this department in 1925 for maintenance and construction of the State roads.

History.—Martin Pring was at the mouth of the Piscataqua in 1603 and, returning to England in the same year, gave an account of the New England coast from Casco bay to Cape Cod bay. Samuel de Champlain discovered the Isles of Shoals and sailed along the New Hampshire coast in 1605, and much more information concerning this part of the New World was gathered in 1614 by Capt. John Smith, who in his *Description of New England* refers to the convenient harbour at the mouth of the Piscataqua and praises the country back from the rocky shore. Under the leadership of Sir Ferdinando Gorges there was formed in 1620 the Council for New England, which procured from King James I. a grant of all the country from sea to sea between 40° and 48° N. lat., and which made nine grants bearing upon the history of New Hampshire. The first of these grants was to John Mason, who has been called "the founder of New Hampshire," on March 9, 1622. The name New Hampshire was first applied to a grant which lay between the Merrimac and Piscataqua, and given to John Mason on Nov. 7, 1629. The first settlement of which there is indisputable evidence was established in 1623 by David Thomson at Little Harbor, now in the town of Rye. Thomson was the head of a company which was organized for fishing and trading and whose entire stock was to be held jointly for five years. He built a house on Odiorne's Point overlooking Little Harbor, and, although he removed to an island in Boston Harbor in 1626, he may have continued to superintend the business of the company until the expiration of the five-year term. At least there was a settlement here which was assessed in 1628, and it may not have been completely abandoned when colonists sent over by the Laconia Company, which had received a grant on Nov. 17, 1629, arrived in 1630. The Laconia Company received its first grant under the erroneous impression that the Piscataqua river had its source in or near Lake Champlain, and its principal object was to establish an extensive fur trade with the Iroquois Indians. The company sent over colonists who occupied the house left standing by Thomson, and, not far away, built "Mason Hall" or the "Great House" in what is now Portsmouth, a name (for the entire settlement) that replaced "Strawberry Banke" in 1653. Edward Hilton with a few associates appears to have established a settlement on Dover Point about the time of Thomson's arrival at Little Harbor, and in the Hilton grant of 1630 it is stated that he had already built houses and planted there; as early as 1630 this settlement was named Dover. In 1638 the Rev. John Wheelwright, an Antinomian leader who had been banished from Massachusetts, founded Exeter on land claimed to have been bought by him from the Indians. In the same year Massachusetts encouraged friendly Puritans to settle Hampton on the same purchase, and about a year later this colony organized Hampton as a town with the right to send a deputy to the general court. Serious dissensions had already arisen between Puritan and Anglican factions in Dover, and Capt. John Underhill, another Antinomian, became for a time a leader of the Puritan faction. Puritan Massachusetts was naturally hostile to the Antinomians at Exeter as well as to the Anglicans at Strawberry Banke. Under these conditions Massachusetts discovered a new claim for its northern boundary. The charter of that colony was drafted under the impression that the Merrimac flowed east for its entire course, but now an investigation was in progress which was to show that its source in Lake Winnepesaukee was several miles north of any of the four settlements in New Hampshire. Accordingly, Massachusetts resolved to make the most of the clause in the charter which described the northern boundary as three English miles north of the Merrimac river, "or to the northward of any and every part thereof," to ignore the conflicting grants to Mason and to extend its jurisdiction over the offending settlements.

The heirs of Mason protested, but little was done about the matter during the period of Puritan ascendancy in the mother country. Immediately after the resignation of Richard Cromwell, however, Robert Tufton Mason (a grandson of the original proprietor), who had become sole heir in 1655, began petitioning first parliament and later the king, for relief. The commission appointed by the king in 1664 to hear and determine complaints in New England decided that Mason's lands were not within the jurisdiction of Massachusetts, and made an attempt to set up a government under which his claims could be tried, but this was a failure. Mason then petitioned again, and this time Massachusetts was requested to send agents to England to answer his complaints. They arrived in Dec. 1676, and the case was tried before the Lords Chief Justices of the King's Bench and Common Pleas in April, 1677. Mason presented no claim to the right of government, and as to the title to the lands claimed by him the court decided that this was a question between him and the several tenants to be determined by the local court having jurisdiction in such matters. Thereupon Mason, in Jan. 1679, petitioned the king to appoint a governor who should have jurisdiction over all the lands which he claimed, and on Sept. 18 of this year New Hampshire was constituted a separate province with a Government vested in a president and council appointed by the king and an assembly chosen by the people. This was the principal outcome of Mason's persistent efforts to establish his rights to the land.

From 1686 to 1689 New Hampshire formed a part of the Dominion of New England, which, after the first few months, was under Sir Edmund Andros as governor-general. There being no provincial authority in New Hampshire at the close of this period, a convention of the leading citizens of its four towns attempted to establish one. Upon the failure of this attempt, a temporary nominal union with Massachusetts was formed, but in 1692 Samuel Allen, the assign of Mason, caused a royal Government to be established with his son-in-law, John Usher, as lieutenant-governor, and during the remainder of the colonial era New Hampshire was separate from Massachusetts except that from 1699 to 1741 the two had the same governor. The boundary disputes between Massachusetts and New Hampshire were long and bitter. Both provinces granted townships within the disputed territory; Massachusetts arrested men there who refused to pay taxes to its officers, and sought to defer the settlement of the dispute. New Hampshire, being on the more friendly terms with the home Government, finally petitioned the king to decide the matter, and in 1737 a royal order referred it to a commission to be composed of councillors from New York, Nova Scotia and Rhode Island. This body agreed upon the eastern boundary but evaded deciding the southern one. Both parties then appealed to the king, and in 1741 the king in council confirmed the decision of the commission in regard to eastern boundary and established a southern boundary very favourable to New Hampshire. The western boundary was not yet defined, and as early as 1749 a controversy over that arose with New York. The governor of New Hampshire granted in the disputed territory 138 townships which were rapidly settled, but there was a reluctance to incur the expense of a contest with so powerful a neighbour as New York. In 1764 New York procured a royal order declaring the western boundary of New Hampshire to be the western bank of the Connecticut river.

At the outbreak of the Revolution New Hampshire had about 80,000 inhabitants, the great majority of whom were with the patriot or Whig Party during that struggle. By June, 1775, the once popular governor, Sir John Wentworth, was a refugee; on Jan. 5, 1776, the fifth Provincial Congress established a provisional Government; June 15 the first assembly elected under that Government declared for independence; and on Aug. 16, 1777, the important victory at Bennington was won by New Hampshire and Vermont troops under the command of Gen. John Stark, who had a commission from New Hampshire. Six States had ratified the Federal Constitution when the New Hampshire convention met at Exeter on Feb. 13, 1788, to accept or reject that instrument, and so

great was the opposition to it among the delegates from the central part of the State that after a discussion of ten days the leaders in favour of ratification dared not risk a decisive vote, but procured an adjournment in order that certain delegates who had been instructed to vote against it might consult their constituents. Eight States had ratified when the convention reassembled at Concord on June 17, and four days later, when a motion to ratify was carried by a vote of 57 to 47, adoption by the necessary nine States was assured.

National elections in New Hampshire were carried by the Federalists until 1816, except in 1804 when President Thomas Jefferson won by a small majority; but within this period of Federalist supremacy in national politics the Democrat-Republicans elected the governor from 1805 to 1812 inclusive except in 1809. In 1816 the Democrats won both State and National elections; and out of the transition from Federalist to Democratic control, which was effected under the leadership of William Plumer (1750–1850), a prominent politician in New Hampshire, arose the famous Dartmouth College Case. As the trustees of this institution were Federalists with the right to fill vacancies in their number, the Democrats attempted to gain control by converting it into a State university and increasing the number of trustees, but when the case reached the U.S. Supreme Court that body pronounced (1819) the charter a contract which the Federal Constitution forbade the State to violate. Heretofore the Federalist régime had taxed the people to support the Congregational Church, but now the Baptists, Methodists and Universalists joined the Democrats, and in 1819 this State support was abolished by the "Toleration Act." Because of Daniel Webster's arguments in the Dartmouth College Case, and because his party had favoured the support of the Congregational Church by public taxation, he became very unpopular in this his native State. Accordingly, his denunciation of President Andrew Jackson's bank policy added strength to the Jacksonian Democracy, and, later, his Whig connections were the greatest source of the Whig Party's weakness in New Hampshire. John Quincy Adams was an intimate friend of William Plumer, the Democratic leader, and carried the State both in 1824 and 1828. The Whigs never won a national or State election, and often their vote was only about one-half that of the Democrats. But the Democrats broke into two factions in 1846 over the question of slavery (*see* HALE, JOHN PARKER); the American or "Know-Nothing" Party elected a governor in 1855 and 1856; and then control of the State passed to the Republican Party which held it until the election of 1912 when the Democrats carried the State for Wilson and elected Samuel D. Felker governor. The Democrats were again successful in the presidential election of 1916 (Wilson, 43,779, Hughes, 43,723), but did not elect another governor until 1922.

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NEW HARMONY, a village in Posey county, Indiana, on the Wabash river, about 22 m. N.W. of Evansville. Pop. (1920) 1,126. It is served by the Illinois Central railway. New Harmony had its beginning in 1814–15, when it became the home of a communistic religious sect known variously as the Harmonists, Harmonites and Rappites, founded in Germany towards the end of the 18th century by George Rapp (1757–1847), a native of Iptingen in Württemberg. Rapp and his followers, who sought to form a community after the manner of the primitive Christian Church, were persecuted in Germany, and in 1803–04 emigrated to Butler county, Pennsylvania. There they established in 1805 a community known as Harmony, consisting of some 600 persons, who held their property in common and in 1807 adopted celibacy. In 1814 Rapp sold most of his Pennsylvania land and bought about 24,735 ac. (in the next ten years more than 14,000 ac. in addition) on the Wabash river in Indiana Territory. In 1814–15 Rapp and a thousand of his followers settled on the Indiana tract, their headquarters being established at New Harmony or Harmonie as they called it. The settlers, mostly Germans, devoted themselves to agriculture, weaving and leather-working so industriously that they prospered from the start. Rapp, however, in 1825 disposed of his lands and property to Robert Owen, having returned with part of his followers to Pennsylvania and founded a new community known as Economy (*q.v.*), in Beaver county, where he died in 1847. Intent on founding a socialistic community, Owen went to the United States in 1824, and purchased Rapp's lands and live stock for $182,000. He interested several well-known scientists in his settlement, and with them came to New Harmony in the spring of 1826. Within six months the community numbered over 1,000. The greater part of the settlers, however, were impractical theorists or adventurers. Constitution after constitution was adopted, and with the adoption of each new constitution and with each new religious discussion a group would secede and form a separate community—in 1828 there were ten. The whole organization broke up in 1827, and Owen left New Harmony in 1828. The Working Men's Institute Public library, founded in 1838 by William Maclure, had in 1907 18,000 volumes; the collection is rich in works dealing with socialism.

See "The Harmony Society," *German-American Annals* (1904); G. B. Lockwood and C. A. Prosser, *The New Harmony Movement* (1907); Meredith Nicholson, *The Hoosiers* (1901); Morris Hillquit, *History of Socialism in the United States* (1903); Frank Podmore, *Robert Owen* (1906); and G. H. Holiday, "An Indiana Village, New Harmony," *Indiana Historical Society Publications* (1906).

NEWHAVEN, a seaport of Sussex, England, 56 m. S. from London by rail, on the English Channel at the mouth of the Ouse. Pop. (1921) 6,435. The port is protected by fortifications. A harbour was first granted to Newhaven in 1713, and during the early part of the 18th century it possessed a large shipping trade. It is now a packet station with a daily service of fast steamers to Dieppe. The tidal harbour is enclosed by two piers and a breakwater, the area being about 30 ac., and the quayage 1,400 yd. With France there is a large traffic in wines, spirits, silk, fruit, vegetables and general provisions.

NEW HAVEN, the largest city of Connecticut, U.S.A., a port of entry, the county seat of New Haven county and the seat of Yale university; in the south-western part of the State, on Long Island sound, 72 m. E.N.E. of New York city. It is on Federal highway 1, and is served by the New York, New Haven and Hartford railroad, interurban trolleys, motor-bus and truck lines and coastwise steamers. Pop. (1920) 162,537 (28% foreign-born white); 1928 local estimate 187,900.

The city occupies 22·4 sq.m. at the head of a broad, deep bay, into which empty three small streams (the Quinnipiac, the Mill and the West rivers). Its site is a level, sandy plain, behind which rises a line of hills, terminating in two spurs, East Rock (360 ft. high) and West Rock (400 ft.), respectively 2½ and 2 m. from the Green. On the central Green of 16 ac., reserved for the public when the town was laid out, are three churches built in 1814: Trinity (Protestant Episcopal), United (Congregational) and Center (Congregational; designed by Ithiel Towne). Facing the Green are some of the buildings of Yale university (*q.v.*), a large hotel and the principal public buildings. The Harkness tower of the memorial quadrangle of the university can be seen from the Green, and near by is the old Grove Street cemetery, containing the graves of many famous Americans. The Yale Bowl (seating 78,000) is in the western part of the city. New Haven has long been called "the city of elms." Parks, playgrounds and public squares cover 1,750 acres. In West Rock park is a cave where the regicide judges Whalley and Goffe are said to have been hid for several weeks when pursued by royal offi-

cers in 1661. Nathan Hale park contains old Ft. Hale (used in 1812), with its moat and defences well preserved. A large tract at Lighthouse point (the eastern end of the harbour) is developed as a municipal bathing beach and seaside park. New Haven is the seat of a State normal school (established 1893), Albertus Magnus College for Women (Roman Catholic), Arnold College for Hygiene and Physical Education, New Haven college, and Connecticut College of Pharmacy. The public school system includes 60 grade and 4 high schools. There are eight parochial schools, and a number of widely-known private academies for boys and for girls, including the Hopkins Grammar school, established in 1664. Among the newspapers are the morning *Journal-Courier* (Independent, established 1766), the evening *Register* (Independent, 1812), the *Times-Union* and four Italian weeklies. Several scientific and learned periodicals are published here.

New Haven is an important commercial and industrial city. The general offices of the New York, New Haven and Hartford railroad are here, and just outside the city is its Cedar Hill freight classification yard, covering 1,160 ac. The traffic of the harbour (nearly all domestic commerce) amounted to 1,282,776 tons in 1926, valued at $112,482,881. There are 277 wholesale houses, doing a large business. The manufacturing industries are widely diversified and highly specialized, with an output in 1925 valued at $110,506,218. Among the leading products are guns, ammunition, hardware and clocks. A coke plant manufactures gas which is piped to towns as far as Hartford. Bank debits in 1927 aggregated $1,289,211,000. The city's assessed valuation for 1927 was $315,738,245. It operates under a mayor and aldermen form of government. The death rate is low.

In the spring of 1638 a company of English Puritans, led by Theophilus Eaton and the Rev. John Davenport, established a settlement here. It was governed under a "plantation covenant" until June 4, 1639, when the "free planters" adopted a theocracy. In 1643–44 the towns of Guilford, Milford, Stamford, Branford and Southold on Long Island were admitted to the "New Haven Jurisdiction." The government of the Jurisdiction was of the strictest Puritan type, but some of the 45 "blue laws" ascribed to it were enactments of other New England Colonies, and some were pure invention. In 1664 New Haven, with the other towns (except Southold) of the Jurisdiction, became part of the Colony of Connecticut, and in 1784 it was chartered as a city. From 1701 to 1873 New Haven was one of the capitals of Connecticut. A State house (designed by Ithiel Towne after the temple of Theseus) stood on the Green, or market place, from 1827 until 1889. In 1716 the Collegiate School of Connecticut, which developed into Yale university, was moved to New Haven from Saybrook. After 1763 a thriving trade with the West Indies, Newfoundland and neighbouring ports on the Atlantic coast began to develop, which flourished, with some periods of depression, until the War of 1812; and after 1800 commerce sprang up with China, the East Indies, the Pacific and the South Seas. A collector of the port was appointed in 1760. In 1769 the merchants at a public meeting unanimously agreed not to import goods from England, but in June 1770, they renounced the agreement and voted to open the port. When the news of the embargo of Boston arrived, a committee of correspondence was formed at once; and through the Revolution the people supported the American cause with ardour, though there were many Loyalists in the town, 75 of whom had property confiscated. On July 5, 1779, the town was invaded and sacked by Gen. Tryon, but he was driven out before he could burn it. When the War of 1812 opened there were fully 600 seamen in the city (among them Captain Isaac Hull), all engaged in privateering or in the regular naval service of the United States. Manufacturing began early. Shoes were shipped from the town in 1647 and iron works were opened in 1656. The loss of foreign trade through the War of 1812, the opening of the Farmington canal in 1828, and the building of the railroad in 1833–38 gave such impetus to industrial development that manufacturing rapidly became the chief interest of the city. In 1820 the population was 8,327; in 1860, 39,267; in 1900, 108,027. New Haven has been the birthplace or the home of many inventors, including Eli Whitney, Eli Whitney Blake, Charles Goodyear, Thomas Sanford, James Brewster, David Bushnell, S. F. B. Morse, Elias Loomis, Chauncey Jerome and Henry S. Parmelee; and it was the home of Noah Webster and Willard Gibbs.

NEW HEBRIDES, an island group in the western Pacific, under French and British joint administration. Area about 5,700 sq. miles. Pop., natives about 60,000, Europeans 882, other nationalities 2,440. For full account of geography, etc., *see* PACIFIC ISLANDS.

HISTORY

The Portuguese Pedro Fernandez de Quiros, sighting Espiritu Santo in 1606, thought he had discovered the great southern continent then believed to exist, and named it Australia del Espiritu Santo. Louis de Bougainville visited the islands in 1768, and Captain Cook, who gave them the name they bear, in 1774. The subsequent visits of several explorers, the exploitation of the sandal-wood, and other products by traders and the arrival of missionaries helped to open up the islands and to give them a certain commercial importance by the middle of the 19th century. Trade was mainly with New Caledonia, and France was thus indicated as the dominant power in the New Hebrides; even British planters pressed France to annex the islands in 1876, but in the following year some of the missionaries urged the same course on England. In 1878 the islands were declared neutral by Great Britain and France. The presence of British and French settlers under independent authority led to unsatisfactory administration, especially in regard to the settlement of civil actions and jurisdiction over the native population. As to the establishment of commercial supremacy, French interests clashed with Australian, and in 1882 M. John Higginson of New Caledonia (d. 1904) consolidated the former by founding the trading society which afterwards became the *Société française des Nouvelles-Hébrides*. In 1886 one of the most serious of many native outbreaks occurred, necessitating a French demonstration of force from New Caledonia. An Anglo-French convention of Nov. 16, 1887, provided for the surveillance of the islands (protection of life and property) by a mixed commission of naval officers. The Anglo-French agreement of 1904 had a clause providing for an arrangement for proper jurisdiction over the natives and for the appointment of a commission to settle disputes between British and French land owners.

On Oct. 20, 1906, a convention was signed in London, confirming a protocol of the preceding Feb. 27, and providing that "the group of the New Hebrides, including the Banks and Torres Islands," should form "a region of joint influence," in which British and French subjects should have equal rights in all respects, and each power should retain jurisdiction over its own subjects or citizens. The claim of other powers to share the joint influence was excluded by the provision that their subjects resident on the islands must be under either British or French jurisdiction. A British and a French high commissioner were appointed, each assisted by a resident commissioner; provision was made for two police forces of equal strength, and the joint naval commission of 1887 was retained for the purpose of keeping order. The high commissioners were given authority over the native chiefs. A joint court was established, consisting of two judges, appointed respectively by Great Britain and France, and a third, to be president, and not a British subject or French citizen, appointed by the king of Spain. The convention provided against the establishment of a penal settlement and the erection of fortifications.

This convention was bitterly criticized in Australia on the ground that many of the provisions which nominally established equality between British and French would operate in practice to the advantage of the French; and there was no little dissatisfaction on the ground that the Australian Government was neither represented at the preliminary conference, nor fully consulted during the negotiations. A second protocol of Aug. 1914, ratified by France and England on March 18, 1922, guaranteed British, French and native interests, fixed the conditions of land-tenure and provided regulations for the recruiting of native labour. Cannibalism still prevails on Espiritu Santo, Malekula and Pentecost Islands.

See *Parliamentary Papers*, France, No. 1 (1888 and 1906); and "Correspondence relating to the Convention. . . ." (Cd. 3288) (1907); M. Johnson, *Cannibal Land* (*New Hebrides*) (1922). (*See* also PACIFIC OCEAN.)

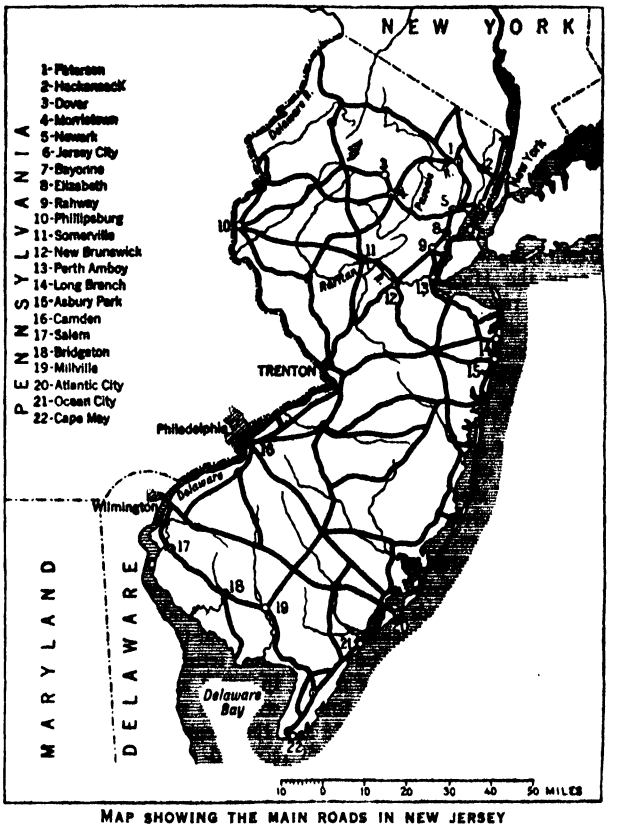
NEW IBERIA, a city of southern Louisiana, U.S.A., 125 m. W. of New Orleans, on Bayou Teche and Federal highway 90; the county seat of Iberia parish. It is served by the Missouri Pacific and the Southern Pacific railways, and by river steamers and barges. Pop. 6,278 in 1920 (34% negroes). This region is the home of the "Acadians" from Nova Scotia, a picturesque and rich agricultural country. Within a few miles are Avery, Jefferson and Weeks islands, all of which have great salt mines. On Jefferson island was the former home (Bob Acres) of Joseph Jefferson, and on Avery there is a large bird refuge. The city was laid out in 1835 and chartered in 1839.

NEW IRELAND, an island of the Bismarck archipelago, lying east of New Guinea, in the Pacific ocean, and north-east of New Britain, practically at right-angles to its northern end (German, Neu-Mecklenburg; native, *Tombara*). It is long and narrow, very mountainous (maximum height, 6,500 ft.), with no rivers of any size. Geologically, it is older than New Britain (*q.v.*, *see* also NEW GUINEA), but it has not the definite volcanic appearances of that island. The coast line is fairly even, and there are good harbours at Kaewieng, Namatanai and Muliama. It is divided into two districts, northern (Kaewieng), and southern (Namatanai), the latter including the small island of New Hanover. Kaewieng is a port with a wharf capable of berthing ships up to 2,000 tons, and has substantial government buildings. There are fair roads in many places, and there is steamer communication with New Britain and the mainland. The natives resemble those of New Britain. New Ireland formed part of German New Guinea; it was captured by Australian forces in 1914, and was mandated by the League of Nations to Australia, by which country it is now administered. The island was seen by Jacob Lemaire and William Cornelis Schouten in 1616, recognized as separate from New Guinea by Dampier, in 1700, and by Philip Carteret, in 1767, as being separate from New Britain.

NEW JERSEY, popularly known as the "Garden State," is one of the Atlantic coast States of the American Union, lying between 41° 21′ 22·6″ and 38° 55′ 40″ N. lat., and 75° 35′ and 73° 53′ 39″ W. longitude. It is bounded, north by the State of New York, east, by the Hudson river, which separates the State from New York, and by the Atlantic ocean; and south and west by the Delaware bay and river, which separate New Jersey from Delaware and Pennsylvania. All the boundaries except the northern are natural. New Jersey has an extreme length, north and south, of 166 m., an extreme width, east and west, of 57 m. and a total area of 8,224 sq.m., of which 710 sq.m. are water-surface.

Physical Features.—There are within the State four distinct topographic belts—the Appalachian, the Highlands, the Triassic Lowland and the Coastal Plain. The folded Appalachian belt crosses the north-west corner of the State, and includes the Kittatinny mountain and valley. The mountain has a north-east-south-west trend, crossing the Delaware river at the Delaware Water Gap and continuing south-west into Pennsylvania. Where the crest of the ridge enters the State its elevation is 1,539 ft.; at High Point, 1¼ m. S.W., the ridge attains a height of 1,805 ft., the highest point within the State. A short distance south-west of this point, in a depression in the crest, is Lake Marcia, at an elevation of 1,570 feet. At the Water Gap the ridge is cut through to its base, and the Delaware river flows through the opening. This gap, 900 ft. wide at the base and 4,500 ft. wide at the top, with sides rising very abruptly to a height of 1,200 ft. and more, is an impressive sight. The Kittatinny valley, south-east of and parallel to the Kittatinny range, is about 40 m. long and 12 m. wide and has an average elevation of 700 feet.

South-east of the Kittatinny valley, and parallel with it, lies the second topographic belt, the Highlands. This region embraces an area of 900 sq.m., having a length, north-east to south-west, of 60 m. and a width varying from 9 to 18 miles. It consists of an upland plateau now dissected by streams into a series of ridges. The average elevation of the Highlands is about 1,000 feet. The third belt, called the Triassic Lowland, occupies about one-fifth of the surface of the State. Its north-western border is marked by a line drawn south-west across the State through Pompton, Morristown, Lebanon and Highbridge to the Delaware; its south-eastern border by a line drawn from Woodbridge to Trenton. The surface is irregular, with altitudes ranging from about sea-level to 900 feet. A noteworthy feature of this area is the series of



MAP SHOWING THE MAIN ROADS IN NEW JERSEY

trap rock ridges. The best known of these is the Palisades ridge, or simply the Palisades, which lines the western bank of the Hudson river. The trap extends to the Kill van Kull channel, and includes, among other ridges, the so-called First and Second Watchung (or Orange) mountains west of the group of suburbs known as the "Oranges." South-east of the Triassic Lowland lies the fourth topographic belt, the Coastal Plain, containing an area of 4,400 sq.m., or slightly more than one-half the entire surface of the State. This belt, bordered on the east, south and west by water, is highest near its centre and lowest along its margins. One-third of the Coastal Plain is below 50 ft. in altitude; two-fifths are between 50 and 100 ft.; and somewhat more than a fourth of the area is over 100 ft. above sea-level. About one-eighth of the area consists of tidal marsh, lying chiefly between the long sandy ridges or barrier beaches of the Atlantic coast and the mainland. For the entire State the average elevation is 250 feet.

The four topographic belts of the State correspond very closely to the outcrops of its geological formations; the rocks of the Appalachian belt being of Palaeozoic age; the formation of the Highlands, Archaean; that of the Triassic Lowland, Triassic; that of the irregular hills of the Coastal Plain, Cretaceous and Tertiary. The great terminal moraine of the glacial epoch crosses the north-east-south-west topographic belts of the State, in an irregular line west and north-west, from Staten Island, N.Y.

The Delaware river, from its junction with the Neversink creek to the capes, flows along the western and southern borders of the State for a distance of 245 m., and has a total drainage area in New Jersey of 2,345 sq. miles. Of equal importance is

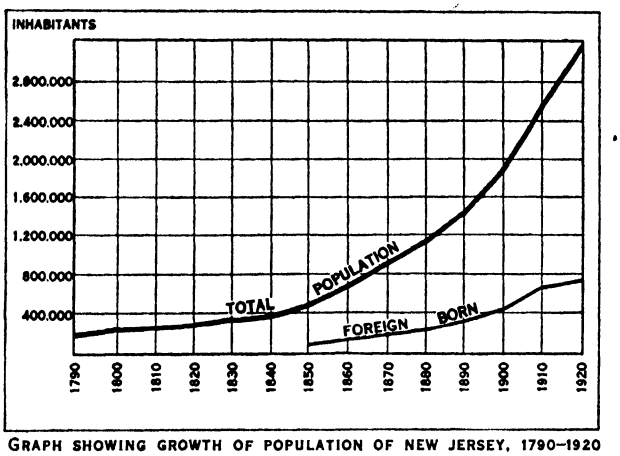
the Hudson, whose lower waters, forming the north-eastern boundary of New Jersey for a distance of 22 m., drain a very small part of the State, but have contributed materially to the State's commercial development. Of the streams of the Highlands and the Triassic Lowland, the Passaic river is the most important. Rising in the north-east—in the southern part of Morris county—it pursues a winding north-easterly course, passing through a gap in the trap rock at Little Falls, and by means of a cascade and a mile of rapids descends 40 feet. At Paterson (*q.v.*), 3 m. farther, the stream passes through a crevasse in the trap rock and has a sheer fall of 70 ft. (the Great Falls of the Passaic). The stream then makes a sharp bend southward and empties into Newark bay. The Passaic and its small tributaries drain an area of about 950 sq. miles. The Hackensack river enters the State about 5 m. W. of the Hudson river, flows almost parallel with that stream, and empties into Newark bay, having a length of 34 m. and a drainage area of 201 sq. miles. The Raritan river, flowing eastwardly through the centre of the State, is the largest stream lying wholly within New Jersey, and drains 1,105 sq. miles. Among the Highlands are numerous lakes, which are popular places of resort during the summer months. Of these the largest and the most frequented are Lake Hopatcong, an irregular body of water in Morris and Sussex counties, and Greenwood lake, lying partly in New York and partly in New Jersey.

The soils of the State exhibit great variety. Those of the northern and central sections are made up in part of glacial drift; those of the south are sandy or loamy, and are locally enriched by deposits of marl. The most fertile soils of the State lie in the clay and marl region, a belt from 10 to 20 m. wide extending across the State in a general south-westerly direction from Long Branch to Salem.

Climate.—Between the extreme northern and southern sections of the State there is a greater variation in climate than would naturally result from their difference in latitude. This is due to the proximity of the ocean in the south and to the relatively high altitudes in the north. The mean annual temperature ranges from 49·2° F at Dover, in the north, to 55·4° at Bridgeton, in the south. At Dover the mean for the winter is 28°, with an extreme minimum recorded of −13°; and the mean for the summer is 70°, with an extreme maximum recorded of 102°. At Atlantic City the mean annual temperature is 52°; for the winter it is 34°, with an extreme of −7°; and for the summer, 70°, with an extreme of 104°. The beaches of New Jersey have rapidly built up with towns and cities that have become popular summer resorts —among the best known of these are Long Branch, Asbury Park, Ocean Grove, Atlantic City (also a winter resort) and Cape May. The normal annual precipitation is 47·7 in., varying from 46·6 in. on the sea-coast to 49·1 in. in the Highlands and the Kittatinny valley.

Population.—The population of New Jersey at certain selected censuses was as follows: 184,139 in 1790; 211,149 in 1800; 489,555 in 1850; 1,131,116 in 1880; 1,444,933 in 1890; 1,883,669 in 1900; 2,537,167 in 1910; and 3,155,900 in 1920, or an increase of 24·4% during the last decade. The State's rank in population was, in 1920, tenth among the States of the Union. On July 1, 1928, according to the U.S. Census bureau estimate, the population of New Jersey was 3,821,000. Of the native-born white population in 1920, 1,212,675 were of native parentage, 829,058 were of foreign parentage and 256,741 were of mixed parentage. The negro population was 117,132 or 3·7% of the whole. Among the various elements comprising the foreign-born population (738,613) were 157,285 Italians; 92,382 Germans; 90,419 Poles; 73,527 Russians; 65,971 Irish; 46,787 English; 40,470 Hungarians; 36,917 Austrians; and 17,781 Scotch. New Jersey, with 420 inhabitants per square mile, ranked third among the States in density of population. The urban population (in places of 2,500 or more) was 78·4% of the total. The principal cities in 1920 were Newark (414,524), Jersey City (298,103), Paterson (135,875), Trenton (119,289), Camden (116,309), Elizabeth (95,783), Bayonne (76,754) and Hoboken (68,166).

Government.—The State is governed under the Constitution of 1844, with subsequent amendments of 1875 and of 1897. The only other Constitution under which the State has been governed was that of 1776. The right of suffrage is conferred upon all citizens of the U.S., 21 years of age and over, who have resided in the State for one year and in the county for five months preceding the election. The executive power is vested in a governor, who is elected for a term of three years and may not serve two successive terms, though he may be re-elected after he has been out



GRAPH SHOWING GROWTH OF POPULATION OF NEW JERSEY, 1790–1920

of office for a full term. He receives a salary of $10,000 a year. If the governor die, resign or be removed from office, or if his office be otherwise vacant, he is succeeded by the president of the senate, who serves until another governor is elected and qualified. The governor's appointive power is unusually large. With the advice and consent of the State senate, he selects the secretary of State, attorney-general, superintendent of public instruction, chancellor, chief justice, judges of the supreme, circuit, inferior and district courts, and the so-called "lay" judges of the court of errors and appeals, in addition to the minor administrative officers. The State treasurer, comptroller and commissioners of deeds are appointed by the two houses of the legislature in joint session.

The legislative department consists of a senate and a general assembly. In the senate each of the 21 counties has one representative, chosen for a term of three years, and about one-third of the membership is chosen each year. The members of the general assembly are elected annually, are limited to 60, and are apportioned among the counties according to population, with the important proviso, however, that every county shall have at least one member. The annual salary of senators and members of the general assembly is $500. The governor may (since 1875) veto any item in any appropriation bill, but any bill (or item) may be passed over his veto by bare majorities of all members elected to each house. Bills not returned to the legislature in five days become law, unless the legislature adjourns in the meantime. Amendments to the Constitution must first be passed by the legislature at two consecutive sessions (receiving a majority vote of all members elected to each house), and then be ratified by the voters at a special election.

The judicial system is complex and is an interesting development from the English system of the 18th century. At its head is a court of errors and appeals composed of the chancellor, the justices of the supreme court and six specially appointed justices. The latter serve for a term of six years and receive a salary of $40 per day. The supreme court consists of a chief justice and eight associate justices appointed by the governor for seven years. The chief justice receives an annual salary of $19,000; the associate justices each receive $18,000 annually. The circuit court has concurrent jurisdiction with the supreme court except in criminal cases. The 12 circuit court judges are appointed by the governor for a term of seven years, and receive an annual salary of $16,000. The court of common pleas, which may be held either by the judge of the court of common pleas (county) or by a justice of the supreme court, may hear appeals from the "small cause court," and has original jurisdiction in all civil

matters except those involving the title of real estate. The court of quarter sessions, which may likewise be held by either the judge of the court of common pleas or by a justice of the supreme court, has jurisdiction over all criminal cases except those of treason or murder. The court of oyer and terminer is a higher criminal court, and has cognizance of all crimes and offences whatever. This court is composed of any supreme court justice and the judge of the court of common pleas. Writs of error in cases punishable with death are returnable only to the court of errors and appeals. The orphans' court has jurisdiction over wills, the right of administration and guardianship, etc., but it may refer any matter coming before it to a master in chancery. The court of chancery is administered by a chancellor, ten vice-chancellors and numerous masters in chancery. Besides the ordinary chancery jurisdiction it hears all applications for divorce or nullity of marriage. The chancellor, who is appointed by the governor for a term of seven years, receives an annual salary of $19,000. Vice-chancellors are appointed by the chancellor for a term of seven years, and receive $18,000 annually. The district court is composed of 31 judges appointed by the governor for a term of five years. The jurisdiction of this court is limited to the county in which it is held; it has authority over suits of a civil nature in which the sum involved does not exceed $500. Each county has a surrogate whose duties mainly relate to will cases. In each township there are from two to five justices of the peace, and in cities, police justices. Suits involving not more than $200 and minor offenses may be tried in justice's or police courts.

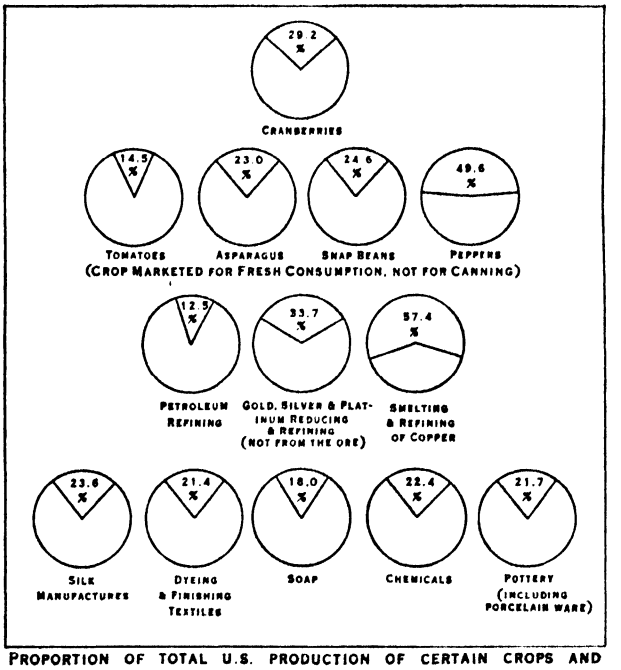
For the purposes of local Government the State is divided into counties (21), cities, townships, towns and boroughs. The Government of the towns is administered through a council, clerk, collector, assessor, treasurer, etc., chosen by popular vote; that of the townships is vested in the annual town meeting, at which administrative officers are elected. Any township with more than 5,000 inhabitants may be incorporated as a town, with its Government vested in a mayor and council. Any township or part thereof with less than 4 sq.m. of territory, and less than 5,000 inhabitants, may be incorporated as a borough, with its Government vested in a mayor and council. In 1911 a law was passed allowing cities to adopt a commission form of Government; in 1923 the city manager form was authorized.

Finances.—The State board of taxes and assessments was created in 1915 by the consolidation of the board of equalization of taxes and the State board of assessors. This board in 1928 had charge of the carrying into effect the laws levying a tax on the gross receipts of gas and electric corporations and of street railway corporations at the average tax rate of the State, in lieu of the tax on property at the local rate; the assessing of all railway and canal companies within the State; the assessing of a State franchise tax against miscellaneous corporations; and the equalization of assessments in the various counties and taxing districts. The net assessed valuation of real and personal property, exclusive of bank and trust company stock, in 1926 was $5,443,448,817; the State tax rate was $3.615 on each $100 of valuation. In the State fund, the total receipts for the year ending June 30, 1926 were $28,142,921, and the total disbursements, $27,825,430. The bonded indebtedness of the State on June 30, 1926 was $67,116,000 distributed as follows: soldiers bonus bonds, $12,000,000; State highway extension bonds, $34,000,000; State highway road bonds, $14,000,000; State highway bridge bonds, $7,000,000; and State certificates issued to the Agricultural college, $116,000.

Education.—The Russell Sage Foundation, after an exhaustive examination of the public-school system of the various States, ranked New Jersey in 1920 first among the States east of the Mississippi river, and fourth in the whole country. The public-school system is administered under the direction of a State board of education and a commissioner of education. The former consists of ten members, not more than one of whom shall be from the same county and not more than five from the same political party. At least two of the members must be women. The commissioner of education is appointed by the governor and confirmed by the senate. He decides controversies that arise under the school law, appoints county superintendents, and apportions State funds. All children between the ages of five and 20 are entitled to attend the public schools in the district in which they reside. Attendance at either of public or private school every day such school is in session is required of all children between the ages of seven and 16, unless taught at home or physically or mentally unfit to attend. Children between the ages of 14 and 16 who have completed five grades may be granted a certificate permitting them to work, but they must attend a continuation school. A pension and annuity fund law provides for teachers after reaching 62 years of age or after 35 years of service.

In 1925–26 the total enrolment of pupils was 744,266. The number of teachers was 24,405; of school buildings, 2,240. Nearly one-half of the pupils received manual or industrial training of some sort. The total expenses of operating the public schools in 1925–26 was $76,034,727. Of this amount, $57,111,205 were for instruction and maintenance and $18,923,522 were for construction and repairs. The average salary paid teachers, exclusive of superintendents and assistant superintendents, was $1,852. The private and parochial schools in 1924, according to the *Statistical Abstract*, had an enrolment of 41,214 pupils.

In addition to the regular public schools, the State maintains normal schools at Trenton, Montclair, Newark, Paterson and Glassboro, a school for the deaf at Trenton, and a Manual Training and Industrial School for Colored Youth at Bordentown. An agricultural college and experiment station has long been maintained in connection with Rutgers college, now Rutgers university, at New Brunswick. In 1918 the legislature designated Rutgers as the State University of New Jersey. The New Jersey College for Women affiliated with the State university was opened in Sept. 1918. There are industrial schools in Newark, Hoboken and Trenton supported in part by the State. Among the institutions of higher education not receiving State aid are Princeton university (*q.v.*) at Princeton; Stevens Institute of Technology at Hoboken; Upsala college at East Orange; Steon Hall college at South Orange; St. Joseph's college at Princeton; Georgian Court college at Lakewood; College of St. Elizabeth at Convent Station; Alma college at Zarephath; New Jersey Law school at Newark; Drew Theological seminary at Madison; Princeton Theological seminary at Princeton; and Immaculate Conception Theological seminary at South Orange.



PROPORTION OF TOTAL U.S. PRODUCTION OF CERTAIN CROPS AND MANUFACTURED PRODUCTS PRODUCED IN NEW JERSEY

Charities and Corrections.—The State supports the following charitable and correctional institutions all under the supervision of the State department of institutions and agencies: hos-

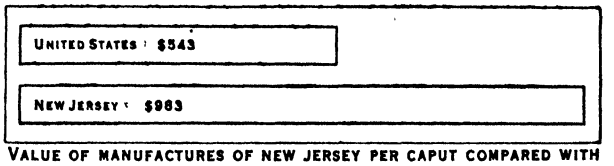
pitals for the insane at Trenton and Greystone Park; a sanatorium for tuberculous diseases at Glen Garden; a village for epileptics near Skillman; a home for feeble-minded women at Vineland; State colonies for feeble-minded males at New Lisbon and Woodbine; a home for disabled soldiers at Kearny; a home for disabled soldiers, sailors and their wives at Vineland; a reformatory for women, near Clinton and a similar institution for men at Rahway; a State home (reform school) for boys, near Jamesburg, and for girls, near Trenton; and a State prison at Trenton.

Agriculture.—The farm acreage of New Jersey steadily decreased between 1900 and 1925, the total acreage for these years being respectively 2,840,966 and 1,924,545. During the same period the number of farms decreased from 34,294 to 29,671. The average size of the farms was 64·9 ac. in 1925 as compared with 82 ac. in 1900. Only 4,723 or 15·9% of the total number of farms were operated by tenants. The value of all farm crops in 1926 was $53,100,000 as compared with $60,100,000 in 1925.

In 1926, according to the *Year Book* of the U.S. department of agriculture, the principal field crops were: potatoes, 7,250,000 bu. ($11,237,500); hay, 416,000 tons ($8,187,300); Indian corn, 8,648,000 bu. ($6,918,400); wheat, 1,320,000 bu. ($1,742,000); oats, 1,650,000 bu. ($825,000) and rye, 779,000 bu. ($740,150). New Jersey ranks among the leaders in the commercial production of many fruits. The fruit and vegetable crops have a total annual value of approximately $25,000,000. In the production of peaches (3,000,000 bu. in 1926), New Jersey is outranked by California and Georgia only.

The number and value of each of the various classes of live stock in the State on Jan. 1, 1927, were as follows: dairy cattle, 119,000 ($13,090,000); other cattle, 38,000 ($1,790,000); swine, 60,000 ($1,260,000); sheep, 6,000 ($71,000); horses, 54,000 ($5,908,000); mules, 5,000 ($590,000). The dairy industry is confined chiefly to the production of milk for consumption in New York, Philadelphia and other large cities. The value of dairy products in 1924 was $15,087,874. Poultry-raising also is an important industry; in 1924 the value of all chickens raised and eggs produced was estimated at $18,763,344.

Manufacturing.—Manufacturing has long been the leading industry of New Jersey. In 1925 the value of the products of the State's 8,204 manufacturing establishments was $3,539,181,253; wages paid to 425,377 employés amounted to $576,235,826. New Jersey ranked first among the States in the refining of petroleum, in the smelting and refining of copper, in shipbuilding, in dyeing and finishing textiles, in the manufacture of silk goods, phonographs and upholstering materials. The State's industrial importance is due, in a great part, to the excellent transportation facilities, and to the proximity of large markets and of great natural resources, such as the clays of New Jersey and the coal and iron of Pennsylvania. The chief manufacturing centres in 1925, as judged by the value of their products, were: Newark ($238,119,543), Jersey City ($139,234,933), Paterson ($94,626,268), Camden ($81,703,257), Trenton ($63,545,450), Bayonne ($53,762,760), Kearny ($49,598,897), Elizabeth ($45,060,486), Passaic ($39,140,591) and Perth Amboy ($34,685,343). Newark is the centre for electrical machinery, paints and varnishes, jewelry, tanning and finishing leather, chemicals, and bread and bakery products. Paterson's chief industries are the dyeing and finishing of textiles and the manufacture of silk. Jersey City is the centre of the State's slaughtering and meat packing industry. Trenton is famous for its pottery and porcelain ware. The ten principal industries of New Jersey, based on the value of their products in 1925, were as follows:



VALUE OF MANUFACTURES OF NEW JERSEY PER CAPUT COMPARED WITH THAT FOR THE U.S. (1925)

Industry	Wage-earners	Value in dollars
Petroleum refining	9,198	$297,288,102
Smelting and refining copper	3,362	224,039,089
Silk manufacturing	28,196	190,712,394
Electrical machinery and apparatus	23,800	151,471,610
Chemicals	11,722	122,699,466
Foundry and machine shop products	19,149	110,202,345
Motor vehicles	4,847	101,519,589
Dyeing and finishing textiles	19,270	92,442,884
Worsted goods	13,727	78,982,704
Cigars and cigarettes	8,739	67,745,767

Other manufactures valued in 1925 at more than $50,000,000 were: canning and preserving fruits and vegetables; gold, silver and platinum, reducing and refining; bread and bakery products; rubber goods; paints and varnishes; and soap.

Minerals.—The total value of the State's mineral products was $76,752,288 in 1925. The value of clay products in 1924 was $46,414,167. Of this total, the value of pottery was $25,968,314, and of brick and tile $20,445,851. The zinc output of the State in 1924 was 84,370 short tons, valued at approximately $12,800,000. In Warren and Sussex counties are abundant materials for the manufacture of Portland cement. In 1925, the chief stone products were trap rock, limestone, sandstone and granite, having a total value of $3,656,943. The manufacture of iron in New Jersey dates from 1674, when the metal was reduced from its ores near Shrewsbury, Monmouth county. The product of the iron mines in 1925 was only 164,523 long tons, valued at $678,021.

Transportation.—The total railway mileage of New Jersey on Jan. 1, 1926, according to the Interstate Commerce Commission, was 2,292 as compared with 2,352 in 1920. Owing to its geographical position, the State is crossed by all railways reaching New York city from the south and west, and all those reaching Philadelphia from the north and east. The eastern terminals of the southern and western lines running from New York city are situated on the western shore of the Hudson river, in Jersey City, Hoboken or Weehawken; whence passengers and freight are carried by ferry to New York. An exception is the Pennsylvania railway which has constructed a tunnel under the Hudson river, and established a terminal on Manhattan island. Jersey City and Hoboken are also connected with New York by electric railway tunnels under the Hudson river; the Holland Vehicular tunnel connects lower New York city with Jersey City. The 21 electric railway companies within the State operated 1,434 m. of track in 1926.

New Jersey was the first state in the Union to pass (1891) a State aid highway act. Since that early beginning, New Jersey has spent many millions of dollars in constructing and maintaining a State highway system, which on Jan. 1, 1927 consisted of 1,458 miles. Of this total 1,297 were surfaced. In 1926 a total of 657,374 motor vehicles were registered.

The water-borne commerce of New Jersey in 1926, exclusive of that of Hoboken and Jersey City which is included in the port of New York, was 1,539,468 cargo tons of imports and 402,892 cargo tons of exports. The chief ports were Bayonne, Newark, Perth Amboy and Carteret.

History.—The earliest inhabitants of New Jersey of whom there is any certain record were the Lenni-Lennapé or Delaware Indians, a branch of the Algonkin family. They were most numerous in the southern and central portions of the State, preferring the river valleys. In the year 1758 an Indian reservation, said to have been the first established within the present limits of the United States, was established at Edgepelick or Brotherton (now called Indian Mills) in Burlington county.

The first authenticated visit of a European to what is now New Jersey was made under French authority by Giovanni da Verrazano, a Florentine navigator, who in the spring of 1524 sailed within Sandy Hook and dropped anchor in the waters of upper

New York bay. In the following year Estevan Gomez, a Portuguese sailor in the service of the emperor Charles V., is said to have made note of the Hudson and Delaware rivers. Voyages to this region for exploration, trade and settlement, however, may be said to have really begun with the year 1609, when Henry Hudson explored the region between Sandy Hook and Raritan bay and sailed up the river which now bears his name. In 1614 Cornelis Jacobsen Mey explored the lower Delaware, and two years later Cornelis Hendricksen more thoroughly explored this stream. In 1623 the first party of permanent homeseekers arrived at New Amsterdam, and a portion of these formed a settlement on the eastern bank of the Delaware and built Ft. Nassau near the site of the present Gloucester City. On the western bank of the Hudson the trading post of Hobocanhackingh, on the site of the present city of Hoboken, was established at an early date. From these places and from New Amsterdam the Dutch spread into the Raritan valley.

In the meantime colonists of another nationality had set foot on the shores of the lower Delaware. In 1638, 50 Swedish colonists landed on the western bank of the Delaware and built Ft. Christina on the site of the modern Wilmington. Five years later, on the eastern bank a triangular fort, called Elfsborg, was constructed near the present Salem. But the Swedish rule was short-lived, as in 1655 the settlements surrendered to Peter Stuyvesant and passed under the control of the Dutch.

On March 12, 1664, Charles II. granted to his brother James, duke of York, all the lands between the Connecticut river and the eastern side of Delaware bay, as well as all the islands between Cape Cod and the Hudson river. An expedition was sent from England in May, under the command of Richard Nicolls, and in the following August the English flag floated over New Amsterdam. In October, Sir Robert Carr took possession of the settlements on the Delaware, and terminated the rule of the Dutch. The few inhabitants of what is now New Jersey acquiesced in the new order. While the expedition commanded by Nicolls was still at sea, the duke of York, by deeds of lease and release, transferred to Lord John Berkeley, baron of Stratton and Sir George Carteret (*q.v.*), all that part of his new possessions extending eastward from the Delaware bay and river to the Atlantic ocean and the Hudson river, and northward from Cape May to a line drawn from the northernmost branch of the Delaware, "which is 41° 40′ lat.," to the Hudson river in 41° N. latitude. To this tract the name of Nova Caesarea, or New Jersey, was given in honour of Carteret, who governed the isle of Jersey in 1643–51. In order to attract immigrants, the proprietors in Feb. 1665 published their "Concession and Agreement," by which they made provision for a governor, a governor's council, and an assembly chosen by the freemen and having the power to levy taxes. Special inducements in the way of land grants were offered to persons embarking with the first governor. In the meantime Governor Nicolls of New York, ignorant of the grant to Berkeley and Carteret, had approved certain Indian sales of land to settlers within New Jersey, and had confirmed their titles to tracts in what became known as Elizabethtown, Middletown and Shrewsbury. In 1669 trouble arose between the proprietary governor and the inhabitants of the towns of Shrewsbury and Middletown over the collection of quit-rents. This caused the duke of York to declare that the grants made by Nicolls were null and void; the king enjoined obedience to the proprietors, and quiet was restored. Another change was impending, however, and in Aug. 1673, when a Dutch fleet appeared off Staten Island, New Jersey for a second time became a part of New Netherland. The period of Dutch rule was short, and by the Treaty of Westminster, of Feb. 9, 1674, the territory was restored to England. The Crown lawyers decided that the rights of the proprietors of New York and New Jersey had been extinguished by the conquest, and that by treaty the lands had been reconveyed, not to the proprietors, but to the king. On June 13, 1674, Charles II. accordingly wrote a letter confirming the title and power of Carteret in the eastern half of New Jersey. No similar grant was made to Berkeley, as on March 18 he had sold his interest in the province to John Fenwicke, sometime major in the parliamentary army and later a member of the Society of Friends, and Edward Byllynge (d. 1687), a Quaker merchant. Financial embarrassments soon caused Byllynge to assign his share in trust for his creditors to three Quakers, William Penn, Gawen Lawrie and Nicholas Lucas. Later they acquired Fenwicke's share also. The Quakers then set about seeking a division of the province more to their advantage and, Sir George Carteret having been persuaded by the duke of York to surrender his grant of July 1674, the so-called "quintipartite deed" was executed on July 1, 1676. This instrument defined the interests of Carteret, Penn, Lawrie, Lucas and Byllynge, by fixing a line of partition from Little Egg harbour to a point on the Delaware river, in 41° 40′ N., and by assigning the province east of this line (East Jersey) to Carteret and the province west of this line (West Jersey), about five-eighths of the whole, to the Quaker associates.

A very liberal frame of Government for West Jersey, drafted presumably by William Penn, and entitled "the Concessions and Agreements of the Proprietors, Freeholders and Inhabitants of West Jersey in America," was adopted in March 1677. This vested the principal powers of Government in an assembly of 100 members, who were to be chosen annually and to be subject to instructions from their constituents. Religious toleration was assured. In Aug. 1677 the ship "Kent" arrived in the Delaware, with 230 Quakers from London and Yorkshire. These founded a settlement, which became the modern Burlington, and in the next few months several hundred more colonists arrived. But the new colony was never actually governed under "the Concessions and Agreements"; for when in 1680 the duke of York confirmed the title to the land to Byllynge and his associates he conveyed the right to govern to Byllynge alone. Although he was one of the signers of the "Concessions and Agreements," Byllynge now commissioned Samuel Jennings as governor of the province, and the other proprietors acquiesced, appointing Byllynge governor and permitting Jennings to serve as his deputy. Jennings immediately called the first assembly, and this body passed a body of fundamental laws providing for a governor and council.

The death of Sir George Carteret in 1680 gave the zealous Andros another chance to lay claim to jurisdiction over New Jersey. On April 30, 1680, a detachment of troops dragged Philip Carteret, the governor of East Jersey, from his bed and carried him prisoner to New York. Here he was confined for four weeks, and was released only on his promise not to exercise any authority until the matter could be referred to England for adjudication. When the assembly of East Jersey met in June, Andros appeared before it as governor and recommended such measures as he deemed advisable, but the deputies refused to pass them. In England, too, his conduct was disavowed and he was called home to answer charges that had been preferred against him. Sir George Carteret had bequeathed his province to eight trustees, who were to administer it for the benefit of his creditors. Early in 1682, after several unsuccessful attempts to effect a sale by other means, the province was offered for sale at public auction, and was purchased by William Penn and 11 associates for £3,400. Later each of these 12 sold one-half of his share to another associate, thus making 24 proprietors; and on March 14 the duke of York confirmed the sale, and gave them all the powers necessary for governing the province. The Government of the 24 proprietors was liberal. Recognizing the necessity of some one in the province with full power "to do all things that may contribute to the good and advancement of the same," they directed the appointment of the American Board of Proprietors—a body of men identified with the province, who with the deputy-governor were to look after the proprietary interests in such matters as the approval of legislation and the granting of lands, and thereby prevent the delay caused by the transmission of such matters to England for approval. In 1686 Perth Amboy, the newly created port of East Jersey, became its seat of Government.

After his accession to the throne in 1685, James II. showed an unyielding determination to annul the privileges of the colonies, and to unite New York, New Jersey and the New England colonies under a single Government. In order, therefore, to save their rights in the soil, the proprietors of East and West Jersey

surrendered their claims to jurisdiction. Andros, previously appointed viceroy of New England, thereupon received a new commission extending his authority over New York and the Jerseys, and in Aug. 1688 he formally annexed these provinces to the dominion of New England. The seizure of Andros by the people of Boston in April 1689, following the news of the revolt in England against James II., gave the Jersey proprietors an opportunity to resume their rights.

In April 1702 all rights of jurisdiction were transferred to the Crown, while the rights to the soil remained in the proprietors. The provinces of East and West Jersey were then united under a Government similar to that of the other royal provinces. Until 1738 the governor of New York was also governor of New Jersey; after that date each colony had its own governor. The legislature met alternately at Burlington and Perth Amboy, until 1790, when Trenton was selected as the capital of the State.

The four decades following the change to royal Government were years of development disturbed, however, by friction between the assembly and the royal governors, and by bitter disputes, accompanied by much rioting, with the proprietors concerning land-titles (1744–49). Independence of the absentee landlords was again claimed by virtue of the grants made by Nicolls nearly a century before. Agriculture at this time was the main pursuit. Between East and West Jersey certain political and religious differences developed. The former, settled largely by people from New England and Long Island, was dominated by Puritans; the latter by Quakers.

The last colonial assembly of New Jersey met in Nov. 1775. From May 26 to July 2, 1776, the second provincial congress met at Burlington, Trenton and New Brunswick and for a time became the supreme governing power. Following the recommendation of the continental congress, that the colonies should create independent Governments, the provincial congress drafted a provincial constitution, which, without being submitted to the people, was published July 3, 1776. In the State were fought some of the most important engagements of the war. When Washington, in the autumn of 1776, was no longer able to hold the lower Hudson he retreated across New Jersey to the Delaware near Trenton and seizing every boat for miles up the river he placed his dispirited troops on the opposite side and left the pursuing army no means of crossing. With about 2,500 men he recrossed the Delaware on the night of Dec. 25, surprised three regiments of Hessians at Trenton the next morning, and took 1,000 prisoners and 1,000 stands of arms. In a series of movements following up his success he outgeneraled the British commander, Lord Cornwallis and on Jan. 3, 1777, defeated a detachment of his army at Princeton (*q.v.*). The American army then went into winter quarters at Morristown. As the British army under Gen. Clinton was retreating, in June 1778, from Philadelphia to New York, the American army engaged it in the battle of Monmouth (June 28, 1778); the result was indecisive.

After the war New Jersey found its commercial existence threatened by New York and Philadelphia, and it was a feeling of weakness from this cause rather than any lack of State pride that caused the State to join in the movements for a closer Federal Union. In the Federal convention at Philadelphia one of the New Jersey delegates, William Paterson (1745–1800), presented what was called the "New Jersey plan" of union, representing the wishes of the smaller States, which objected to representation in a National Congress being based on wealth or on population. The New Jersey plan left its impress in the provision of the Constitution (approved in the convention on July 7) for equal representation in the national Senate. The Federal Constitution was ratified by a unanimous vote in the State convention which met at Trenton on Dec. 18, 1787.

The State's own Constitution, which had been adopted in 1776 and amended in 1777, retained a number of features of colonial Government ill-adapted to a State increasingly democratic. The basis of representation was the county rather than population; property qualifications were placed on members of the legislative council and of the assembly. These and the property qualifications for suffrage, which was granted to "all inhabitants of this State of full age, who are worth 50 lb. proclamation money, clear estate in the same," etc., were soon considered undemocratic; and the democratic tendency of certain election officers may be seen from their construing the words "all inhabitants of full age" to include women, and from their permitting women to vote.

Agitation for constitutional reform resulted in a constitutional convention, which met at Trenton from May 14 to June 29, 1844, and drafted a new frame of government, introducing a number of radical changes. This instrument was ratified on Aug. 13 at the polls. The election of the governor was taken from the legislature and given to the people; the powers of Government were distributed among legislative, executive and judicial departments; representation in the assembly was based on population; and the property qualification was abolished.

Toward the political questions that disturbed the American people immediately before the Civil War the attitude of the State was conservative, although a few vestiges of the slavery system remained until the adoption of the 13th amendment to the Federal Constitution. In 1852 the free-soil candidate for the presidency received only 350 votes in New Jersey; and in 1856 the Democratic candidate received a plurality of 18,605 votes, even though William L. Dayton, a citizen of the State, was the Republican nominee for the vice-presidency. In 1860 three of the State's electoral votes were given to Douglas and four to Lincoln. During the Civil War New Jersey furnished 89,305 men for the Union cause and incurred extraordinary expenditures to the amount of $2,894,385. The State readily consented to the 13th and 14th amendments to the Federal Constitution, but in 1868 withdrew its consent to the latter. The 15th Amendment was rejected by one legislature, but was accepted by its successor, in which the Republican Party had obtained a majority.

Industrially the early part of the 19th century was marked in New Jersey by the construction of bridges and turnpikes, the utilization of water power for manufactures, and the introduction of steam motive power upon the navigable waters. The war of 1812 with England interrupted this material progress, and at its beginning was so unpopular, especially with the Quakers, that the Federalists carried the elections in the autumn of 1812. Material progress in New Jersey after the war is indicated by the construction of the Morris (1824–36) and the Delaware and Raritan (1826–38) canals, and the completion of its first railway, the Camden and Amboy, in 1834.

In the years following the Civil War there was a bitter railway war. New Jersey, in order to encourage canals and railways, had granted monopolistic privileges to several of the earlier companies; by consolidation they had virtually gained a monopoly over the route between New York and Philadelphia. In 1871 these entire properties were leased for 999 years to the Pennsylvania Railway Company. This combination threatened to monopolize traffic, and it was opposed by several of the newer railways and by the general public; in 1873 the State passed a general railway law giving other railways than the Pennsylvania the right to connect New York and Philadelphia.

This same period was marked by great industrial development. Towards corporations the policy of New Jersey was very liberal; there was no limit fixed either to capitalization or to bonded indebtedness; and the tax rate was lower for large than for small corporations. Under this liberal policy so many large combinations of capital were incorporated under the laws of the State that it was sometimes called "the home of the trusts." This method of encouraging corporations was reversed by the passage in 1913 of a series of acts widely known as the "Seven Sisters," the purpose of which was the elimination of the power of trusts to create monopoly, limitation of production, price fixing and restraint of trade. In the meantime laws had been passed limiting public service franchises to 20 years, unless extended to 40 years by the voters of the municipality concerned. The laws governing elections were radically changed in 1911 and subsequently, by provisions extending the application of the direct primary law and providing the blanket ballot and safeguards against frauds. A proposed amendment to the State Constitution in 1915 giving women full suffrage was defeated by over 50,000 votes. By enlightened

labour legislation, New Jersey has done much in promoting the safety and health of the State's large industrial population.

Before 1800 the State was dominated by the Federalist Party; from that date until 1896, except in the Civil War period, it was generally controlled by the Democrats, and from 1896 to 1911 by the Republicans. In the elections for the State executive the Democratic Party was successful from 1910–28 with the exception of the election in 1916. From 1914 the Republicans controlled both branches of the legislature.

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NEW JERSEY TEA (*Ceanothus americanus*), a North American shrub of the buckthorn family (Rhamnaceae), called also red-root, native to dry open woods and gravelly banks from Maine to Manitoba and southward to Florida and Texas. Its low, branching stems, 1 to 3 ft. high, which spring from a dark red root, bear ovate, three-ribbed, somewhat downy, toothed leaves and attractive white flowers in umbel-like clusters. During the Revolutionary War the leaves were used as tea. (*See* CEANOTHUS.)

NEW JERUSALEM CHURCH or NEW CHURCH, the community founded by the followers of Emmanuel Swedenborg (*q.v.*). Swedenborg himself took no steps to found a church, but having given a new interpretation of Scripture, it was inevitable that those who accepted his doctrine should separate themselves and organize a society in accordance therewith. Those who received them fully during Swedenborg's lifetime were few and scattered, but courageously undertook the task of dissemination, and gave themselves to translating and distributing their master's writings. Two Anglican clergymen were conspicuous in this work: Thomas Hartley (d. 1784), rector of Winwick, and John Clowes (1743–1831), vicar of St. John's, Manchester. Hartley translated *Heaven and Hell* (1778) and *True Christian Religion* (1781); Clowes, who taught New Church doctrine in the existing churches and was opposed to the forming of new organizations, translated 17 volumes, including the *Arcana Coelestia,* and published over 50 volumes of exposition and defence. Through his influence Lancashire became the stronghold of the Swedenborgians.

The first organised congregation of Swedenborgians met in a church in Great Eastcheap in January 1788; and in April 1789 a General Conference of British Swedenborgians was held in Great Eastcheap Church, followed by another and by the publication of a journal, the *New Jerusalem Magazine,* in 1790. In the provinces the first church was at Birmingham (1791), followed by one at Manchester and another at Liverpool (1793). The Accrington church, the largest in Great Britain, was founded in 1802. Many of the early converts to the New Church were among the most fervent advocates of the abolition of slavery, one was the medical officer of the first batch of convicts sent to Botany Bay.

In 1815 the Conference took up the question of home missionary work, and its agents were able to found many branches of the church. In 1813 the Manchester and Salford (now the North of England) Missionary Society was founded, chiefly to provide preachers for the smaller churches in its area; in 1857 a National Missionary Institution was founded and endowed, to which most of the local ones have been affiliated. Other denominational agencies have been concerned with the printing and circulation of Swedenborgian literature, a training college for the ministry (founded in 1852), and a Ministers' Aid Fund (1854), and an Orphanage (1881). The constitution of the New Church is of the Independent Congregational type; the Conference may advise and counsel, but cannot compel the obedience of the societies. Returns for 1928 showed 70 societies with about 6,300 members.

The New Church in Europe.—In Sweden the Philanthropic Exegetic Society was formed by C. F. Nordenskiold in 1786 to collect documents about Swedenborg and to publish his writings. The introduction of alchemy and mesmerism led to its dissolution in 1789, but its work was continued by the society "Pro fide et charitate," which existed from 1796 to 1820. For many years the works of Swedenborg and his followers were proscribed, and receivers of his writings fined or deprived of office, but in 1866, when religious liberty had made progress, the cause was again taken up; in 1875 the society of "Confessors of the New Church" was formed in Stockholm, and propaganda has been carried on in most of the towns of Sweden, as also in Norway and Denmark. In Germany the great name is that of Immanuel Tafel (d. 1863), librarian of Tübingen, who not only edited, translated and published, but in 1848 founded a "Union of the New Church in Germany and Switzerland" which held quarterly meetings. In Switzerland, on the contrary, there is an organized body of the New Church. In France about 1838 J. F. E. Le Boys de Guays began his masterly translation of all Swedenborg's theological works; and nearly every European country has some known adherents.

In America.—About 1784 James Glen, a London Scot, delivered lectures in Philadelphia and Boston and circulated some of Swedenborg's works. Francis Bailey, state printer of Pennsylvania, was attracted by them and became active in their promulgation. During the next ten years a number of prominent men gave their support to the teaching, which spread inland and southward.

In Australia, etc.—The formation of societies in Australia began at Adelaide in 1844. Melbourne and Sydney followed in 1854, Brisbane in 1865. New Zealand has a church at Auckland (1883). Mission churches have been established in Japan, the Philippine Islands and British Guiana; and in 1910 David W. Mooki organized a Church for the natives of South Africa.

See L. P. Mercer, *The New Jerusalem in the World's Religious Congresses of 1893; Minutes of the General Conference of the New Church* (annual); *Journal of the Annual Session of the General Convention of the New Jerusalem in the United States of America.*

NEW KENSINGTON, a borough of Westmoreland county, Pennsylvania, U.S.A., on the Allegheny river and the Pennsylvania railroad, 18 m. N.E. of Pittsburgh. Pop. 11,987 in 1920 (24% foreign-born white); estimated locally at 14,500 in 1928. It is a coal-mining centre, and has important manufactures (including tin plate, glass, white lead, aluminum, malleable iron

and car springs), with an output in 1925 valued at $30,680,293. The borough was founded in 1891 and incorporated in 1892.

NEW LONDON, a city of south-eastern Connecticut, U.S.A., on the west bank of the Thames river, 3 m. from Long Island sound; a port of entry and one of the county seats of New London county. It is on Federal highway 1, and is served by the Central Vermont and the New York, New Haven and Hartford railways, and steamship lines. Pop. (1920) 25,688 (23% foreign-born white); 1928 local estimate 35,000. The city, facing south-east, lies on sloping ground which commands wide views of the sound and the surrounding country from its higher points. The fine natural harbour is a U.S. submarine base, and on Fisher's island (8 m. S.E.) is Ft. H. G. Wright, headquarters of the Long Island Sound harbour defences. At the entrance to the harbour, on either side of the river, stand Ft. Trumbull and Ft. Griswold (no longer in use). New London is a summer resort and a station of several yacht clubs. The annual boat races between Harvard and Yale are rowed on the river near the city. Among the points of special interest are the town mill (1650); the Hempstead mansion (1678); the old cemetery north-east of the city, laid out in 1653; a school-house in which Nathan Hale taught; and a court-house built in 1785. At Ft. Trumbull is the U.S. Coast Guard academy and section base. The Connecticut College for Women (chartered 1911) occupies 350 ac. within the city limits. Two endowed high schools and an endowed industrial school are included in the public school system. The traffic of the harbour (which has a 1,000 ft. pier built by the State in 1917) amounted to 631,044 tons in 1925, valued at $280,697,973, and consisted largely of general merchandise. Foreign trade was represented by imports of lumber ($160,000) and exports of automobiles ($1,254,600). The city's varied manufactures were valued in 1925 at $13,375,367. The assessed valuation for 1926 was $42,613,315. New London was founded in 1646 by John Winthrop the younger. In 1658 the present name was substituted for the Indian "Nameaug" and the river Monhegin became the Thames. The city was incorporated in 1784. In the 18th century New London had a large trade with the West Indies, Gibraltar and the Barbary States, but this declined after the War of 1812. It was also an important whaling and sealing port. During the Revolution it was a rendezvous for privateers. The first naval expedition was organized in its harbour in 1776.

NEW LONDON, a city of Wisconsin, U.S.A., on the Wolf river, 20 m. N.W. of Lake Winnebago, in Outagamie and Waupaca counties. It is served by the Chicago and North Western and the Green Bay and Western railways. Pop. (1920), 4,667. It is a dairying region and has various manufacturing industries.

NEW MADRID, a city and the county seat of New Madrid county, Mo., U.S.A., on the right bank of the Mississippi river, about 35 m. S. by W. of Cairo, Ill. Pop. (1910) 1,882; (1920) 1,908. It is served by the St. Louis Southwestern railway and by river barges. The city is a shipping point for a rich grain, cotton, live stock and lumber region. Among its manufactures are lumber, staves and hoops. The municipality owns its waterworks. Owing to the encroachments of the Mississippi river, the site of the first permanent settlement of New Madrid is said to lie now about 1½ m. from the east bank of the river, in Kentucky. This settlement was made in 1788, on an elaborately laid out town site, and was named New Madrid by its founder, Col. George Morgan (1742–1810), who, late in 1787, had received a grant of a large tract of land on the right bank of the Mississippi river from Don Diego de Gardoqui, Spanish minister to the United States. The tract lay within the province of "Louisiana," and the grant to Morgan was a part of Gardoqui's plan to annex to that province the western American settlements. Earthquake shocks in 1811 and 1812 caused a general emigration.

New Madrid was occupied by Confederate troops under Gen. Gideon J. Pillow, on July 28, 1861, and after the surrender of Ft. Donelson (Feb. 16, 1862) the troops previously at Columbus, forming the Confederate left flank, were withdrawn to New Madrid and Island No. 10 (in the Mississippi about 10 m. S.). Early in March, Major-General John Pope and Commodore A. H. Foote proceeded against the positions on the left bank; New Madrid, then in command of Gen. John P. McGown, was evacuated on the 14th; (Admiral) Henry Walke (1808–96), commanding the "Carondelet," ran past the batteries of Island No. 10 and the shore batteries on April 4, and Lieutenant-Commander Egbert Thompson, commanding the "Pittsburgh," on the 7th; meanwhile the Federals under the direction of Col. Josiah W. Bissell (b. 1818), of the engineer corps, had, with great difficulty, constructed an artificial channel to New Madrid across the peninsula (swamp land) formed by a great loop of the Mississippi; troops were conveyed by transports through this channel below the island, Federal batteries having been established on the right bank of the river; the retreat of the Confederates down stream was effectually blocked; they evacuated the island on April 7, and on the 8th the garrison and the forces stationed in the shore batteries, a total of about 7,000, under Gen. W. W. Mackall, was surrendered at Tiptonville.

NEWMAN, FRANCIS WILLIAM (1805–1897), English scholar and miscellaneous writer, younger brother of Cardinal Newman, was born in London on June 27, 1805. He was educated at Ealing, and at Oxford, where he was elected fellow of Balliol in 1826. Conscientious scruples respecting the ceremony of infant baptism led him to resign his fellowship in 1830, and he went to Baghdad as assistant in the mission of the Rev. A. N. Groves. In 1833 he returned to England on behalf of the mission, but finding himself suspected of heterodoxy, he became classical tutor in an unsectarian college at Bristol. In 1840 he became professor of Latin in Manchester New College, the Unitarian seminary long established at York, and the parent of Manchester college, Oxford. In 1846 he became professor in University college, London, where he remained until 1869. In 1847 he published anonymously a *History of the Hebrew Monarchy*, intended to introduce the results of German investigation in this department of Biblical criticism. In 1849 appeared *The Soul, her Sorrows and Aspirations*, and in 1850, *Phases of Faith, or Passages from the History of my Creed*—the former a tender but searching analysis of the relations of the spirit of man with the Creator; the latter a religious autobiography detailing the author's passage from Calvinism to pure theism. It is on these two books that Prof. Newman's fame rests, though he was a versatile writer on many subjects. His last publication, *Contributions chiefly to the Early History of Cardinal Newman* (1891), was severely criticised. He died at Weston-super-Mare on Oct. 7, 1897.

See T. G. Sieveking, *Memoir and Letters of Francis W. Newman* (1909).

NEWMAN, JOHN HENRY (1801–1890), English cardinal, was born in London on Feb. 21, 1801, the eldest son of John Newman, banker, of the firm of Ramsbottom, Newman and Company. At the age of seven Newman was sent to a private school conducted by Dr. Nicholas at Ealing. At the age of 15 he experienced "conversion," an incident which throughout life remains "more certain than that he had hands or feet." In 1816 he matriculated at Trinity college, Oxford. After graduation in 1821 he took pupils and read for a fellowship at Oriel, to which he was elected in 1822. Two years later he was ordained, and became curate of St. Clement's, Oxford. For a year he was vice-principal of the St. Alban's hall, but in 1826 he became tutor at Oriel. In 1827 he was appointed vicar of St. Mary's (to which was attached the chapelry of Littlemore) and in 1831–32 was select preacher before the university. In 1832 a difference with Hawkins, provost of Oriel, on the "substantially religious nature" of a tutorship, led to his resignation from that post. He then went for a tour on the Mediterranean with R. H. Froude, but at that time was still strongly Protestant in his views, as his comments on his stay in Rome show. During this tour he wrote many of the poems in the *Lyra Apostolica*, and "Lead, Kindly Light."

Tractarian Movement.—He was at home again in Oxford on July 9, 1833, and on the 14th Keble preached at St. Mary's an assize sermon on "National Apostasy," which Newman afterwards regarded as the inauguration of the Oxford Movement. In the words of Dean Church, it was "Keble who inspired, Froude who gave the impetus and Newman who took up the work"; but the first organization of it was due to H. J. Rose, editor of the

British Magazine, who has been styled "the Cambridge originator of the Oxford Movement." It was in his rectory house at Hadleigh, Suffolk, that a meeting of High Church clergymen was held, July 25–29 (Newman was not present), at which it was resolved to fight for "the apostolical succession and the integrity of the Prayer-Book." A few weeks later, Newman started, apparently on his own initiative, the *Tracts for the Times*, from which the movement was subsequently named "Tractarian." Its aim was to secure for the Church of England a definite basis of doctrine and discipline, in case either of disestablishment or of a determination of High Churchmen to quit the establishment. The teaching of the tracts was supplemented by Newman's Sunday afternoon sermons at St. Mary's, the influence of which was very great during the next eight years. In 1835 Pusey joined the movement, which, so far as concerned ritual observances, was later called "Puseyite"; and in 1836 its supporters secured further coherence by their united opposition to the appointment of Hampden as regius professor of divinity. His Bampton lectures (in the preparation of which Blanco White had assisted him) were suspected of heresy, and this suspicion was accentuated by a pamphlet put forth by Newman, *Elucidations of Dr. Hampden's Theological Statements*.

At this date Newman became editor of the *British Critic*, and he also gave courses of lectures in a side-chapel of St. Mary's in defence of the *via media* of the Anglican Church as between Romanism and popular Protestantism. His influence in Oxford was supreme about the year 1839, when, however, his study of the monophysite heresy first raised in his mind a doubt as to whether the Anglican position was really tenable on those principles of ecclesiastical authority which he had accepted; and this doubt returned when he read, in Wiseman's article in the *Dublin Review* on "The Anglican Claim," the words of St. Augustine against the Donatists, *securus iudicat orbis terrarum*, words which suggested a simpler authoritative rule than that of the teaching of antiquity. He continued his work, however, as a High Anglican controversialist until he had published, in 1841, *Tract 90*, the last of the series, in which he put forth, as a kind of proof charge, to test the tenability of all Catholic doctrine within the Church of England, a detailed examination of the XXXIX Articles, suggesting that their negations were not directed against the authorized creed of Roman Catholics, but only against popular errors and exaggeration. This theory, though not altogether new, aroused much indignation in Oxford, and, at the request of the bishop of Oxford, the publication of the *Tracts* came to an end. At this date Newman also resigned the editorship of the *British Critic*, and was thenceforth, as he himself later described it, "on his deathbed as regards membership with the Anglican Church." He now concluded that the position of Anglicans was similar to that of the semi-Arians in the Arian controversy; and the arrangement made at this time that an Anglican bishopric should be established in Jerusalem, the appointment to lie alternately with the British and Prussian Governments, was to him further evidence of the non-apostolical character of the Church of England. In 1842 he withdrew to Littlemore, and lived there under monastic conditions with a small band of followers, their life being one of great physical austerity as well as of anxiety and suspense. To his disciples there he assigned the task of writing lives of the English saints, while his own time was largely devoted to the completion of an essay on the development of Christian doctrine, by which principle he sought to reconcile himself to the elaborated creed and the practical system of the Roman Church. In Feb. 1843 he published, as an advertisement in the *Oxford Conservative Journal*, an anonymous but otherwise formal retractation of all the hard things he had said against Rome; and in September, after the secession of one of the inmates of the house, he preached his last Anglican sermon at Littlemore and resigned the living of St. Mary's.

Reception into the Catholic Church.—But still an interval of two years elapsed before he was formally received into the Roman Catholic Church (Oct. 9, 1845) by Father Dominic, an Italian Passionist. In Feb. 1846 he left Oxford for Oscott, where Bishop Wiseman, then vicar-apostolic of the Midland district, resided; and in October he proceeded to Rome, where he was ordained priest and was given the degree of D.D. by the pope. At the close of 1847 he returned to England as an Oratorian, and resided first at Maryvale (near Oscott); then at St. Wilfrid's college, Cheadle; then at St. Ann's, Alcester street, Birmingham; and finally at Edgbaston, where spacious premises were built for the community, and where (except for four years in Ireland) he lived a secluded life for nearly 40 years. Before the house at Edgbaston was occupied he had established the London Oratory, with Father Faber as its superior, and there (in King William street, Strand) he delivered a course of lectures on "The Present Position of Catholics in England," in the fifth of which he protested against the anti-Catholic utterances of Dr. Achilli, an ex-Dominican friar, whom he accused in detail of numerous acts of immorality. Popular Protestant feeling ran very high at the time, partly in consequence of the recent establishment of a Roman Catholic diocesan hierarchy by Pius IX., and criminal proceedings against Newman for libel resulted in an acknowledged gross miscarriage of justice. He was found guilty, and was sentenced to pay a fine of £100, while his expenses as defendant amounted to about £14,000, a sum that was at once raised by public subscription, a surplus being spent on the purchase of Rednall, a small property picturesquely situated on the Lickey hills, with a chapel and cemetery, where Newman now lies buried.

In 1854, at the request of the Irish bishops, Newman went to Dublin as rector of the newly-established Catholic university there. But practical organization was not among his gifts, and the bishops became jealous of his influence, so that after four years he retired, the best outcome of his stay there being a volume of lectures entitled *Idea of a University*, containing some of his most effective writing. In 1858 he projected a branch house of the Oratory at Oxford; but this was opposed by Manning and others, as likely to induce Catholics to send their sons to that university, and the scheme was abandoned. In 1859 he established, in connection with the Birmingham Oratory, a school for the education of the sons of gentlemen on lines similar to those of the English public schools, an important work in which he never ceased to take the greatest interest. But all this time (since 1841) Newman had been under a cloud, so far as concerned the great mass of cultivated Englishmen, and he was now awaiting an opportunity to vindicate his career; and in 1862 he began to prepare memoranda for the purpose.

Works.—The occasion came when, in Jan. 1864, Charles Kingsley, reviewing Froude's *History of England* in *Macmillan's Magazine*, incidentally asserted that "Father Newman informs us that truth for its own sake need not be, and on the whole ought not to be, a virtue of the Roman clergy." After some preliminary sparring between the two, Newman published, in bi-monthly parts, his *Apologia pro vita sua*, a religious autobiography of unsurpassed interest, the simple confidential tone of which "revolutionized the popular estimate of its author," establishing the strength and sincerity of the convictions which had led him into the Roman Catholic Church.

In 1870 he put forth his *Grammar of Assent*, the most closely reasoned of his works, in which the case for religious belief is maintained by arguments differing somewhat from those commonly used by Catholic theologians; and in 1877, in the republication of his Anglican works, he added to the two volumes containing his defence of the *via media* a long preface and numerous notes in which he criticized and replied to sundry anti-Catholic arguments of his own in the original issues. At the time of the Vatican Council (1869–70) he was known to be opposed to the definition of Papal infallibility, and in a private letter to his bishop (Ullathorne), surreptitiously published, he denounced the "insolent and aggressive faction" that had pushed the matter forward. But he made no sign of disapproval when the doctrine was defined, and subsequently, in a letter nominally addressed to the duke of Norfolk on the occasion of Mr. Gladstone's accusing the Roman Church of having "equally repudiated modern thought and ancient history," Newman affirmed that he had always believed the doctrine, and had only feared the deterrent

effect of its definition on conversions on account of acknowledged historical difficulties.

In 1878 his old college (Trinity), to his great delight, elected him an honorary fellow, and he revisited Oxford after an interval of 32 years. At the same date died Pope Pius IX., who had long mistrusted him; and Leo XIII. was encouraged by the duke of Norfolk and other distinguished Roman Catholic laymen to make Newman a cardinal, the distinction being a marked one, because he was a simple priest and not resident in Rome. The offer was made in Feb. 1879, and the announcement of it was received with universal applause throughout the English-speaking world. The "creation" took place on May 12, with the title of St. George in Velabro, Newman taking occasion while in Rome to insist on the lifelong consistency of his opposition to "liberalism in religion." After an illness that excited apprehension he returned to England, and thenceforward resided at the Oratory until his death, Aug. 11, 1890, making occasional visits to London, and chiefly to his old friend, R. W. Church, dean of St. Paul's, who as proctor had vetoed the condemnation of *Tract 90* in 1841.

Personality.—Newman's influence as controversialist and preacher was very great. Although he never called himself a mystic, he showed that, in his judgment, spiritual truth is apprehended by direct intuition, as an antecedent necessity to the professedly purely rational basis of the Roman Catholic creed. Within the Anglican Church, and even within the more strictly Protestant Churches, his influence was greater, but in a different direction, viz., in showing the necessity of dogma and the indispensableness of the austere, ascetic, chastened and graver side of the Christian religion. If his teaching as to the Church was less widely followed, it was because of doubts as to the thoroughness of his knowledge of history and as to his freedom from bias as a critic. Some hundreds of clergymen, influenced by the movement of which for ten or twelve years he was the acknowledged leader, made their submission to the Church of Rome. The natural tendency of his mind is often (and correctly) spoken of as sceptical. He held that, apart from an interior and unreasoned conviction, there is no cogent proof of the existence of God; and in *Tract 85* he dealt with the difficulties of the Creed and of the canon of Scripture, with apparent implication that they are insurmountable unless overridden by the authority of an infallible Church. In his own case these views did not lead to scepticism, because he had always possessed the necessary interior conviction.

He was a man of magnetic personality, with an intense belief in the significance of his own career; and his character may be described as feminine, both in its strength and in its weakness. As a poet he had inspiration and genuine power. "The Dream of Gerontius," is generally recognized as a masterpiece. His prose style is fresh and vigorous.

There is at Oxford a bust of Newman by Woolner. His portrait by Ouless is at the Birmingham Oratory, and his portrait by Millais is in the possession of the duke of Norfolk, a replica being at the London Oratory. Outside the latter building, facing Brompton road, is a marble statue of Newman as cardinal.

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NEWMARCH, WILLIAM (1820–1882), English economist and statistician, was born at Thirsk, Yorkshire, on Jan. 28, 1820. He was secretary of the Globe Insurance Company (1851–62), and chief officer in the banking-house of Glyn, Mills and Co., (1862–81). He was one of the honorary secretaries, editor of its journal, and in 1869–71 president of the Royal Statistical Society and a fellow of the Royal Society. Newmarch died at Torquay on March 23, 1882. After his death his friends founded in his memory, a Newmarch lectureship in economic science at University college, London.

He was the author of an essay, published in 1855, *On the Loans raised by Mr. Pitt during the first French War, 1793–1801, with some statements in defence of the Methods of Funding employed.*

NEWMARKET, a market town of Cambridgeshire, England, 13½ m. E. by N. of Cambridge, on the Bury branch of the L.N.E. railway. Pop. of urban district (1921), 9,767. A part of the town is in Suffolk, and the urban district is in the administrative county of West Suffolk. Newmarket has been celebrated for its horse-races from the time of James I., though at that time there was more of coursing and hawking than horse-racing. Charles I. instituted the first cup race here. The race-course, which lies south-west of the town, has a full extent of 4 m., but is divided into different lengths to suit various races. It intersects the Devil's Ditch or Dyke (sometimes also known as St. Edmund's Dyke) an earthwork consisting of a ditch and mound about 7½ m. long. It starts south-east of the Swaffham-Burwell road, and the ditch has a depth of 15 ft., the slope from the top of the dyke to the bottom of the ditch measures 62 ft., while the overall breadth of dyke and ditch is 37 yards. From negative evidence it is surmised that it belongs to the Iron age, and that the builders were the Iceni. Roman remains have been found in the neighbourhood, and in later times the dyke formed part of the boundary of East Anglia. (*See* C. Fox, *Archaeology of the Cambridge Region*, 1923.)

NEW MEXICO, popularly known as the "Sunshine" State, is situated in the south-western part of the United States between 31° 20′ and 37° N. lat., and 103° and 109° W. longitude. It is bounded north by Colorado; east by Oklahoma and Texas; south by Texas and the republic of Mexico; and west by Arizona. It has an extreme length north and south of 400 m., and extreme width east and west of 358 m. and a total area of 122,634 sq.m., of which 131 sq.m. are water surface.

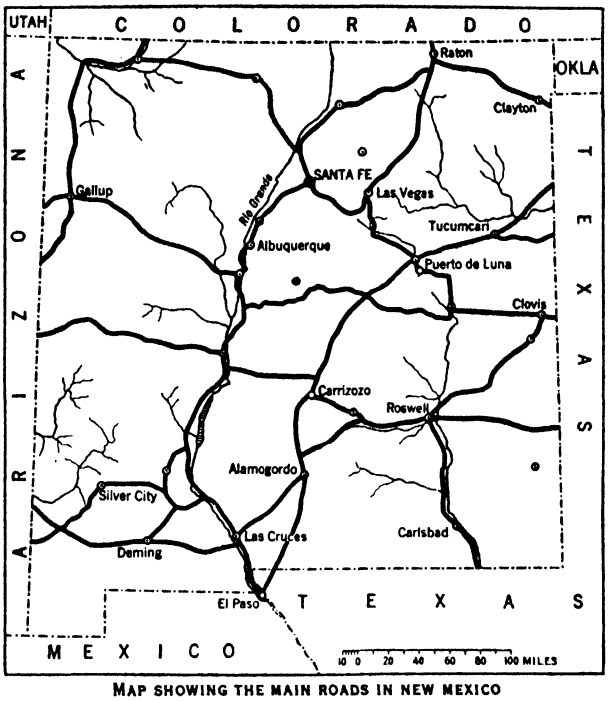
Physical Features.—The borders of the State are characterized by high plateaux cut by deep canyons, while in the central part faulted mountains surround comparatively level areas filled with alluvial deposits. Between the Rio Grande and the Staked plains the mountains form a more continuous range than on the west side of the river where the elevated areas form the main continental divide. The Sangre de Cristo mass is a part of the Colorado mountains which extend into New Mexico slightly east of the north-central part of the State and east of the Rio Grande. South of this northern mass two series of ridges extend to the southern boundary: the one near the Rio Grande, called in places from north to south the Sandía, the Manzano, the San Andrés, the Oscura and the Organ mountains; while the eastern group consists of the Hills of Pedernal, the White, the Sacramento and the Guadalupe mountains.

On the west side of the Rio Grande the San Juan mountains dominate the country north of the Chama river. A second somewhat smaller mass lies between the Chama and the Jemez river, the Jemez mountains. Across the Puerco the Mount Taylor mountains carry the main divide in a south-western direction to the Chusca and Zuñi mountains, which are continued farther south in one of the largest mountain masses of the State, the Mogollons, with the San Mateo and the Magdalena as outlying ridges in the direction of the Rio Grande, and the Black Range forming the south-eastern part. In the extreme south-western part of the State the western mountains terminate in several parallel ridges; the Burro, the Pyramid, the Big Hatchet and the Peloncillo mountains.

The major divides following the tops of the ranges and high plateaux run generally north and south. Of the most important

there may be mentioned the divides between the Pecos and the Canadian valleys; between the Pecos and Tularosa valleys; between the Tularosa and the Rio Grande; and between the Rio Grande and the San Juan, Little Colorado and Gila valleys.

The rivers are the only important bodies of water that make up a part of the physiography of the State. In the north-eastern part of the State, in Union county, two of the branches of the



MAP SHOWING THE MAIN ROADS IN NEW MEXICO

Arkansas river have their sources. These are the Cimarron and the North Canadian rivers. A third branch of the Arkansas, the Canadian, flows through Colfax, Mora, San Miguel and Quay counties. As the Canadian drains the eastern part of the Sangre de Cristo Range, so the Pecos river receives the water from the southern part of the range and flows in a southerly direction across the State. The Rio Grande is the only important river in New Mexico that does not have its source within the State. It enters New Mexico in a deep canyon a short distance to the east of the 106 meridian, and flows south through the centre of the State. On the western side of the continental divide the principal rivers are the San Juan, Little Colorado and Gila, tributaries of the Colorado which flows to the Gulf of California.

The principal characteristics of the arid soils of New Mexico are: a large amount of mineral matter; a small amount of organic matter; deep soils; and a marked degree of productivity when irrigated.

Climate.—The winter rainy season is created by comparatively dry westerly winds blowing from the Pacific, coming into New Mexico from the north-east and north-west. In the summer the place of these winds is taken by a monsoon wind from the south, south-west or south-east. When they reach the mountainous districts of New Mexico they are cooled. This results in giving New Mexico a summer period of sub-tropical monsoon rains. The average rainfall for the State is about 15 in. annually. On some sections of the southern plains it is as low as 6 in. while in the mountain districts of the north it rises to 25 or 30 inches. The skies are generally clear and sunshine is abundant; the days are warm but the nights are cool. At Santa Fe, where the mountains and plains meet, the mean annual temperature is 48·8° F; the mean for the winter is 30·9° and for the summer 67°; and the highest and lowest temperatures ever were 97° and −13°.

Flora and Fauna.—The physiographical conditions of New Mexico determine, in a measure, the distribution of plants and animals. Six life zones are represented in the State, due to variation in altitude which is a striking characteristic of mountainous areas. The Lower Sonoran is the zone of mesquite, occupying the valleys of the southern part of the State. For agricultural purposes it is the most important of the zones, due to the long growing period and the high temperatures. The woody plants of this region include the creosote bush, the Spanish bayonet, the screw bean, the desert willow, and valley cottonwood. Cactuses in a variety of species are a part of the flora of this zone.

Among the mammals there are a number of species of rats, mice, squirrels, rabbits, skunks and bats. There are also the jaguar, the New Mexico desert fox, the Mearns coyote, the Mexican badger and the New Mexico weasel. The birds are numerous.

The Upper Sonoran, the largest of the zones, ranks first in economic wealth. It embraces the grazing lands that include about three-fourths of the State, or 92,000 square miles. The grasses that give this zone its value are the grama, the galleta, buffalo and porcupine. Several species of deer, coyotes, antelopes, wolves, prairie dogs and mountain sheep are common to the area.

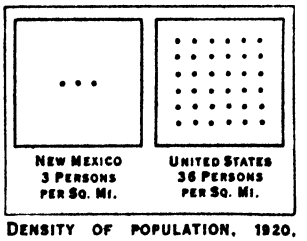
The Transition zone, covering about 10,000 sq.m., is the section of the State important for timber. Very little agriculture is carried on, but there is good range for stock. The Merriam elk, Rocky mountain lion, Mexican mountain lion, the mountain bobcat, mountain coyote, Mexican wolf, black bear, grizzly bear, otter and mink are found in this zone.

The Canadian zone is about one-fifth the size of the Transition. Its importance lies in the water-supply that it stores for the regions of lower altitude. Its lowest parts on the cold slopes are at an altitude of 8,500 feet. The trees found are the Bristol cone pine, the western white pine, Douglas spruce and the balsam.

The Hudsonian is a very narrow zone along the timber line on the upper slopes of the high mountains with an area of 300 square miles. The trees and shrubs include the Siberian juniper, Englemann's fir, Parry's fir, several species of currants and sedges. The mammals are few, being mountain sheep, Rocky Mountain woodchuck, the grey and dusky rock cony.

The Arctic-Alpine is the smallest of the life zone represented in New Mexico. The area is above the timber line, at about 12,500 feet. Among the plants are the Colorado poppy, several species of saxifrages, sedges and rushes, the dwarfed closed gentian, alpine larkspur, alpine sagebrush. Few mammals enter the region.

Population.—The Indians of New Mexico constitute an interesting part of the population. They consist of two types: the nomadic Indians who have been settled on reservations by the U.S. Government; and the Pueblo Indians, who live a communal life which was well established long before the Spanish came to the New World. There are 18 subdivisions of the latter group living mainly in the Rio Grande valley. The social system is based upon the family as the main unit, dominated by the mother who is the owner of the home. The total Indian population of the State in 1910 was 20,573 and in 1920, 19,512. The Navajo number about 9,000; the Apache, 1,000; and the Pueblos, 9,000. The largest Pueblo community is Zuñi which had a population of 1,667 in 1910. The census of 1910 gave two others a population of over 1,000; Laguna, 1,472 and Isleta, 1,000. The total population of the State has increased from 160,282 in 1890 to 360,350 in 1920. The 1928 estimate of the U.S. Census Bureau was 396,000. The decade from 1900 to 1910 witnessed the greatest increase, from 195,310 to 327,301, or 67·6%. A total of 47,942 in 1920 were foreign-born or of foreign parentage. Of this number 19,906 were Mexicans, the majority of whom belonged to the lower or "peon" class; a mixture of Indian and Spanish blood. The negroes have increased from 1,628, in 1910 to 5,733 in 1920. A sprinkling of Japanese and Chinese constitute the other non-white element in the State. The State Constitution provides that laws shall be published in both English and Spanish, and no citizen can be deprived of the right to sit on juries or to hold office



DENSITY OF POPULATION, 1920, COMPARED WITH AVERAGE FOR U.S.

because he cannot speak English. The dual language situation has presented a difficult problem for the schools, but every pupil is required to learn English by which it is hoped to solve it for the future. Albuquerque is the largest city, having an estimated population of 27,000 in 1925. The capital city, Santa Fe, had 7,239 inhabitants in 1920.

Government.—With slight amendments the Constitution adopted in 1911 remains the basis of the State Government. Amendments may be proposed by a majority of the members in each house and must then be voted upon by the people at the next general election or a special election called not less than six months after adjournment of the legislature.

The State legislature is composed of a senate and house of representatives having 24 and 49 members respectively in 1927. Regular sessions are held in odd-numbered years, beginning the second Tuesday in January, and are restricted in length to 60 days. Special sessions not to last over 30 days may be called by the governor but must confine their business to specific matters mentioned in the governor's proclamation. Representatives are elected for two years and senators for four years, the latter, contrary to the practice in most States, being all elected at one time. The governor possesses a veto power which can be overridden by a two-thirds vote of the legislative members present and voting in each house. The people of New Mexico possess the referendum privilege but not the power of initiative. In the National Congress the State is represented by two senators and one representative.

The Constitution provides for 11 elective administrative officers, namely, governor, lieutenant governor, secretary of State, auditor, treasurer, attorney general, commissioner of public lands and three corporation commissioners, all serving two years. They may succeed themselves for one term but are not afterwards eligible for re-election until a two year period has elapsed, except the lieutenant governor who may succeed himself indefinitely. The number of elective officers seriously limits the governor's control over his administration.

A supreme court holds one session a year, which lasts as long as the justices think proper, trying cases appealed from the lower courts. There are three supreme court justices elected one at a time for terms of eight years each. There are nine district courts holding two regular sessions each year at the county seat. The district judge is elected for six years. There are probate courts in each county and justices of the peace in each precinct.

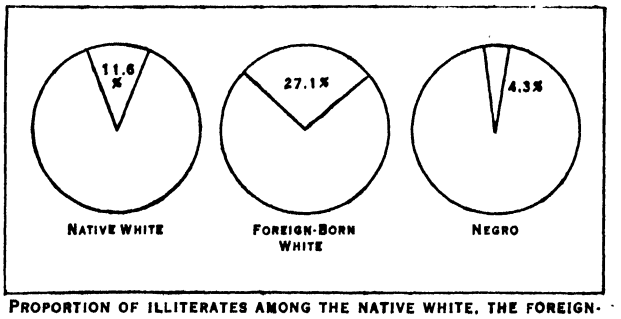
Finance.—The value of all tangible property in New Mexico was estimated in 1922 at $852,000,000 or $2,299 per caput. The total taxes levied by State, county, town and school district governments the same year amounted to $8,805,000 or $23.89 per caput. Their per caput rate was lower than any other Western State, the next lowest being $37.82 in Utah. Revenues of the State Government amounted in 1925 to $7,908,000, of which but $1,713,000 was derived from taxation. Public lands, motor licences, a gasolene tax of five cents a gallon, and Federal road aid supplied most of the remainder. Expenditures amounted to $8,634,000 of which $4,240,000 was for current and maintenance expenses and $4,577,000 for permanent improvements. The State bonded indebtedness on June 30, 1926 was $3,919,500, a decrease of over $1,000,000 from that of 1922.

In the same year there were 63 banks in the State (31 of them national banks) with resources and liabilities totalling $39,213,000.

Education.—Previous to 1891 when the general public school system of New Mexico was established, education was carried on mainly by private and religious agencies which established mission schools and academies. These are still numerous. There were in 1924–25 42 private and parochial schools of elementary standing with 5,879 pupils enrolled. Progress in the public school system was slow from 1891 until 1911 when Statehood was granted, but has been rapid since as is shown by the increase in expenditures for public schools from $793,000 in 1910 to $4,835,000 in 1925.

The governing authority of the public school system is the State board of education consisting of the governor, the superintendent of public instruction, who is elected for two years, and five members, who are appointed by the governor. The school population of the State in the year 1924–25 numbered 120,114 of which 92,615 was enrolled in public schools. The average daily attendance was 63,241. There were 61 public and 10 private high schools with 250 teachers and 6,301 pupils. There were in the entire public school system 2,011 teachers in rural districts and 1,083 in city districts.

The University of New Mexico, with its distinctive buildings in the Indian Pueblo type of architecture is situated on a *mesa*



PROPORTION OF ILLITERATES AMONG THE NATIVE WHITE, THE FOREIGN-BORN WHITE, AND THE NEGROES, 1920

about a mile from and overlooking the city of Albuquerque. Its attendance increased from 235 in 1915 to 990 in 1928, its faculty members from 21 to 54 and its buildings from 8 to 17 in number. The State School of Mines, located at Socorro, had an enrolment of 76 students and a teaching staff of 11 members in 1925. The College of Agriculture and Mechanic Arts near Las Cruces, in the fertile Mesilla valley had a staff of 39 members and an enrolment of 287 students. The New Mexico agricultural experiment station is a part of the institution. The New Mexico Military institute, a school of high rating, at Roswell is also supported in part by State funds. It offers a course of work covering the four years of high school and first two years of college. The New Mexico Normal university at Las Vegas contains a training school, a high school department and a four year normal department. Similar in organization is the New Mexico Teachers' college at Silver City. At El Rito is a Spanish-American normal school designed to instruct teachers for the Spanish districts.

Charities and Corrections.—The State penitentiary, located at Santa Fe, was established in 1882. A State reform school was established at Springer in 1909. A girls' welfare board, created in 1919, established a home in Albuquerque for girls under 18. The charitable institutions include the asylum for the insane at Las Vegas, a miner's hospital at Raton, the asylum for the deaf and dumb at Santa Fe and the institute for the blind at Alamogordo. In 1884 the Territorial legislature adopted the Asylum of the Sisters of Charity at Santa Fe as the State orphan's home, with little change in its organization.

Agriculture and Live Stock.—The eastern one-third of the State and especially the north-eastern counties contain the most important crop-producing districts. In Curry, Roosevelt, Quay, Harding, Union and Colfax counties an average rainfall of 15·5 in. (1914–24) permits of considerable dry farming, while over the rest of the State crops are dependent almost entirely upon irrigation and confined to those river valleys where it is practicable. Though 27,859,325 ac. or a little more than one-third of the State was owned as farm land in 1925 (an increase over 11,270,021 ac. in 1910 and 24,409,633 ac. in 1920) only 1,784,851 ac. were crop land. There were in 1925 31,687 farms, valued, together with all farm property, at $236,300,000. The 1920 valuation was $325,185,000.

The river basins containing irrigated lands are the Rio Grande, Pecos, Canadian, San Juan and Gila with their tributaries and the Cimarron, Rio Mimbres, Rio Tularosa, Trinchera and Fresno. The area capable of irrigation under existing projects amounted to 644,970 ac. in 1910 and 696,119 ac. in 1919. In the latter year 233,893 ac. were harvested with a crop valued at $11,400,144 or $48.74 per acre. The cost of irrigation operation and maintenance averaged $2.41 per acre. The Carlsbad project in the Pecos valley is a prosperous achievement of the U. S. Reclama-

tion Service. Another Federal undertaking of greater extent is the Rio Grande project of 150,000 ac. shared by New Mexico, Mexico and Texas which was constructed at a cost of $14,071,706.

The estimated value of all crops in 1926 was $33,800,000 as compared with $28,600,000 in 1925 and $40,000,000 in 1924. Chief in value in 1926 was wheat, reaching $6,242,000. Hay was next to wheat, and much more evenly distributed over the State. The tame hay crop in 1926 amounted to 435,000 tons, the wild crop to 33,000 tons. Approximately three-fourths of the tame crop was alfalfa to which 121,000 ac. were devoted. The cotton crop, valued at $7,560,000 in 1925, declined in 1926 to $5,004,000. Corn in 1926 was valued at $3,845,000 and was well distributed over all irrigated areas. Sorghum in 1926 was valued at $1,047,000. The bean crop of 1925 was valued at $1,317,000 and of 1926 at $2,179,000. Minor crops and their valuations in 1926 were: potatoes, $290,000; barley, $135,000; and broom corn, $246,000. Apples to the number of 1,147,000 bu. were raised in 1926; also 131,000 bu. of peaches.

Live stock on New Mexico ranches and farms amounted in value in 1910 to $43,494,679; 1920 to $93,626,000; 1925 to $52,671,000. The decrease in 1925 from the 1920 valuation represents not a decline in numbers, which remained about stationary, but in price. There were in 1927, 166,000 horses valued at $5,586,000; 34,000 mules valued at $1,500,000; 1,189,000 cattle valued at $36,887,000 and 2,490,000 sheep valued at $21,789,000. Cattle, though decreasing slightly in number, showed an appreciation in value of over $8,000,000 between 1925 and 1927. Dairying, while a growing industry, is not important in New Mexico, there being but 39,383 milch cows in 1925. The major portion of the cattle are still raised on large ranches for beef purposes. Ranches average from 60 to 80 sections in size but very little of the land (10% to 25%) is owned by the rancher himself. About half is leased from the National Forest Service, from private owners (often homesteaders who have failed), or from the railways or the State. In the south-western counties about 25% is public domain, and in the south-central counties about 40%. From 1922 to 1925 New Mexico shipped an average of 531,600 cattle annually. The value of sheep increased from $8,124,000 in 1922 to $21,789,000 in 1927. Sheep are raised all over New Mexico, but are more numerous in the southern and western parts of the State, while the north-western counties are sheep territory almost exclusively. From 1922 to 1925 inclusive an average of 588,610 sheep were annually shipped from the State. The wool output of 1926 totalled 12,060,000 lb., valued at $3,630,000, but the average weight of a fleece was but 5·9 lb. compared with a 7·8 lb. average for the entire United States.

Mining.—Though New Mexico was once an important silver-producing State, the 20th century brought an increased demand for the baser metals, especially copper, zinc and lead, and capital was drawn to their production. Showing a steady increase in output and value after the depression of 1921 copper became the leading mineral in 1925, its production amounting to 76,427,825 lb. valued at $10,852,751. The estimate for 1926 amounted to 82,600,000 lb. valued approximately at $11,300,000. About 99% of the copper is mined in Grant and Hidalgo, chiefly from the Chino Copper Company's operations in the Central district and from the 85 mines in the Lordsburg district. Zinc production increased from 9,246 tons in 1925 to 12,100 tons in 1926—the 1925 valuation amounting to $1,405,415. Lead also showed a rapid increase from $290,761 in value in 1924 to $654,000 in 1926. The silver and gold mined in 1925 amounted in value to $510,176 and $549,073 respectively.

Rivalling copper closely for the leadership among mineral products is coal. In 1925 2,556,851 tons valued at $8,611,000 were produced. Coal areas cover approximately 15,000 sq.m. and are hardly touched as yet. Good bituminous deposits are found at White Oaks, Carthage, Abbey, Cerrillos, Raton, Van Houten and Dawson. Activities in the petroleum field resulted in a leap in production from 98,000 bbl. in 1924 to 1,060,000 bbl. in 1925 and in value from $127,000 to $1,815,000. The output for 1926 was estimated at 1,627,000 barrels.

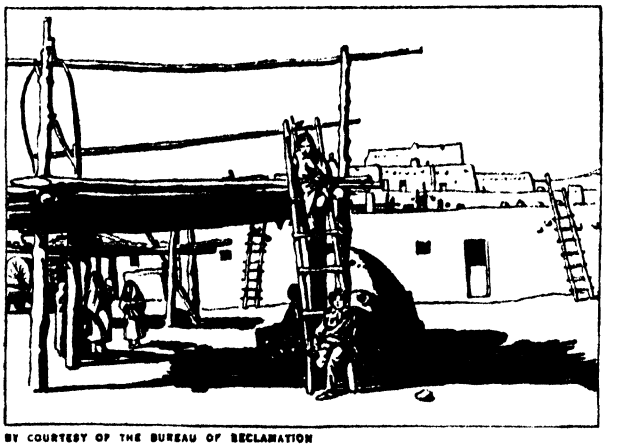
New Mexico is generously endowed with beautiful stone suitable for building purposes.

Manufactures.—As New Mexico is primarily a mining and stock-raising region, its manufacturing industries, though growing, are still of comparatively little importance. The value of the products of manufacturing establishments increased from $9,320,000 in 1914 to $20,422,126 in 1923, or 119%, but dropped to $19,458,585 in 1925. Of the latter figure $9,954,204 was added by the manufacturing process. There were in 1925 200 establishments, paying $5,083,211 in wages to 4,629 wage earners. Albuquerque with 28 establishments and 1,317 workers turning out products valued at $5,016,303 was the main manufacturing centre. The chief industries were car construction and repair shops together with railway repair shops, $5,842,735; lumber and timber products, $5,752,649.

Transportation.—In 1925 there were 2,998 m. of railway in New Mexico. About one-half belonged to the Atchison, Topeka and Santa Fe system, whose trans-continental line crosses the northern one-third of the State. Another transcontinental line, the Southern Pacific, crosses the southern part of New Mexico westward from El Paso, Texas. The rural highway system totals in all 48,295 m. of which 2,441 m. were surfaced in 1926. The State highway system, which includes all the principal through routes, totals 9,214 m. of which 1,685 m. were surfaced in 1926. Expenditures by the State for highways amounting to about $3,500,000 annually from 1921 to 1925, were derived largely from motor vehicle and gasolene taxes and Federal aid.

History.—In the period 1525–43 explorations extending from Florida to the California coast paved the way for the later colonization of Florida and New Mexico in the latter part of the 16th century, Texas in the early part of the 18th and California in the latter part of that century. The first of the expeditions was that of Narváez. The journey of the treasurer of this Florida adventure, Cabeza de Vaca, extended over the period from 1528 to 1536.

The appointment of Antonio de Mendoza as first viceroy of New Spain in 1535 marked the beginning of a period of improved organization in the continental possessions of Spain. Early in 1539 Friar Marcos de Niza was chosen by the viceroy to investigate the land north of Culiacán and inaugurate a new policy in Indian affairs. When Friar Marcos left Culiacán, March 1539, he was accompanied by Estevánico, as guide, who was one of



BY COURTESY OF THE BUREAU OF RECLAMATION

EXTERIOR VIEW OF TAOS, SHOWING ONE OF THE TWO SIX-STOREYED PUEBLOS AND THE LADDERS BY WHICH IT IS ENTERED

the four survivors of the Narváez expedition. The party reached the vicinity of the Zuñi pueblos, in the western part of New Mexico. In the following year the well-equipped expedition of 270 soldiers under Coronado arrived by the same trail. The Zuñi pueblos were conquered and the expedition established winter headquarters near the present town of Bernalillo. The Grand Canyon of the Colorado was discovered and other parties explored the Rio Grande valley and the country as far east as the present State of Kansas.

An expedition was organized by the Franciscan friar, Augustín

Rodríguez in the summer of 1581 for the purpose of converting the Indians of the lands to the north of Mexico. A year later Antonio de Espejo led an expedition to rescue the friars of the Rodríguez party, who had remained in New Mexico without protection after the return of their military escort to Mexico. (The name New Mexico seems to have been applied to the Pueblos of the Rio Grande valley in the summer of 1582, although the name applied by the members of the Rodríguez expedition, San Felipe, and the name given by Espejo, Nueva Andalucía, were probably sometimes used.) Near the close of the century a contract was made with Juan de Oñate for the colonization of New Mexico. The expedition was assembled in the vicinity of Santa Bárbara in August 1597, and after several delays proceeded up the Rio Grande. The first settlement was made at San Juan de los Caballeros in the Chama river valley, July 11, 1598. The construction of the first church in New Mexico was completed and mass was celebrated on Sept. 9, 1598. The present capital of New Mexico, Santa Fe, was founded in 1609.

New Mexico remained a frontier mission field during the 17th century. Twenty friars were serving by 1624; the churches numbered 43; and the number of Christian Indians 34,000. The total Spanish population at the end of the century was only 2,000, which shows that the colony had not become an important source of wealth. The differences between the Indian culture and the Spanish European manner of life were the principal causes of the revolt of the Pueblos in 1680. The Pueblo Indians were willing to accept the God of the Christians as an additional protecting power, but they could not give up their own beliefs concerning the spirits of the universe without completely destroying their organized tribal life, because every phase of their existence is affected by their conceptions of the relation of the tribe to the world. The Spanish settlers abandoned their holdings and retreated southward to El Paso. Diego de Vargas effected a reconquest of the province between 1692 and 1696. Albuquerque was founded in 1706 and by 1799 had a population of 4,020. The total population of the province at the close of the 18th century was about 30,000; 20,000 Spanish and 10,000 Indians.

The internal affairs of New Mexico prior to 1821 were not affected to any great degree by the revolutionary developments which took place during this period in Spain and Mexico. New Mexico became a political subdivision of the Mexican Republic; granted independence from Spain by the Treaty of Córdoba, Aug. 24, 1821. Trade with the American settlements in the Missouri valley, which had been discouraged during the Spanish régime, was legalized in 1821. An annual caravan set out from Missouri in the spring of the year. The value of the merchandise carried on the outward journey increased from $15,000 in 1822 to $450,000 in 1843. The Santa Fe trade was a success because merchandise could be freighted across the plains to the markets of New Mexico and sold for a lower price than goods could be brought from Vera Cruz by way of Chihuahua.

The Republic of Texas claimed the Rio Grande as its western boundary. The prosperous Santa Fe trade, which would be a rich source of taxation, encouraged Texas to assert this claim. An expedition was organized in 1841 which arrived in New Mexico in a disorganized condition and surrendered to Governor Armijo at Anton Chico. A second expedition in 1843 also failed.

Upon the outbreak of war with Mexico the army of the West under command of Col. Stephen Watts Kearny, occupied Las Vegas Aug. 15, 1846 and took formal possession of the country. The capital was occupied three days later and a military government was established which ruled the territory for five years. The civil government was retained for two years during which period a rebellion broke out resulting in the assassination of Governor Bent at Taos, on Jan. 19, 1847. The Territory of New Mexico was created by act of Congress, Sept. 9, 1850, extending from the 103 meridian of longitude on the east to the Territory of California on the west. The present boundaries were fixed by 1863 with the formation of the Territory of Arizona from the western half, and the Territory of Colorado from a northern portion two years earlier.

At the outbreak of the Civil War the Territory was invaded by a Confederate force, under command of Brig.-gen. H. H. Sibley, which marched up the Rio Grande valley and occupied the capital. The Union army under command of Col. E. R. S. Canby, with reinforcements from Colorado, won the decisive battle of the campaign at Apache canyon, on March 28, 1862. The period following the American occupation was marked by the solution



BY COURTESY OF THE ATCHISON, TOPEKA AND SANTA FE RAILROAD

THE STATE ART MUSEUM AT SANTA FE

of the nomadic Indian problem and the economic development of the territory. A reservation was established in 1868 for the Navajo Indians in the north-western part of the Territory; the Mescalero Apache were settled in the southern part of the Territory in 1873; and the Jicarilla Apache in the northern part in 1880. The legal status of the Pueblo Indian was complicated by the Treaty of Guadalupe Hidalgo and later decisions of the U.S. Supreme Court.

The building of railways into the West, the increasing population, and the quieting of the Indians resulted in a great increase in cattle and sheep. The overflowing cattle herds of Texas were used to stock the ranges in New Mexico and the States to the north. The Goodnight-Chisom trail up the Pecos valley was followed by the overland drives to the ranges in Colorado and Wyoming; and to the railway shipping points in Kansas. Conflicts occurred between the cattle and sheep raisers over water and the use of the open range. The most bitter of these was the Lincoln county war which started in 1877 and lasted about three years. The Atchison, Topeka and Santa Fe railway was extended to Albuquerque in 1880. A year later connection was made with the Southern Pacific railway at Deming, which placed the Territory on a transcontinental line. With the advent of the railways mining and irrigation developed; the population increased and a public school system was established in 1891.

The Spanish and Mexican land grants in New Mexico have constituted one of the most difficult land problems in the history of the State. The Treaty of Guadalupe Hidalgo confirmed the grants but the lack of accurate documents complicated the problem of settling conflicting claims. The establishment of the U.S. court of private land claims, March 3, 1891, was the beginning of a policy of settling titles by means of court proceedings.

Constant efforts were made to secure Statehood. The Enabling Act was passed by Congress on June 20, 1910. A Constitution, drawn up by the people, was accepted by Congress and signed by the president on Aug. 21, 1911. The State was formally admitted on Jan. 6, 1912.

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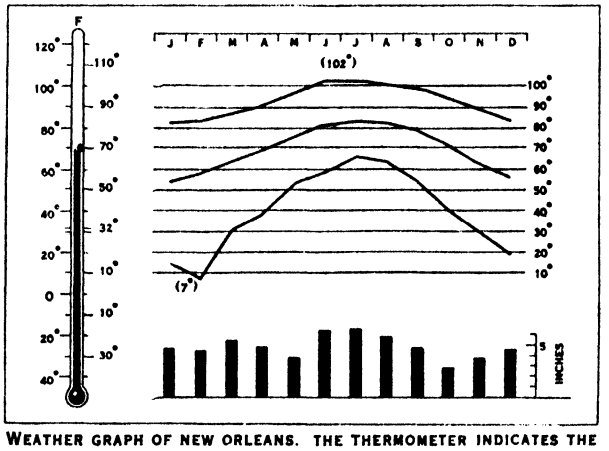
NEWNAN, a city of western Georgia, U.S.A., the county seat of Coweta county; on Federal highway 29, 40 m. S.W. of Atlanta. It is served by the Atlanta and West Point and the Central of Georgia railways. Pop. 7,037 in 1920 (44% negroes). It is a shipping point for cotton, bright-leaf tobacco, corn, peanuts, garden truck, hogs, cattle and poultry.

NEW ORLEANS, a city of Louisiana, U.S.A., situated on the east bank of the Mississippi river about 107 m. from its mouth. It was originally on a bend in the river and from that fact its popular name, "Crescent City," was derived.

Physical Features.—The soil is an alluvial deposit from the river and, therefore, has its greatest elevation at the river bank, where the ground behind the levees is from 10 to 15 ft. above the mean level of the Gulf of Mexico; but the lower parts of the city are below gulf level. Built on the narrow ridge of land at the river bank, the growing city first expanded along the river front and later, the cypress swamps between the river and Lake Pontchartrain having been cleared and drained, covered a distance of from 4·5 to 7·3 miles. The river approaches New Orleans flowing eastward, turns rather abruptly to the south at the upper municipal limits, then eastward as it passes the modern city, and finally northward in one of the sharpest bends to be found in the lower river, near the site of the original city, or *vieux carré.*

The difficulties involved in building a city on such a site as that of New Orleans were great. Drainage, sanitation and a satisfactory water supply were realized nearly two centuries after the establishment of the first settlement, and in the interim yellow fever and cholera took frightful tolls. Modern engineering



WEATHER GRAPH OF NEW ORLEANS. THE THERMOMETER INDICATES THE NORMAL ANNUAL MEAN TEMPERATURE. THE MIDDLE CURVE SHOWS THE NORMAL MONTHLY MEAN TEMPERATURE; THE CURVES ABOVE AND BELOW, THE HIGHEST AND LOWEST EVER RECORDED IN EACH MONTH. THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION

and sanitation finally triumphed, and to-day New Orleans is one of the healthiest cities of the world.

The boundaries of the parish of Orleans and the city of New Orleans are the same, embracing an area of 196 sq. miles. The boundary line is very irregular, but may be given approximately as Lake Pontchartrain on the north, the Rigolets and Lake Borgne on the east, the parish of St. Bernard and the Mississippi river on the south, and Jefferson parish on the west. The city gradually expanded by spreading along the higher lands near the river bank.

New Orleans is noted for its mild and balmy winters; the summers are uniformly warm but extreme heat is unknown, and the highest temperature recorded by the weather bureau is 102° F, while a temperature of 100° F is seldom reached, owing to the cool breezes from the Gulf of Mexico. Mean temperature is:—

January	54·5°	July	82·4°
February	57·2	August	82·3
March	63·0	September	79·4
April	68·9	October	70·4
May	75·2	November	61·9
June	80·9	December	55·7
Yearly average			69·3

The rainfall averages 56·77 in., well distributed through the year.

Population.—The population of New Orleans was 339,075 in 1910 and 387,219 in 1920. On July 1, 1928, it was approximately 429,400 of which nearly 75% were white and the rest preponderantly negroes. Every country of Europe is represented. Among the foreign-born the Italians are the most numerous; other nationalities of great numerical strength are Irish, Germans, English and French. The French, because of the creole element, feel perfectly at home, speaking their own language, and living among sympathetic surroundings. The creoles are the descendants of the French and Spanish settlers of Louisiana. When the city passed under the American flag the Americans built up a quarter for themselves, up stream from the *vieux carré,* the upper boundary of which was Canal street. The line is not as strictly drawn now as in earlier years, as many creoles have settled in the newer portions of the city and some Americans have moved to the French quarter. This change has been more pronounced in the third decade of the 20th century during which time a lively interest in the old quarter has developed into a movement to preserve those buildings and other historical sites of the city.

Water Supply, Drainage and Sewerage.—The entire city, except for its levees, is below the river high water mark while a large portion of it is below that of Lake Pontchartrain. Combined with these difficulties New Orleans has heavy rainfall; occasionally over 3 in. in one hour, 7 in. in 5 hours and 9 in. in 12 hours, having been experienced. As a result of the occasional excessive rainfalls, it has been necessary to provide large canal systems to convey the water to and from the pumping plants, and eight pumping stations for the removal of storm water have been built. A number of these drainage canals are built of reinforced concrete, lined and covered with masonry and are often under the roadway of streets; some of the open canals are lined with creosoted timber. The largest of the concrete canals are 25 ft. or more in width and when running full, have 9 ft. or more depth of water. To keep the water moving in these canals the city has an aggregation of low lift pumps with a capacity of over 7,000,000,000 gal. per day.

The sewage of the city is collected separately from the drainage and is finally discharged into the Mississippi, where the dilution is so great that it is not noticeable further down stream. Like the drainage, the sewage has to be pumped, much of it through two or more lifts, and this is accomplished by electric pumping stations operating automatically.

In the early days of the colony the turbid water from the Mississippi was carried from the river and settled in large earthen jars. Wells were used to supply water for household purposes but not for human consumption. In 1810, a first attempt was made to establish waterworks. In 1833 the Commercial Bank was organized for the purpose of establishing waterworks in New Orleans and iron pipes replaced the early wooden ones. In 1869 the city bought the system from the company, issuing bonds for that purpose; but lack of funds and bad management obliged the city in 1877 to give a monopoly to the New Orleans Water-Works company. The river water was too muddy to be useful for most purposes and cisterns were preferred, although a time of drought often caused scant supply. To solve the problems involved and to study the methods of treatment for purification of the river water, an experimental plant was established in 1900, and a process adopted for softening by the use of lime and small amounts of sulphate of iron, producing a coagulation whereby the fine clay particles are brought together into large masses that will settle out in a few hours, or which are large enough to be

completely removed by the filters. By this process, first put into operation in 1909, New Orleans has had continuously an abundant supply of clear, pure water of the highest quality. Additions to the water purification plant, nearly completed in 1928, will increase the capacity to 112,000,000 gal. per day, and, if necessary, to 160,000,000.

Streets, Bridges and Parks.—The streets of the *vieux carré*, or old French city, are narrow, but in the newer portions there are many wide avenues and boulevards, some of which were originally canals. Some of the avenues, such as St. Charles, Esplanade, Claiborne and others, were originally laid out with sufficient width for a street on each side, accommodating traffic in both directions and with a "neutral ground" between which has been used for street car tracks and planted with trees.

New Orleans is situated on the Old Spanish Trail which extends from San Diego, Calif., to St. Augustine, Fla. It is at the southern end of the Jefferson highway which runs to Winnipeg, and the Colonial highway which leads to New York. The Jackson and Mississippi Valley highways lead to points in the Middle West and the Mississippi valley. Early in the year 1928 the New Orleans-Pontchartrain bridge was opened to traffic. This concrete structure is nearly 25,000 ft. in length and was built by a private corporation at a cost of $5,500,000.

New Orleans is well supplied with parks. Audubon park, with 234 ac., is situated in the upper portion of the city and contains a statue of Audubon. City park on City Park avenue has recently been increased to 1,426 ac. by the purchase of a tract extending all the way to Lake Pontchartrain. West End park has largely been built up by hydraulic dredging. There are numerous smaller parks well distributed throughout the city.

New Orleans is developing a tract of about 1,400 ac. on the south-east shore of Lake Pontchartrain, where the land is being built up by hydraulic dredging from the bed of the lake. The tract will contain 25 m. of boulevards and driveways, with parks and bathing beaches having a combined length of two miles.

Gas and Electricity.—Electric cars were first used in New Orleans in 1893. At that time there were several independent competing lines which were later consolidated into a modern, efficient system. The New Orleans public service supplies electricity for power and lighting, and supplies natural gas to power plants and for domestic use.

Port.—New Orleans is one of the largest North American ports, accommodating between 90 and 100 steamship lines; 908 vessels with a total net tonnage of 11,204,573 tons entered the port in the year ending Aug. 31, 1927. The limits of the Port of New Orleans include the parish of Orleans and a part of the parishes of Jefferson and St. Bernard bordering on the Mississippi, with a frontage of 41·4 m. on both sides of the river. About 7 m. of river front is equipped with publicly owned wharves, steel sheds, cotton warehouses, grain elevators, coal tipples and other modern facilities. The Inner Harbour navigation canal extends for 5 m. from the river to Lake Pontchartrain. Recent development of South West pass with an available depth of 35 ft., has made the port available to the largest ships.

Transportation.—Twelve railroad lines enter New Orleans: the Gulf Coast Lines, Illinois Central, Yazoo and Mississippi Valley, Louisiana Railway and Navigation Company, Louisiana Southern, Louisville and Nashville, Missouri Pacific, New Orleans Great Northern, New Orleans and Lower Coast, Southern Pacific, Southern Railway and the Texas Pacific. New Orleans owns and operates a Public Belt railroad, extending the length of the docks. The Federal Barge line supplies freight service to points on the Mississippi and Warrior rivers.

Commerce, Industry and Municipal Statistics.—The Merchants' Progressive Association of 1898 and the Progressive Union, which succeeded it the following year, were the organizations leading to the Association of Commerce in 1913. There are 14 bureaux and departments, and the membership is over 5,000. In 1928 there were over 660 factories, whose output was evaluated at $158,141,868. The New Orleans Clearing House was organized in 1872; and there were in 1928 about a dozen large banks. The growth of the city may be shown by the following comparative figures:—

	1910	1927
Financial		
Bank debits	$2,991,128,000	$4,165,757,000
Bank resources	$131,771,263	$330,171,886
Property valuation	$230,846,187	$607,086,071
Buildings and utilities		
Building permits	$3,422,251	$16,011,635
Water consumed—gallons	5,578,000,000	11,151,717,700
Water mains, miles	325	585
Commerce and transportation		
Water cargoes—short tons	3,964,109	16,538,167
Public belt railway, cars handled	113,727	334,265
Street railway mileage	162	209
Hard surface streets—mileage	114	263
Public schools		
Enrolment number	42,733	68,356
Value of property	$2,688,000	$15,481,282
Public libraries		
Number of volumes	100,102	235,982
Circulation	350,746	916,825
Health		
Deaths per 1,000 white-resident	14·23	11·97

Education.—The New Orleans public-school system consisted in 1928 of 63 kindergartens and elementary schools, five high-schools, one vocational school for girls and one normal school, for white pupils, and of 19 elementary and one high and normal school for coloured pupils. There were 12 elementary evening schools and one evening high-school for coloured pupils. The enrolment for 1926–27 was, for white schools, 48,731, and for coloured schools, 19,625, a total of 68,356; and the expenditure exclusive of building was $3,568,743. There were over 60 private schools in New Orleans in 1927, and the Catholic Church has a system of parochial schools, each parish church conducting a school under the direction of the parish priest and, in most cases, taught by nuns. Uniform text-books are used and the classes are graded according to public school standards. There are several preparatory schools among which are Rugby academy, New Orleans academy, Holy Cross college and the Christian Brothers college. The Delgado Trades school was opened, near City park in 1921. The Isidore Newman Manual Training school was founded in 1903 and has a capacity of about 600 boys and girls.

Tulane University.—The history of Tulane university dates back to the foundation of the medical college in 1834. It was chartered in 1835 and in the following year issued the first degree in medicine conferred in the South-west. The Constitution of 1845 provided for the establishment of a university in New Orleans, embracing the medical college to which law and academic departments were to be added.

In 1882 Paul Tulane, for many years a merchant in New Orleans, gave liberally for the higher education of "the white young persons in the city of New Orleans." His entire donations reached the sum of $1,050,000. He died at Princeton, N.J., in 1887. In 1884 the board of administrators of the Tulane educational fund received from the legislature complete and perpetual control of the university of Louisiana. This act was ratified in 1888 and again in the Constitutions of 1898, 1913 and 1921.

Tulane university had a total enrolment of 2,988 in all departments during the session of 1926–27, exclusive of the summer school, which numbered 1,751 more. Its endowment was then approximately $8,000,000.

Loyola University.—In 1904, the Jesuit Fathers opened a school opposite Audubon park. A collegiate course was added and in 1912 the legislature granted them power to confer "degrees in arts and sciences and all the learned professions, such as are granted by other universities in the United States."

Monuments, Public Institutions and Customs.—The Delgado Art museum in City park was established by a gift from Isaac M. Delgado in 1911. There is a nucleus of an art collection containing many works of great merit. The annual exhibition of the Art Association is an important event. The Cabildo houses an important historical museum containing much of interest and

value pertaining to the history of Louisiana and New Orleans. The Presbytery, facing Jackson square on the side of the Cathedral of St. Louis, contains a valuable museum of natural history, principally relating to Louisiana. The Confederate Memorial hall contains relics of the Civil War. It is located on Camp street adjoining the Howard library. The Tulane university museum occupies the entire third floor of Gibson hall; it contains petrological, paleontological, zoological and anthropological sections. The Art museum in the Tilton Memorial library of Tulane university embraces the Linton-Surget collection of works of art. At Tulane university is the Gates collection of manuscripts, documents and other material relative to Mexico and Central America. This is constantly being added to by the expeditions and researches of the department of Middle American research, which has a permanent endowment of $300,000.

New Orleans has a number of excellent hospitals: the Baptist; Charity; City (for mental diseases); Eye, Ear, Nose and Throat; Hôtel Dieu; Presbyterian; Soniat Mercy; and the U.S. Marine and U.S. Veterans' hospitals, the St. Rita Surgical and Touro infirmaries. Practically all of the charitable institutions of New Orleans receive contributions from a community chest. In 1928 these amounted to more than $900,000.

Over 50 newspapers and periodicals are published in New Orleans, including two morning and two afternoon papers. The *New Orleans Picayune* was founded in 1837, the *Daily Times* in 1863, the *Daily Democrat* in 1875. The two latter formed the *Times-Democrat* in 1881 and this and the *Picayune* became the *Times-Picayune* in 1914. The *Daily Item* began publication in 1877; the *Daily States* started in 1880. The *Morning Tribune* was first published in 1924.

There are some 300 churches in New Orleans, representing different denominations. Roman Catholic churches are the most numerous.

The French opera house, designed by Gallier, was erected in 1859 at the corner of Bourbon and Toulouse streets. It was a distinctive and widely known centre of artistic and social life in New Orleans for many years. The Mardi Gras balls were held there until the building was destroyed by fire in 1919.

The carnival season extends from Twelfth Night to Lent, and its climax is reached in the festivities of Mardi Gras, the eve of Ash Wednesday. The ancient custom of celebrating the carnival was brought to New Orleans by the Latin peoples, and especially by the young creoles who studied in Paris and returned to live in New Orleans. Beginning with Twelfth Night there is a series of brilliant balls, and during the last week the balls of Momus, Proteus and Comus, preceded by gorgeous pageants, bring the season of mirth to a conclusion. On Mardi Gras Rex parades the streets and at night the final parade is that of Comus.

Among writers and historians of note associated closely with New Orleans should be mentioned: John James Audubon, C. E. A. Gayarré, Alcée Fortier, Grace King, Mary Ashley Townsend, Lafcadio Hearn, George W. Cable and Mollie Moore Davis.

Government.—The city government was at first carried out by a mayor and administrators, seven in number. Finally, in 1912, by act of the legislature, the commission form of government was adopted; the mayor became commissioner of public affairs. Four other commissioners have charge of public finances, public safety, public utilities and public property. At the first regular meeting after the election, the commission council by a majority vote assigns one of the councilmen to each of the above named departments.

History.—The city of La Nouvelle Orleans was founded by a French governor of Louisiana, Jean Baptiste Le Moyne, Sieur de Bienville, and was named in honour of the Regent, the Duc d'Orléans. The island of Orleans was chosen for the site, on an elevation along the east bank of the river and about 107 m. from its mouth, between the head of Bayou St. John and the river. Among the advantages of this site were the higher land, accessibility by two main waterways (the Mississippi and the lakes), and by Bayou St. John for the small craft of that day. On the other side of the river it was not far to Bayou Barataria, which later was destined to become the rendezvous of the famous pirates, Jean and Pierre Lafitte, and which offered access to the gulf without stemming the current of the Mississippi.

There is some doubt as to the exact date of the founding of New Orleans, but it is generally given as 1718. It was then proposed that John Law's famous company, which had obtained charter for the territory from France, should move its headquarters from the barren coast country to the new site. New Orleans thus became the capital of the Colony in 1722. At this time the city had but 100 houses and 500 inhabitants. It was laid out in approximately a parallelogram, 4,000 ft. long on the river by 1,800 ft. in depth, divided into regular squares 300 ft. on each side. In 1724 the streets were named. The houses were rude cabins of split cypress boards, roofed with cypress bark. They were separated from one another by willow copses and weed-grown ponds swarming with reptiles. Two squares on the river front near the centre of the city were set apart for military and ecclesiastical uses. The front was the Place d'Armes, now Jackson square; the rear one was early occupied by a church. In 1726 a monastery was erected to the east of the church for the Capuchin monks, who had arrived two years earlier. A company of Ursuline nuns came to New Orleans in 1727. At the same time the Jesuits arrived and received a large tract of land from Bienville, the French governor. This tract, bounded by what is now Common, Tchoupitoulas, Annunciation and Terpsichore streets, was later added to by donation and purchase and extended to Felicity street. Here the Jesuits cultivated myrtle, the wax of which was then a staple article of commerce; the orange, the fig, indigo and probably sugar-cane. These became staple crops. The Order was suppressed for political reasons in 1763 and its great plantation confiscated by the king of Spain.

Many storms and disasters occurred during the early years of the city. In 1719 the river rose to a great height and the site was completely inundated to a depth of a few inches. In 1722 a hurricane destroyed 30 houses and damaged crops. German colonists who had settled on the banks of the Arkansas managed to reach New Orleans and there prayed Bienville to send them back to their homes. He persuaded them to establish themselves along the river above the city, and thus was formed the nucleus of the German settlement, which to this day is called the German coast.

There were few women of good character in the Colony in the early days; and many of the better class of settlers, missing their home life, desired to return to France. It thus became imperative that if the settlement was to survive, the men must have good wives to make homes for them. When Bienville left the Colony in 1724, he promised to send a load of good women as soon as possible. In 1727 the "Casket Girls" (*Filles à la cassette*) arrived and were placed under the care of the Ursuline nuns whose convent had been established in the same year. They were first domiciled in Bienville's former home, but in 1730 their own house on Chartres and Ursuline streets was completed. This is the oldest building in the United States west of the Alleghenies.

In 1763 the Treaty of Paris was concluded between France and England. By this treaty England gained all the territory east of the Mississippi except the Isle of Orleans. On Nov. 3, 1762, Louis XV. had, by the secret treaty of St. Ildefonso, given the Isle of Orleans and all of Louisiana west of the Mississippi to his cousin, Charles III. of Spain. It was not until Oct. 1764 that the French king notified governor Abbadie of the transfer of the Colony, nearly two years previously, to Spain, and ordered him to surrender Louisiana to accredited Spanish commissioners when they should present themselves. There was sorrow and dismay when these tidings were received. In 1783, the Treaty of Paris confirmed Spain in possession of this territory and granted free and open navigation of the Mississippi river to the subjects of Great Britain and the United States. In 1788, and again in 1794, fires destroyed large portions of the city. By the first, 19 squares were devastated, and 856 houses were burned. The second fire destroyed 212 houses and caused a loss estimated at $2,600,000. Rebuilding with brick instead of wood, resulted in a more permanent city.

During this period the Spanish Governor, Almonaster y

Rojas, was the greatest benefactor of New Orleans; he gave freely of his private fortune for many purposes. He rented in perpetuity the squares flanking the Place d'Armes and erected a row of brick buildings to be used as shops and retail stores. These were replaced in 1845 by the Pontalba buildings, which bear the name of their builder, Baroness Pontalba, a daughter of the governor. He rebuilt the Charity hospital, which had been destroyed by a hurricane, and a chapel for the Ursuline nuns. Through his generosity the cathedral was completed in 1794; it was constructed of bricks and had much the same appearance as to-day except in details of the belfry and towers. A town-hall, or hall of the Cabildo, presented to the city in 1795, was used as a meeting place of the Spanish Cabildo. It was here that the formal transfer of Louisiana from France to the United States took place.

Before the cultivation of sugar-cane the staple crop of Louisiana had been indigo; but it did not prove successful. In 1794 Etienne de Boré succeeded in making granulated sugar. His plantation is now within the city limits. By the Treaty of Madrid, signed in Oct. 1795, Spain and the United States agreed that New Orleans should be open to the Americans as a port of deposit for three years; the produce was to be free of duty but a reasonable price for storage was to be paid. The commerce of New Orleans increased greatly, the levee was the scene of noisy, bustling business.

The purchase of Louisiana by the United States in 1803 had a further beneficial effect on trade. The first half of that year showed an increase of 37% in tonnage over that of 1802; exports exceeded $2,000,000 and imports $2,500,000. The flat-boat trade with the upper valley also increased enormously. Above the *vieux carré* commercial houses were erected and this newer portion of the city gradually became a business centre. Above the Terre Commune, Common street, was Madame Gravier's plantation, a part of the former Jesuit grant. Many of the street names are reminders of the first owners or of the first use of the locality. Gravier street bears the name of its original owner; Poydras that of a philanthropist; Magazine was so named because of the great tobacco warehouses on Magazine and Common, and Camp street because of a slave camp between Poydras and Girod. An aristocratic suburb was along the Bayou St. John road. Below the old city the Marigny plantation was settled by the French.

In 1805, New Orleans was incorporated as a city and the people exercised their right of suffrage for the first time in electing aldermen. Between 1803 and 1810 the population more than doubled with the arrival of many whites, mulattoes and slaves from Cuba, Santo Domingo and other islands of the West Indies. The creoles of those islands had much in common with the creoles of Louisiana—many were of French ancestry, they had the same religion, language and political ideas, and had met with the same political misfortunes. The creoles were numerically so strong that they dominated the city.

On Jan. 10, 1812, the "New Orleans," a steam propelled vessel built by Nicholas Roosevelt, arrived on her maiden trip from Pittsburgh.

The War of 1812 found New Orleans without adequate defences; Wilkinson was ordered to occupy that part of Florida west of the Perdido river; the Creek Indians massacred 350 whites at Ft. Mimms, Miss.; drunken Choctaws roamed the streets of New Orleans; Barataria bay was held by the Lafittes and their band of piratical smugglers, who appeared daily in the city. Claiborne had great difficulty in raising the quota of 1,000 men called for by the President, but finally accomplished it. Congress ordered Jackson to proceed to New Orleans for its defence.

Commerce on the Mississippi was greatly stimulated by the advent of steam navigation. In 1817, 1,500 flat-boats and 500 barges brought the produce of the valley to New Orleans. Four years later 287 steamboats, 441 flat-boats and 174 barges moored along the water front of the city. The American section became the market for cotton, tobacco, pork, beef, corn and flour, while the old city retained control of coffee, indigo, sugar, rice, foreign fruits and wine. In the year 1825, the imports and exports of the city were valued at $17,000,000, and by 1835 at more than $53,000,000, a part of the increase being due to the extraordinary rise of prices throughout the country. The population was cosmopolitan. In 1815 it numbered 33,000 and in 1820 had advanced to 41,000. Commerce increased more rapidly than population because of the absence of manufacturing; between 1830 and 1840 trade advanced 75% and the population only 20%.

In 1847–48 the exports of domestic products from New Orleans exceeded those of New York, although the total exports were less than those of the northern city; but imports at New Orleans were far less.

In 1842 receipts from the interior were valued at $45,700,000 and in 1851 they had increased to $107,000,000. One tenth of the arrivals were now steamships. This trade was carried on in spite of the danger from bars on entering the river; in the space of a few weeks, in 1852, 40 ships went aground at the entrance to the river. The terrible yellow fever epidemics of 1853–55 reduced the volume of trade, which was regained, however, and a high-water mark reached in 1857, to be followed by a financial crash which was disastrous to the business houses of New Orleans.

Louisiana seceded from the Union on Jan. 26, 1861. New Orleans was recognized as a strategic point by the authorities at Washington and two expeditions started to secure the Mississippi for the Union: Grant was to descend the river and Farragut and Butler were to ascend it. The city had sent 5,000 soldiers to the defence of the northern line of the Confederacy but the Southern Government seemed oblivious to the importance of holding New Orleans. While Grant was endeavouring to push his way down stream, Farragut was entering the river from the gulf with a fleet of 43 vessels. The assistance asked by Gen. Lovell could not be given by the Confederacy. An attempt was made to obstruct the passage of the Federal fleet by cables put across the river below the city, but New Orleans was captured by Farragut on April 25, 1862 and the city front blazed with the fire from thousands of bales of cotton and hogsheads of sugar and molasses which were burned to prevent their falling into the hands of the Federals.

Gen. Benjamin T. Butler with 15,000 soldiers took charge of the city on May 1, 1862. Mayor Monroe was removed from office and a military commandant appointed in his place. The city council was replaced by the bureau of finance and the bureau of streets and landings. Butler's rule in New Orleans was execrated by the people of the city and he was removed before the year expired.

The Republican Congress decided that the Southern States should be regarded as conquered territory, reconstructed and admitted to the Union. First of all the new freemen were to be secured in the enjoyment of their citizenship and suffrage. The white men of the State were virtually deprived of the ballot by all the restrictions placed upon its exercise. In the wake of the war came a host of undesirables seeking fortunes by easy means. They became known as "carpet baggers," and their Southern friends and associates were known as "scalawags." In New Orleans they gained control of the city government through leadership of the voting population—largely composed of the newly enfranchised negroes. The property of the city disappeared; extravagant expenditures reached $6,961,381 by 1872 and the bonded indebtedness $21,000,000, paying up to 10% interest.

The citizens of New Orleans formed the "White League" for the expulsion of the "carpet-bag" government and for restoring white supremacy. To frustrate their plan an order was issued forbidding a citizen to keep a firearm even in his home. It was rumoured that a ship was to arrive on Sept. 14, 1874, with a cargo of ammunition and the metropolitan police formed at the foot of Canal street with mounted cannon to prevent the citizens from reaching the vessel. The White League formed at Poydras street and moved out to the levee; a skirmish followed in which the metropolitan police were worsted, suffering considerable loss. By gradual successes the White League restored white control.

Improvements made but slow progress during restoration times and for many years after; the city undertook the operation of the water works in 1869; a drainage system was proposed in 1871 but proved too expensive to be carried out; in 1871 the board of park commissioners bought the Upper City park, now Audubon park. The population in 1860 was 168,755 and had





PHOTOGRAPHS, EWING GALLOWAY

VIEWS OF THE OLD AND NEW CITY OF NEW ORLEANS

1. Air view of New Orleans, showing at the left Canal Street, the centre of the retail business district, and the sky-scrapers of the modern city. In the middle distance is the Mississippi River
2. The historic Jackson Square, formerly called the "Place d'Armes," in the old French quarter. On one side is St. Louis Cathedral flanked by the Calabozo (calaboose) and the Cabildo, once the government buildings of the French. In the latter Lafayette was lodged in 1825 as the city's guest. On adjoining sides of the square are the so-called "Pontalba Mansions" built by the Baroness de Pontalba on her estate in 1849, now used as tenements

increased by 1870 to 191,418. During this decade many freed negroes had come to the city from the country districts. In 1870 the fifth and sixth districts were added by the annexation of the town of Algiers on the opposite bank of the river and of Jefferson City (formerly Lafayette), a town adjoining the fourth district. In 1874 Carrollton was admitted as the seventh municipal district, and New Orleans attained its present limits.

In the spring of 1927, New Orleans was saved from the great Mississippi river flood, which temporarily made much of Louisiana and other States an inland sea, by blasting the levee at Poydras, about 15 m. below the city, on April 29. This operation sacrificed the adjacent parishes of St. Bernard and Plaquemines at a cost to the city of approximately $5,000,000.

About 35 m. above New Orleans a spillway is being constructed to remove 250,000 second-feet of water from the river during excessive floods and deliver it into Lake Pontchartrain. This will reduce the gauge heights at the city and will eliminate the fear of the Mississippi river during future floods. (W. B. G.)

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The Battle of New Orleans.—This was the final engagement of the American War of 1812 (*q.v.*), fought on Jan. 8, 1815, between the forces of the United States, under Maj.-gen. Andrew Jackson, and those of Great Britain under Maj.-gen. Sir Edward Pakenham. The abdication of Napoleon in April 1814 made it possible for Great Britain to give more attention to her American antagonists. The Gulf of Mexico region was selected for the attack, and late in 1814 a fleet of 50 vessels and an army of nearly 10,000 veterans were dispatched to the region of the Mississippi river. The British advance was made by way of Lake Borgne and the Villere canal to the bank of the Mississippi where the advance-guard appeared on Dec. 23, 1814. Jackson was wholly surprised by this movement but with a superior force made an immediate (Dec. 24) attack with such effect that the British decided to wait for the main army and their artillery. This gave Jackson time to fortify a dry canal and to receive additional reinforcements.

At last, in the early morning of Jan. 8, 1815, a direct attack was made on the now strongly entrenched line of the defenders at Chalmette, near the Mississippi river. It failed disastrously with a loss of about 2,000 out of 9,000 British troops engaged, among the dead being Pakenham and Maj.-gen. Gibbs. The British attack on the right bank had been successful but Gen. Lambert, Pakenham's successor, was unwilling to take the responsibility of any further fighting. The expedition was soon abandoned, and by the end of the month the troops embarked for England. The American loss proved to be 71, out of a total of about 4,000 engaged on both sides of the river. The battle of New Orleans had no bearing on the outcome of the war as peace had been made at Ghent 15 days before the battle was fought, but news of the battle and the peace reached Washington almost together. (*See* WAR OF 1812.)

NEW PHILADELPHIA, a city of eastern Ohio, U.S.A., 75 m. S. by E. of Cleveland, adjoining Dover, on the Tuscarawas river and Federal highway 21, at an altitude of 890 ft.; the county seat of Tuscarawas county. It is served by the Baltimore and Ohio, the Pennsylvania and electric railways. Pop. 10,718 in 1920 (92% native white); estimated locally at over 12,000 in 1928. Coal and fire-clay abound in the immediate vicinity, and the city has important manufactures (including enamelled ware, tinplate, electric and vacuum sweepers, iron castings, steel, trucks, trailers and brick) with an output in 1925 valued at $6,380,691. There are 16 large plants in the county making sewer pipe, and 25 making brick. On May 3, 1772, a company of Christian Indians led by the Moravian missionary, David Zeisberger (1721–1808), came from western Pennsylvania, and three months later John Heckewelder (1743–1823) arrived with 200 more Indians. They laid out the town of Schoenbrunn at the "big spring" a little southeast of the present city of New Philadelphia, built the first church and the first school-house in Ohio, and more than 60 dwellings of hewn timber, but were obliged to abandon the settlement in 1777 on account of the hostility of the neighbouring Indians. The site of Schoenbrunn, discovered in 1923, has been bought by the Ohio State Archaeological and Historical Society, which proposes to reconstruct the pioneer town. Other missions were planted in this region at Gnadenhütten (1772), Lichtenau (1776) and Salem (1780). On March 7 and 8, 1782, the 96 peaceful Christian Indians at Gnadenhütten were tricked and brutally massacred by a force of 100 whites sent out from Ft. Pitt under Col. Williamson. At Zoar, 5 m. N. of New Philadelphia, a settlement was made in 1817 by 225 Germans under the leadership of Joseph Bimeler. In 1824 they organized a communistic society, which lasted until 1898. New Philadelphia was founded in 1804 by John Knisely, from Pennsylvania. It was incorporated as a village in 1815 and chartered as a city in 1896.

NEW PLYMOUTH, a municipality and seaport on the west coast of North Island, New Zealand, capital of the provincial district of Taranaki, 258 m. north-north-west of Wellington by rail. Pop. (1927) 16,790. The district is not unjustly termed "the garden of New Zealand." It is highly fertile, cereals and fruits growing well; and it is one of the chief dairy centres of New Zealand. The settlement was founded in 1841 by the Plymouth Company under the auspices of the New Zealand Company, and chiefly consisted of emigrants from Devonshire and Cornwall. On the seashore in the neighbourhood are extensive deposits of ironsand.

NEWPORT, a municipal, county and parliamentary borough, seaport and market town of Monmouthshire, England, on the Usk, 5 m. from its confluence with the Severn, and 133½ m. from London by the G.W. railway. Pop. (1921) 92,358. It lies chiefly on the right (west) bank of the river, and on the east, north and west it is sheltered by a line of hills.

An ancient mesne borough and castle, it occupied an important position on the Welsh marches. The town, which is not mentioned in Domesday, grew up round the castle built early in the 12th century. Giraldus Cambrensis, writing in 1187, calls it *Novus Burgus,* probably to distinguish it from Caerleon, whose prosperity declined as that of Newport increased. From Robert Fitz Hamon (d. 1107) the lordship passed to the earls of Gloucester and Stafford and the dukes of Buckingham. Hugh le Despenser, who held the lordship for a short time, obtained in 1323 a charter of liberties for the burgesses, granting them freedom from toll throughout England, Ireland and Aquitaine. The earl of Stafford granted a further charter in 1385, confirmed by his grandson in 1427, which gave the burgesses the right of self-government and of a merchant gild. On the attainder of the duke of Buckingham in 1483 the lordship lapsed to the Crown, of whom it was held in the 16th and 17th centuries by the Pembrokes, and in the 19th by the Beauforts. The town was incorporated by charter of James I. in 1624 under the title of "Mayor and Bailiffs." This charter was confirmed by Charles II. in 1685. In 1385 the borough obtained a market lasting 15 days from the vigil of St. Lawrence (Aug. 10). The charter of 1624 granted two fairs, one on the feast of the Ascension, and a second on St. Leonard's day (Nov. 6). Newport was the scene of a serious Chartist riot in 1839.

The old parish church of St. Woollos (since 1921 the cathedral church of the Anglican diocese of Monmouth) stands on Stow hill. Originally it consisted only of the present nave, a fine specimen of grand, though unadorned, Norman architecture; but a massive square tower (of the time of Henry III.) and a chancel were subsequently added; a large western Early English lady-chapel is interposed between the nave and the tower. The castle, founded at the close of the 11th century, was greatly altered in the late Perpendicular period. The old Dominican monastery is entirely rebuilt and occupied as a private residence; but there are a few fragments of a house of White Friars. There is a museum and art gallery. Newport owes a rapid increase in importance during the second half of the 19th century to its situa-

tion on a deep and spacious tidal river, which renders it an outlet for the eastern section of the South Wales coalfields.

Its population in 1801 was only 1,135. The Old dock was partially formed in 1842, while the Alexandra was opened in 1875. There were many subsequent extensions of the docks (particularly in 1907 and 1913), which are now owned by the G.W.R. company. The administration of the docks is in the hands of the Harbour commissioners. There are the Alexandra, North and South, docks with a quayage of 7,839 and 17,189 ft. respectively, and the Town (Old) dock with a quayage of 4,853 feet. The average depth of water in both Alexandra docks, which form a single sheet of water, is 45 ft. at spring tides and 35 ft. at neap tides. In the Old dock the depths are 30 ft. and 20 ft. respectively. There are two dry docks connected with the Alexandra docks, one owned by the G.W.R. company being 523 ft. long and 74 ft. wide, while the privately owned dry dock is 415 ft. long and 60 ft. wide. There are six other private dry docks all of them entered from the river. The town has grown rapidly during the first quarter of the 20th century under a town planning scheme, and extensive building has been carried out at Somerleyton and St. Julien's. It is now spreading over Caerleon. Newport returns one member to parliament.

NEWPORT, market town, municipal borough, the chief town of the Isle of Wight, England. Pop. (1921) 11,031. It is situated near the centre of the island, at the head of the navigation of the Medina river, 5 m. S. from its mouth at Cowes. It is the chief centre of the railway system of the island. The church of St. Thomas of Canterbury was rebuilt in 1854 in the Decorated style. The guildhall, erected in 1816, includes the town-hall in the upper story with the market-place below. There are a corn exchange and museum. The grammar school was founded in 1612, and there is a blue-coat school for girls founded in 1761. The Albany barracks and Parkhurst prison lie north of the town. A considerable trade is carried on in timber, malt, wheat and flour. It is supposed that Newport (*Neuport*) was a Roman settlement, then known as *Medina*. There are no traces of Saxon occupation, and no evidence that Newport became a borough before the reign of Henry II. The first charter was granted by Richard de Redvers between 1177 and 1184, and confirmed in 1349 by Edward III. and afterwards by successive kings. The borough was incorporated by James I. in 1607, and a second charter of incorporation granted by Charles I. in 1637 is that by which Newport was governed until 1835. It was represented in parliament in 1295, but no other return was made until 1584, when it regularly sent two members. From 1867 to 1885 it sent one but in 1885 its representation was merged in that of the island. A fair was formerly held on Whit-Monday, the two following days and the three Saturdays nearest Whitsuntide. The Saturday market dates from 1184, and there is a Wednesday cattle market. Owing to its facilities for trade, Newport early superseded Carisbrooke as the capital of the island.

NEWPORT, a market town and urban district of Shropshire, England, 18 m. E.N.E. of Shrewsbury, with stations on the G.W.R. and L.M.S.R., and on the Shrewsbury canal. Pop. (1921) 3,054. Newport is not mentioned in Domesday, but at the time of the Conquest formed part of the manor of Edgmond, which William I. gave with the rest of Shropshire to Roger, earl of Shrewsbury. Henry I. is thought to have founded the borough, at first called New Borough, after the manor had come into his hands through the forfeiture of Robert de Belesme. The site was probably chosen partly on account of the fisheries which are mentioned in Domesday. Henry II. granted all the liberties, rights and customs which the town enjoyed under Henry I. Henry III. granted the borough with the manor of Edgmond, to Henry de Audley. Confirmation charters were granted by Edward I. in 1287 and Edward II. in 1311. The town was incorporated in 1551 by Edward VI. whose charter was confirmed by James I. in 1604. The governing body consisted of a high steward, deputy steward, two water-bailiffs and 28 burgesses, but the corporation was abolished by the Municipal Corporation Act of 1883, and a Local Board was formed, which, under the Local Government Act, gave place in 1894 to an urban district council. The church of St. Nicholas is Early English and Perpendicular. There is an ancient market cross. Newport possesses a grammar school founded in 1665. To the south of the town are the ruins of Lilleshall abbey.

NEWPORT, a city of Campbell county, Kentucky, U.S.A., on the Ohio river, opposite Cincinnati and adjoining Bellevue, and separated from Covington only by the Licking river. It is on Federal highways 25 and 27, and is served by the Chesapeake and Ohio and the Louisville and Nashville railways, inter-urban trolley and motor-bus lines, and river steamers. Pop. 29,317 in 1920 (90% native white). It is a residential suburb of Cincinnati, and also an important industrial centre, with rolling mills, steel works and other manufacturing plants. The factory output in 1925 was valued at $17,171,617. In the highlands 2 m. back of the city is Ft. Thomas (a U.S. military post, established in 1888 to supersede Newport barracks [1804]) and a town of the same name (pop. 5,028 in 1920). Newport was laid out in 1791, incorporated as a town in 1795 and chartered as a city in 1834.

NEWPORT, a city of Rhode Island, U.S.A., 30 m. S. by E. of Providence, occupying the southern end of the island of Rhode Island (or Aquidneck); a port of entry, the county seat of Newport county, a place of great historic interest, and a fashionable summer and autumn resort. It is served by the New York, New Haven and Hartford railroad, motor-bus lines, various ferries and the Fall River line of steamers. Pop. (1920) 30,255 (19% foreign-born white and 5% negroes).

From the harbour on the west the city rises to a gently rolling plateau with maximum elevations of about 250 feet. The climate is mild and equable throughout the greater part of the year. The "Old Town," with its narrow streets and 18th century houses, climbs the hill back of the harbour. At the head of Washington square, or the Parade, stands the old State House (or Colony House, when it was built in 1739), now used by the county court, containing a full-length portrait of Washington by Gilbert Stuart, where Washington, Adams, Jackson and other presidents have been entertained. Near by are the birthplace of Commodore Perry, and the Vernon house (built in 1758, and occupied by Rochambeau during the Revolution), which still has its beautiful mahogany balustrades, panelled chimney-pieces and Delft-tiled hearths. Trinity church (1725) has a lovely white spire, tipped with a golden crown. At the head of Touro street (named for Isaac Touro, an early rabbi of Dutch nativity) is the Hebrew cemetery (established in 1677) and farther down the street is a fine synagogue (1763) said to be the oldest in America. The old Friends' meeting house, part of which dates from 1699 (the first one built on American soil) is now a museum, and its extensive grounds are used as playfields. In Touro park, near the upper end of Bellevue avenue, is the old stone mill, frequently attributed (as by Longfellow in his *Skeleton in Armor*) to the Norsemen; and near by is the Redwood library, incorporated in 1747 (a development of the Philosophical Society founded in 1730), occupying a building erected in 1750, and named for Abraham Redwood (d. 1788), a Friend who contributed £500 for books. A little farther on is the Casino, and from this point Bellevue avenue, extending south to the ocean, is bordered on both sides with the summer "cottages" of wealthy New Yorkers—palatial structures representing almost every possible style of architecture, set in ancient trees and modern gardens, behind high stone or brick walls or grilled fences. A horse show has been held every year since 1896, and a dog show is also an annual event. On Conanicut island, west of Newport, is the old town of Jamestown (pop. [1925] 1,773) also a summer resort.

Newport's inner harbour, formed by a deep indentation in the western shore, has a depth of about 18 ft. and is almost landlocked. It is guarded by Ft. Adams on the point forming its western boundary. On Goat island, lying in the entrance of the harbour, is Ft. Walcott, with a U.S. torpedo station; and on Coasters Harbor island, farther north, off which the old frigate "Constellation" rides at anchor, are a training station of the U.S. navy, a Naval War college, a Naval hospital and old Ft. Greene. The traffic of the harbour (entirely domestic commerce) amounted to 146,532 tons in 1925, valued at $14,220,157.

Newport was founded in 1639 by John Clarke, William Coddington and other Antinomians, who had been driven out of the Massachusetts Bay Colony. The Baptist church they organized

in 1640 is the oldest in the United States, after the one in Providence. An independent government by judge and elders was established, but in 1647 the town united with Providence, Portsmouth and Warwick to form the Colony of Rhode Island and Providence plantations, under the charter secured by Roger Williams in 1644. In 1656 there was an influx of English Friends. The first newspaper was published in 1732 by James Franklin (a brother of Benjamin), whose son James in 1758 established the *Mercury*, still published. Between 1739 and 1760 great fortunes were made in the "triangular trade" with Africa and the Barbadoes, in which rum from Newport was exchanged for slaves in Africa, who were exchanged for sugar and molasses in the Barbadoes, which were brought back to Newport to be made into more rum. In 1770 Newport's foreign trade was greater than that of New York, but it was entirely destroyed by the Revolution, when the town was in the hands of the British from Dec. 1776 to Oct. 25, 1779. After the evacuation of the British it was occupied by French troops under Rochambeau, and in 1780–81 it was a station of the French fleet. Newport was chartered as a city in 1784; resumed the town form of government in 1787; was again chartered as a city in 1853; and secured a new charter in 1906. Until 1900 it was one of the capitals of Rhode Island. The influx of wealthy New Yorkers began after the Civil War.

NEWPORT, a city of northern Vermont, U.S.A., a port of entry and the county seat of Orleans county; beautifully situated at the southern end of Lake Memphremagog, 6 m. from the Canadian border. It is on Federal highway 5, and is served by the Canadian Pacific and the Quebec Central railways, and in summer by lake steamers. Pop. (1920) 4,976. It is a summer resort, a centre for winter sports, a shipping point for maple-sugar and farm products, and has several manufacturing industries. It was founded about 1810 and incorporated as a city in 1918.

NEWPORT NEWS, a city and a port of entry of southeastern Virginia, U.S.A., on the north side of Hampton Roads and the James river, opposite Norfolk; in Warwick county, but independent of it. It is on Federal highway 60; is the tide-water terminus of the Chesapeake and Ohio railway; and is served also by interurban trolley, motor-bus and truck lines, several ferries and numerous steamship lines. Pop. 35,596 in 1920 (40% negroes); estimated at 53,300 in 1928. Newport News is one of the four cities forming the port of Hampton Roads (*q.v.*), the principal coal and tobacco port of the United States. Its harbour, spacious and well protected, is connected with the ocean by a channel 600 ft. wide and 35 ft. deep. Nearly a mile of the water front, at the southern end of the city, is occupied by the great railway terminal, covering 337 ac., and comprising 125 m. of track, storage space for 4,500 cars, warehouses with 1,500,000 sq.ft. of floor space, piers specially equipped for handling bunker and cargo coal and other commodities, and a grain elevator with a capacity of 1,000,000 bushels. Farther north on the river are the ship-yards (among the largest in the country) which have built many United States battleships, cruisers, gunboats and numerous merchant vessels (including the largest ever built in America, the S.S. "California," of 31,000 tons displacement, completed in 1928), and where in 1922–23 the "Leviathan" was reconditioned. Between these two outstanding features of the city, about the centre of the water front, is a public park, and near by a municipal harbour for small boats. Newport News exports over 7,000,000 tons of coal and 145,000,000 lb. of tobacco in a year. Its total water-borne commerce in 1926 amounted to 8,887,442 tons. The exports, chiefly tobacco, coal and automobiles, were valued in 1925 at $53,352,024; the imports, largely copra, pulpwood, manganese ore and fertilizer materials, at $3,933,519. Shipbuilding and repairing are the principal manufacturing industries. The aggregate factory output in 1925 was valued at $19,719,194. The city operates under a commission-manager form of government. Its assessed valuation for 1928 was $44,160,902.

A settlement of Irish colonists was planted here in 1621 by Daniel Gookin, and the name was chosen to honour Capt. Christopher Newport, an associate of John Smith, and Sir William Newce, on whose advice the site was selected. It remained a small hamlet until in 1881 it became the eastern terminus of the Chesapeake and Ohio railway. The city was laid out in 1882 and incorporated in 1896. By 1900 it had a population of 19,635.

NEWPORT PAGNELL, a market town in Buckinghamshire, England, 56 m. N.W. by N. of London, on the L.M.S. railway, and at the junction of the river Ouzel with the Ouse. Pop. (1921) 4,142. The church of St. Paul and St. Peter has Early English portions. The almshouse called Queen Anne's Hospital is named from Anne of Denmark, queen of James I., who reconstituted a foundation of the time of Edward I.

NEWQUAY, a seaport and watering-place of Cornwall, England, 14 m. N. of Truro by rail. Pop. of urban district (1921) 6,637. It is situated on Newquay bay, sheltered to the west by Towan head. The harbour, artificially constructed, and equipped with a jetty and piers, admits vessels of 200 tons. China stone and china clay are exported and coal is the chief import.

NEW ROCHELLE, a city of Westchester county, New York, U.S.A., on Long Island sound, the Boston Post road and Hutchinson River parkway, 16 m. N.E. of the Grand Central station in New York city. It is served by the New York, New Haven and Hartford and electric railways. Pop. (1920) 36,213 (23% foreign-born white); 1928 local estimate 48,800. New Rochelle is primarily a residential suburb of New York, with some fine old colonial dwellings still standing, and many beautiful modern residential districts of park-like contour. It is the seat of the College of New Rochelle (Roman Catholic; 1904). The city has an area of 10·2 sq.m., 9 m. of water front, and a rolling surface reaching an altitude of 289 feet. Zoning ordinances are in effect, and there is a city-planning commission. Besides three city parks covering 83 ac., there are within the city limits parks, parkways and bathing beaches (including Glen island) aggregating 385 ac., owned by the county. There is comparatively little manufacturing, except for local consumption. The Knickerbocker Press is in the outskirts of the city. The assessed valuation for 1927 was $134,200,524, and the value of exempt property is estimated at $15,000,000. On the landward side the city is fringed by residential suburbs, including Larchmont, Pelham and Pelham Manor. The farm given by the State to Thomas Paine at the close of the Revolution is marked by a monument on the road to White Plains, and the farmhouse is now a museum. On David's island, 2 m. S.W. of New Rochelle, is Ft. Slocum, a U.S. army post. The New York Athletic club has a country clubhouse on Travers island, just east of Pelham Manor. The first settlement of importance on the site of New Rochelle was made in 1688 by Huguenots, some of whom came from La Rochelle. The village was incorporated in 1847 and in 1899 it became a city. In 1850 the population was 2,458. By 1900 it had grown to 14,720, and between 1900 and 1910 it practically doubled.

NEW ROSS, a town of co. Wexford, Ireland, on the Barrow, 2 m. below its junction with the Nore, 102 m. S.S.W. of Dublin by the Great Southern railway. Pop. (1926) 5,009. St. Alban built the abbey of Rossmactreoin, which gave rise to the ancient city Rossglas. There are remains in Rosbercon of a 13th century Dominican foundation. According to Camden, New Ross was founded by Isabella, daughter of Strongbow and wife of William Marshal, afterwards earl of Pembroke. A charter granted to it by Roger Bigod in the reign of Edward I., was extended by James I. and James II. In 1269 the town was surrounded by walls. The fortresses were dismantled by Cromwell, but some remains are extant. The Barrow is crossed by a swivel bridge. The inland water communications reach to Dublin by means of the Barrow and the Grand canal. The Nore is navigable to Inistioge. New Ross has breweries and tan-yards, a salmon fishery, and exports agricultural produce. The urban district includes Rosbercon.

NEWRY, a seaport and market town of co. Down, Ireland, on the Newry water and Newry canal at the extreme head of Carlingford lough, 73 m. N. of Dublin by the Great Northern railway. Pop. (1921) urban dist. 11,963. In 1175 an abbey was founded here by Maurice M'Loughlin, king of Ireland. It was converted in 1543 into a collegiate church for secular priests, and was dissolved by Edward VI., who granted it to Sir Nicholas

Bagenal, marshal of Ireland. In 1689 Newry was set on fire by the duke of Berwick when in retreat before Schomberg. Charters were granted to the town by James I. and James II. Until 1898 a portion of Newry was situated in co. Armagh. A mile N.E. of the town is a notable rath or enclosure, taking its name of Crown rath from traditional single encounters between native princes in contention for the sovereignty. The L.M.S. railway connects Newry with the deep-water harbour at Greenore; and there is an electric railway to Bessbrook in co. Armagh. The western part, called Ballybot, is connected with the eastern part, or old town, by bridges over the canal and over the tidal water. The port admits vessels of 3,000 tons to Victoria basin, 3 m. from the town.

NEWS AGENCY. An agency which supplies news to periodicals, clubs, associations, or private persons, by telegram, in manuscript, proof, by tape machine or duplicated; less frequently by telephone. A news agency does not itself publish news but supplies information privately to its subscribers.

British News Agencies.—These may conveniently be divided into four categories:

(1) *Propaganda News Agencies.* These are generally small in size and confine their information to the particular question in which they are interested. Examples are the Labour Press Service and the Protestant Press Bureau. Information from these bureaus, though sent out in good faith, is necessarily scrutinized more carefully for possible bias by the experienced journalist than information received from other sources. In general these bureaus are not commercially profitable enterprises but are subsidized by political or other organizations.

(2) *Local Agencies.* In a number of middlesized towns there are news or reporting agencies such as the Bradford Press Bureau or the Aberystwyth News Agency, whose object is not merely to serve the local press with news of every kind but to take in some measure the place of a local correspondent for the lesser London dailies. Agencies of this class and the first frequently send in unsolicited information, to be paid for if and as used. Agencies of the two following classes rarely do so.

(3) *Technical Agencies.* These, such as the Aviation News Agency, the Commercial Press Telegram Bureau, the Hockey Reporting Agency, explain their function by their names. They are mostly situated in London, and they necessarily appeal to a limited clientele; but some, especially the sporting agencies, are very considerable enterprises.

(4) *National Agencies.* Infinitely the most important form of news agency is the national agency, both from the range of its activities, the size of its staff and its powerful and subtle influence in the press. Of these, though the name of the British United Press is occurring more and more frequently in the columns of London dailies, there are but four of prime importance: the Press Association Ltd., which deals only with home affairs, Reuters' Ltd., which deals only with foreign affairs, the Central News Ltd., and the Exchange Telegraph Company Ltd., both of which cover both fields.

Use of News Agency Material. An inexperienced reader may well be surprised when he finds that a high percentage of the general news in two supposedly hostile dailies is given in identically the same phrasing, word for word and comma for comma. A closer investigation will disclose, either prominent or hidden in the second or third sentence, an ascription to the Exchange, Reuters, or Central News: if there is none, the "copy" is probably Press Association matter. It is now true that the material from which is made up a high proportion of those papers which do not, like the *Times* or the *Observer,* maintain a very large staff of correspondents, is identical: the scope of the editor and subeditors is now largely confined to the selection and presentation of material which has been presented in identical form at the same minute to every other London office. The task of a newspaper staff is consequently nowadays no longer exclusively the procuring of news but very largely the *cuisine* of standard material which arrives automatically. The influence of the agencies has been severely attacked as limiting the freedom of the press. The sources of information are narrowed and it is stated that there is more possibility of bias or suppression. On the other hand, as will be shown, the field of information is far more effectively "covered" than was possible last century.

All newspapers rely chiefly on the agencies for the receipt of what may be called formal or expected news such as university intelligence, market returns or city quotations. In the same category, to a large extent, fall many ministerial statements, which are often circulated through the Press Association or other agencies. Such circulation obviates the calling together of some scores of reporters to hear precisely the same words; moreover, an experienced politician, though he may add in an interview extra details for the papers he desires to favour, will not make his general statement until he is assured that the agency representatives are present, as through them he can speak to the whole British and much of the Colonial press.

For general news, the agencies cover a larger area than any one journal could. At any one of the smaller London police courts, for example, an interesting or scandalous case may at any moment come up without warning. No private reporting staff could hope to catch every such case, but an agency man is almost certain to be in attendance. If, again, it is known that a case or a function of unusual interest is expected in a town where the paper concerned has no correspondent, a "special" is ordered from an agency, which details one of its reporters, for that day only, to telegraph an exclusive report to its client.

Agency material, in London, is delivered by telegram, by duplicated sheets delivered by hand, and (in the case of the Central News, Reuters and the Exchange) by tape machines. The largest foreign service is supplied by Reuters, used by the British government during the World War for propaganda purposes and denounced as mendacious by the German Press, as in the famous cartoon *Das Reuter Denkmal.* The agencies have been charged with bias in their presentation of news, especially foreign news. The truth or otherwise of this charge must be a matter of opinion, but it can safely be said that there is no authenticated case of the agencies having refused their services to a journal to whose policy they objected. The power of the American Associated Press has no parallel in Britain, nor have the disputes over its exclusiveness and the competition for "A.P. franchises."

The services provided for the provincial press are in some ways even more extensive, as they include "London letters" and often the only reports received of Parliamentary proceedings. Even syndicated "leaders" are often sent out, and propaganda agencies supply newspapers (other than dailies) half-printed, with blank pages for local information. The staff of the agencies are for the most part organized in the National Union of Journalists, and salaries, in comparison with pre-war rates, have notably increased. (R. W. P.)

United States.—Two rival principles underlie American news agencies. The Associated Press and the Canadian Press represent one principle, that of pure co-operation and mutuality, and the United Press Associations and the International News Service represent the opposite fundamental in that they are profit-making corporations, collecting and selling service on commercial lines. There is lively competition in the news agency field, both for group domination and for reportorial achievement. In one sense, all of the news services serve a common ideal which is to deliver to their "members" or "clients" the important news by the most rapid means, written true to authenticated or evidential facts without bias, opinion or undue colour.

The development of the American news agency dates back to the struggle of the pioneer press of New York. While individual editors of the colonial press and their successors for 50 years had with interesting enterprise employed the foot-courier, the packet, the stage-coach, the pony-express, the canal-boat and the primitive steam-train, the birth of the idea that there might be co-operation among several newspapers in the collection of news which all could share occurred just 100 years ago when the Association of Morning Newspapers was organized in New York for the purpose of maintaining boats to meet ships as they came up the bay bearing news from Europe. The first telegraph line, running from Washington to Baltimore, was not opened until 1843. Fifteen years later the Atlantic cable was opened for

traffic. Other co-operative news agencies, concerned with the business of meeting ships in New York harbour, were later organized and from a merger of these the New York Associated Press, a co-operative news-gathering organization of New York newspapers, was formed. It was mutual in New York, but sold its product to newspapers in other American cities. In various sections of the United States other small, co-operative or privately owned news agencies gradually came into being, such as the New England Associated Press, the Southern Associated Press and the Western Associated Press. The United Press, which is not to be confused with the United Press Associations of this day, was established as a national rival to the various Associated Press units, then only beginning to co-operate. Morse's invention of the telegraph was the basis of these agency operations. In 1892 the unified Associated Press took the field as the rival of the old United Press. It succeeded in making contracts for the exclusive use in the United States of the news reports of the leading European agencies—Reuter in Great Britain, Wolff in Germany and Havas in France. These connections had previously been in favour of the United Press and their loss resulted in the failure of the latter organization. To supplant the United Press several agencies were formed by groups of newspapers outside of the Associated Press group. They were the Publishers' Press and the Laffan Service operating in the eastern States, the Scripps-McRae Press Association, operating in the Middle West and the Scripps-Blade Service, operating in Pacific coast States. Except for the Laffan Service, which was finally discontinued, these services merged to form the United Press Associations of to-day. The organization was completed in 1907. The Associated Press was reorganized in 1900 and incorporated under the laws of New York, as a purely co-operative association that could declare no dividends, that elected its membership and shared the cost of operation among members who are individuals representing newspapers, not the newspapers themselves. The International News Service and the Universal News Service, the former to serve evening and Sunday newspapers and the latter to serve morning and Sunday newspapers, on a commercial basis, were established by William Randolph Hearst in 1906. Early in 1928 the Universal Service left the "spot-news" field to give its exclusive attention to special or "feature" news. The Canadian Associated Press is co-operative, non-profit making, its elected members dividing the costs of operation. It works in close relation to the Associated Press, with an exchange of news reports. (M. E. P.)

NEW SIBERIAN ISLANDS are situated off the Arctic coast of Siberia, from 73° to 76° 6′ N., and 135° 30′ to 151° E. The name is loosely applied, covering either the northern group only of these islands, for which the name of New Siberian or Anjou Islands ought properly to be reserved, or the southern group as well, which ought to retain its name of Lyakhov Islands. Some confusion prevails also as to whether the islands Bennett, Jokhov, Vilkitski, Henrietta and Jeannette, ought to be included in the same archipelago, or described separately as the Jeannette or De Long Islands. The first three of these belong geographically, and probably geologically to the New Siberian group, from which they are less than 100 m. distant. Henrietta and Jeannette Islands lie 200 m. north-east of Novaya Sibir Island, in 157° to 159° E. Sannikov Land, reported by J. Sannikov in 1805 to lie north of Kotelni Island, probably does not exist. The islands form part of the Yakutsk Soviet Republic.

The *New Siberian Islands* consist of Kotelni, the largest (116 m. long, 100 m. wide), having the small island Byelkovski near its western shore; Thaddeus (Faddeevski), in the middle; and Novaya Sibir, New Siberia, in the east (90 m. long, 40 m. wide). Kotelni is the largest and reaches an altitude of 1,200 ft. in the volcanic Malakatyn-tas mountain. It is built of Silurian coral limestones (Llandovery division), containing a rich fossil fauna. The same Silurian deposits are widely spread on the mainland as far as the Olenek. Middle Devonian limestones and slates are all faulted north-north-west and south-south-east. Triassic slates appear in the south-east. Diabases pierce to Devonian rocks. The eastern portion of the island, named Bunge's Land, is covered with Post-Tertiary deposits. Novaya Sibir Island attains altitudes of 200 to 300 ft. in its western portion. The so-called Wood Mountains, which were supposed to be accumulations of floating wood, are denudations of Miocene deposits containing layers of brown coal with full stems of trees. These Tertiary deposits are characterized by a rich flora and fauna, testifying to a climate once very much warmer. The only representative of tree vegetation now is a dwarf willow 1 in. high.

The *Lyakhov Islands* consist of Bolshoi, or Blizhni, which is separated by Laptev Strait, 27 m. wide, from Svyatoi Nos of Siberia; Mali, or Dalni; and several smaller islands to the west of Mali. Bolshoi too consists of granite protruding from beneath non-fossiliferous deposits. Along its southern coast Baron Toll found immense layers of fossil ice, 70 ft. thick, evidently relics from the Ice Age, covered by an upper layer of Post-Tertiary deposits containing numbers of perfectly well-preserved mammoth remains, rhinoceros, *Ovibos*, and bones of the horse, reindeer, American stag, antelope, *saiga*, and even the tiger, associated with relics of forest vegetation. A stem of *Alnus fruticosa*, 90 ft. high, was found with all its roots and even fruit. Similar deposits of ground ice occur in Vasilievski Island. Basalts and Tertiary brown coal deposits enter into the composition of the southern extremity of Bennett Island; Vilkitski Island is low (50 ft.) and basaltic. Bennett and Henrietta Islands have a few small glaciers. The New Siberian Islands have none.

The climate of these islands is very severe. In 1886 the winter ended only in June, to begin anew in August (May 21, −5·8° F; Oct. 16, −34·6°). The highest summer temperature was 50°. Flocks of geese and other birds come to the islands in summer. The lemmings are numerous. Reindeer, followed by wolves, come across the ice from Siberia; the fox and polar bear feed on the lemmings. There is much driftwood. The islands have been long known to Siberian hunters who come for furs and fossil ivory.

A Yakutsk Cossack, named Vaghin, wintered on Bolshoi in 1712, but it was a merchant, Lyakhov, who first described the two greater islands of this group in 1770, and three years later reached on sledges the largest island of the New Siberian group, which he named Kotelni. M. Hedenstrom, accompanied by Sannikov, explored the archipelago and published a map of it in 1811. Anjou visited it in 1821–23. A scientific expedition under Dr. A. Bunge (including Baron E. Toll) explored it in 1885–86. Toll revisited it in 1893 with Shileiko, and again in 1900 with F. G. Seeberg in the "Zarya." The Russian hydrographical expedition in "Taimir" and "Vaigach" in 1912 did some surveys in the New Siberian Islands; in 1913 it discovered Vilkitski Island and in 1914, Jokhov Island. The "Maud" in 1924 visited the New Siberian Islands. (*See* ARCTIC REGIONS.)

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NEW SOUTH WALES, a state of the Commonwealth of Australia, lying in the south-east, and occupying 309,432 sq.m. or 10·4% of the continent. From the east coast (Point Danger-Cape Howe, 700 miles) to the western boundary which runs for 240 miles along longitude 141° E., the average breadth is *c.* 650 miles. The northern boundary lies along lat. 29° S. and further east, along the Upper Darling (Barwon-Macintyre-Dumaresq) streams and thence along a crooked line of highland divide (Macpherson Range, etc.) to Point Danger. The southern boundary is formed by the middle and upper Murray to the head of the Indi (Forest Hill), thence in a straight line south-east to Cape Howe.

Physiographically four main divisions may be distinguished, corresponding to fairly well-marked climatic and economic areas.

(i.) **Eastern Highlands,** the most striking, as also the most decisive, of the relief features, consists of a belt of plateaux extending from the Macpherson Range on the north to the Australian Alps (*q.v.*) on the south. (*See* AUSTRALIA: *Geomorphology; Queensland.*) In the north the *New England Plateau* (*c.* 200 miles long, 70–80 miles broad, with *c.* 9,000 sq. miles lying above 3,000 ft.) rises in its centre to *c.* 5,000 ft.—Ben Lomond,

5,000 ft.; Mount Capoompeta, 5,100 ft.—sinks at either extremity to *c.* 4,000 ft.; Mount Lindsay (Macpherson Range), 4,064 ft.; Oxley's Peak (Liverpool Range), 4,500 ft.—and has considerable outliers, on the west the volcanic Nandewars (4,000 ft.) and Warrumbungle Range (3,000 ft.), and on the east and south the semi-detached spurs carved out by stream erosion into the likeness of ranges—Hastings, Mount Royal, Liverpool, etc., "Ranges." To the south of these ranges the plateau belt is broken across and the Central Plateau is separated from the more northerly by the remarkable Hunter River valley, the saddle at the head of which (near Cassilis) lies at *c.* 1,500 ft. The *Central Plateau* extends from this gap to the Lake George depression just north of the Federal Capital Territory. In general it repeats the features of the New England Plateau (*cf.* volcanic outliers on the west: Canobolas group, *c.* 3,000 ft.) but it is smaller and lower, few areas rising above 4,000 ft., and altitudes vary considerably. Its north-eastern section, the Blue Mountain Plateau, capped with (Triassic) sandstone, tilts from 4,000 ft. (west) to 700 ft. (east). From the Lake George fault-depression ("Senkungsfeld") to the border extends the *Southern Plateau*, a portion of the Australian Alps, a series of massive flattish-topped blocks diversified by (mainly north to south) down-faulted depressions (Mount Kosciusko, 7,328 ft.). Geologically this highland belt is characterised by its prevailingly ancient rocks (pre-Cambrian granites, folded Palaeozoics, etc.); by the volcanic flows (basalt, trachyte, etc.) which form cappings over considerable areas; by the extensive faulting which has differentiated levels, dislocated former drainage and resulted, in particular, in the abrupt scarps and declivities of the eastern flank; by the flattening by erosion (peneplanation) of the surfaces.

(ii.) **The Coastal Lowlands** belong structurally to the highland belt, being mainly, perhaps, down-faulted portions of it. The coast-line also appears in certain stretches (*e.g.*, in the south) to be fault-determined. Almost everywhere the plateaux behind break away in sharp declivities and form steep backing walls often scarred by deep gorges. The coastal lowlands are mostly narrow (10–20 miles)—often mere deltaic fringes at river-mouths. In three places—around Sydney, Hunter River, Clarence-Richmond-Tweed rivers—they form roomier basins in which later rock-formations (*e.g.*, Triassic) have been preserved. The Hunter-Goulburn Valley is a down-faulted trough worked out by erosion in weak strata and breaks across the highlands, running almost straight south-east to north-west for 120 miles to the Cassilis saddle (*v. sup.*) and is floored in its lower part with deltaic deposits. The structure of the Hunter Valley and of the Sydney Basin accounts for the outcropping of valuable coal seams. The coast-line, backed in many parts by bold heights, consists mainly of a succession of rugged promontories alternating with sandy bays and some inlets. In the central portion, on the other hand, subsidence has produced fine drowned valley harbours (Sydney, Port Stephens, Broken Bay, etc.).

(iii.) **The Western Slopes** are the "ramp" of the eastern plateaux, their uneven but relatively gentle declivity towards the great interior plains. In addition to outliers of the highlands (Mount Exmouth group, Curumbenya Range, etc.) the Cobar (*c.* 300 miles south-east–north-west; 150 miles wide; altitude 500–1,000 ft.) and Wyalong peneplains—worn-down relics of the buckled ancient floor which protrude through the later surface deposits—are the chief irregularities, though the streams have excavated long and broad transverse furrows.

(iv.) **The (Western) Plains** occupy all the remainder (nearly ⅔) of the State except the north-west corner where the Barrier "Range" (*c.* 100 miles north to south; 30 miles east to west; altitude *c.* 2,000 ft. or 500 ft. above the surrounding plains) forms a series of hard etched and scarped ridges and resembles in structure the Cobar "peneplain." The immense plains—substantially the basins of the Upper Darling and a good part of that of the Murray—are floored with recent deposits (probably residuals of an earlier and wetter epoch). The western portions, and the older and higher of these deposits, are prevailingly red and are generally fertile. Black soils are found in the river valleys (*e.g.*, middle Macquarie, Castlereagh, Namoi, etc.) and along the silted-up courses of old streams. The streams, meandering, distributing, and flooding wide over these levels, are continually spreading fresh alluvium. The northern portion (80,000 sq. miles) reaching south-eastwards to Dubbo, falls within the Great Artesian basin, and the south-western parts (Riverina) fall within the Murray-River artesian area. In the former area bores vary from *c.* 90–4,340 ft. (av. *c.* 1,750 ft.), while 380 flowing wells discharge 80,780,000 gals. a day (maximum for single well, 1·5 million gallons).

Of the rivers the coastward-draining are relatively short, the Hunter and Hawkesbury, each *c.* 340 m. are the longest—rapid and constant-flowing streams, and owing to recent (Pleistocene and earlier) uplift, they are vigorously cutting back and excavating deep canyon-like gorges in the plateaux behind (*cf.* upper Macleay gorge, 3,000 ft. deep), creating wild and beautiful scenery and opportunities for the development of water-power. The lower basins are undulating to hilly with rich alluvial flats. Sand-barred mouths are common and also lagoon-like lakes (*e.g.*, Lake Macquarie) due to damming of mouths by marine drift. (*Cf.* south to north current along the coast.) Few are navigable for any great distance and then usually for small craft only (*e.g.*, Hawkesbury, 70 miles; Macleay, 39 miles; Shoalhaven, 22 miles). *See* also RICHMOND RIVER. The inward-flowing streams have been referred to. (*See* AUSTRALIA: *Drainage.*) Of the Murray, 1,200 miles are within New South Wales. Recent measurements have given the following results: Darling, length 1,702 miles, drainage area 221,700 sq. miles; Murrumbidgee, 981 and 10,700; Lachlan, 922 and 10,420; Macquarie, 590 and 10,090; Namoi, 526 and 9,820.

Climate.—Situated wholly in the temperate zone, New South Wales has a generally moderate climate. Average temperatures are higher by 5°–7° F in the north than in the south, and the range increases towards the interior, the mean daily range on the coast being *c.* 19° F, in the western plains *c.* 26° F. The transition zone between summer and winter rains passes diagonally (north-west to south-east) through the State. The area south-west of the line Broken Hill-Wagga-Albury receives winter rains mainly from Antarctic depressions ("lows"); the area north-east of a sinuous line running from the north-west corner of the State to Newcastle receives summer rains from tropical (monsoonal) "lows"; the intervening belt receives rain from both quarters and, in the east, from the passage of anticyclones ("highs") also. The east receives much more rain, and more uniformly, than the interior, the isohyetal lines except in the south and south-west running roughly parallel with the coast. The extremes are in the north-east corner (80 in. per ann.) and in the north-west (7 in.). Only 42% of the total area receives an average of over 20 in. per ann.; 15% receives less than 10 in. which is also more or less erratic. Heavy rains cause extensive flooding of the streams resulting often in serious loss; droughts are also a recurrent difficulty, especially in the interior. The rate of evaporation increases from *c.* 40 in. a year on the coast to *c.* 100 in. in the north-west with concomitant seasonal aridity and the drying up of streams. Four main climatic divisions, corresponding to the physiographic, may be distinguished: (i.) *Coast:* relatively high and regular rainfall coming mainly from the sea, with mild and humid conditions. Av. ann. temps., in the north 76°–57° F, in the south 68°–51° F; rainfall 30–80 in. per ann., greater in the north. (*See* LISMORE, NEWCASTLE, SYDNEY.) (ii.) *Tablelands:* cool and bracing climate with cold winters in the south; uniform and reliable rainfall. Average ann. temps.: in the north 70°–45° F; in the south 63°–38° F; av. ann. rainfall, 40 in. in the east to 30 in. in the west. (*See* BATHURST.) (iii.) *Western Slopes:* a drier, sunny and healthy climate with uniformly distributed rainfall. Temperatures are higher in the north, summer: 81°–73° F, winter, 53°–46° F; rainfall (av. ann.): 30 in. in the east, 20 in. in the west. North of the Lachlan the rains come from the north in February–May; the Riverina has light, but fairly reliable, winter showers. (*See* ALBURY.) (iv.) *Western Plains:* a dry climate, invigorating in winter, but liable to suffer from droughts, dust-storms and, more locally, from floods. Temperatures are higher in the north—av. ann.: summer 84°–75°; winter 54°–49° F. Av. ann. rainfall from 7 in. in the north-west; 10–15 in. along the Darling; 20 in.

in the east. (*See* BROKEN HILL.)

Economics.—The general facts relating to the distribution of minerals, soils and natural vegetation have been given under AUSTRALIA (*q.v.*). The clear physical differentiations indicated above, together with the stage of growth attained, give the economic development of New South Wales a marked regional character. Climate, relief, location of minerals and accessibility (*i.e.*, communications) are dominant factors in the distribution of the population. The following survey therefore proceeds upon the basis of four regions, viz., Western Plains; Central Plains; Tablelands; Coastal Lowlands. The last three occupy belts roughly parallel with the coast-line and admit of subdivision into North, Central and Southern sections.

Western Plains, occupying the west and north-west portion (80,312,000 ac. = 125,487 sq.m. or ⅔ of the State) west of the courses of the Lachlan, Marra, and Upper Darling (Barwon) rivers, has abundance of good soils but a poor and unreliable rainfall—8–10 in.; under 10 in. over ¼ of its area—and suffers occasionally from fierce heats, droughts, floods and always from introduced rabbits. Mining and pastoral pursuits alone have importance. In the north-west is Broken Hill (*q.v.*); the once-famous Cobar-Nymagee copper area, which is just included in the east, has suspended production, and opal mining (White Cliffs, etc., in the north-west; Lightning Ridge field—12,000 acres—in the north-east—is depressed (output 1926: £11,500). It is an area of isolation, "wide open spaces," large long-term leaseholds, over 63% of the total area being occupied by 196 holdings of over 100,000 acres each. The country produces fine-wooled merinos, but its carrying capacity varies greatly with the seasons and is generally low (40–130 sheep per sq. mile according to season, or ⅓ of that of the lands further east). The livestock (1926) consisted mainly of 8,560,000 sheep, 100,000 head of cattle, 30,000 horses, and the total production (1925–26) of 65,000,000 lb. wool (less than ⅛ of the total pastoral produce of the State); minerals and mineral products to value of £5,072,000. The total population is 44,500 (1 person per 3 sq. miles; without Broken Hill, 1 per 6 sq. miles) or 1·9% of the population of the State, Broken Hill alone accounting for 24,000. Apart from this the settlements consist mainly of collecting and distributing centres for pastoral areas situated on railway lines (Cobar, etc.), on rivers (Wilcannia, Wentworth), or on both (Bourke, population *c.* 1,000; Walgett, Menindee, etc.) besides isolated stations and mining camps. Railways link Bourke, Cobar, Walgett and other towns on or near the eastern boundary—rivers with the eastern parts of the State and with Sydney, and the recently completed line from Sydney to Broken Hill (Condobolin-Ivanhoe-Menindee) traverses the heart of the area (east to west) and should help to develop much territory. Though increasingly tapped by railways the Darling still carries traffic (*e.g.*, wool to South Australia) in good seasons, and for the rest transport is by camel etc., train—increasingly by motor—over rough tracks.

The Central Plains form a natural extension of the western, large portions of them being little distinguished as regards relief from the latter. Thus in the north-west they comprise the low flat lands stretching east of the Barwon-Marra rivers, and in the south-east the broad Riverina plains are only divided from the western plains by the Murrumbidgee and Lachlan rivers. Further east the land slopes gradually up, but, except in the centre (Cobar-Wyalong area) there is little above 1,000 ft. and few rugged features. But its rainfall, though rather scanty and unreliable, is better than that further west (15–24 in., the greater quantity in the north—18–28 in.—being balanced by greater evaporation). The rivers from the highlands further east stream across these lowlands but are of no great service, being irregular in flow, entrenched in places, and liable to flood. Artesian supplies have proved a great boon and have been extensively exploited, especially in the north-west and south-west. The soils, red-brown loams and black soils, are good but the latter are very heavy and have only recently begun to be worked. Of the total area (*c.* 41,420,000 ac. = 64,719 sq.m.) some $\frac{2}{10}$ are occupied, of which 62% has been alienated from the Crown, and though holdings of 10,000 acres and upwards account for 19% (89 over 50,000 ac. each), medium to small-sized holdings are common further east and particularly in the Riverina. The area, in fact, forms a climatic and economic transition zone. In the west pastoral pursuits; in the east, mixed agriculture and grazing; in the Riverina and a few other parts agriculture alone, or dairying alone, are practised. The area contains 40% of the agricultural lands of the State; and in the north-west and south-west portions are some of the best sheep-lands. Along the east the fringes of the wheat-belt are included. The 10 in. winter rainfall line (7 months: April-October, the growing season) runs roughly down the middle (north-north-east–south-south-west) of the area, and to this the wheat "frontier" approximates, falling behind it in the north-east but overstepping it to the extent of 5,000,000 acres and pushing forward into rainfall areas of 8–9 in. (April–Oct.) in the centre and particularly in the south-west (Riverina). Thus, while grazing, with a little mixed and other farming, predominates in the north, mixed farming—mainly sheep and wheat—arable farming, fruit-growing (vines, etc.) and dairying increase in importance in the south. A special place, in virtue of its irrigation areas, and its wider range of possibilities, is taken by the Riverina (*q.v.*). The total live-stock amounted (1926) to 18,413,000 sheep, 300,000 cattle, 132,000 horses, 12,000 dairy cattle, but the numbers vary greatly according to season (*e.g.*, sheep: 1891, 25,000,000; 1921, 14,000,000; dairy cattle: 1911, 48,000). Similarly the sheep-carrying capacity, though high (266·6 per sq. mile) varies from 351–205 per sq. mile. The total production of the area (1925–26) amounted to: wool, 136,500,000 lb.; wheat, 11,400,000 bu.; butter, 216,000,000 lb.; minerals, etc., £672,000. With a total population of 115,640, the area has a population density of 1·8 persons per sq. mile. The chief settlements, apart from the pastoral river centres common to this and the Western Plains (Walgett, Hillston, Balranald, etc.), are centres of mixed pastoral and farming areas: Moree (3,300), Narrabri—a thriving railway junction town in a sheep, dairy, and fruit area, with butter factories and freezing works—and Coonamble in the north, Nyngan and Condobolin in the centre, and a large number of similar settlements in the Riverina.

The Western Slopes consist in the main of gently rolling country which rises from levels of under 1,000 ft. to elevations of over 2,000 ft. and merges into the plateaux to the east. It is essentially the zone of the upper, and fairly roomy, basins of the western rivers, but in the north-west and south-west the narrower head-water valleys and plateau margins are included in the administrative division. The rainfall is abundant and also fairly reliable (19–34 in.—rather more in the north, 24–33 in., more varied in the south where the Australian Alps are approached: 16–40 in.). The outcrops of ancient rocks along these slopes, as also the stream-beds descending over them, have yielded rich stores of minerals, and Forbes, Temora, Wyalong, Grenfell, etc., were once famous mining centres. Some gold-mining is still carried on, tin is obtained at Ardlethan, chrome iron at Gundagai, and a little coal is worked near Gunnedah. But in general mining has been succeeded by agriculture as the value of the red soils for wheat has become known. Out of the total area, 28,164,000 ac. (*c.* 44,000 sq. miles) ⅔ is occupied. Wheat, needing dry summers and an optimum growing-season (April–Oct.) rainfall of 11–15 in., finds these conditions in a belt *c.* 500 miles long (north-west–south-east), about 100–130 m. wide, and limited on the east by a line about 120 m. from the coast, the coastal portions having proved too humid. Within this belt are 53,000,000 ac. of which about 26,000,000 ac. seem capable of cultivation, and of this ½ would normally be used for growing wheat-hay (fodder). The area of possible wheat cultivation has greatly increased, nearly 20,000,000 additional acres having been occupied for this purpose in 1904–22. The total area actually cultivated to wheat (1926) is about 8,000,000 ac., about one-half of which is under wheat at any time. Fruit-growing and dairying are also carried on, and along some of the rivers irrigation also (*e.g.*, Forbes, Dubbo, Ardlethan). Grazing (mainly sheep) is everywhere important. The great bulk of the holdings within the area lie between 100 and 3,000 acres. Livestock total: sheep, 15,670,000 with the very high average density of 389 per sq.m.; cattle, 416,000;

horses, 197,000; dairy cattle, 41,000. In addition to primary production there are butter-factories, freezing works, flour and saw mills, etc., and in certain railway centres (*e.g.*, Junee, Quirindi) are large railway engineering works. The total population (1926) was 205,190 (4·7 per sq. mile). The towns (Tamworth, 6,000; Dubbo, 5,150; Forbes, 4,700; Parkes, 4,260; Junee, Cootamundra and Temora, *c.* 3,500) are mainly centres for agricultural and pastoral producing areas, adding often the functions of railway junctions, mining, and (on a small scale) industrial centres. Production (1926): wool, 114,457,000 lb.; wheat, 20,334,000 bu.; butter, 6,298,000 lb.; minerals and manufactures, £1,493,000.

The Tablelands extend to the east of the above division and are bounded on the east almost everywhere by abrupt and often rugged and precipitous declivities. They include much level or rolling country capable of cultivation but much, especially in the south (Alps, Australian, *q.v.*), is too rough for anything but grazing. The climate is also cool or cold and, though bracing, tends to be wet. (Rainfall, 24–53 in.; in the north 30–38 in.; in the south 19–65 in.) Mining, formerly extensive, is still important. The tin resources of the Northern Plateau (Tingah, Emmaville) are actively exploited; silver ores of high quality are mined at Yerranderie (Burragorang Valley); gold is mined at various places: Bathurst, Uralla, etc.; the iron deposits of Cadia (reserves 10,000,000 tons) and Carcoar are utilised in the industries of Lithgow (*q.v.*) and smaller deposits exist at Goulburn and Queanbeyan, while the most westerly outcrops of the Sydney Basin coal deposits crop out and are worked at Lithgow. Of the total area (26,480,000 ac.=41,725 sq.m.) about 77% (20,000,000 ac.) is occupied, but less than one-half is alienated from the Crown. The climate is, in general, too damp for wheat but such as is grown is also found mainly in the central area. Sheep-grazing is carried on from north to south, though the central parts lead in this also. The highlands favour a different type of sheep from the Plains—not so robust but of exceptionally fine and dense wool. The New England wool, being reputed to be one of the best of all spinning wools, and the Southern Tablelands (*e.g.*, Monaro district) are also noted. The area carried (1926) 10,219,000 sheep (214·7 per sq.m.); 438,000 cattle; 110,000 horses, and 45,000 dairy cattle. Apart from Lithgow (*q.v.*) manufacturing industries are confined mainly to the larger towns (flour milling, tanning, soap-making, railway engineering, etc.), but the noted beauty of the scenery and the relative coolness of summer attract numerous visitors and in the areas within easy railway reach of Sydney and Newcastle the tourist industry is important. The total population is 230,000 (5·5 per sq.m.) but it is mainly concentrated in certain localities, wide areas being relatively bare. The towns and settlements are centres for pastoral, agricultural, and mining districts; many are tourist centres as well, while some are also railway-junction towns with a certain industrial activity. In the Northern Plateau, Armidale (*q.v.*: pop. 5,750), Glen Innes (4,500) and Tenterfield are on the main northern railway line (Sydney to Brisbane) and combine most of these functions, serving as holiday centres especially for Newcastle and the north coast towns. On the highlands west of Sydney (Blue mountains) holiday and tourist resorts are more important—Katoomba (10,000); Goulburn (12,000), also an agricultural centre with some industries—while further west, Bathurst (*q.v.*, 9,400) and Orange (8,000) combine this with the other functions mentioned. Further removed, such towns as Cowra (4,300), Young (3,500), Mudgee (3,000), Wellington (3,340) are rather more agricultural and pastoral (wheat and sheep) centres and belong almost as much to the Western Slopes division. Lithgow (*q.v.*, 16,400) with its iron, steel and other industries stands rather apart as an outlier of the coastal industrial areas.

Production.—In 1926 production was: wool, 79,230,000 lb.; wheat, 2,100,000 bu.; butter, 4,136,000 lb.; minerals, £1,322,000; manufactures, £2,687,000. The Federal Capital Territory falls within this area (*see* CANBERRA) and was formerly mainly devoted to grazing (sheep). On the edges of the southern tableland (west of Yass) is the famous Burrinjuck dam, the headworks of an important Riverina (*q.v.*) irrigation scheme.

The Coastal Lowlands, irregular, broken and detached patches or mere strips scattered and stretched along the eastern margins, are yet economically and in general social respects perhaps the most important regional element in the State. Relatively small in extent (22,237,000 ac.=34,745 sq.m.) they contain 1,770,000 inhabitants (75·7% of the total population; 43·4 per sq.m.); the great majority of large towns, including the capital; nearly all the coal-fields and manufacturing areas; all the sugar-growing, the bulk of the dairying and maize-growing areas, besides all the sea-ports, with the financial and commercial nerve-centres of the State. The largest, and also the most important, individual areas are the Sydney and Hunter River lowlands in the centre, the Clarence-Richmond-Tweed basins in the north, and the Illawarra district in the south. These are described separately (*see* SYDNEY, SINGLETON, RICHMOND, WOLLONGONG) and a general survey alone is given here. The climate is mild and humid, and distinctly warmer in the north (rainfall: 30–62 in.; 35–76 in. in the north, 27–61 in. in the south). Apart from river-bottoms and some coastal flats, the terrain is hilly or broken and the cultivable area is small, and of this area less than a quarter was cultivated in 1925–26. The broken lands—tableland scarps, valleys, foothills, etc.—are valuable for mining (*e.g.*, Clarence Valley) and the intersection and laying bare of coal-seams by river action and coastal faulting is a fact of importance. The extensive timber resources have been greatly depleted, though some is still cut in the Northern and Hunter valleys. In many parts the topography and climate offer facilities for water-power development (*cf.* Nymboida-Clarence scheme), while the rougher interior country is also used for cattle. Wheat and sheep are virtually excluded by the dampness of the climate, but 95% of the holdings used for dairying are in this area. All the sugar grown in the State is cultivated in the northern districts (1926: 19,400 ac.). Considerable quantities of fruit are grown—tropical fruits in the north, vines, oranges, etc., in the (north-east) Hunter valley and in the Sydney Basin—and mixed agriculture is practised (maize, lucerne, potatoes in the north and centre). Live-stock (1926): cattle, 1,000,000; dairy cattle, 795,000; horses, 203,000; sheep, 996,000. The holdings are comparatively small: 400–500 acres. The outcropping of coal in convenient positions has given rise to a coal-mining and coal-exporting industry (*see* BULLI, MAITLAND)—in 1928 very depressed—and more recently to growing manufacturing industries centred chiefly in or near Newcastle, Sydney, Port Kembla (*q.v.*). Here is the chief and growing industrial "hub" of the Commonwealth. Here, also, are the financial and commercial headquarters—the central banking, wool-broking, railway and shipping, political and social organisations—of the State. Of ports, Sydney and Newcastle—the former good, the latter indifferent as a harbour—are the most important, but Grafton (a river port), Coff's Harbour and Byron Bay in the north have actual importance or possibilities as outlets for local trade and the same applies to Port Stephens as a possible outlet for the Lower Hunter district. Jervis Bay is the destined site for the port of the Federal Capital. Associated with the coasts are also fishing (mainly in the northern estuaries and lakes; 1926: £556,000), and the tourist and holiday-resort industries. Of the total population of the area (*v. sup.*) Sydney alone accounts for 1,101,200, and a further 200,000 are contained in the Sydney Basin (Cumberland County). The lower Hunter Valley and coasts immediately north of it (*i.e.*, substantially the Newcastle [*q.v.*]-Maitland [*q.v.*] district) count a further 280,000. Of northern towns Lismore (*q.v.*, 9,300), Grafton (4,800), Casino (3,450) are important local centres, while in the south, Nowra, Wollongong, Kiama are local exporting centres and health resorts. Production (1925–26): butter, 94,334,000 lb.; wool, 7,075,000 lb.; minerals, £8,051,000; manufactures, £57,625,000.

Statistical Summary. *Area*—excluding Federal Capital Territory; including 176 sq.m. of harbours—309,432 sq.m., 10·40% of total area of Australia.

Population (March, 1928): 2,414,000; 7·80 per sq.m.; *c.* 39% of Commonwealth; rate of increase (1926), natural 1·34%; natural+immigration 2·14%; metropolitan 45·6%; 99% of area contains only 655,300 inhabitants.

Occupations (Census 1921: total population 2,101,968; main classes only); *Breadwinners:* 42·29%; *Primary Producers:* 9·98% (agricultural, 4·52%; pastoral and dairying, 3·14%; mining, 1·57%). *Industrial,* 13·62%. *Commercial and Transport,* 16·68%.

Production (1925–26): Total, £160,615,000. *Primary Industries:* £95,777,000 (pastoral, £42,369,000; agricultural, £20,741,000; dairying—including pigs, bees, poultry—£14,712,000; mining, *c.* £12,000,000; forests, fisheries, etc., £5,609,000). *Manufacturing Industries:* £64,838,000. Production per head of population: *Primary:* £41.13.8 (pastoral, *c.* £18; agricultural, £9; dairying, £6.8; mining, £5.7.6). *Manufacturing:* £28.4.4. *Total:* £68.18.0.

Pastoral Industry (1926): *Sheep,* 54,630,000 (highest since 1891, 61,831,000) including 45,560,000 merino; Wool, 495,820,000 lb. = £35,377,000 (at Sydney); average weight of clip, 8·1–8·8 lb. *Cattle*: 2,937,000 (including 632,000 dairy cattle). *Horses*: 651,000. *Milk*: 290,000,000 gal. *Butter*: 107,000,000 lb. *Cheese c.* 6,500,000 lb.

Agriculture: Area under cultivation (1926): *c.* 11,100,000 ac. (crops alone, 4,550,000 ac.) Wheat, 3–3·5 mill. ac.; 28·6–66·7 mill. bu.; £6.7–£16.7 mill. = 31–58% of total agric. produce. Hay, 750,000–1·1 mill. ac.; 866,000–1·6 mill. tons; £5·5–£8·9 mill. = 23–41%. Maize, 120,000–166,000 ac.; 3·28–4·6 mill. bu.; £630,000–894,000 = 2–4%.

Mining: Total value of all minerals produced to end of 1926 = *c.* £400,000,000. Total output (1926), £12,000,000; (silver-lead, £4,400,000; zinc, £1,360,000); coal, *c.* £9,500,000 (northern fields, *c.* £6,800,000; southern and western, etc, *c.* £1,600,000).

Manufacturing Industries (1911 and 1925–26): Factories: (1911) 5,000; (1925–26) 8,200. Employees: 66,000 and 174,000 (= 3·7% increase, *cf.* 2·0% increase of population as a whole). Raw materials and fuel: £15,600,000 and £105,125,000. Value of output: £25,700,000 and £170,000,000. Employees: Metallurgical and machinery, 45,000; clothing and textiles, 35,000; food, drink, etc., 21,000.

Communications—Railways: Total mileage open 1926 (including Federal and private lines), 6,218 miles (4 ft. 8½ in. gauge, 5,710) = 1 m. railway per 374 inhabitants or per 50 sq. miles. Av. ann. increase of mileage, 155·38 miles. Total capital expended (1926), £105,238,000. Net earnings: £4,419,000 = 4·30% interest on capital invested.

Trade: Total (1921–1926), £91–127 mill. (Imports £43–£72 mill.; Exports £42.5–60.5 mill.) Per head of population: £43–£60 (Imports: £20–34; exports: £19.10–£27).

Exports: Wool: £21–£25 mill. = 45–50% of total exports.

Wheat and Flour: £5.8–£7.85 = 11–17%. *Meat, hides, leather, etc.:* £5·5–£6·7 mill. = 12–13%. *Butter: c.* £2 mill. = 3–4%. *Coal:* £1·4 mill. (falling) = 3–1·7%. *Other Minerals: c.* £3 mill. = 5–6·5%. Total pastoral products £36,500,000 = 58.1% of total over seas exports.

Shipping (all classes): *c.* 3,000 vessels; 9 mill. registered tonnage, discharging 3·5–4 mill. tons and shipping 5–5·6 mill. tons cargo.

Social Conditions: Hospitals: private: 620 (beds: 4,940); public, 159 (9,229). Total (Government) expenditure on charitable relief (1925–26): £5,825,000 = £2.10.9 per head of population. (Maternity allowances: £270,000; State wards [children]: £500,000; Hospitals, asylums, etc.: £820,000; pensions: £3·5 mill.). State advances for building homes (1926): £1,620,000. Parks, recreation grounds, etc.: 240,000 ac.

Education: Schools (1925): public, 3,162; private, 696. Pupils: public, 336,800; private, 82,200 = 92% of those requiring instruction. (O. H. T. R.)

HISTORY

Early History.—New South Wales was discovered by Captain Cook on April 20, 1770 (*see* AUSTRALIA). On Jan. 20, 1788, the "Sirius," commanded by Captain Arthur Phillip, R.N., reached Botany Bay with an armed trader, three store-ships and six transports. The persons on board the fleet included 40 women, 202 marines of various ranks under Major Ross, five doctors, a few mechanics, and 756 convicts. The live stock consisted of one bull and four cows, a stallion and three mares, some sheep, goats, pigs and a large number of fowls. The expedition was well provided with seeds of all descriptions. As Botany Bay was found unsuitable, the settlement was transferred to Port Jackson, near the present site of Sydney. Later on, other convict-ships arrived; and, in 1793, came the first free settlers, who were presented with grants of land. By 1800 the population was 5,000.

In 1809 Captain Macquarie became governor, and, during his administration, New South Wales was transformed from a penal settlement to a colony. Schools and churches had already been erected, a newspaper, the *Sydney Gazette and New South Wales Advertiser,* had been started, and attempts made to acclimatize the drama. Macquarie was the first governor to open up the country. He formed roads and built bridges in the districts along the coast, and commenced a track across the Blue Mountains. Attracted by the success of Captain John M'Arthur with merino sheep, more free settlers began to arrive in 1817; but not until the governorship of Sir Richard Bourke (1831–37) did they obtain trial by jury, free press, a legislature with very limited representation, free grants of land, and religious equality. Settlement had progressed at a rapid rate. Parramatta, Richmond, and Windsor were founded before 1798, and Newcastle, Maitland, and Morpeth early in the 19th century; but the towns of the interior, Goulburn, Bathurst, and others were not begun till about 1835. Then, again, the explorations which followed the passage of the Blue Mountains opened up a large portion of South-Eastern Australia. By 1840, owing to the formation of other colonies, New South Wales, which originally signified the mainland of Australia and the islands in the South Pacific, comprised only the three eastern states of today. Sale by auction of the public lands was now substituted for free grants; and squatters were allowed to occupy sparse areas on payment of a small annual licence. In 1851, when Victoria became a separate colony, the population of New South Wales had risen from the 76,793 of 1837 to 187,243, and the annual exports amounted to £2,309,580. In 1851 also, gold was discovered near Bathurst by E. H. Hargraves, and transportation was at last abolished.

The New Constitution Bill was passed in 1853, and two years later, approved by the British Parliament. The Bill provided for an elected assembly and a nominated council; vote by ballot was introduced; the number of members in the assembly was increased to 80, and the franchise was granted to every adult male after six months' residence. The census of 1857 gave the population of Sydney and suburbs as 81,327. In 1859 Queensland was constituted a separate colony.

From 1861 to 1888.—After 1861 the land policy was entirely revised. Sir John Robertson, in his Land Bill, introduced the principle of deferred payments for the purchase of crown lands. Residence and cultivation were considered more important than a sufficient price. After much opposition the measure was passed and the other colonies adopted similar legislation. The distinction between the descendants of convicts and the descendants of free settlers was now finally abandoned. In 1862 a large force, military and police, was despatched to Lambing Flat, in order to protect the Chinamen from ill-treatment by the miners. At this time bushranging became frequent, and only with great difficulty was stamped out.

H.R.H. the duke of Edinburgh visited the colony in 1868. An attempt was made upon his life by a man named O'Farrell, who was subsequently hanged. A census taken in 1871 showed that the population was 503,981, and the exports £11,245,032. During the governorship of Sir Hercules Robinson (1872–79) the Fiji Islands were annexed; telegraphic communication with England and mail communication with the United States were established, and a coalition between Sir Henry Parkes (premier and colonial secretary) and Sir John Robertson at length made it possible to develop some continuous policy. The census of 1880 gave the population of the colony as 751,468, of whom 411,149 were males and 340,319 females. In this year the railway to Melbourne was completed, and in 1883 valuable deposits of silver were discovered at Broken Hill. In 1885 the British Government accepted the offer of a contingent from New South Wales to aid the imperial

troops in the Sudan. The railway to Queensland was opened in 1888 by the new governor, Lord Carrington. In the same year the government prevented the landing of some Chinese passengers and passed laws practically prohibiting the immigration of Chinamen.

Federation.—In 1889, the premier, Sir Henry Parkes, gave his support to the movement for Australasian federation, and New South Wales was represented at the first conference held in Melbourne at the beginning of 1890 (*see* AUSTRALIA). Early in 1891 the great strike, which at one time had threatened to paralyse the trade of the colony, came to an end. A board of arbitration and conciliation to hear and determine labour questions and disputes was formed, and by later legislation its powers were strengthened. (For labour legislation *see* AUSTRALIA.) The census of 1891 showed that the population was 1,134,207, of whom the aborigines numbered 7,705 and the Chinese 12,781. In 1893 a financial crisis resulted in the suspension of ten banks; but with two exceptions they were reconstructed, and by the following year the effects of the depression had passed away. In 1896 a conference of Australian premiers was held at Sydney to consider the question of federation. The then premier, Mr. Reid, was rather lukewarm, as he considered that the free-trade policy of New South Wales would be overridden by its protectionist neighbours. But his hand was to a great extent forced by a People's Federation convention held at Bathurst, and, ultimately, a considerable majority in favour of federation was obtained.

From 1899 to 1927.—During the South African War (1899–1902) New South Wales sent 314 officers and 5,796 men, more than one-third of the total number raised by Australia. In spite of the great drought of 1902, the state made progress, and during the period 1901–14 the cultivated area was almost doubled. Scientific breeding of wheat and dry-farming were important factors in this increase. The protectionist policy of the Federal Government helped the manufacturers, and the change from free trade did not appear to injure the prosperity of the country.

The influence of the Labour Party was manifested in the adoption of laws extending the arbitration system, and from 1906 "assisted immigration" became its accepted policy. In 1912 fruit-growing began in the irrigation area of the Murrumbidgee. After 1918 a policy of closer settlement for ex-service men was initiated and further encouragement given to immigration from Great Britain.

The railway strike of 1917 had far-reaching effects: it raised legal and constitutional questions of importance and caused, ten years later, the downfall of the Labour Ministry. In 1925, Mr. Lang, the Labour premier, had instructed the Railway Commissioners to reduce in rank the men who had not taken part in the strike. The arbitration court forbade the Commissioners to carry out the premier's instruction. Thereupon Mr. Lang introduced his Railway Bill to annul the decision of the court. This was passed in the assembly but rejected by the legislative council. As the council is a nominated body, Mr. Lang recommended to the governor that twenty-five new members (all pledged to support the bill) should be added to its number. The recommendation was, after some demur, accepted, but, when a further bill was brought forward to abolish the council, some of the new councillors refused to die for the party and the bill was rejected by 47 to 41. Public meetings were held protesting against the actions of Mr. Lang. The press suggested a referendum or a general election, and when in 1927 a general election did take place the Labour government was defeated by a Nationalist and Country Party coalition.

(H. D. N.)

NEWSPAPERS (*see* also COPYRIGHT, LIBEL, CONTEMPT OF COURT). For legal definition of newspapers in the strict sense reference should be made to the article on PRESS LAWS, but for the purpose of this article the term comprises daily or weekly publications mainly concerned with the reporting, illustrating and commenting upon current events. (For magazines and the like *see* PERIODICALS.)

Early History.—In the days before printing the earliest equivalent of the modern newspaper was the series of public announcements called *Acta Diurna* issued during the Roman empire and posted up in the same way as the French postal *affiches* of to-day and copied by scribes for dispatch to provincial subscribers. A like series of official reports was made in China as early as the 7th century, but in a general sense right up to the invention of printing (*q.v.*) the dissemination of news in all countries was by the slow process of word of mouth and by private letter. After the discovery of printing pamphlets or single sheets announcing some item of news were often issued.

It is now generally supposed that the first of them to be published regularly was a German publication the *Avisa Relation oder Zeitung*, first printed in 1609. Then came the Antwerp *Nieuwe Tijdingen* in 1616, and in May 1622 appeared what is now conceded to be the first English newspaper proper, *The Weekly Newes from Italy, Germany, etc.*, London, published by Nicholas Bourne and Thomas Archer. These enterprising editor-publishers, however, had a formidable competitor in Nathaniel Butter, a freeman of the Stationers' Company, who in June 1605 had momentarily satisfied the public demand for sensation, as greedy then as it is now, by reports of two dramatic murder trials in Yorkshire, one of which was the Calverley case. Butter had published *Newes from Spain* in 1611, and when the *Weekly Newes* appeared he almost immediately brought out a rival quarto sheet named *Newes from Most Parts of Christendom*, and its success was so great that a Butter-Archer fusion followed. Their joint production was called the *Newes of the Present Week*. It must not be assumed that during the whole period this journal was published regularly every week, but it is the earliest continuous English newspaper, so far as known to historians. In 1638 Charles I. gave Butter the right of publishing foreign news on payment of £10 a year towards the repair of St. Paul's cathedral, but in the following year he fell under the displeasure of the licenser of the press. Despite the latter's decree of suppression Butter brought out his paper all the same, and he lived to a great age, dying in 1664. Archer had died in 1634.

I. BRITISH NEWSPAPERS[1]

In the reign of Queen Elizabeth the news writer was well established. Formerly he did not fulfil an independent calling but was a retainer in the service of some great noble whom he kept equipped with such intelligence as his master required, but the gradual spread of learning led to a demand, especially in districts remote from London, for a regular supply of news. For a long period the purveyors of these letters, who must be regarded as journalists, syndicated (to use an expression familiar to modern journalism) their information in manuscript form, and there was more than one organisation for the interchange of letters between London and the provinces. Of these early news-letters good examples are in the *Paston Letters* and the *Sydney Papers*.

First Newspapers.—It was at one time believed that the earliest regular English newspaper was an *English Mercurie* of 1588, said to have been printed in the year of the Spanish Armada. Copies are in the British Museum, but it was afterwards proved that these early copies in mss. and print were forgeries.

There is in the British Museum a *Mercurius Gallobelgicus*, the work of D. M. Janson, of Cologne. A fairly thick octavo book, giving a Latin chronicle of events from 1587 to 1594, it is really a sort of annual register. It was continued down to 1635. The *Mercurius Gallobelgicus* is chiefly interesting because, by circulating in England, it started the idea of a periodical supplying foreign news, and apparently became to English contemporaries a type of the newfangled news-summaries; and the title *Mercurius* or Mercury—as representing the messenger of the gods—thus became a common one for English periodicals. On June 1st, 1619, Ralph Rounthwaite entered at Stationers' Hall *A Relation of all matters done in Bohemia, Austria, Poland, Sletia, France, etc., that is worthy of relating, since the 2nd of March 1618* (1619 N.S.) *until the 4th of May*. Again at the beginning of November 1621 Bartholomew Downes and another entered in like manner *The certaine and true newes from all parts*

[1] In the following section have been incorporated certain sections of the articles by E. Edwards in the 9th edition and by H. Chisholm in the later editions of the *Encyclopædia Britannica*.

of Germany and Poland, to this present 20 of October 1621. No copy of either of these papers is now known to exist. But in May 1622 we arrive at a regular weekly newspaper which may still be seen in the British Museum, the *Weekly Newes* of Archer and Bourne referred to above.

Freeing the Press.—The first periodical with a title was a *Mercurius Britannicus* published by Archer (1625; the earliest copy in existence being No. 16, April 7), which probably lasted till the end of 1627. But the activity of the newspapermen was checked by the Star Chamber edict in 1632 against the printing of news from foreign parts. The next step in the evolution of the newspaper was due to the abolition of the Star Chamber in 1641, and the consequent freeing of the press; and at last we come to the English periodical with domestic news. In November 1641 begins *The Head of severall proceedings in the present parliament* (outside title) or *Diurnal Occurrences* (inside title), the latter being the title under which it was soon known as a weekly; and on Jan. 31, 1642 appeared *A Perfect Diurnal of the Passages in Parliament.* These were printed for William Cooke, and were written apparently by Samuel Pecke, "the first of the patriarchs of English domestic journalism" (J. B. Williams). The weekly *Diurnals* were on the side of the parliament until in Jan. 1643 appeared at Oxford the first Royalist diurnal, named *Mercurius Aulicus, a Diurnal communicating the intelligence and affaires of the Court to the rest of the Kingdome* (continued till Sept. 1645, and soon succeeded by *Mercurius Academicus*), which struck a higher literary note. It was conducted by Sir John Berkenhead, a Fellow of All Souls, whose style is said to reflect that of the Parliamentary oratory of his day. He afterwards became master of requests. *Mercurius Civicus,* the first regularly illustrated periodical in London, was started by the parliamentarian Richard Collings on May 11, 1643 (continued to Dec. 1646); Collings had also started earlier in the year the *Kingdome's Weekly Intelligencer,* which lasted till Oct. 1649. In September 1643 appeared another Puritan opponent of *M. Aulicus* in the later *Mercurius Britannicus* of Captain Thomas Audley, which in September 1644 was taken over and continued for nearly two years by Marchamont (or Marchmont) Nedham. Nedham was a master of invective and one of the earliest to change sides when it suited him. From Oct. 1649 to June 1650, by a new act of parliament, the licensed press itself was entirely suppressed, and in 1649 two official journals were issued, *A Brief Relation* (up to Oct. 1650) and *Severall Proceedings in Parliament* (till Sept. 1655), a third licensed periodical, *A Perfect Diurnall* (till Sept. 1655), being added later in the year, and a fourth, *Mercurius Politicus* (of which Milton was the editor for a year or so and Nedham one of the principal writers), starting on June 13, 1650 (continuing till April 12, 1660). After the middle of 1650 there was a revival of some of the older licensed news-books; but the *Weekly Intelligence of the Commonwealth* (July 1650 to Sept. 1655), by R. Collings, was the only important newcomer up to September 1655, when Cromwell suppressed all such publications with the exception of *Mercurius Politicus* and the *Publick Intelligencer* (Oct. 1655 to April 1660), both being official and conducted by Nedham.

Till Cromwell's death (Sept. 3rd, 1658) Nedham reigned alone in the press, but in 1659 a rival appeared in Henry Muddiman (a great writer also of "news-letters"), whose *Parliamentary Intelligencer,* renamed the *Kingdom's Intelligencer* (till Aug. 1663), was supported by General Monk. Nedham's journalistic career came finally to an end (he died in 1678) at the hand of Monk's council of state in April 1660. His successor, Muddiman, was supplanted in 1663 by Sir Roger L'Estrange, formerly a Royalist cavalry officer who narrowly escaped execution during the commonwealth; he was appointed "surveyor of the press." On him was conferred by royal grant—as it proved, for only a short period—"all the sole privilege of writing, printing and publishing all narratives, advertisements, mercuries, intelligencers, diurnals and other books of public intelligence; . . . with power to search for and seize the unlicensed and treasonable schismatical and scandalous books and papers." L'Estrange discontinued *Mercurius Politicus* and *Kingdom's Intelligencer* and substituted two papers, the *Intelligencer* (Aug. 1) and the *Newes* (Sept. 3) at a halfpenny, the former on Mondays and the latter on Thursdays; they were continued till Jan. 29, 1666, but from the beginning of 1664 the *Intelligencer* was made consecutive with the *Newes,* numbered and paged as one.

The London Gazette.—The first number of the bi-weekly *Oxford Gazette,* licensed by Lord Arlington and written by Muddiman, was published on Nov. 16, 1665. It was a "paper" of news, of the same size and shape as Muddiman's news-letters. With the publication of the 24th number (Monday, Feb. 5, 1666 O.S.) the *Oxford Gazette* became the *London Gazette,* which has appeared twice a week, on Tuesdays and Fridays, ever since as the official organ of Government. After the Revolution of 1688 the press censorship was relaxed, being finally abandoned in 1693, and a number of newspapers came into being, including the *Universal Intelligence, English Courant, London Courant, London Mercury, London Intelligence, Orange Gazette, Flying Post, Post-Boy,* a daily which lasted only four days, and the *Lincoln, Rutland,* and *Stamford Mercury,* now the oldest of the provincial papers. In 1699 appeared the *Edinburgh Gazette,* a bi-weekly, and in 1702 the *Daily Courant,* the first English daily, a small sheet printed on one side only, the editor-printer of which confined himself to news and not views.

Defoe and Lloyd.—It is Daniel Defoe who is the first English journalistic writer of national importance. In Feb. 1704 he began his weekly, *The Review,* which eventually was printed three times a week and was a forerunner of the *Tatler* (started by Steele in 1709) and the *Spectator* (started by Steele and Addison in 1711). Defoe's *Review* came to an end in 1713, and between 1716 and 1720 he published a monthly with an old title, *Mercurius Politicus.* By some authorities Defoe is considered the originator of the serial story.

The *Examiner,* which was started in 1710 as the chief Tory organ, enjoyed as its most influential contributor Swift, the father of the leading article. Edited by Dr. William King, afterwards principal of St. Mary's hall, Oxford, this political journal had brilliant contributors in Bolingbroke, Prior, Atterbury and Arbuthnot. Swift had control of the journal for 33 numbers between November, 1710, and June, 1711, but on becoming dean of St. Patrick's he gave up regular journalistic work. There followed a number of other political journals, such as the *Craftsman,* the *Whig Examiner,* and the *Medley.*

In 1696 Edward Lloyd—the virtual founder of the famous "Lloyd's" of commerce—started a thrice-a-week paper, *Lloyd's News,* which had but a brief existence in its first shape, but was the precursor of the *Lloyd's List* of the present day. No. 76 of the original paper contained a paragraph referring to the House of Lords, for the appearance of which a public apology must, the publisher was told, be made. He preferred to discontinue his publication (February 1697). Nearly thirty years afterwards he in part revived it, under the title of *Lloyd's List*—published at first weekly, afterwards twice a week (*see* F. Martin, *History of Lloyds,* 66–77 and 107–120). This dates from 1726. It is now a daily.

Stamp Tax of 1712.—The increasing popularity and influence of the newspaper press could not fail to be distasteful to the government of the day. The paper which seems to contain the first germ of the newspaper tax is still preserved amongst the treasury papers, and probably belongs to the year 1711. "There are published weekly," says the writer, "about 44,000 newspapers, viz., *Daily Courant, London Post, English Post, London Gazette, Postman, Postboy, Flying Post, Review* and *Observator.*" ("A Proposition to Increase the Revenue of the Stamp-Office," Redington, *Calendar of Treasury Papers, 1708–1714,* p. 235.) The duty eventually imposed (1712) was a halfpenny on papers of half a sheet or less, and a penny on such as ranged from half a sheet to a single sheet (10 Anne, c. xix. § 101).

Swift's doubt expressed in his *Journal to Stella* (Aug. 7, 1712) as to the ability of the *Spectator* to hold out against the tax was justified by its discontinuance in Dec. 1712, Steele starting the *Guardian* in 1713, which only ran for six months. But some of the worst journals that were already in existence kept their ground, and the number of such ere long increased. An enumeration of the

London papers of 1714 comprises the *Daily Courant*, the *Examiner*, the *British Merchant*, the *Lover*, the *Patriot*, the *Monitor*, the *Flying Post*, the *Postboy*, *Mercator*, the *Weekly Pacquet* and *Dunton's Ghost*. Another enumeration in 1733 includes the *Daily Courant*, the *Craftsman*, *Fog's Journal*, *Mist's Journal*, the *London Journal*, the *Free Briton*, the *'Grub Street Journal*, the *Weekly Register*, the *Universal Spectator*, the *Auditor*, the *Weekly Miscellany*, the *London Crier*, *Read's Journal*, *Oedipus or the Postman Remounted*, the *St. James's Post*, the *London Evening Post* and the *London Daily Post*, which afterwards became better known as the *Public Advertiser*. Part of this increase may fairly be ascribed to political corruption. Later towards the middle of the same century the provisions and the penalties of the Stamp Act were made more stringent. Yet the number of newspapers continued to rise. In 1753 the aggregate number of copies of newspapers annually sold in England, on an average of three years, amounted to 7,411,757. In 1760 it had risen to 9,464,790, and in 1767 to 11,300,980. In 1776 the number of newspapers published in London alone had increased to fifty-three.

18th Century Journalists.—Thus the 18th century saw the gradual development of the purely political journal side by side with those papers which were primarily devoted to news, domestic and foreign, and commerce. It was left to Steele and Addison (*q.v.*) to develop the social side of journalism in their journals named above which have found a permanent place in English literature. Nor must we omit Dr. Johnson's 2d. bi-weekly, the *Rambler*, started in 1750, and his weekly, the *Idler* (1758). In 1761 the *North Briton* came out and it was largely due to Wilkes' determined fight for the liberty of the press (*see* WILKES, JOHN) that at length the last shackles on free expression of opinion in Britain were cut away, and by 1772 the right to publish parliamentary reports had been established.

The outstanding daily paper in the middle of the 18th century was the *Public Advertiser*, which for some 25 years had been called the *General Advertiser* (and for some time the *London Daily Post*). It was published with notable success by Henry Woodfall and his son Henry Samson Woodfall, and it was in this paper that appeared the famous Letters of Junius (*q.v.*), which have been attributed to Philip Francis. These papers led to a marked increase in its circulation, the monthly sale in Dec. 1771 being close on 84,000 as compared with 47,500 seven years previously. But in 1798 it was merged in the *Public Ledger*.

Early 19th Century.—In 1769 William Woodfall started the *Morning Chronicle*, whose daily circulation in 1819 reached 4,000, and in 1843, at a time when Dickens was a contributor, 6,000. But in another six years the circulation had fallen to 3,000. For some five years it became the property of the duke of Newcastle, Mr. Gladstone, and others, but finally ended insolvent, after a life of over ninety years. Another longlived daily paper, whose top circulation was about 6,000, was the *Morning Herald* (1781–1869). Two other important dailies were started in the 18th century which still exist, the *Morning Post* and *The Times;* these are dealt with later, together with the *Morning Advertiser*, founded in 1794. It was William Cobbett (*q.v.*) who first attempted to reach the masses by his pen, and reduced the price of his *Weekly Political Register* from 1s.–0½d. to twopence in his endeavour to appeal to the working classes for support of those principles of parliamentary reform dear to his heart. In 1808 Leigh Hunt brought out the *Examiner* whose frank criticism of the prince regent landed him and a brother in gaol. This weekly journal had quite a long lease of life and excelled in dramatic criticism, besides giving an excellent review of the events of the week in all branches of public affairs.

Abolition of Taxes on Knowledge.—The development of the press was enormously assisted by the gradual abolition of the "taxes on knowledge," and also by the introduction of a cheap postal system. In 1756 an additional halfpenny was added to the tax of 1712. In 1765 and in 1773 various restrictive regulations were imposed. In 1789 the three-halfpence was increased to twopence, in 1798 to twopence-halfpenny, in 1804 to threepence-halfpenny, and in 1815 to fourpence, less a discount of 20%. As prosecutions multiplied, and the penalties became more serious, revolutionary tendencies increased in a still greater ratio. Blasphemy was added to sedition. Penny and halfpenny journals were established which dealt exclusively with narratives of gross vice and crime. Between 1831 and 1835 hundreds of unstamped newspapers made their appearance. The political tone of most of them was fiercely revolutionary. Prosecution followed prosecution; but all failed to suppress the obnoxious publications.

To Bulwer Lytton, the novelist and politician (Lord Lytton, *q.v.*), and subsequently to Milner Gibson and Richard Cobden, is chiefly due the credit of grappling with this question in the House of Commons in a manner which secured first the reduction of the tax to a penny in 1836, and then its total abolition in 1855. The number of newspapers established from the early part of 1855, when the repeal of the duty had become a certainty, and continuing in existence at the beginning of 1857, amounted to 107; 26 were metropolitan and 81 provincial. The duties on paper itself were finally abolished in 1861.

The abolition of the stamp taxes brought about such reductions in the prices of newspapers that they speedily began to reach the many instead of the few. Some idea of the extent of the tax on knowledge imposed in the early 19th century may be gathered from the fact that the number of stamps issued in 1820 was close on 29,400,000, and the incidence of the advertisement tax, fixed at 3s. 6d. in 1804, made it impossible for the newspaper owner to pass on the stamp tax to the advertiser, as is done nowadays with regard to all commodities of popular consumption. In 1828 the proprietors of *The Times* had to pay the State over £68,000 in stamp and advertisement taxes and paper duty. But after the reduction of the stamp tax in 1836 from 4d. to 1d. the circulation of English newspapers, based on the stamp returns, rose from 39,000,000 to 122,000,000 in 1854.

Lord Northcliffe, or Alfred Harmsworth as he then was, was the pioneer of the half-penny daily newspaper towards the end of the century. He wrote an article for the 11th edition of the *Encyclopædia Britannica*, in which after sketching the development of the British press he pointed out that "the development—and indeed the possibility—of the cheap daily paper was due to a number of causes operating together during the latter half of the 19th century. Among these, the first place must undoubtedly be given to the cheapening of paper, through the introduction of wood pulp and the perfecting of the machinery used in the manufacture. From 1875 to 1885 paper cheapened rapidly, and it has been estimated that the introduction of wood pulp trebled the circulation of newspapers in England. Keen competition in the paper trade also did much to lower prices. At the same time the prime cost of newspaper production was increased by the introduction of improved machinery into the printing office. The growth of advertisements must also be taken into account in considering the evolution of the halfpenny journal. The income from this source alone made it possible to embark upon journalistic enterprises which would otherwise have been simply to court disaster. The popular journal of the present day does not, however, owe its existence and success merely to questions of diminished cost and improved methods of production. A change has come over the public mind. The modern reader likes his news in a brief, handy form, so that he can see at a glance the main facts without the task of reading through wordy articles. This is especially the case with the man of business, who desires to master the news of the past 24 hours as he travels to his office in the morning. It is to economize time rather than money that the modern reader would often prefer a halfpenny paper; while the man of leisure, who likes to peruse leading articles and full descriptive accounts, finds what he needs in the more highly priced journals. The halfpenny paper in England has not had to contend with the opposition that the penny newspaper met from its threepenny contemporaries in the 'fifties and 'sixties. This is largely due to the fact that in most cases the contributors, paper, printing and general arrangement of the cheaper journal do not leave much room for criticism. G. A. Sala once complained that the reporters of the older papers objected to work side by side with him when he represented the first penny London daily (the *Daily Telegraph*), through fear of losing caste, but this does not now

apply, for in the United Kingdom, France and the United States the cheap journals, owing to their vast circulation, are able to offer the best rates of remuneration, and can thus command the services of some of the best men in all the various departments of journalism."

Newspaper Expansion.—The history of journalism in the 17th century has been divided by a well-known writer on the press, H. R. Fox Bourne, roughly into four stages: (1) persecution; (2) liberation, 1830–1855; (3) cheapening, 1855–1875; (4) widening, since 1875. The first three stages have already been outlined, but the widening process, which has gone on ever since, must be traced to the wonderful progress in the technique of newspaper production and the vast increase in the reading public resulting from the development in State education. Perhaps the most notable event at the beginning of the cheapening stage was the foundation of the *Daily Telegraph and Courier* in June 1855 at 2d., which was reduced to 1d. in ten weeks, with the result that in six months it had the then remarkable circulation of 27,000 a day. Julius Reuter founded in Paris in 1849 the great foreign news agency which still bears his name though it is now controlled by the Press Association, an organization for the gathering and dissemination of domestic news which was founded in 1865. This was preceded in 1863 by the Central Press and followed in 1870 by the Central News and next the Exchange Telegraph with their ticker machines.

It is appropriate at this stage to sketch the history of the great English newspapers.

THE LONDON PRESS

The Times, which occupies the premier position among English newspapers, was started by John Walter on Jan. 1, 1785 under the name of the *Daily Universal Register*. Then, as now, it was printed in Printing House square, Blackfriars. The founder promised the readers of the new journal that it would contain nothing to wound anyone's delicacy or corrupt the mind, that it would abstain from unfair partisanship and scandalous scurrility, and that it would be a faithful recorder of legitimate intelligence. On Jan. 1, 1788 its title was changed to *The Times,* and this great newspaper has ever since been the pre-eminent national journal and daily historical record. It came into existence when a new wave of democratic thought was spreading over Europe, and the French revolution was already brewing. Free expression of opinion in the press was still a thing of the future, and within a few years of the establishment of his paper Walter had several sojourns in Newgate and had to pay several fines for criticisms of the authorities. One of his offences was the statement that the then prince of Wales and other royal princes had by their misconduct incurred the just disapprobation of George III.

John Walter the second practically took over the reins in 1803, and he also had to encounter the active opposition of governments whom he had occasion to criticise, including that of William Pitt. He introduced a better system of news transmission and steam printing (1814) with the result that he was able to make the proud announcement that 1,100 sheets had been impressed in one hour. In view of the newspaper and advertisement tax and other disabilities, it was a considerable achievement when in 1815, the year of Waterloo, the daily circulation reached 5,000. In twenty years this was doubled, in 1851 it had reached 40,000, and three years later it was over 50,000, when its most circulated rival, the *Morning Advertiser,* had a sale of less than 8,000 copies. When John Walter the second assumed control *The Times* was a small four-page sheet. When he gave up control in 1847 it consisted of twelve large pages. Sir John Stoddart, later governor of Malta, was the editor for several years up to 1816. He was succeeded by Thomas Barnes, and when the latter's health began to fail much of the editorial work devolved upon Captain Edward Sterling, whose pontifical and sometimes explosive style caused Carlyle to say: "he more than any other man was *The Times,* and thundered through it to the shaking of the spheres." Carlyle also called him "Captain Whirlwind," and the popular title of "the Thunderer" often given to *The Times* dated from his time. In those days the most powerful writer in its columns on foreign affairs was Crabb Robinson; his place was taken at a later date by Henry Reeve.

In 1841 on the death of Barnes the editorial chair was taken by quite a young man, John Thaddeus Delane, whose brilliant career in this capacity lasted until 1877. His place was taken by Dr. Thomas Chenery, who died in 1884 and was succeeded by George Earle Buckle, who since his retirement in 1912 has won a niche in English literature by his life of Disraeli. Meanwhile since 1848 John Walter the third had been in command. He died in 1894, and was succeeded by Arthur Walter.

About the beginning of the 20th century *The Times* had begun to feel the influence of the more go-ahead methods of the popular press, and there was a loss of circulation and revenue which became a grave source of anxiety to its owners. It was a period when another great London daily paper, the *Standard,* was *in extremis*. Finally in 1908 Lord Northcliffe realised his ambition of long years and acquired the chief control of the "Thunderer," with A. Walter as chairman of the company which was created to carry it on, and Moberly Bell as managing director. It cannot be said that Lord Northcliffe's administration was consistently successful but he thoroughly remodelled the organisation and increased its efficiency in all departments. There is no doubt that by the introduction of sound business methods he laid a solid foundation upon which the present remarkable prosperity of the paper is largely based. Under his rule the price of *The Times* at different periods was threepence, twopence, and a penny. At earlier dates the price had been: 1796, 4½d.; 1799, 6d.; 1809, 6½d.; 1815, 7d.; 1836, 5d.; 1855, 4d.; and 1861 (on the abolition of the newspaper tax) 3d., at which it remained right up to the end of the 19th century. It is now (1929) 2d. On his retirement Buckle was succeeded as editor by Geoffrey Dawson, then a young man, formerly private secretary of Lord Milner and editor of the *Johannesburg Star.* During the World War he retired from the editorship owing to a difference of opinion with Lord Northcliffe and his place was taken by Wickham Steed. When after the war and the death of Lord Northcliffe, Major J. J. Astor, M.P., became its chairman and chief proprietor, Geoffrey Dawson again became editor. Major Astor secured the future independence of the paper by a deed establishing a body of trustees consisting of holders of various public offices whose consent would be required to validate any future transfer of ownership.

The Times excels in every department, mainly by employing experts in particular subjects. It is the only newspaper whose law reports are recognised by the courts as authentic, these reports being done day by day by skilled barrister reporters. Similarly *The Times* specialises in its presentation of foreign affairs and has maintained for nearly a century in the chief capitals of the world an able staff of foreign correspondents, of whom one of the most famous was de Blowitz, who among his many "scoops," secured for *The Times* the privilege of being able to publish exclusively the text of the Berlin Treaty of 1878 on the very day that it was signed.

The principal adjuncts to *The Times* are the literary supplement, which surveys the whole field of new literature every Thursday, the weekly edition, first published in 1877, containing a summary of the week's news, *The Times* law reports (mentioned above), the educational supplement and the trade and engineering supplement, which are weekly publications, and the index, an invaluable record of the events of the day recorded in the newspaper, which is published quarterly. In addition *The Times* issues at intervals handsome supplements to its readers without any extra charge.

The publishing department of *The Times* has invaded several new fields of enterprise. *The Times Atlas* was first published in 1895, and this publication was supplemented by that of *The Times* (previously Longmans') *Gazetteer.* A much larger and more important venture was the issue in 1898 of a reprint of the ninth edition of the *Encyclopædia Britannica* at less than half the original price, on a new system of terms (known as *The Times* system) that enabled the purchaser to receive the whole work at once and to pay for it by a series of equal monthly payments. This was followed by a similar sale of the *Century Dictionary* and of a reprint of the first 50 years of *Punch;* and 11 new vol-

umes of the *Encyclopædia Britannica*, supplementing the ninth edition, and forming with it the tenth edition, were issued by *The Times* in 1902 on similar terms (*see* ENCYCLOPAEDIA). There was also *The Times History of the War in South Africa* of 1899–1902.

The Daily Telegraph, another great national daily, first published as the *Daily Telegraph and Courier*, was published on June 29, 1855, as a twopenny newspaper. It was owned by Colonel Sleigh who transferred the ownership to Joseph Moses Levy in the following September. Levy produced it as the first penny newspaper in London, the name *Courier* being subsequently dropped. His son Edward Lawson (later the first Baron Burnham, soon became editor, which post he continued to hold till 1885. A long list of distinguished members of the staff included Sir Edwin Arnold, George Augustus Sala, for many years the uncrowned king of Fleet St., Professor E. Dicey, Sir J. M. Le Sage, Bennet Burleigh, the war correspondent, J. L. Garvin, and H. D. Traill; and among dramatic and literary critics Clement Scott and W. L. Courtney. After 1890 the Hon. Harry Lawson, the eldest son of the owner (now Viscount Burnham), assisted in the general control. The *Daily Telegraph* became the especial organ of the middle classes and shortly before the advent of the halfpenny daily newspaper had achieved so remarkable a success that it could claim the largest circulation in the world. It was consistently Liberal up to 1878 when it opposed Gladstone's foreign policy, and at the Irish Home Rule split in 1886 it became Unionist. Its enterprises included the financing of an important archaeological exploration in Nineveh resulting in the discovery of a number of fragments of the cuneiform narrative of the deluge, and the despatch, in co-operation with the New York *Herald*, of Sir H. M. Stanley, on a successful exploration into darkest Africa. The *Daily Telegraph* successfully weathered the World War, increasing its price to 2d. at which it (1929) remains. On the death of Sir J. Le Sage a few years ago he was succeeded in the editorial chair by J. Miller, who died after a short tenure, his place being taken by A. E. Watson, the present (1929) editor. In December 1927 Lord Burnham and his family sold the *Daily Telegraph* to Sir William and Sir Gomer Berry and Sir Edward Iliffe under whose control it has continued its same policy.

The Morning Post is the oldest of London daily newspapers extant. It was founded in 1772 as the *Morning Post and Daily Advertising Pamphlet*, a paper of eight pages, 12 inches long by 8. It was mostly an advertising sheet including State lotteries, which were legal and popular at that time. It developed into a national newspaper under the ownership of Peter and Daniel Stuart after 1795, and attracted a wonderful galaxy of writers, including Sir James Mackintosh, Samuel Taylor Coleridge, Southey, Arthur Young, the poet Moore, Wordsworth, and Charles Lamb. It has always maintained a tradition of vigorous and unblenching criticism, and Nicholas Byrne, the editor-owner who succeeded Daniel Stuart, was murdered in his office as the result of an article which had given offence. At the beginning of the 19th century the circulation was about 4,000 a day. In 1850 the paper came under the control of Peter Borthwick, who had sat for a long period as M.P. for Evesham, and on his death in 1852 he was succeeded by his son, Algernon, who had been a brilliant Paris correspondent for the *Morning Post*. Under his régime the paper settled down to a prolonged prosperity as a Conservative journal and before long became the leading society paper, whose fashionable characteristics often made it the butt of Thackeray's satirical pen. During Lord Palmerston's tenure of the Foreign Office the *Morning Post* was always regarded as his especial organ, and even in those early days it was distinguished for its robust imperialism in foreign affairs. In 1877 Borthwick became sole owner, and four years later he reduced the price from 3d. to 1d. at which it stood till the World War, when the price was raised to 2d. Borthwick became a knight, then a baronet, and was raised to the peerage as Lord Glenesk in 1895. When Lord Glenesk died in 1908 the ownership passed to his only surviving child, Countess Bathurst, who carried on the traditions of the paper (which was consistently Protectionist) until she disposed of it in 1923 to a group headed by the duke of Northumberland. Among the editors of the *Morning Post* have been Sir William Hardman, J. Nicol Dunn, Sir Fabian Ware, and H. A. Gwynne, the present (1929) editor. The price of the paper was reduced to 1d. in 1927.

The Daily News & Westminster Gazette (the *Daily News* absorbed the *Westminster Gazette* in Feb. 1928) is the oldest Liberal newspaper published in London. It was founded in 1846 under the editorship of Charles Dickens who retired after a few weeks, being succeeded for a year or so by John Forster, later his biographer. The original staff included Mark Lemon, afterwards editor of *Punch*, and Douglas Jerrold. The *Daily News* has a consistent record as the champion of Liberalism; it led British public opinion in sympathizing with the North in the American Civil War, in supporting the war of freedom in Italy, and the emancipation of Bulgaria and the Armenians. The price of the paper was reduced to 1d. in 1868. Under the control of Sir John Robinson it attained a high reputation for its foreign correspondence, beginning with the celebrated Archibald Forbes in the Franco-German war 1870.

On a change in ownership after the retirement of Sir John Robinson, Sir E. T. Cook, who had been editor of the *Westminster Gazette*, became editor of the *Daily News* from 1896. He resigned in 1901 in consequence of another change in ownership. Cook was a Liberal Imperialist and the paper had passed under the control of D. Lloyd George and his friends; and afterwards passed under that of the Cadbury family. After an interregnum A. G. Gardiner was the next editor. In 1904 the price of the paper was reduced to a halfpenny. Gardiner resigned the editorship after the World War and was succeeded by Stuart Hodgson as editor; Tom Clarke joined the paper in 1926 as managing editor. The *Daily News* absorbed the *Morning Leader* and acquired the *Star* in 1909, and has maintained that journal as a lively and independent exponent of Liberalism. The *Daily News* is the only penny London paper which makes a daily feature of literature. It is printed in Manchester as well as in London.

The Daily Chronicle, unlike the *Daily News* which was started under distinguished auspices, was the outgrowth of a London local daily, the *Clerkenwell News*, and was established in 1877. It consisted almost entirely of small advertisements and Edward Lloyd, the founder of *Lloyd's Weekly News* turned it into a general morning London newspaper. During the Home Rule controversies of the '80s it was Liberal Unionist, but under the editorship of A. E. Fletcher (1895) it became Gladstonian Liberal. Fletcher was an idealist who sympathized with Labour and had a passion for literature. During his editorship literature was developed in the newspaper as a regular feature. Fletcher was succeeded by H. W. Massingham who, while maintaining the literary features, made the paper a more robust political organ. Massingham was a Radical; and had formerly been editor of the *Star*. He lost his position on the *Chronicle* because of his opposition to the Boer War. He was succeeded by W. J. Fisher and the paper pursued a humdrum career and was a declining property when in 1904 Robert Donald was appointed editor, with the object of revitalising the paper. The price was reduced to halfpenny and at once the paper entered upon a new era of prosperity and prestige which reached its height during the World War. During the long Liberal régime from 1906 to the year of 1915, the *Chronicle* was regarded as the chief supporter of the Left Wing of the Government. The *Chronicle* was a pioneer in the introduction of illustrations by leading artists, those contributing to the *Chronicle* including Burne Jones, Joseph Pennell, who was art editor, and Linley Sambourne. It made a high reputation for its foreign correspondence, and took a leading part in exposing public abuses.

The paper was sold to D. Lloyd George and his friends in the autumn of 1918, when Sir Robert Donald retired from his position as editor and as managing director of the company. It has since been edited by Ernest A. Perris, who joined it as news editor in 1904. In 1927 it was sold to two Indian merchants, Sir David Yule and Sir Thomas Catto, Lloyd George retaining a minority interest. Lord Reading was appointed chairman. The chairman has changed six times in ten years. Sir David Yule died in July 1928, and William Harrison, who (1929) is chairman, on behalf of the Inveresk Paper Company, Limited, acquired a

controlling interest in the paper and its associated journals. The *Daily Chronicle* is published simultaneously in London and Leeds.

The Daily Mail started by Alfred and Harold Harmsworth in 1896 as a halfpenny daily newspaper is one of the miracles of journalism. It was a phenomenal success from the first number. At the dawn of the present century it had already reached the million mark, and it has never looked back. In 1904 Sir Alfred Harmsworth (by that time a baronet) started the *Continental Daily Mail* in Paris, now the property of Lord Rothermere. The *Daily Mail* publishes an edition in Manchester and an Atlantic edition on the chief transatlantic steamships.

From the first the *Daily Mail* broke away from the traditional conception that a daily newspaper should espouse or reflect a particular political policy. The *Daily Mail* has been sternly independent and sometimes embarrassing to Governments and politicians but it generally registered the majority public opinion. Lord Northcliffe (as he became later) was not only a brilliant organiser but a keen journalist imbuing by personal contact all members of the able staff which he gathered around him with some of his own dynamic enthusiasm. The *Daily Mail* has been the pioneer in many enterprises in journalism and in national interests, including the invaluable help which it gave to aviation. Lord Northcliffe and his associates also deserve credit for offering inducements hitherto unequalled for special correspondents. It has brought into the profession men and women of high literary standing and has led to an increase in professional remuneration of journalists of all classes.

For many years the editor-in-chief was Thomas Marlowe, who retired two or three years after the death of Lord Northcliffe, and was succeeded by W. G. Fish.

Since it came under the control of Lord Rothermere on the death of his brother its phenomenal success has continued both in regard to increase in sales and in profit making. The annual profit of the *Daily Mail* alone is understood to exceed £1,000,000. Its daily net sale in 1928 reached 2,000,000.

The Daily Express, which was founded as a half-penny newspaper in 1900 by the late Sir C. Arthur Pearson, is second only to the *Daily Mail* in circulation. In its first issue it published a message of good will from the Kaiser William, and announced: "Our policy is patriotism, our party is the British empire."

It struck a new note, since imitated by other papers, of publishing its principal news on the first page, which became, so to speak, the shop-window. In 1902 R. D. Blumenfeld joined the staff; he became editor in 1904, and in 1912, when Sir Arthur Pearson lost his sight, formed a syndicate which acquired control. Lord Beaverbrook began to take an interest in the paper while it was financially in low water and during the war obtained complete control. Blumenfeld remained the managing editor. Immediately after the War the *Daily Express* showed increased vitality. Lord Beaverbrook spent prodigious sums out of revenue in developing the paper. To a large extent it is his personal organ—and expresses his views on political and other affairs.

The *Daily Express* is printed simultaneously in London, Manchester and Glasgow.

The Daily Herald (price 1d.), the official organ of the Trades Union Congress, after passing through severe financial difficulties has now definitely taken its place among London dailies. It occupies a unique position in the press as the only daily newspaper exclusively devoted to the interests of the Labour party. It is more of a political organ than a general newspaper, and is financed mainly by trade unions.

A notable addition to Labour journalism took place in April, 1929, when the Co-operative Societies affiliated with Labour acquired *Reynolds' Newspaper,* which was established over 80 years ago and has been consistently conducted on democratic lines.

Other Dailies.—There is only one sporting daily newspaper in London, the *Sporting Life* (started in 1859) with which was amalgamated after the World War the *Sportsman* (founded 1865). The famous old sporting newspaper *Bell's Life* was absorbed by the *Sporting Life* in 1886. Finance is represented by the *Financial News* (founded in 1884) and the *Financial Times* (1888) which absorbed the *Financier,* now each 2d.

London Evening Newspapers.—There are only three London evening newspapers surviving, each published at 1d. The oldest of these is the *Evening Standard,* first published as an evening edition of the *Standard,* which was founded in 1827. It has absorbed in turn the *St. James's Gazette,* the *Globe* and the *Pall Mall Gazette.* It is now the property of the Beaverbrook group.

The *Evening News* was founded in 1881, and after many vicissitudes of fortune when in low water was acquired in 1895 by Alfred and Harold Harmsworth and Kennedy Jones. It was the Harmsworths' first incursion into daily journalism, and made a rich experimental field for the *Daily Mail.* The *Evening News* is one of the Associated Newspaper group and has the largest circulation of any of the evening papers in the country.

The *Star,* the only Liberal evening paper in London, was started by T. P. O'Connor in 1888 as a halfpenny journal in support of Gladstone. In 1909 it was acquired by the *Daily News.*

Great Papers of the Past.—Fleet street is crowded with the ghosts of journals which in their time have filled important places in the life of the country. There was the *Morning Chronicle* which began its career in the 18th century and had among its contributors Sheridan, Sir J. Mackintosh, John Campbell (afterwards Lord Chancellor), Campbell, the poet, Thomas Moore, Lord Brougham, Byron, William Hazlitt, John Stuart Mill, Charles Lamb and Thackeray. John Black, its most famous editor used to say that one of the paper's parliamentary reporters, Charles Dickens, was the best shorthand writer he had ever known. After a notable career the *Morning Chronicle* died in 1862.

The *Standard* was established as an evening paper in the Tory interest (as the express organ of the opponents of the measure for removing Roman Catholic disabilities) in 1827, its first editor being Stanley Lees Giffard, father of the first earl of Halsbury. In the '50s it was purchased by James Johnstone, who brought out the *Standard* as a morning paper (June 29, 1857), increased its size from four to eight pages, and reduced the price from fourpence to twopence. In Feb. 1858 Johnstone again reduced the price, this time to a penny. One of its contributors in the 'sixties was Lord Robert Cecil, later Lord Salisbury, the prime minister. In the early '60s it engaged William Heseltine Mudford. He was sent as special correspondent to Jamaica in 1865 to report upon the troubles which involved the recall of Governor Eyre; a further period in the gallery of the House of Commons followed, and in 1876 Mudford became editor. Johnstone, the proprietor to whose energy and perspicacity the paper owed so much, died in 1878, and under his will Mudford was appointed editor and manager for life, or until resignation. Already a great property, the *Standard* in Mudford's hands entered upon a very successful period. Alfred Austin, T. H. S. Escott, Miss Frances Power Cobbe and Professor Palmer were all writing for the paper at the same time. It had many famous war correspondents, foremost among whom were G. A. Henty, the famous author of boys' books; John A. Cameron, who was killed at Abu Klea; and William Maxwell. In January 1900 Mudford retired, and was succeeded in the editorship by G. Byron Curtis (d. 1907). In November 1904 the *Standard,* which had at that time taken rather a strong line in deprecating the tariff reform movement within the Unionist party, was sold to (Sir) C. Arthur Pearson, who was chairman of the Tariff Reform League, and H. A. Gwynne became editor. In 1910 it passed into the control of Davison Dalziel (the late Lord Dalziel) and disappeared during the war.

A disastrous experiment in newspaper production was the *Tribune,* founded by Franklin Thomasson in 1906 as a solid penny daily. After gathering a brilliant staff and expending very large sums he found it necessary to discontinue the paper in 1908. The unhappy enterprise is described in Sir Philip Gibb's novel "The Street of Adventure." The *Echo* was established by Cassells in 1868 and afterwards owned in turn by Albert Grant, the company promoter, Passmore Edwards, Andrew Carnegie, and the late Sam Storey. The *Echo* perished in 1905.

The *Globe* was founded in 1803, and after many years as a leading Whig organ it turned Conservative in 1866 when it became the property of a syndicate which included Sir Stafford Northcote

(Lord Iddesleigh). Two years later it assumed the deep pink hue which it kept until its demise after the World War. The first number of the *Pall Mall Gazette* (the name being borrowed from the incident in which Thackeray describes Captain Shandon in the Marshalsea prison drafting the prospectus of the *Pall Mall Gazette* as a paper "written by gentlemen for gentlemen") appeared in February 1865. Its first editor was Frederick Greenwood, who gathered round him a brilliant array of talent in Sir Henry Maine, Sir J. Fitzjames Stephen, Anthony Trollope, Charles Reade, George Henry Lewes, George Eliot, Matthew Arnold, and Richard Jefferies. In 1875 Greenwood was able to convey to Disraeli news of the French bid to secure control of the Suez Canal, thereby enabling Britain to get in first. It had been a consistent supporter of Disraeli, and when on changing hands it became Liberal John Morley became editor, with W. T. Stead as assistant editor. In 1882 its price was reduced from 2d. to 1d.

When Morley exchanged journalism for politics in 1883, he was succeeded by W. T. Stead (*q.v.*), with Alfred Milner, afterwards Lord Milner, as his assistant. Stead's adventurous career as the editor came to an end in 1889, in consequence of his publishing a series of articles called "The Maiden Tribute of Modern Babylon," purporting to further the Criminal Law Amendment Bill. He was succeeded by E. T. Cook. The *Pall Mall Gazette* was now steadily Liberal and a strong advocate of Irish Home Rule. It had two distinguished editors at a later date in Sir Douglas Straight and J. L. Garvin, and finally passed through several hands before its decease.

Founded in 1880 by H. Hucks Gibbs (afterwards Lord Aldenham), for Frederick Greenwood to edit when he had left the *Pall Mall*, the *St. James's Gazette* represented the more intellectual and literary side of Tory journalism in opposition to the new Liberalism of Mr. Greenwood's former organ. In 1888 the paper having then been sold, Greenwood retired and was succeeded as editor (1888–1897) by (Sir) Sidney Low, who in his turn was succeeded by Hugh Chisholm (1897–1900). Among the contributors were Rudyard Kipling, Sir James Barrie and G. S. Street.

Towards the end of the 19th century it assumed a more popular style and shape, and for a year or two before its acquisition by (Sir) C. Arthur Pearson in 1903 and its final merging in the *Evening Standard* it was edited by Ronald MacNeill (Lord Cushendun).

When the *Pall Mall Gazette* was sold to Lord Astor in 1892 and converted into a Conservative organ, E. T. Cook, the editor, and most of his staff resigned; in 1893 they came together again on the *Westminster Gazette*, newly started for the purpose by Sir G. Newnes (who had made a fortune out of *Tit-bits* and other popular papers) as a penny Liberal evening paper. It was printed on green paper. The paper was conducted on the lines of the old *Pall Mall*, and it had the advantage of a brilliant political cartoonist in F. Carruthers Gould. In 1895 Cook was appointed editor of the *Daily News*, and his place was ably filled by J. Alfred Spender, who had been his assistant-editor, F. C. Gould (who was knighted in 1906) being his chief assistant. Apart from Sir F. C. Gould's cartoons, the *Westminster* became conspicuous in London evening journalism for its high standard of judicious political and literary criticism. It gradually became the chief organ of Liberal thought in London. In 1908 a change of proprietorship took place, the paper being sold by Sir G. Newnes (d. 1910) to a group of Liberal capitalists including the late Lord Cowdray and Lord Melchett (then Mr. A. Mond), but without affecting the *personnel* or policy of the paper. How the famous green *Westminster* finally vanished after the war to be replaced by the daily newspaper of the same name, which was merged in the *Daily News* in 1928, has already been stated.

BRITISH PROVINCIAL PRESS

The first provincial paper in England was the weekly *Worcester Postman* started in 1690, now *Berrow's Worcester Journal*. Next in 1695 was born the *Lincoln, Rutland and Stamford Mercury*, now known by the last two names only, and in the first 20 years of the 18th century a number of other journals sprang up in country towns, practically all weekly papers. At the beginning of the 19th century the provincial press consisted of less than a hundred journals, as compared with many thousands at the present day. They were at that time practically without influence and presented a minimum of local news without expressing any views. Benjamin Flower, printer of the *Cambridge Intelligencer*, who in 1799 was haled before the House of Lords for breach of privilege in commenting upon some action by a bishop, fined £100 and sent to Newgate for six months, was the first to introduce the leading article in the provincial press. *The Leeds Mercury*, founded in 1717, under the control of Edward Baines (1801) became the most important and influential of the north country papers in the first half of the 19th century. For many years it admitted neither theatrical nor racing matter to its columns until the sentiment of its readers in Lancashire and Yorkshire underwent a change in regard to these forms of amusement. After the Reform Act of 1830 and the contemporaneous spread of self-education and establishment of reading circles and newspaper clubs, the country newspapers developed in importance and usefulness, being forced to assuage the public thirst for information and instruction. It was not however till the final removal of the taxes on knowledge, already described, that the provincial press came into its own, and from being strictly local organs began to show almost as large an interest in affairs of national importance as their London contemporaries.

Within ten years of the abolition of the paper duty penny morning newspapers had taken up commanding positions in Edinburgh, Glasgow, Dundee and Aberdeen; in Liverpool, Manchester, Leeds, Bradford, Newcastle and Sheffield; in Birmingham and Nottingham; in Bristol, Cardiff and Plymouth; and across St. George's Channel in Dublin, Cork, Belfast and Waterford. But any real importance as organs of opinion was still confined to only a few of the great penny provincial dailies, notably the *Yorkshire Post, Manchester Guardian, Birmingham Post* (1857), *Sheffield Telegraph* (associated with Sir W. Leng), *Liverpool Daily Post, Leeds Mercury* and *Western Morning News;* others too numerous to mention here were at the same time cradling journalists who were to become famous in a larger sphere, such as the *Darlington Northern Echo*, on which W. T. Stead made his début, while Joseph Cowen for some years made the Newcastle *Daily Chronicle* a powerful force.

In the early 'seventies such a thing as a full telegraphic report in a provincial morning newspaper of parliamentary proceedings, or of a speech by a leading statesman, was almost unheard of. The Press Association had not then covered the country with its organization. Reuter's foreign news service very briefly reported important events. Between 1870 and 1880 a complete revolution was effected, as the result of social and educational changes. Newspapers that had been content to fill their columns with local news and clippings from London and distant provincial papers put such matter aside. Telegraphic news crushed it out. When in Feb. 1870 the government took over the telegraph system, and gave special terms for press messages, English and Irish newspapers, following Scotland's lead, began to open offices in London with special wires. The Press Association spread its news-collecting organization over the whole country, and was stimulated to activity by the rising opposition of the Central News. The universal use of news agency messages tended to a uniformity from which the more enterprising journals saved themselves by special London letters, parliamentary sketches and other exclusive contributions. In 1881 the reporters' gallery in the House of Commons was opened to some provincial newspapers. The first syndicate to send out war correspondents was formed by the *Glasgow News*, the *Liverpool Daily Post, Manchester Courier, Birmingham Gazette* and *Western Morning News*, who despatched two correspondents to Egypt. The Central News also sent out war correspondents to Egypt and the Sudan. During the South African War (1899–1902) the leading provincial newspapers, however, all formed syndicates amongst themselves to secure war telegrams, and in many cases made arrangements for the simultaneous publication of the letters and telegrams of leading London journals.

Leading Provincial Newspapers.—The leading English provincial daily papers in 1929 were:

The *Manchester Guardian*, price 2d., founded in 1821 as a weekly Whig organ and for the last fifty years the chief exponent of Liberalism outside London. During this latter period it has been edited by C. P. Scott, and has maintained a standard of excellence in all its branches that has given it a world-wide reputation. Apart from its vigorous politics it enjoys an unrivalled literary prestige, and a dignity of expression and presentation, unsullied by recourse to the methods of self-advertisement which seem necessary to those more popular newspapers that seek huge circulations. It became a penny paper in 1857, two years after it had been turned into a daily journal. Prominent names associated with it have been C. E. Montague (who died in 1928), C. P. Scott's son-in-law, L. T. Hobhouse, Andrew Lang, Richard Jefferies, Richard Whiteing (who died in June 1928), Sir Claude Phillips, George Saintsbury, Laurence Housman, G. W. E. Russell, and Spenser Wilkinson. In its book reviewing, its dramatic criticism, and its foreign correspondence alone the *Manchester Guardian* exercises an unparalleled influence in provincial journalism, and is usually regarded as a national organ.

The Yorkshire Post, price 2d., started in 1866 as a Conservative paper and now ranks as the principal Conservative newspaper outside London, enjoying a national prestige extending far beyond the borders of Yorkshire. In its early years it devoted especial attention to racing, which was neglected by most local papers in the county in those days, and under the control of the Beckett family it rapidly attained a solid prosperity which it still maintains. It has had talented editors in H. J. Palmer, J. S. R. Phillips, and Arthur H. Mann (its present—1929—editor).

The *Birmingham Daily Post*, price 1d., founded in 1857 by J. F. Feeney and John Jaffray (afterwards made a baronet) and now controlled by Sir Charles Hyde, Bart. It holds a position in the midlands analogous to that of the *Yorkshire Post* in the north, and is edited by G. W. Hubbard.

The *Liverpool Daily Post and Mercury*, price 1d., founded in 1853 as a Liberal paper, and for many years possessing as its editor the outstanding personality of Sir Edward Russell. In 1904 it absorbed the *Liverpool Mercury* (founded in 1811), and it holds a pre-eminent place in the life of the great seaport.

Scotland, Wales and Ireland.—In Scotland the leading newspapers are the *Scotsman* and the *Glasgow Herald*, each 2d. The former was started as a biweekly in 1817 and became a daily in 1855. It was Liberal until the Home Rule split in 1886 when it adopted the Unionist cause. Alexander Russell was its most famous editor in the 19th century (1848–1876) and for many years it has been the only Edinburgh morning newspaper.

The *Glasgow Herald* dates from 1783, when it first came out with the extra name "and Advertiser" tacked on. It has a great literary reputation, well maintained under Sir Robert Bruce's present editorship. He follows an illustrious line of editors, including Samuel Hunter, George Outram, Dr. Russell, and Dr. Wallace. The *Glasgow Herald* has a high reputation as a commercial organ and is credited with having a larger sale than any newspaper published at 2d. outside London.

The daily newspapers of Scotland, which for the latter part of the 19th century were predominantly Liberal, are now Conservative, except the *Edinburgh Evening News*.

The chief newspaper in Wales is the *Western Mail*, Cardiff, which has recently absorbed the *South Wales Daily News*, and thus becomes the only morning paper in the Principality.

The only important newspaper town in Northern Ireland is Belfast, which has two historic newspapers: the *Belfast News Letter*, which has been in existence about 200 years, and the *Northern Whig*, which celebrated its centenary some years ago. The *Irish News* is the provincial organ of Nationalist opinion. The only evening newspaper in 1928 was the *Belfast Telegraph* (1½ d.).

SUNDAY NEWSPAPERS

The rise of the Sunday newspapers in the last twelve years is alluded to elsewhere. Here it may be noted that the historic Sunday newspapers, unlike some of the historic daily newspapers, show great vitality.

The *Observer*, which is the most powerful political organ of the Sunday newspapers and saw the light in the year 1791, a period when France had entered upon a revolution which was to shake the foundations of Europe and change the course of history. The *Observer* reported the battle of Trafalgar, 1805, without headlines and ten years later Wellington's dispatch on the Battle of Waterloo as if it were the heading of a parliamentary Blue Book. The *Observer* kept on its respectable but somewhat sombre career until it was acquired by Lord Astor and edited by J. L. Garvin, when it assumed a distinctive character, a virile independence in its political outlook while it made a strong feature of foreign correspondence, literature, the drama, etc.

The *Sunday Times*, another historic Sunday newspaper which was founded in 1822, is parallel with the *Observer* except that it is more moderate and consistent in its political outlook, but there is not much to choose between the two newspapers in regard to their general features. The *Sunday Times* is notable in respect that it laid the foundations of the Berry family in the newspaper world. It was the first general newspaper acquired by Sir William Berry, who bought it in 1915. He has exercised a particular control over it. The editor is (1929) Leonard Rees.

Another old Sunday newspaper is *Lloyd's Weekly News*, now known as the *Sunday News*, started by Edward Lloyd in 1842. A year later the *News of the World* was founded. During the last 20 years it has become the most widely circulated of all newspapers. *Reynolds Illustrated Newspaper*, a democratic organ, was started in 1850, and the *People* (Conservative), in 1881.

The two Sunday picture papers are the *Sunday Pictorial* and the *Sunday Graphic*. The other Sunday papers vary in the degree to which they cater for the masses by sensational news, crime stories, prizes, competitions, coupons, etc. The *Sunday Dispatch* (formerly the *Weekly Dispatch*) and the *Sunday Express* are somewhat similar in type and less popular in their appeal than other journals which exceed them in sale, headed by the *News of the World*, which has a sale of nearly four millions, the *People*, the *Empire News*. Other most widely circulated Sunday papers are the *Sunday Chronicle* and the *Sunday News*. A development since the war has been provincial Sunday newspapers outside Manchester, the home of the *Sunday Chronicle* and the *Empire News*, such as the *Sunday Sun*, Newcastle, the *Sunday Post*, Glasgow, the *Sunday Mercury*, Birmingham, and the *Sunday Sentinel*, Stafford. The aggregate sale of all the Sunday newspapers is estimated to be 16,000,000.

DEVELOPMENT OF THE MODERN NEWSPAPER

It was the last quarter of the 19th century that witnessed the beginning of changes in journalism which moulded the present character of the British newspapers. The first sign of change was struck by W. T. Stead in the *Pall Mall Gazette*, over 40 years ago. He popularised the interview, and humanised political journalism. He was cramped in his activities, as he edited an afternoon review rather than a newspaper. The influence which the *Pall Mall Gazette* exercised under Frederick Greenwood, John Morley, W. T. Stead, and E. T. Cook was indirect. It had no popular appeal.

The first break in old traditions and appeal to democracy through the press came when T. P. O'Connor founded the *Star* in Jan. 1888. With the *Star* began a new type of popular journal. Human interest was its daily fare, and though small in size its scope was as wide and diversified as life. Politics and crime, special and personal news, finance and serial stories, books and fashions, labour, art, music, were all popularised by O'Connor. He had on his staff seven men who were afterwards editors of London newspapers, and the men who began their careers on the *Star* and gained fame in their own spheres in later years include George Bernard Shaw, A. B. Walkley, the greatest dramatic critic of his time, and that wayward genius Joseph Pennell.

As already mentioned the big advance in the new journalism was left to Alfred Harmsworth, the late Lord Northcliffe (*q.v.*). Newspapers were the second stage of his meteoric career. He began with *Answers* and other periodicals, following the lead of Sir George Newnes with his *Tit-Bits*, and soon surpassed him. After his success in this sphere of journalism, Lord Northcliffe

and his brother, Harold Harmsworth (now Lord Rothermere), acquired the London *Evening News*, and on this founded their phenomenal success in halfpenny morning journalism.

The 20th Century.—The introduction of half-tone pictures to illustrate the news of the day was another new element in extending the sphere of the daily press and in popularising it. Encouraged by the support which he received from women readers of the *Daily Mail* and of his many weekly variety papers, Lord Northcliffe issued a newspaper which was to be edited by women for women. He produced the *Daily Mirror*, intended to be a higher type of paper than the *Daily Mail*, and to appeal more to the interests of serious-minded women. It was still-born. It was Lord Northcliffe's greatest failure. But it was a lucky failure. The paper which was intended to be the women's *Times* was transformed into the first illustrated halfpenny daily newspaper. The *Daily Mirror* was bought by Lord Rothermere, and became as great a financial success as the *Daily Mail*.

The *Daily Sketch* was the next halfpenny daily picture paper to be published. The *Daily Graphic* had existed for many years as a penny daily illustrated paper, but never attained great success nor won popular favour. All newspapers began, one after the other, to introduce a page of half-tone pictures and to publish other pictures in their news columns, the *Times* and the *Daily Telegraph* being among the last to adopt this feature.

Meanwhile other newspapers had been compelled by the success of the *Daily Mail*, followed by the *Daily Express*, to come down to a halfpenny and similarly to make their appeal to the masses. Leading articles became shorter, feature pages were introduced, and a magazine page with short articles and items of the tit-bit character, though it must not be assumed that this abbreviated style carried with it any real degeneration of journalism.

The World War brought more changes. At first, like all other industries, except those concerned with the production of munitions or in some way associated with catering for the forces, the press was disorganized. The Government recognised that the press was an essential element in national effort, and facilities were granted to newspapers, both in regard to obtaining materials and in retaining man power. For the first time also, war correspondents became more than camp followers, were granted uniforms and became officially attached to armies.

No industry has undergone such dramatic changes since the World War as the press. The late Kennedy Jones, who was associated with the Harmsworths in founding the *Daily Mail*, said to the late Lord Morley: "You found journalism a profession, we have made it a branch of trade." It has now become also a branch of finance.

THE ERA OF AMALGAMATIONS

The great change from the private proprietorial system to limited liability companies was initiated by Lord Northcliffe in promoting limited liability companies to take over Harmsworth Bros., the most successful periodical business, and afterwards *The Evening News*. Amalgamations and groupings of papers followed. Referring to this phase of newspaper development Sir Robert Donald, in an address at York, as president of the Institute of Journalists, in 1913, said: "Combination has been the chief characteristic of industry all over the world, and the press could not remain outside this tendency. One company sometimes owns or controls a series of newspapers. There have been absorptions, amalgamations and alliances, with the result that vast aggregations of capital have been built up in which thousands of shareholders are interested. These agglomerations, piling up power and wealth, are controlled by the same forces which operate in other fields of industrial activity." He also predicted that the future would see combinations increase; there would be fewer newspapers, and "colossal circulations would continue to grow." The newspaper run as a luxury and for a mission, and not as a business enterprise, would be squeezed out of existence. There would therefore be fewer newspapers, but the total circulations would be greater.

These predictions, made a year before the World War, have been fulfilled, but no one foresaw that the press combinations would reach such gigantic proportions, or become so immensely profitable. The war facilitated and expedited the rise of the press syndicates. One has only to look at the Stock Exchange quotations to realise the influence of finance on the Press and the power of the press in finance.

There has however been a decrease in the number of newspapers. In 1928 there were in Great Britain, Northern Ireland, and the Irish Free State, 2,150 newspapers, distributed as follows: London 992, of which 21 were morning, including specialist papers (*Jewish Express*, in Hebrew, *Jewish Times*, *Lloyd's List*, and *Lloyd's Daily Index*), and 3 evening dailies (and the *Jewish Evening News*, published in Whitechapel). The newspapers in the English provinces and Wales, including localised issues, numbered 1,363, of which 35 were morning and 80 evening dailies; Scotland, 228, including 6 morning and 10 evening dailies; Ireland, 161, including 8 morning and 5 evening dailies; the British Isles, 16, of which 5 were dailies.

Twenty years previously there were nearly 200 more newspapers than in 1928, although the population greatly increased during these two decades.

The rise of the newspaper combination has dethroned all the old newspaper dynasties. The Walters of *The Times* are no longer in control of that great national newspaper. The Borthwicks of *The Morning Post*, the Lloyds of the *Daily Chronicle* and *Lloyds News*, the Hultons of the *Manchester Daily Dispatch*, etc.; the Ingrams of the *Illustrated London News;* Cox of the *Field;* and, in the provinces, Byles of the *Bradford Observer*, Baynes of the *Leeds Mercury*, Cowen of the *Newcastle Chronicle*, and others have been displaced. The last of the monarchs of Fleet Street to give up their splendid isolation were the Lawsons of the *Daily Telegraph*. It was a shock to the newspaper world when, in December 1927, the second Lord Burnham sold the paper which his grandfather founded and his father—a newspaper genius—installed in the first place in British journalism.

New Owners of the Press.—New magnates have assumed power. No longer are newspapers the personal properties of the Borthwicks, Lawsons and the Walters; they belong to shareholders who entrust their money to the care of a directorate. Greatest of the new barons of the press are the Harmsworths, headed by Viscount Rothermere. The Berrys, the newest monarchs in the newspaper world, are still young in their generation, and Lord Beaverbrook—a Canadian by birth—has not lived in England 20 years.

The most spectacular financial newspaper deal was that involved in the creation of the *Daily Mail* Trust, Limited. It was incorporated on Sept. 27, 1922 and purchased the 400,000 deferred (controlling) shares in Associated Newspapers, Ltd., as sanctioned by the court on the death of Lord Northcliffe. The price paid was £1,600,000, which was met by an issue of 7 per cent first mortgage debentures. Early in 1923 the trust purchased 49 per cent in the *London Express* Newspaper, Ltd. A little later it purchased the large newspaper business of E. Hulton and Company, Ltd., and paid for it by a second issue of £8,000,000 7 per cent debentures, liquidating out of the proceeds the former issue of £1,600,000 debentures. At the same time the trust retained 49 per cent. interest in *The Evening Standard*, which had been included in the Hulton group but was transferred to Lord Beaverbrook. In the same year the trust sold the greater portion of the Hulton press to the Berry brothers for more than the original purchase price, while retaining possession of *The Daily Sketch*, *The Sunday Herald* and new printing works; these three assets being subsequently promoted and sold for £1,600,000 under control of Lord Rothermere. The trust paid £4 for the deferred shares in Associated Newspapers, Ltd. They appreciated almost as much again. The trust in two years discharged a debenture obligation of £9,000,000.

The Rothermere Group.—The most powerful newspaper group in Great Britain is that controlled by Lord Rothermere, not because of the number of newspapers combined or associated, but on account of their predominantly national character and the immense financial resources behind them. The chief Rothermere groups are:—

The Associated Newspapers, Ltd., owning the *Daily Mail, Evening News, Sunday Dispatch, Overseas Mail.*

Capital:	£
5% Cumulative Preference shares	500,000
7% Cumulative Ordinary shares	000,000
Deferred shares	2,250,000
Total	£3,350,000

Daily Mirror Newspaper, Ltd.

Capital:	£
8% Cumulative Preference shares	800,000
Ordinary shares	1,400,000
Total	£2,200,000

In the spring of 1928 the ordinary shares of the Daily Mirror and Associated Newspaper Companies were converted each into four shares of a nominal value of 5s. The value of these shares in the summer of 1928 was in the case of the Associated Newspapers 24s., and in the case of the *Daily Mirror* 35s.

Sunday Pictorial, Ltd.

Capital:	£
8% Cumulative Preference shares	500,000
£1 Ordinary shares	1,500,000
Total	£2,000,000

These companies are shareholders in the Daily Mail trust, controlled by Lord Rothermere, already referred to. The financial strength of the Rothermere newspapers is not indicated by the amount of dividends which they distribute, as they build up great reserves and have no prior debenture or other charges.

In Feb. 1928, Lord Rothermere also promoted *Northcliffe Newspapers*, Ltd. (share capital £2,500,000; loan capital £3,000,000, 5½ per cent guaranteed debenture stock), primarily for establishing or acquiring "in selected centres of large population throughout the country evening newspapers which, by reason of possessing the advantages of extensive organization and large resources, will be the most up to date in the country."

It was stated in the prospectus that the surplus assets of Associated Newspapers and of the Daily Mirror were respectively £5,129,000 and £2,500,000—excluding good will and all liabilities. The debenture stock was guaranteed by the Associated Newspapers, Ltd., and the *Daily Mirror* Newspapers, Ltd. The 5 per cent. debenture stock was very much oversubscribed. The share capital was divided into £2,400,000, £1 ordinary shares and £100,000 £1 management shares. Two shillings was paid on all the management shares and on £1,400,000 ordinary shares, so that the company started with capital in cash amounting to £3,150,000, with £2,260,000 uncalled share capital.

During the summer of 1928 Northcliffe Newspapers, Ltd., acquired several prominent newspapers and made arrangements to start new evening newspapers in selected centres as announced in the prospectus. The *Daily Mirror* Company, acting independently or in association with Northcliffe Newspapers, acquired several well-established evening newspapers and founded a regional Sunday paper at Stafford.

The capital of the various Rothermere companies does not by any means indicate their financial strength and great earning capacity. They possess a complete dual organization between the Associated Newspapers and the *Daily Mirror*, and are building up a third national organization in the Northcliffe Newspapers. All these newspapers are safeguarded in regard to the supply of paper; they control mills in Newfoundland, Canada and England. The following table shows the capitalisation of their paper making companies:—

Anglo-Newfoundland Development Co., Ltd.

Capital issued
- $6,439,585, Ordinary Shares.
- $2,426,010, 8% Cumulative Preference Shares.
- $1,594,255, Second Preference Shares.

As at 31·8·27
- £ 280,625, 5% Debentures.
- £1,118,650, 6% Second Mortgage Bonds.

The Associated Newspapers Limited hold a majority of the Ordinary Shares.

A. E. Reed & Company Limited

Capital: £293,970, 6% First Mortgage Debenture.
£240,000, 6½% Cumulative Preference Shares.
£225,000, Ordinary Shares.

Daily Mirror Newspapers Ltd., hold a majority of the Ordinary Shares.

Bowaters Paper Mills Limited

Capital: £275,000, 7½% Cumulative Participating Preference Shares.
£295,600, 6½% First Mortgage Debentures.
£193,000, Ordinary Shares.

Majority of Ordinary Shares held by W. V. Bowater & Sons Ltd., which is in turn controlled by "Daily Mirror Newspapers Ltd."

The Empire Paper Mills (1922) Ltd.

Capital: £400,000. Ordinary Shares of £1 each.
All the shares are held by Associated Newspapers Ltd.

Anglo-Canadian Pulp & Paper Mills Ltd.

Capital: $8,000,000, 7% Preference Shares. (Cumulative from October, 1929.)
£3,000,000, 6½% Mortgage Debentures.
135,000 Shares of Common Stock of no par value.

The Berry Group.—The largest newspaper proprietary in Great Britain and in the world is that controlled by Sir William and Sir Gomer Berry, whose rise in the newspaper business has been as romantic as their success has been phenomenal. Their vast interests are the creation of little more than ten years' activities.

The founder of the business, William E. Berry, like Alfred Harmsworth before him, served an apprenticeship in the humble spheres of journalism, beginning on the *Merthyr Times*. He went to London in 1898 as sub-editor on the *Investors' Guardian*, and though he quickly showed a special *penchant* for financial journalism, he worked on the staffs of several papers before launching out as a newspaper proprietor. In 1901 he started the *Advertising World*, the first production of the kind in the United Kingdom, and in the same year was joined by his brother Gomer. Together they started and owned various weekly and monthly papers, and when in 1915 they acquired the *Sunday Times* and introduced a new vitality into that old established newspaper they were already recognised as important newcomers to the press industry. In quick succession they acquired the *Graphic*, the *Daily Graphic*, the *Bystander*, the *Financier*, the *Financial Times*, the old established house of Cassells, with its periodicals and big publishing business, and Weldon's Fashion Journals. In 1923 they bought *Kelly's Directories* including the famous *London Post Office Directory*. Later an alliance was formed between the company owning Kelly's directories and Iliffe and Sons who own a leading group of trade and technical journals. Large printing works went with these two concerns. While the foregoing were big transactions from the financial point of view the Berrys were not firmly established in the newspaper world until 1924 when they bought most of the publications of Edward Hulton Ltd. which had been acquired by Lord Rothermere and Lord Beaverbrook, and formed the Allied Newspapers Ltd., which included the *Sunday Times*. The group contained widely circulated and popular newspapers, including the *Manchester Daily Dispatch*, the *Manchester Evening Chronicle*, the *Sunday Chronicle*, the *Empire News*, the *Sporting Chronicle*, and sundry other publications. About the same time they took over the control of another important newspaper property, the *Sheffield Daily Telegraph* and *Evening Telegraph*, with a number of popular periodicals. Another big milestone in their progress was reached in the following year when they bought all the newspapers in Newcastle except one, namely the *North Mail*, the *Newcastle Evening Chronicle*, the *Sunday Sun*, etc., and simultaneously acquired the *Glasgow Daily Record*, the *Glasgow Evening News*, and *Sunday Mail*. To this group was added in 1926 the *North Eastern Daily Gazette* of Middlesbrough, and the Allied Northern Newspapers Co. Ltd. formed with a capital, including debentures, of four million pounds. Very soon afterwards the Berrys purchased from Lord Rothermere the two papers which he had retained from the

Hulton group, namely, the *Daily Sketch* and the *Sunday Graphic*, which were formed into a separate company. Towards the end of 1927 Sir William and Sir Gomer Berry—both having been made baronets in recognition of their public services, Sir William in 1922 and Sir Gomer in 1927—startled the newspaper world by acquiring the *Daily Telegraph* from Lord Burnham and his family. Sir Edward Iliffe was a partner in this transaction. The new owners immediately began to put new life into this sound and sedate organ of the English commercial and middle classes. Important paper making works went with the newspaper. The capital involved in this transaction has not been made public.

It is probable that the Berrys would have been content to have consolidated their properties but in 1928 a new newspaper war was started and they took up the challenge. They bought the *Derby Express*, the *Bristol Times and Mirror*, the *Bristol Evening Times*, the *Aberdeen Press & Journal* and the *Aberdeen Evening Express*.

For several years the Berry family have had control of the *Western Mail* and *Evening Express*, Cardiff, and in August 1928 bought the *South Wales Daily News* and *South Wales Echo*—the other papers in Cardiff.

While the foregoing list of newspaper properties controlled by the Berry companies are a formidable combination they do not by any means complete the wide range of their interests in the publishing business. In 1927 they bought the Amalgamated Press Ltd., the business founded by the late Lord Northcliffe and his brother Lord Rothermere. It was largely in the hands of the trustees of the Northcliffe estate and the Berrys were the successful bidders. It is the largest periodical business in the world and publishes over 120 weekly and monthly publications. Its capital was £3,000,000. The Berrys paid £9,000,000 and have paid dividends on the increased capital.

Like all big combinations the Berrys proceeded to safeguard themselves regarding the supply of raw material. They acquired with the Amalgamated Press the Imperial Paper Mills and in 1927 bought the famous Edward Lloyd Paper Mills, the biggest single concern of the kind in the world, so that they became the biggest paper manufacturers in Great Britain, as well as the largest newspaper and periodical owners.

The issued loan and share capital of the various Berry enterprises belonging to public companies was, in the summer of 1928, as follows:

	£
Allied Newspapers Ltd.	8,250,000
Allied Northern Newspapers Ltd.	4,000,000
Daily Sketch and *Sunday Graphic* Ltd.	2,584,096
Financial Times Ltd.	1,500,000
Kelly's *Directories* Ltd.	1,131,372
Weldon's Publications Ltd.	385,000
Amalgamated Press Ltd.	9,200,000
Bristol Times and Mirror Ltd.	138,337
Aberdeen Newspapers Ltd.	188,310
Edward Lloyd Investment Co. Ltd.	4,500,000

The capitalization of the Cardiff newspapers and the one in Derby has not yet been published, but will probably be £1½ million.

The Berry press "trusts" have not provoked the same criticism among public men or fears from journalists as has been the case with other newspaper combinations because they have not used their powers to push themselves or to run particular policies. They have maintained the character of the publications acquired, retaining local management and giving their editors considerable latitude. They have not over-centralized. So far as the reading public of the different papers are concerned they do not notice marked changes in the appearance and character of the publications. The centralized control is mainly commercial and financial. All the Berry companies are financially successful. Their progress has been steady and while their loan capital is heavy their earning capacity has up to now increased and the ordinary shares stand at a premium.

Apart from periodicals which number about 200 the Berry combinations control in London three daily newspapers and two Sunday newspapers; in the provinces, eight morning, eight evening, three Sunday newspapers; fourteen weekly newspapers; in Scotland two morning, two evening, and two weekly newspapers and one Sunday newspaper.

The Beaverbrook Group.—The Beaverbrook group, in which Lord Rothermere has a minority interest, consists of *The Daily Express*, *The Sunday Express*, owned by London *Express* Newspapers, Ltd. (capital £539,439), and *The Evening Standard*. The policy of Lord Beaverbrook has not been to distribute dividends on the ordinary shares, but to extend plant and building, reduce capital and organise a future impregnable position.

The commercial possibilities of Lord Beaverbrook's newspapers have not yet been tested. Judged by the rapid expansion which they have made in recent years and the volume of advertising which they carry it is a fair assumption that if the intensive development policy were discontinued these journals would be next to the Associated Newspapers in earning capacity.

Daily Chronicle Group.—The *Daily Chronicle* Investment Corporation Trust was formed in July 1927 to take over the properties of the United Newspapers (1918) Ltd., with a capital of £3,050,000 consisting of £800,000 7% first cumulative preference shares, £700,000 8% second cumulative preference shares, £1,400,000 ordinary shares, £1 each, and 3,000,000 deferred shares of 1/- each. The corporation owns the *Daily Chronicle*, the *Sunday News*, the *Edinburgh Evening News*, the *Yorkshire Evening News*, and the *Doncaster Gazette*.

In July 1928 after the death of Sir David Yule and the retirement of Sir Thomas Catto, their interests were acquired by Mr. William Harrison on behalf of the Inveresk Paper Co., Ltd., of which he was chairman. Mr. Harrison had previously entered the newspaper field by acquiring the *Lancashire Daily Post*, Preston, and an interest in the *Hull Daily Mail* and *Grimsby Telegraph*. Besides his interests in daily newspapers, Mr. Harrison, as already mentioned, is chairman of Illustrated Newspapers, Ltd., which own nearly a dozen illustrated and trade papers. Mr. Harrison also controls most of the paper-making mills in Great Britain outside of newsprint mills.

The Starmer Group.—This is an association of 32 provincial newspapers with London headquarters at Newspaper house. The founders were the Rowntree family and Sir Charles Starmer, who began his newspaper career on the *Northern Echo* (Darlington). With the Rowntrees and Lord Cowdray, he built up this group, which includes the *Northern Echo*, *Sheffield Independent*, *Sheffield Mail*, *Nottingham Evening News*, *Nottingham Journal*, *Birmingham Gazette*, *Yorkshire Observer*, *Yorkshire Gazette*, *Bradford Telegraph and Argus*, *Birmingham Evening Dispatch*, *Lincolnshire Chronicle*, and a number of weeklies. The *Westminster Gazette* (morning paper) belonged to this group until its merging with the *Daily News* in Feb. 1928.

Other Combinations.—A financial group was promoted in July 1928 comprising the *Financial News*, the *Investors' Chronicle*, half interest in the *Economist*, the *Banker*, and the *Liverpool Journal of Commerce*, with a share capital of £550,000. One condition was that the editorship of the *Economist* should always be independent. The promoters of the issue were the printing firm of Messrs. Eyre and Spottiswoode.

Among the largest combinations of newspaper properties outside the big combines may be mentioned:

The Liverpool Daily Post and Echo Ltd., which owns the *Daily Post*, *Liverpool Echo*, *Liverpool Courier and Express*—all the newspapers in the city and neighbourhood.

The Consolidated Newspapers, Ltd., belonging to Sir Leicester Harmsworth, owns the *Western Morning News*, the *Mercury*, and the *Evening Herald*, Plymouth—the only morning and evening papers in that town—an evening paper in Exeter, and one in Torquay. In the summer of 1928 Sir Leicester Harmsworth acquired the *Field*, the *Queen*, and the *Law Times*.

The *Glasgow Herald* (Outram & Co.) Ltd., of Glasgow, with the *Bulletin* (an illustrated morning paper), the *Evening Times*, and the *Citizen*.

D. C. Thomson & Co., Ltd., own all newspapers and publications in Dundee, including the only morning and the only evening paper in that city, a Sunday newspaper, and a large number of weeklies.

The Yorkshire Conservative Newspaper Co., Ltd., are the proprietors of the *Yorkshire Post*, including *Yorkshire Evening Post*, and *Leeds Mercury*.

Anglo-Foreign Newspapers, Ltd., formed in Jan. 1929, has acquired interests in various newspapers and trade journals.

Organisations.—A net-work of organisations exists for employers and workers. In the newspaper business collective bargaining is the rule. On the employers' side, there is the Newspaper Proprietors' Association, which represents the London press, the Newspaper Society for the provincial press, the Scottish Newspaper Proprietors' Association, and the Irish Newspaper Society. There is also the British Trade and Technical Trade Journals Organisation.

Since 1913 the position of the working journalist has been vastly improved by the continued activities of the Institute of Journalists, incorporated by royal charter in 1890, and more especially by the influence exercised by the National Union of Journalists, founded in 1907, which is a trade union and has been the means of raising the standard among working journalists and of establishing the principle of minimum salaries.

At first competitive, the two bodies now show a tendency to become mutually complementary, the institute specialising in the professional, cultural and benevolent interests of the journalist, and the union concerning itself primarily with questions of salaries, hours and working conditions. The institute gives full membership to all bona fide journalists; the union restricts voting membership to journalists who cannot exercise the powers of an employer; thus, generally, editors, managing editors, and director-journalists are not eligible for full membership of the Union, and favour membership of the chartered body.

On the side of the manual workers there is also a complete net-work of organisations. The chief federated societies are the Typographical Association, representing compositors throughout the country; the London Society of Compositors; the National Society of Operative Printers and Assistants and Printing Machine Managers. Press telegraphists; correctors of the press; electrotypers and stereotypers; pressmen; paper-makers and others engaged in connection with newspapers, all have their unions. Beyond the federated societies is a large number of affiliated federations covering Great Britain.

Advertisers have organisations also, including advertising managers, circulation managers, and, indeed, every one associated with the production and distribution side of the press. News-agents combine chiefly in the Federation of Wholesale Newsagents and the National Federation of Retail Newsagents.

The General Strike and the Press.—A development of the coal dispute in England, which came to a head at the end of April 1926, was a general strike organised by the General Council of the Trades Union Congress. An important preliminary incident was a stoppage of work which occurred in the office of the *Daily Mail*. (*See* GENERAL STRIKE.)

After the first few days certain newspapers began to re-appear in the first instance mostly by photographic processes, in two or four diminutive pages, which were gradually increased in size as voluntary labour was obtained. The Government by voluntary labour issued from the office of the *Morning Post* the *British Gazette*, which was under the control of Winston Churchill. It soon attained a very large circulation. The Trades Union Congress retaliated by producing the *British Worker* by trade-union labour. The newspaper and periodical business probably suffered more by the strike than any other industry, as a considerable proportion of the staff had to be retained and heavy general expenses incurred. The general strike was called off on Thursday, May 13, and after negotiations the newspapers resumed normal production on Tuesday the 18th.

After the strike an agreement was entered into between all organizations representing employers and employed which defines the functions of both parties. The agreement between the Newspaper Proprietors' Association and the respective unions, which was a notable landmark in collective bargaining, is as follows:—

1. There shall be no interference with the contents of newspapers owned by members of this Association.
2. There shall be no interference with, or victimisation of, any members of the staff who worked or returned to work during the strike, either in their own or in any other office. Nor shall there be any victimisation by the employers.
3. There shall be no interference by members of the unions with the management of businesses, or with the right of the management to employ, promote, or discharge members of the staffs. Nor shall it be necessary for private secretaries or managers of departments not engaged in production to be members of a union.
4. No chapel meetings shall be held during working hours.
5. The strict observance of agreements in the newspaper trades shall be regarded as a matter of honour affecting each individual employer or employee.

Empire Press Union.—An organization which represents not only the Press of Great Britain but of the Dominions is the Empire Press Union, which was the outcome of the first Imperial Press Conference held in 1909. It represents newspapers, either by proprietors or responsible members of the staff. It has branch sections in the overseas dominions and keeps a permanent supervision over such questions affecting cable services and charges, and matters of common interest to the press as a whole. The second Imperial Press Conference was held in Canada in 1920, and the third in Australia in 1925. The first president of the Empire Press Union was the first Lord Burnham, and he was succeeded by his son, the present Lord Burnham. The chairman of the Council from 1915–26 was Sir Robert Donald, who was succeeded by J. L. Garvin, and was followed by Major the Hon. J. J. Astor. The Empire Press Union has insisted continuously on better and cheaper communications with the overseas dominions and has devoted particular attention to the promotion of empire wireless.

Page Fellowship.—American newspaper fellowships in memory of Walter Hines Page, the great ambassador, were established by the English Speaking Union of the United States in 1926 for the purpose of promoting more understanding among other English-speaking people through the medium of the press. Fellowships are awarded to British journalists who spend a year in the United States actually at work on newspapers and in the study of public questions. A British committee in co-operation with the English Speaking Union of the British empire selects the fellows, the first of whom was J. A. Spender, who spent three months in America in 1927.

International Press Conference.—The first international conference of newspaper experts held under the auspices of the League of Nations was held at Geneva in August, 1927. It was attended by editors and newspaper men from all over the world. Lord Burnham, then president of the English Newspaper Proprietors' Association and the Empire Press Union, presided. A series of resolutions were passed dealing with tariffs for telegraphs, telephones and wireless and improvement in communications, transport of newspapers, professional facilities for journalists, which have been referred to the League's organization for communications and transit for study and report. Other resolutions referring to postal subscriptions to newspapers, protection of news, censorship in peace time and facilities for travel tours, scholarships, railway fares, repressive measures, etc., will be considered by the Council of the League.

JOURNALISM AND JOURNALISTS

Although there is a well-defined qualification and status for civil servants, clergymen, doctors, dentists, barristers, solicitors, chartered accountants, journalism still continues to be such an indeterminate calling that there is no precise qualification or status for a journalist. The editor of *The Times* is equally a journalist with the more humble, but in his sphere no less necessary, police court reporter, and there are many people who call themselves journalists who supplement incomes from other sources by contributions to newspapers and periodicals. Especially during the present century there has been a notable increase in the number of people who have made their mark in other spheres, in politics, the Church, and public fields of activity to embark in journalism and compete with the regular journalist for considerably higher emoluments, and so general has this practice become that the prime minister of Great Britain, Stanley Baldwin, was able to announce as a matter of self-congratulation that he had never contributed for payment an article of any sort to a newspaper.

Several efforts have been made by the Institute of Journalists to create a standard that would result in every working journalist having to undergo such training and pass such examinations as are necessary in the recognized professions. Courses of journalism at the University of London following a series of lectures organized by Sir Sidney Lee during the World War were established in 1922 and have been well supported. Since 1923 exhibitions to the journalism courses to the value of £1,000 per annum have been awarded. The journalism committee of the University of London has also arranged for the delivery of addresses by well-known journalists and literary men.

Generally speaking, the staff of a national daily newspaper consists of an editor-in-chief, an assistant editor, a day editor, a night editor, a news editor, with his staff of reporters, a foreign editor, with a staff of sub-editors, the chief sub-editor, with a staff of sub-editors (one of whom in some offices has the unattractive description of "copy-taster," because he classifies and distributes the "copy" or news material as it comes in), in addition to a literary editor, sporting editor, dramatic, film and music critics, leader writers, and experts on such subjects as the fighting services, motoring, wireless, racing and golf. That is the interior journalistic organization, as distinguished from the managerial, advertising and numerous other departments. The exterior organization includes a chain of correspondents all over the country and in the capitals of the world.

The legal relations of the Press to the public are dealt with elsewhere (*see* PRESS LAWS, LIBEL, COPYRIGHT, CONTEMPT). So far as the relations of a newspaper staff with its employers are concerned, journalists are subject to the same law of contract of service as any other persons, subject to a custom by which in the absence of any contract, the following periods of notice must be given: editors and assistant editors, from six to twelve months, according to the relative standing of the newspaper; sub-editors, from three to six months; reporters, from one to three months. As a rule there are special circumstances which are decided by a jury on the merits, and the schedule given above has not yet received judicial recognition as a custom irrespective of the facts and the position of the newspaper, though it has been followed by the courts in the main. The editor is responsible for everything that goes into his paper, even the advertisement columns, and if a libel or contempt creeps in inadvertently he is expected to shoulder the responsibility in relation to the outsider rather than the contributor or the sub-editor that passed the offending matter, though the latter as a rule has to submit to disciplinary treatment within the office.

Subordination of the Editor.—Compared with 50 years ago, the most marked change in the personal side of British journalism has been the ascendancy of the proprietor and the subordination of the editor. This is reflected in the now prevailing habit of referring to the Rothermere press, the Beaverbrook press and the Berry press. There are now only a few well-known editors whose personalities are impressed on the public mind. First, there is C. P. Scott, the veteran editor of *The Manchester Guardian*, who is also one of the proprietors of his paper. C. P. Scott represents the finest type of editor-proprietor in England, while his journal, distinguished for its honesty and consistency, stands for the highest ideals of journalism and has acquired a great international reputation and influence. It has been under the control of C. P. Scott for over half a century. On the occasion of the centenary of *The Manchester Guardian* in May 1921, King George congratulated C. P. Scott on his 50 years' association with the paper which, "under your courageous and high-minded guidance, has secured for itself a position of such eminence and esteem in the world of journalism."

The other great personality in English journalism is J. L. Garvin, editor of *The Observer*, who is pre-eminent as a writing editor, brilliant and independent. He is a recognised authority on foreign affairs, and has exercised an influence on world politics for many years. In 1926 he took on new responsibilities, becoming editor of *The Encyclopædia Britannica* and chairman of the Empire Press Union. Four editors of London papers who were controlling policies before and during the World War lost their posts, partly through proprietorial changes. H. W. Massingham, who had been editor of two daily newspapers and, afterwards of *The Nation*, died in 1924, soon after he was displaced from the editorship of that journal; A. G. Gardiner, of *The Daily News*, J. A. Spender, of *The Westminster Gazette*, and Sir Robert Donald, of *The Daily Chronicle*, who had all for many years been controlling editors, left their positions during these years.

The proprietor who pushes himself before the public occasionally prints signed articles in his papers. He uses them as vehicles for expressing his personal views. One effect of the change, accentuated by the syndication of newspapers, is that consistency is not so well maintained and editorial responsibility is very much weakened. The old conception of an anonymous entity, who regarded a newspaper as a public trust and took responsibility seriously, has been dispelled. One individual may be in financial control of several or many newspapers; but as organs of opinion they either become a "gramophone press," or different interpretations are given to the same policy in papers under the same ownership. The mass production of public opinion does not carry weight.

The Times has reverted to its traditional policy, as the first newspaper in the world, occupying its place with easy dignity. Its scholarly editor, Geoffrey Dawson, maintains anonymity, while the controlling proprietor, Hon. J. J. Astor, M.P., maintains the reserved tradition of the Walters. The change has, however, assured *The Times* the position of independence as a national newspaper. When *The Times* Holding Company, Ltd., acquired Lord Northcliffe's controlling interest in the newspaper, special restrictions and conditions were introduced, which provided that none of the shares may be transferred to any person other than Major Astor or John Walter, unless or until such person shall have been approved as a proper person to hold ordinary shares in the company by a resolution of the committee which the articles of association appointed. The same restriction applies to a corporation. The committee consists of the persons who for the time being are the lord chief justice of England, the warden of All Souls college, the president of the Royal Society, the president of the Institute of Chartered Accountants and the governor of the Bank of England. The decisions of this committee must be by a majority of votes, the chairman to have a casting vote. In exercising their decision in regard to the transfer of shares the committee must have regard to the importance of maintaining the best traditions of *The Times* newspaper, and national rather than personal interests, and eliminating as far as reasonably possible questions of personal ambition and commercial profit.

Lord Rothermere only occasionally contributes articles to his newspapers, and then only on subjects upon which he holds strong personal views.

Sir William Berry and Sir Gomer Berry carry on their vast and varied interests in a commercial spirit without bringing their personalities before their many millions of readers. An arresting personality in the British Press is Lord Beaverbrook—controlling proprietor of *The Daily Express*, *Sunday Express* and *Evening Standard*. He went into the newspaper business during the World War and it was not long before he showed striking gifts for the particular kind of journalism which he took up. He has the news and the political sense highly developed and if he frequently annoys he always interests.

Cheaper Communications.—Cheaper and quicker means of communication and distribution of news is always in process of evolution. What are known as "loaded cables" have been laid down, increasing enormously the capacity and speed by which messages can be transmitted by cable, the advantages of which newspapers will share. In the address to the Institute of Journalists in 1913, to which reference has already been made, Sir Robert Donald visualized a time when news would be collected by wireless telephone and the reporter would always have a portable telephone with him, with which to communicate with his paper without the trouble of going to the telephone office, or writing out a message. The competitor, he said, to the national newspaper would not be another national newspaper, but

a method of circulating news by means of some scientific mechanism for transmitting the spoken word. He predicted that all the news of the day would be laid on to houses and offices, just like gas and water. During the years 1924 and 1925 the development of broadcasting brought this vision within the region of realisation. Newspapers look on this development with a watchful eye, lest it should, in addition to supplementing their functions, arrest their progress.

A revolution has taken place in long distance communication. New inventions have quadrupled the carrying capacity and speed of submarine cables and simultaneously short wave or beam wireless has more than caught up with the cables. On the main world routes where the two systems have come into competition the cables have suffered. This development in wireless, which was due to Senatore Marconi, has definitely established wireless as the cheapest and quickest means of communication over long distances and has therefore rendered a valuable service to the press. Cables are, however, more efficient in direct communication and have greater accuracy. On the other hand wireless can reach all parts of the world and will link up vast territories which will never be connected by telegraph. In fact it is doubtful whether more cables will be constructed except in association with wireless. The services should be complementary.

The interest of the press in these developments is to get the advantage of cheaper and quicker means of communication. In contracts proposed for wireless services to the British Government and in resolutions passed by Imperial Press Conferences, it was always assumed that the tariff for wireless would be one-third less than cable rates. When the beam and short-wave system came into operation in 1927, it was proved that wireless could operate profitably at these reduced rates. As this competition was threatening the existence of cables, the British Government called an Imperial Conference in 1927, which sought a solution of the problem in the interest of empire communication, by endorsing a merger of all cable and wireless undertakings within the British empire. It was assumed that under unified control the users, including the newspapers, would get better service at lower rates.

More revolutionary than long distance wireless was the introduction of receiving illustrations by wire. The chief London newspapers began in 1928 reproducing wireless pictures of events which took place thousands of miles away and it is expected that this development will become a regular feature of the press in a few years' time. The use of wireless telephony will also become more general. The effect of all these developments will be to widen the scope of newspapers and bring the people of the world closer together.

The Future of British Newspapers.—The revolution which took place in English journalism immediately preceding, during, and after the World War was characterised not by improvements in the traditional features of newspapers, but by the introduction of extraneous elements. These extraneous elements and methods were intended to force sales by making people buy more than one paper and several copies of the same paper. They were also intended to keep readers once secured by non-journalistic attractions and thus permanently increase and stabilise sales. As sales were made the basis of advertising rates, after Lord Northcliffe had set the example of issuing sales certificates, it became imperative to maintain a ratio between sales and advertising rates.

The chief feature adopted to capture new readers and attach them to a newspaper was insurance. Newspaper insurance, beginning modestly both as regards the accidents covered and the amounts recoverable, increased enormously until many subjects besides accidents to registered readers were covered, and the payments reached £12,500 on death by a railway accident. By the middle of 1928 the *Daily Mail* had paid over £1,000,000 under its insurance scheme. From the readers' point of view newspaper insurance is a good investment. No premium beyond the price of the paper is necessary. The system suits newsagents too, as they add to their list of permanent purchasers. Some newspapers carry their own insurance, while others pay premiums to insurance companies in proportion to their sales. In every case insurance companies investigate and settle claims. It does not seem that newspaper insurance has been inimical to normal insurance business. It is supplementary, not competitive.

Newspaper insurance has become a tremendous factor in the life of the people. Every year it is extended through its adoption by more newspapers and through the increase in payments. The newspaper which possesses the greatest financial resources will always lead in insurance. Heavy expenditure is incurred in the attempts to make insurance pay. An army of canvassers are employed, going from house to house in order to secure new readers; and poster and other advertising campaigns are carried on regardless of expense.

Newspaper insurance differs from company insurance. A company takes premiums from clients, but hopes that they may escape accidents and prolong their lives. Newspapers on the other hand seem to rejoice—in headlines—over fatal accidents which befall their readers and boast about the amount of money they pay out. One reader killed in a railway accident brings a hundred new readers into the net. Newspaper insurance has come to stay.

In addition to insurance many newspapers resort to a variety of competitions to capture readers. These competitions, some of which require little skill or knowledge, carry big prizes. The coupon system, which usually accompanies prize competitions, induced readers to buy many copies of the same issue for the sake of the coupon, as entries are not limited. This kind of coupon competition was declared by the High Court in October 1928 to be illegal and was stopped. There are many other competitions, including beauty contests and competitions referring to all kinds of sport. The cross-word puzzle competition has become almost universal and handsome prizes are offered for correct results. This is a competition which requires a certain amount of knowledge to solve. The general knowledge examination which has been adopted by all kinds of newspapers and periodicals demands greater intelligence, but in this case few prizes are offered.

The same comment applies to all competitions carrying prizes as to insurance—success depends on the amount of money spent in pushing schemes, and not so much on the merits of the schemes.

Other extraneous features have been introduced into journalism in the race for sales, or to stimulate advertisements, including devices by which readers may receive presents of various articles or beneficial considerations,—free trips, free entertainments, etc., —State events are organized and exhibitions held. Newspapers which do not resort to these expedients to foster business find themselves at a disadvantage. There are examples of newspapers which contain more news and better reading matter than their contemporaries, but which, because they decline to adopt insurance, or competitions, or puzzles,—as undignified or incompatible with their conception of the mission of the press,—fall behind, become unprofitable, and unless subsidized for political reasons, cease to exist.

The modern newspaper caters for all classes. It is severely sectionalised, and while the interests touched upon are more comprehensive than they were twenty years ago, the space devoted to general news of the day is very much less. Except in the case of a few newspapers, speeches are not reported at any length, and politics is treated as a subject of minor interest. Newspapers have become more or less imitative, and no journal is permitted to get more than a day ahead with a new feature or a new development. While minor changes are numerous, there has been no revolutionary change in the characteristics of daily journalism since the days of Lord Northcliffe. The popular cross-word puzzle, the general knowledge questions, and the comic strips which have been almost universally adopted, are importations from America.

The widening of interest in the contents of newspapers, colossal sales, amalgamations, and local monopolies do not fully explain the phenomenal financial success of newspapers since 1918. As compared with pre-war times newspapers have doubled their selling price and quadrupled their charges for advertisements, but there has not been a commensurate rise in the cost of raw materials, of labour, or of transport.

The chief factor in making for newspaper prosperity has been the increase in advertising. Newspaper advertising has become a vital factor in national industry and salesmanship. There has

been a quickening of the business sense, a determination to open up new markets, to increase consumption. Simultaneously there took place in England a revolution in the methods and style of advertising. The advertising agent, instead of being a mere conduit pipe, has become a highly scientific expert. More firms have been induced to advertise, and the experience of scientific publicity has been followed by larger allocations for this branch of salesmanship. The newspapers have reaped the benefit of the originality, resource, thought and enterprise which the advertising consultants apply to their business.

All these factors in recent newspaper development have made the newspaper business more and more dependent on finance. The consolidation of the press has continued without a break since 1918,—amalgamations, syndicates, trusts have followed upon each other. The impetus given to advertising enabled companies which were over-capitalised when promoted to return handsome profits. The only break in the movement towards trustification came in 1928, when Lord Rothermere launched his scheme for competitive evening newspapers in the provinces. How that scheme, which was welcomed by advertisers and journalists, will develop remains to be seen. Only a man with powerful financial resources behind him could undertake such an enterprise. Few new newspapers will be started, because the syndicated press is firmly entrenched and can exhaust the resources of any ordinary competitor.

The future of the British newspaper, therefore, becomes a question of finance. It is estimated that three-fourths of the newspapers in England and Scotland, and a greater proportion of newspaper sales are controlled by large corporations or by local monopolistic companies. These big corporations are not going to dissolve, and local monopolies will not be challenged except by a corporation.

Multiple ownership of newspapers possesses all the commercial and financial advantages of other big businesses, but mass production and centralised control destroy individuality. As members of a big combine newspapers lose character: they tend towards a standardised type. They may be better productions than is possible under isolated ownership, but the old conceptions of a newspaper as an institution with a soul of its own, which could not be measured by ordinary commercial standards, is gone.

The paramount interest of press trusts is to earn dividends for shareholders. It may be that four or five corporations with several hundred thousand shareholders will compete vigorously, but fights for supremacy usually end in understandings, in division of territory, in agreements and amalgamations. It is quite probable that the whole press of England may fall under the control of two or three trustified ownerships acting in co-operation.

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II. THE BRITISH DOMINIONS

Irish Free State.—Newspapers in the Irish Free State are settling down to dominion conditions, but it cannot be said that the new political freedom has stimulated newspaper enterprises. The Dublin morning papers are now *The Irish Times* and *The Irish Independent,* and the evening papers, *The Herald* and *The Dublin Evening Mail.* In 1910 there were four morning papers and three evening papers in the Irish capital. The historic *Freeman's Journal* passed through many vicissitudes, and finally disappeared in 1923, after 160 years of existence. There are two morning papers and one evening paper in Cork. British newspapers, daily and weekly, have a considerable sale in the Irish Free State.

Canada.—There are no more independent newspapers than those published in the British overseas dominions. They are comparatively free from Government influences, and are not subject to the domination of syndicates or trusts. The press of each dominion has its own characteristics. Canadian newspapers not unnaturally reflect the style and appearance of American newspapers, while retaining some of the more sedate qualities of English journalism. There are no Sunday newspapers in Canada, although American Sunday newspapers are sold at railway stations and at hotels throughout the dominion. The evening press is more important than the morning press. Such evening papers as *The Montreal Star* and *The Toronto Globe* have very large sales and are second to none in enterprise. The Canadian press publishes a great deal of British news and carries American magazine features.

There are no national newspapers in Canada, as the Dominion is too vast for papers to circulate beyond the area of one province, but there are several newspapers of national reputation and wide political influence, such as *The Manitoba Free Press, The Montreal Gazette, The Toronto Globe, The Vancouver Daily Province,* and *The Halifax Chronicle.* In merit, such newspapers stand high, and Canadian journalists are continually being tempted to cross the border to fill important posts on the American press, and in recent years have been drawn in greater numbers to London. In some towns, such as Ottawa, the same papers have morning and evening issues. There are no big newspaper trusts in Canada. There is a chain under the same ownership including newspapers in Hamilton, Ontario, Ottawa, Regina and Vancouver City, but otherwise the combines are local. There is a healthy French press in the Quebec province. *La Presse* of Montreal claims to have the largest sale of any newspaper in Canada, French or English. Every town in Canada, even if its population does not exceed 5,000, has a daily newspaper, as is the case in most communities in other British dominions. The trade and technical press of Canada compares well with similar papers in other countries. Monthly publications are at a disadvantage because of competition from the excellent cheap magazines and Sunday supplements from the United States, which regard the dominion as a dependency for periodical literature.

The small town of St. John's, population 38,645, in the large island dominion of Newfoundland, prides itself on having one morning and three evening newspapers.

Australia.—Australian newspapers are dignified in appearance and possess solid qualities. As the number of newspapers is comparatively few for a growing community, they are almost without exception highly prosperous and very efficiently equipped. In Melbourne, which with its suburbs has over a million inhabitants, there are only two general morning newspapers—*The Age* and *The Argus,* and a pictorial paper—and one evening paper, the *Herald.* Many attempts have been made at competition with the *Herald,* but all have failed.

The chief newspaper centre in Australia is Sydney, which has seven daily newspapers—four morning, two evening, and one commercial. The *Melbourne Age* and the *Sydney Morning Herald,* occupy a first position among empire newspapers. The *Daily Guardian* most resembles the popular newspaper in England.

With regard to the capitals of the other States of the Commonwealth, Brisbane has two morning and two evening dailies, Adelaide two morning and one evening, Perth one morning and one evening paper. Hobart, the capital of Tasmania, has only one paper. In several of the cities a daily commercial news-sheet is issued and a very large number of weeklies. The weekly newspaper occupies a very important place in Australian journalism as it covers a large number of smaller towns few of which have daily newspapers. An exception is Rockhampton, in Queensland, which although it has only a population of 31,000, boasts of one morning and one evening paper. Launceston, in Tasmania, which has only a population of 35,000 in the city and suburbs, contains one morning and one evening paper.

The Australian newspapers comprise numerous trade journals,

general weekly papers, and also humorous journals. The Sydney *Bulletin, Truth* and *Smith's Weekly* have the largest sale among weekly papers.

New Zealand.—With a total population of about 1,500,000 New Zealand has a very healthy newspaper press, in style and characteristics similar to the Australian newspapers. Wellington, the capital, with a population of 93,000, has one morning and one evening paper. Christchurch, which has 40,000 more population, has two morning and two evening papers; Dunedin one morning and one evening. Invercargill, with a population of only 22,000 has two morning newspapers. New Plymouth, with a population of 16,000, has one morning and one evening.

South Africa.—With a white population of less than a million and a half divided between the British and the Dutch, the Union of South Africa makes a good show in the matter of the press. The more important newspapers are in the English language. They include *The Cape Times, The Cape Argus* and *The Johannesburg Star,* which are first-class papers. Newspapers are sometimes printed in the dual languages. In Bloemfontein and Pretoria there are one Dutch and one English paper; in Durban, two morning newspapers in English. Johannesburg has fewer newspapers than one would expect from a city of its population and commercial importance: there is only one morning and one evening newspaper in English.

Newspapers in South Africa are divided into associated groups, and there are also combinations of news agencies, advertising and distributing agencies, all of which tends to handicap enterprise and limit the number of newspapers. The leading Dutch papers are *Die Burger* and *Ons Land* of Cape Town, and the *Volkstem* of Pretoria.

India.—Up to the removal (*see* PRESS LAWS) of the rigid newspaper licensing system in British India in 1835 under the inspiration of Macaulay there were very few British or vernacular newspapers. At the Mutiny in 1857 the restrictions were partly restored, and though the Indian press has grown tremendously in volume it is still subject to severe Government regulations. Apart from obscure native sheets there are about 200 newspapers and periodicals published in British India. The part played by English newspapers in India cannot be measured by the copies which they sell. In Calcutta, with a population of nearly 1,500,000, is published the oldest newspaper in India, *The Englishman* (1821), and also the most popular, *The Statesman. The Times of India* (Bombay), *The Madras Mail, The Pioneer* of Allahabad, *The Civil and Military Gazette* of Lahore, are the best-known papers and organs of opinion. There is quite a number of official journals in India. The vernacular papers are growing in number and in influence, and some of the Nationalist organs are published in English—as, for instance, the *Amrita Bazar Patrika* of Calcutta. Some papers are published in two languages, in English and vernacular.

III. NEWSPAPERS IN CONTINENTAL COUNTRIES

Freedom of the press in Continental countries has not kept pace with the development of political constitutions. Since the reconstruction of Europe after the World War there has been an increase of newspapers and particularly of organs of political opinion. In France, Germany, Belgium, Austria and Hungary, press conditions are somewhat the same as in pre-war days. In Russia there is practically no freedom of the press, and the same may be said with regard to Italy. In the new States of Czecho-Slovakia, Rumania and Yugo-Slavia, censorship and suppression of newspapers are carried on to as great an extent as before the war. In Poland there has been a revival of newspapers, but here again in regions inhabited by minority races the press is only tolerated. In all these new countries journalism is a hazardous profession, and has not gained in strength or dignity. In every country the extreme political Left is represented by propagandist newspapers, and while these journals are occasionally suppressed in the countries in which they are published, they are allowed to circulate in neighbouring countries.

Newspapers of France.—In no other country is the political influence of the press so great, or its literary merits so high, as in France. In France journalism is literature and literature is journalism. Some of the greatest literary men of France have been created by the press; and the greatest literary critics have contributed to it. Journalism is also inextricably intermixed with politics. It was so in the time of Cardinal Richelieu, at the inception of the press, and in the time of Napoleon. Napoleon had great respect for the press. While he censored and suppressed journals he was always ready to use them to his advantage. There have been presidents of the republic, prime ministers, ministers, colonial governors, academicians and others who attain high positions in national life, who graduated through the press. When they retire, they return to their muttons. The most famous journalistic statesman was Georges Clemenceau, the great war premier. He retired a year after the treaty of peace was signed, and at the age of 80 was an unsuccessful candidate for the presidency. He did not profess disappointment at his failure, but consoled himself with the observation: "What matter? with good pen and paper one could be king of the world."

The outstanding features of French newspapers are the signed article, dramatic and literary criticism, the short story, and the small items known as *chronique.* The collection and presentation of news, as will be shown, was a late development in the history of the French press. Not many decades since it was said that French newspapers were dated to-morrow and contained the news of the day before yesterday. While the literary reputation of the French press stands high, its commercial and political morality is not on the whole quite so commendable. Many newspapers are run for, or by, ambitious politicians, or in some interest, and nearly all of them accept inspiration from the Foreign Office. Ministers change frequently but the system remains. It is like part of the constitution.

The annals of French journalism begin with the *Gazette* (afterwards called the *Gazette de France*), established in 1631 under the patronage and with the active co-operation of Cardinal Richelieu. The first editor and printer was Théophraste Renaudot. The first weekly number apparently appeared in May 1631. So much, at least, may be inferred from the date (4th July 1631) of the sixth number, which was the first dated publication. Each number of the paper, which cost 6 centimes, consisted of a single sheet (eight pages) in small quarto, and was divided into two parts—the first simply entitled *Gazette,* the second *Nouvelles ordinaires de divers endroits.* It commonly began with foreign and ended with home news. Much of its earliest foreign news came direct from the minister, and not seldom in his own hand. Louis XIII. took a keen interest in the progress of the infant *Gazette,* and was a frequent contributor, now and then taking his little paragraphs to the printing office himself, and seeing them put into type. In Oct. 1631 Renaudot obtained letters patent to himself and his heirs, conferring the exclusive privilege of printing and selling, where and how they might please, "the gazettes, news and narratives of all that has passed or may pass within and without the kingdom." At his death in Oct. 1653 Renaudot left the *Gazette* to his sons in flourishing circumstances. Its place is now filled by the *Journal Officiel.*

In 1672 the *Mercure galant* was established by Donneau de Vizé. Its title was later changed to *Nouveau Mercure,* and in 1728 to *Mercure de France,* a designation retained, with slight modification, until 1853, when the paper finally ceased. It had many prominent contributors. In 1790 its circulation rose very rapidly and reached for a time 13,000 copies. Mirabeau styled it in debate "the most able of the newspapers." Great pains were taken in the collection of statistics and state papers, the absence of which from the French newspaper press had helped to depress its credit as compared with the political journalism of England and to some extent of Germany.

Under Napoleon the organ of official information was the *Moniteur* (*Gazette nationale, ou le moniteur universel*), founded in 1789 under the same general management with the *Mercure.* The *Moniteur* kept step with the majority of the assembly, the *Mercure* with the minority. So marked a contrast between two journals with one proprietor gave too favourable a leverage to the republican wits not to be turned to good account. Camille Des-

moulins depicted him as Janus—one face radiant at the blessings of coming liberty, the other plunged in grief for the epoch that was rapidly disappearing.

The only other newspaper of a date anterior to the Revolution which need be noticed here is the first French daily, the *Journal de Paris*, which was started on New Year's Day of 1777 and lived till 1819. Its period of highest prosperity may be dated about 1792, when its circulation is said to have exceeded 20,000. The *Journal des Débats*, which still flourishes, was founded in 1789 by Baudouin.

The cheap journalism of Paris began in 1836 (1st July) with the journal of Girardin, *La Presse*, followed instantly by *Le Siècle*, under the management of Dutacq, to whom, it is said—not incredibly—the original idea was really due. The first-named journal attained a circulation of 10,000 copies within three months of its commencement and soon doubled that number. The *Siècle* prospered even more strikingly, and in a few years had reached a circulation (then without precedent in France) of 38,000 copies.

The rapid growth of the newspaper press of Paris under Louis-Philippe will be best appreciated from the fact that, while in 1828 the number of stamps issued was 28 millions, in 1836, 1843, 1845 and 1846 the figures were 42, 61, 65 and 79 millions respectively. At the last-mentioned date the papers with a circulation of upwards of 10,000 were (besides the *Moniteur*, of which the circulation was chiefly official and gratuitous) as follows: *Le Siècle*, 31,000; *La Presse* and *Le Constitutionnel*, between 20,000 and 25,000; *Journal des Débats* and *L'Epoque*, 10,000 to 15,000.

The impulse given to the growth of advertisements in the days which followed July 1830 became, as the years rolled on, sufficiently developed to induce the formation of a company—in which one of the Laffittes took part—to farm them, or rather to farm a certain conspicuous page of each newspaper, at a yearly rent of £12,000 sterling (300,000 francs), so far (at first) as regarded the four leading journals (*Débats, Constitutionnel, Siècle, Presse*), to which were afterwards added two others (*Le Pays* and *La Patrie*). The combination greatly embarrassed advertisers, first, since its great aim was to force them either to advertise in all, whether addressing the classes to be canvassed or not, or else to pay for each advertisement in a selected newspaper the price of many proferred advertisements in all the papers collectively, and, secondly, because by many repetitions in certain newspapers no additional publicity was really gained, two or three of the favoured journals circulating for the main amongst the same class of buyers.

On July 16, 1850, the assembly passed what is called the *"loi Tinguy"* (from the name of the otherwise obscure deputy who proposed it), by which the author of every newspaper article on any subject, political, philosophical or religious, was bound to affix his name to it, on penalty of a fine of 500 francs for the first offence, and of 1,000 francs for its repetition. Every false or feigned signature was to be punished by a fine of 1,000 francs, "together with six months' imprisonment, both for the author and the editor." The practical working of this law lay in the creation of a new functionary in the more important newspaper offices, who was called *secrétaire de la rédaction*, and was, in fact, the scapegoat *ex officio*. The *"loi Tinguy,"* though now long repealed, has had a permanent influence on French journalism in the continued prevalence of signed articles, and the consequent prominence of individual writers as compared with the same class of work in other countries.

In 1858 the order of the six leading Parisian papers in point of circulation was—(1) *Siècle*, (2) *Presse*, (3) *Constitutionnel*, (4) *Patrie*, (5) *Débats*, (6) *Assemblée*. The number of provincial papers exceeded five hundred. "Newspapers, nowadays," wrote a keenly observant publicist in that year, "are almanacs, bulletins, advertising mediums, rather than the guides and the centres of opinion." In 1866 the change had become more marked still. The monetary success of Girardin's many commercial speculations in this branch of commerce greatly increased the number of Parisian journals, whilst lowering the status and circulation of those of established rank. In 1872 the circulation of *Le Petit Journal* (founded 1863), the pioneer of the French halfpenny press, was 212,500, and it went on rapidly increasing. In 1874 an elaborate return showed that in the 35 principal towns of France, comprising a population of 2,566,000 their respective journals had an aggregate weekly issue of 2,800,000 copies. In 1878 the total number of journals of all kinds published in France was 2,200. Of these 150 were political, strictly speaking, of which Paris published 49. Of Parisian journals other than political there were 1,141 (including 71 religious, 104 legal, 153 commercial, 134 technological, 98 scientific and medical, 59 artistic). At that date *Le Figaro* had a circulation of about 70,000, *Le Petit Journal* (at a halfpenny) one of about 650,000.

The law concerning the liberty of the press, of July 29, 1881, abolished suretyship for newspapers, decentralised their registration, and took away the former discretionary power, lodged in the home office, of interdicting the circulation in France of foreign journals. The home minister might still prohibit a single number of a newspaper; only the whole council of ministers, duly convened, could prohibit the circulation of a foreign newspaper absolutely.

The newspapers of Paris, and similarly of France, practically doubled in number between 1880 and 1900. In 1880 there were about 120 Paris newspapers, in 1890 about 160, and in 1900 about 240. The total number of newspapers, as distinguished from periodicals, published in France during 1900 was in round numbers 2,400, of which about 2,160 appeared in 540 provincial towns.

The history of the French press during the last twenty years of the 19th century followed very closely that of the country itself, Boulangist and anti-Boulangist, Dreyfusist or anti-Dreyfusist, Republican or Nationalist; finally it became either Moderate Republican or Radical Socialist, with a sprinkling of Nationalist organs and a small minority of Royalist and Bonapartist sheets.

The French papers, of whatever party, took an increased interest during this period in foreign matters and much improved their organisation for collecting news. *L'Eclair* gave less attention to the discussion of political questions from the party point of view than to the collection of news, and was followed by the *Echo de Paris* (1884) and *Le Matin*, which also dates from 1884, and which by an arrangement with the London *Times* gave every day a translation of most of the telegrams published in that newspaper. The *journal d'information*, as these papers were called, took its place beside the journal properly so-called, more perhaps as a rival than as a complement. The natural result followed, and the more old-type newspapers took steps to provide their readers with news as well as with leading articles, current and literary topics, society gossip, dramatic criticism and law reports. Nothing perhaps was so striking after 1890 as the demand of the French public for foreign and colonial news, or the readiness of the papers to supply it by means of special representatives independent of the news agencies. An enlargement of the individual newspapers followed, accompanied by a reduction of price.

In home matters the French press made greater progress still in the rapid and accurate collection of news, and in this respect the provincial press showed more enterprise and more ability than that of Paris. Its development was remarkable, for whereas in 1880 the inhabitants of the departments had to await the arrival of the Parisian papers for their news, they now had the advantage of being supplied every morning with local newspapers inferior to none of the best organs of Paris. Among the best provincial papers may be mentioned *La Gironde* and *La Petite Gironde* of Bordeaux, *La Dépêche* of Toulouse, *Le Lyon Républicain, L'Echo du Nord* of Lille, *Le Journal de Rouen*, all having a staff in Paris engaged in collecting news, reporting parliamentary proceedings and law cases, telegraphed or telephoned during the night and published early the next morning in their respective localities. Being perfectly independent of purely Parisian opinion or even bias, the decentralisation of the French provincial press became complete; it became also more independent politically than the Paris press. Several journals had and still have national reputations: the *Dépêche* of Toulouse, with its 12 editions daily, the *Progrès* of Lyons, the *Petit Marseilles, La Petite Gironde* of Bordeaux. The small local press exercises an independent influence during elections.

The French Press has been little changed by the World War. During the War many newspapers temporarily disappeared, owing to the lack of staff, or of means, or shortage of paper. All papers were under a severe censorship and, more than ever, were the servants of the Government.

In 1928 there were 337 journals published in Paris, of which two were official dailies. There were 127 sporting newspapers, of which five were dailies. The number of newspapers published in the provinces was 3,100, including publications of all descriptions.

France was the first country to have national newspapers with sales of over 1,000,000. The sale was stimulated more by two serial stories run by each paper than by news, but since the war news has become more conspicuous in such widely circulated papers as the *Petit Parisien* (1,200,000), *Le Petit Journal* (1,000,000), *Le Matin* (900,000), and the *Journal* (800,000), which may be described as the "Big Four of the Paris Press." Following upon these in point of sales comes the *Echo de Paris* (800,000). The better-known political papers are *Le Temps*, the venerable *Journal des Débats* (founded in 1789 by Baudouin), *La Liberté*, *L'Oeuvre*, *L'Humanité* and the *Ère Nouvelle*. The *Figaro* (begun 1854, but a daily from 1866) maintains its unique position. Characteristics of all the popular Press are still signed articles and serial stories. There is a popular daily illustrated paper, *Excelsior*, established 1910, and numerous dailies devoted to sport, finance, the drama, motoring, etc. Every phase of politics is represented in the Paris press, from Legitimist to Communist, and every trade and interest has its organ.

Improvements have taken place in the mechanical equipment of the French press in recent years, and there has been a marked increase in illustrated weeklies and monthlies. The best known weeklies are the dignified *Illustration* and the gay *Vie Parisienne*, which flourished during the war, the literary *Annales Politiques et Littéraires*, and a light variety paper *Nos Loisirs*. The *Revue des Deux Mondes*, the *Mercure de France* and the *Revue Hebdomadaire* are the best known monthlies. The sale of the French press is pushed all over Europe. The chief news agency, Havas, has official support. There is also a universal wireless service which broadcasts news and propaganda. It is a subsidiary of the wireless company, which holds a concession from the State.

English journalism in France was for nearly a century mainly associated with *Galignani's Messenger* (1814–1904), which was killed by the competition of the Paris edition of the *New York Herald*. It had been preceded by Sampson Perry's *Argus* (1809), a Napoleonic organ. In May 1905 a new era of English journalism on the Continent began by the institution of the Paris edition of the London *Daily Mail*. There are three other papers printed in English: the *Chicago Tribune*, the *New York Herald-Tribune* and the *Paris Times* (evening).

Newspapers in Germany.—Under the old German empire there was liberty of the press within reason, but certain papers were exploited or influenced by the Government for its own purposes. Before 1914 German journalists had begun to conquer positions in the political world, and the press was gaining in independence. To-day the German press has complete freedom. It is the most serious press in Europe. There are few sensational newspapers. Newspapers do not sell because of sport or "stunts." Journals which cater for the special interests of the working classes discuss economic and industrial problems, and do not merely confine themselves to news. Literature, the drama, art, music and economics occupy a greater proportion of space in German newspapers than in the press of any other country.

Printed newspapers in Germany begin with the *Avisa Relation oder Zeitung* (1609), followed by the *Frankfurter Journal*, in 1615 of Egenolph Emmel. The following year saw the foundation of the *Frankfurter Oberpostamtszeitung*—continued until the year 1866 as *Frankfurter Postzeitung*. Fulda appears to have been the next German town to possess a newspaper, then Hildesheim (1619) and Herford (1630). In the course of the century almost all German cities of the first rank possessed their respective journals. The earliest in Leipzig bears the date 1660. The *Rostocker Zeitung* was founded in 1710. The *Hamburgischer Correspondent* (1714) was originally published under the name of *Holsteinische Zeitungs-Correspondenz*, two years earlier, and was almost the only German newspaper which really drew its foreign news from "our own correspondent." Berlin had in the 18th century two papers, those of Voss (the *Vossische Zeitung*, 1722) and of J. K. P. Spener (1749–1827; the *Spener'sche Zeitung*, or *Berlinische Nachrichten*, 1772). Some half-dozen papers which glimmered in the surrounding darkness were the reservoirs whence the rest replenished their little lamps. On the whole, it may be said that the German newspapers were of very small account until after the outbreak of the French Revolution. Meanwhile the ms. news-letters, as in earlier days, continued to enjoy a large circulation in Germany. Many came from London. The correspondence, for instance, known under the name of "Mary Pinearis"—that, apparently, of a French refugee settled in London—had a great German circulation between 1725 and 1735. Another series was edited by the Cologne gazetteer, Jean Ignace de Rodérique, also a French refugee, and remembered as the subject of a characteristic despatch from Frederick II. of Prussia to his envoy in that city, enclosing 100 ducats to be expended in hiring a stout fellow with a cudgel to give a beating to the gazetteer as the punishment for an offensive paragraph. The money, it seems, was earned, for Rodérique was well-nigh killed. At Berlin itself, Franz Hermann Ortgies carried on a brisk trade in these news-letters (1728–1735), until he too came under displeasure on account of them, was kept in prison several months, and then exiled for life. Nor, indeed, can any journal of a high order be mentioned of prior appearance to the *Allgemeine Zeitung*, founded at Leipzig by the bookseller Cotta (at first under the title of *Neueste Weltkunde*) in 1798. Its articles gave offence to the Austrian court, and the paper had to change both its title and its place of publication. It had been commenced at Tübingen, and removed to Stuttgart; it was then transferred to Ulm, and again to Augsburg. It was Cotta's aim to make this the organ of statesmen and publicists, to reach the public through the thinkers, to hold an even balance between the rival parties of the day, and to provide a trustworthy magazine of materials for the historians to come; and, in the course of time, his plan was so worked out as to raise the *Allgemeine Zeitung* into European fame. Cotta was also the founder, at various periods, of the *Morgenblatt*, which became famous for its critical ability and tact, of *Vesperus*, of *Das Inland*, of *Nemesis*, of the *Oppositionsblatt* of Weimar (for a time edited by Bertuch), and even of the *Archives Parisiennes*.

Whilst French influence was dominant in Germany, the German papers were naturally little more than echoes of the Parisian press. But amidst the excitements of the "war of liberation" a crowd of new journals appeared. Some of these journals lasted but two or three years. Most of the survivors fell victims to that resolution of the diet (Sept. 20, 1819) which subjected the newspaper press, even of countries where the censorship had been formally abolished, to police superintendence.

A similar crop of new papers of revolutionary tendency followed the upheavals of 1830 and 1848. These were equally short-lived, but it is nevertheless undeniable that a marked improvement in the ability and energy of the German political press may be dated from this period.

In Prince Bismarck's days the press bureau of the Prussian Ministry of the Interior, and a similar organization in the Imperial Home Office, used to furnish hundreds of petty local newspapers known as *Kreis-blätter* with whole articles gratis, so that the policy of the government might be advocated in every nook and corner of the country. The numerous journals in which these communications used to appear simultaneously and in an identical form were the government organs to which the Radical and Socialist opposition more particularly applied the term "reptile press." Later this practice of wholesale inspiration was abandoned, but there remained many channels, public and private, through which almost every department of the government could communicate information to newspapers in all parts of Germany.

At the beginning of the 20th century the position and influence of the German press were passing through a period of change. The Germans had become a newspaper-reading people. Indeed, with the remarkable growth of the commercial spirit in Germany

The new tydings out of Italie are not yet com.

Out of Weenen, the 6 November.

THe French Ambaſſadour hath cauſed the Earle of Dampier to be buried ſtately at Preſburg In the meane while hath Bethlem Gabor cited all the Hungeriſh States , to com together at Preſburg the 5. of this preſent , to diſcourſe aboute the Crovvning & other cauſes concerning the ſame Kingdom.

The Hungarians continue vvith roveing againſt theſe Lands. In like manner thoſe of Moravia , vvhich are fallen vppon the Coſackes yeſter night by Hollevn, ſet them on fire , and ſlaine many dead , the reſt vvill revenge the ſame.

Heere is certaine nevves com , that the Crabats , as alſo the Lord Bucian, are fallen unto Bethem Gabor.

The Emperour ſends the Earle of Altheim as Ambaſſadour to Crackovv in Polca, to appeare vpon the ſame meeting-day.

Novv comes tidings, that Bethem Gabor is at Thurna, there doe gather to gether great ſtore of States.

The Emper. Maj. hath appoynted heere a meeting-day vpon the 1. of Decemb. thereupon ſhould app. are the 4. Proclaimed States. The appoynted taxing ſhall bring up a great ſom of money.

Out of Prage , the 5 of November.

Three dayes agone are paſſed by, 2 mile from this Cittie 6000 Hungarians (choſen out Soldiers) under the General Rodiferns, vvhich are gon to our Head-camp. & the Enimie lieth yet near unto ours by Rackonitz , though the crie goeth, that the enimie cauſed all his might to com togither, to com this vvayes againſt Prage, if that comes to paſſe, it ſhall not ron of vvithout blovves, the vvhich might be revealed vvith in fevv dayes.

It continues, that in the Satſer Crais are gathered togither 10000 Countrie-men, moſt high-dutch-men againſt Meiſſen, & no Bohemians , they vvill help the King to drive the enimie out of the Land . In like manner ſom certaine 1000 Countrie-men rebel in the Lemmariſcher Crais, but it is feared that thoſe Countrie-men are ſtarred up , through practiſe of the Adverſarie , that the enimie in the meane vvhile might com to Prage . Wee underſtand, that Bucquoy hath not been in the Camp, but by the Duke of Saxen ſom certaine dayes , therefore vve are to looke to our ſelves, for feare of Trecherie . And it is thought that the Emperour vvill leave Auſtria to the Hungerians, & ice to effect his intention only vppon Prague.

Out of Ceul n, the 21, Novemb.

Writing from Marpurg in Heſſen , that the Earle of the ſame Land, doth cauſe the foreſaid Cittie to be ſtrongly fortined , there on doe vvorke many 100 men dayly , and there is muſtered in the Earle ſhip Zigenheym nor long ſince 1. Governement of foote-meh , & 6. Cornets of horſe-men , the foore-men are ſent to Marpurg & Rintfels. But the horſe-men are lodged in the Villages about the Cittie, & thereafter are alſo muſtered the Duke of Saxen Lavvenburgs Government in Tries-Zigenheym, novv further vvhere they ſhallbe laid & uſed, is yet unknovvn. The ſames Brothers Governement, there quarter is laid by Caſſel , the Soldiers vvhich are taken on about Hamburg, Lubeck, in the Duke ſhip of Holſteen , & Meckelenburg, ſhould alſo be muſtered about Caſſel, & be uſed vvhere neede ſhall require .

Since the laſt vve cannot enquire, that there is any thing of any importance paſſed betvvixt the Marquis Spinola & the United Princes. We underſtand that the foreſaid Spinola vvil lay his Souldiers in Garniſon vvith the firſt , & deale them unto divers places, on part to Oppenheym, Alzey, Ingelheym & Cruiſnach, the other part at Summeren & Bacharach , the ſpeech goeth that there ſhallbe layed vvith in Ments a good Company in Garniſon.

The Biſhop at Halberſtadt, Duke Chriſtiaen at Bruynſvvyck, doth cauſe to be taken on 2000 Muſquetters, to ſend to the United Princes.

Heere is tydings , that betvveen the King of Bohemia & the Emperours folke hath beene a great Battel about Prage , but becauſe there is different vvriting & ſpeaking there upon , ſo cannot for this time any certainety thereof be vvritten, but muſt vvayte for the next Poſt. As alſo of the Cittie Pilſen , vvhich the Earle of Manſvelt (ſo the ſpeech goeth) ſhould have delivered into the Emperours hands.

From Cadan in Bohemia , 4 mile from Racnnitz, the 12. November.

From Solts is certaine advſe that the Emperours folk have made them ſelves vvith all theire might out of theire Camp, & taken their vvay to vvards Praghe, like as they vveare then com to the long mile , but as the King underſtand ſuch , he is broken up vvith his armey, and com to the 10g mile betoren the enimie, vvhere they have had a very ſtrong Battelle & on both ſides more then 6000 men ſlaine, though moſt on the Kings ſide , alſo hath the enimie gotten of the King ſom peeces of Ordenaunce and vvaggens vvith amunitie, ſo that the King muſt retire back to Praghe , and the enimie to the Weiſſenberg , there he lies yet and roves from thence to the Low Marſch the Crais unto Brix, hath taken in, Trebnitz Pidan & Dux, alſo laid folk upon Leutmaritcher Slaner , and Launer paſſages, that the Paſſage upon Prage is vvholy taken avvay, and this day is com heere in a certain Perſon that bringes tydinghs unto our Magiſtrat, that betvvixt Sonnevvend and Patronit, vvhere the enimie hath lien are found ſom certaine 1000 dead Bodies , & on the other ſide there King lay alſo ſom certaine 1000. dead bodies, vvhat is com to paſſe betvvixt both vve ſhal ſhortly heare.

Out of Amberghe, in the Vpper-Pallatine, the 17. dito.

Here hath beene a greate crie, that the Duke of Beyeren ſhould have taken in Praghe, and beaten our King out of the fielde, but is not certaine , for the Earle of Solms vvrites out of Waltſuſion of the 14 of this preſent , that the Duke of Beyeren vvas broken up with his camp very ſtil, & marched in al haſt to Prage, though they had left ſom 100 men vvhich lay in theire quarter ſoom houres , vvhich made fires there in , that on vvoulde not have thought but that the vvhole Armay had layen there ſtill , but as ours underſtood that they vveregon follovved them preſently, though the Beyerens vvere com to Weiſſenberg before but the 8 of this preſent have ours ſett upon the Beyerens by force, and fought the vvhole day togither , that on both ſides are ſlaine aboute 8000 men , and very many ſhould be hurt. Our King, vvith the Lord General the Earle of Hohenlo , alſo the vvhole armay are vvith in Prage, & the Duke of Beyeren uppon the Weyſſenbergh & Stern ; vve hoope that they ſhall ſhortly be driven from thence What further is done betvvixt them, vve look for every houre to enquire further thereof & it ſeeme none can com from Prage, becaute the paſſages are every vvhere ſhut.

Out of Coulen, the 24 of November.

Letters out of Neurenburgke of the 20 of this preſent, make mention , that they had advice from the Borders of Bohemia , that there had beene a very great Battel by Prage, betvveen the King & the Duke of Beyeren , & many 1000. ſlaine on both ſides, but that the Duke of Beyeren ſhould have any folke vvith in Prage, is yet uncertaine , there uppon under the Merchants vvith in Neurenberge are laid many 100 Florins that the Emperour , nor the Duke of Beyeren have no folke vvith in Prage. The cauſe that here comes no certainty thereof, is this, That all paſſages are ſo beſet, & ſo dangerous to travaile, that it is to vvondered at, & not enough to be vvritte of, vvhat roveing, ſpoyling and killing is done dayly uppon all vvayes.

Vppon the Schanſe Prieſts cap is ſtrongly builded, & buy dayly much vvood lime & ſtone, to make houſes there upon, and ſo provide them ſelves for the vvhole vvinter. And are not long ſince in the night 500 Souldiers paſſed by Dure out of Gulik, ſo the ſpeech goeth, there meaning ſhoulde be to build a nievv Schanſe by Flamersheym , to take avvay the paſſage from the Marquis Spinola.

Imprinted at Amſterdam by George Veſeler, A. 1620. The 2. of Decemember.

And are to be ſoulde by Petrus Keerius , dvvelling in the Calverſtreete , in the uncertaine time.

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

REPRODUCTION OF AN EARLY NEWSPAPER

Two-page newspaper printed in Amsterdam, December 2, 1620, by George Veseler. One of the first newspapers to be printed in English

The *Tägliche Rundschau,* which spoke authoritatively on foreign affairs, ceased publication on June 30, 1928. The more popular papers in Berlin have sales exceeding 250,000. Among the most widely circulated papers outside Berlin are the *Düsseldorfer Nachrichten* (Independent-National), which reaches the same figure, the *Frankfurter General-Anzeiger,* 115,000, the *Hamburger Anzeiger,* 110,000, the *Leipziger Neueste Nachrichten* (Patriotic), 175,000, the *Müncher Neueste Nachrichten* (National), 145,000, the Dortmund *General Anzeiger* (non-party), 122,000, and the *Dresdenner Neueste Nachrichten* (People's Party), over 100,000. There are a number of Communist journals, including, besides the Berlin *Rote Fahne,* papers in the following cities: Breslau, the *Arbeiterzeitung,* sale 15,000; Chemnitz, *Der Kampfer,* 75,000; Bochum, the *Westfälische Arbeiter Zeitung,* 22,000; Essen, the *Ruhr Echo,* 47,000; Hamburg, the *Volkszeitung,* 25,000; Leipzig, the *Sächsische Arbeiterzeitung,* 30,000.

There are several newspapers which occupy a status and exercise an influence in German journalism and public life which cannot be measured by sales. The *Frankfurter Zeitung,* already mentioned, is perhaps the most powerful. It has 19 issues a week—morning and afternoon. Of a similar type is the *Kölnische Zeitung,* which was founded in 1848, and of which Bismarck once said that it was "worth an army corps on the Rhine"; and the *Hamburger Nachrichten,* founded in 1792. The *Jenaische Zeitung* has been in the same family since it was founded in 1674. A still older paper, the *Königsberger Hartungsche Zeitung,* dating from 1640, keeps its flag flying in the Eastern outpost on the Baltic. Papers published in districts which are inhabited by Germans, although not now under the German flag, are intensely Nationalist, such as the *Saarbrücker Zeitung,* papers in Polish Upper Silesia, Danzig and other territories formerly in the Empire.

In Germany, no general newspapers are published on Monday, except two or three in Berlin. Sunday is a day of rest to newspaper workers. The provincial morning papers in Germany issue three editions during the day, the contents varying more or less. In Berlin, two editions are issued. There are few afternoon papers in Germany.

The external form and arrangement of German newspapers is puzzling at first sight to an English reader. The outside sheet contains the editorial articles and news, while the middle of the paper is taken up by supplements which can be added to indefinitely. The quantity of extraneous matter, such as articles on literary, social and technical subjects, is enormous, and even the most serious political journals invariably publish a novel in serial form, as well as numerous novelettes and sketches. The local news in Berlin and other large cities is written with the minuteness and the familiarity of style of a village chronicle, and gives the impression that every one is occupied in observing the doings of his neighbour. The signed article is very much in vogue, and most writers and salaried correspondents have at least a cypher or initial by which they are distinguished.

According to the *Politischer Almanach* there are over 100 important newspapers in Germany, and 38 serious political journals, representing all shades of political opinion. There are 24 large news agencies in Berlin, with branches in the chief cities. All the political parties have their Press agencies.

Among the best-known German reviews are the *Preussische Jahrbücher, Deutsche Rundschau, Neue Rundschau, Deutsche Stimme, Süddeutsche Monatschefte* and the *Neue Zeit.* The *Reichsanzeiger* corresponds to the *London Gazette.*

Austria.—Austria with its diminished population, now between 6 and 7 million, has naturally many fewer newspapers than formerly, although the leading journals, such as the *Neue Freie Presse* and the *Neues Wiener Journal,* circulate amongst the German-speaking population throughout the territory of the old Austro-Hungarian monarchy. Vienna has a vigorous local press representing all political parties, including the Communists. There is freedom of the press in Austria.

Hungary.—With regard to Hungary the position is different. Hungary has now a population of 8 million, but journals in the Magyar language do not circulate outside the diminished area of Hungary, as the authorities in the Succession States prohibit them. This restriction has had an unfortunate effect on Hungarian journalism. There are still ten daily newspapers in Budapest, but very few in the provinces, and it is stated that not more than three newspapers in Budapest, owing to the restriction of the area of circulation, are now commercial successes. The *Pester Lloyd,* published in German in Budapest, is a newspaper of international reputation and celebrated its 70th anniversary in 1928. Papers published in the Magyar language to serve the Hungarian minorities in Czechoslovakia, Rumania and Yugoslavia have a precarious existence. The most widely-circulated newspaper in Budapest is the *Pesti Hirlap,* which is followed by the *Az Est.* The other best known Hungarian newspapers are the *Magyarorszag* (Hungary) and *Magyarság* (Hungarian People).

Czechoslovakia.—The newly-won freedom in Czechoslovakia led to a great increase in the number of newspapers. It is a country with many political parties, and each party has its organ. There are many daily papers in Prague and the other chief cities in the republic. Unfortunately while the constitution of Czechoslovakia guarantees freedom of the press, this provision is not observed. Ever since the republic was established there has been press censorship,—originally preventive, but latterly censorious, and in some cases it has taken the form of suppression. This action applies to newspapers in all languages—Slovak, German and Hungarian,—but as regards Czech it is applied only to Communist journals. A very close supervision of newspapers is exercised by the Ministry of Justice through the police; no reasons are given for suppressing newspapers, and no compensation paid for the loss incurred by the newspaper proprietors.

While the police suppress newspapers, the Government uses the press for its own propagandist purposes. Several papers may be regarded as the official organs of the different parties in power. The Czech Foreign Office has an organ in the German language, the *Prager Presse,* and weekly journals in French and English, while a number of newspapers in the Czech language may be regarded as official.

Italy.—Before the advent of Mussolini's Fascist regime, the Italian Press laws were based on a royal decree of 1848. In Italy now newspapers are only permitted to exist by favour of the Government. The independence of the press has almost disappeared under the Mussolini regime. In 1924 a decree was issued which made newspapers liable to suppression and editors to punishment if they published "tendencious news" which might embarrass the Government in foreign or domestic affairs. This policy developed so that by 1926 the freedom of the press in Italy had ceased to exist. Journalists' organizations are also under the control of the Government.

Where the press was not muzzled there was a forced change of proprietorship in harmony with Fascist policy. This was the case with the well-known *Corriere della Sera* of Milan, for some years the most powerful organ in Italy. The *Stampa* of Turin, although never strongly anti-Fascist, was tamed; the same fate overtook the influential journal in the south, the *Mattino* of Naples. The complexion of the best-known papers in Rome has been changed. The only journals which enjoy a certain restrained independence are the semi-official organs of the Vatican. A number of newspapers have ceased to exist, and the journalists' associations have been placed under the control of Government commissioners. There are fewer papers in proportion to the population in Italy than in any other country in Europe except Russia.

Russia.—Freedom of the press has been completely suppressed in Soviet Russia. In Tsarist Russia censorship was severe, but a measure of toleration existed. In Soviet Russia censorship is applied before the matter is printed, which has to be submitted to an official editorial board known as the Gosizdat. There is a further check on the publication of news and expression of opinion, as newspapers are only published under the auspices of the governing authorities and are thus practically all official organs.

In 1914 there were 17 dailies in the capital, some of them of international reputation, such as the *Novoe Vrèmja,* and the *Retch,* and five in Moscow. In 1910 there were 52 daily newspapers in Russia, of which 13 were in St. Petersburg (Leningrad), and four in Moscow, exclusive of papers in Finland and

Polish Russia. In 1926 almost all the press was concentrated in Moscow. There were 11 morning and evening papers in Moscow, but only two of any importance, the *Izvestia* and the *Pravda*. In Leningrad there were only two morning papers, the *Pravda* and the *Krasnaya Gazeta*. The number of daily newspapers in Russia in 1928 did not exceed twenty. Scope, it is claimed, is given to what are called "worker correspondents" in the industrial centres, and a feature is the widespread interest in "wall" newspapers. Some papers appeal technically and otherwise to the peasant class.

Belgium.—Belgium possesses a vigorous press, published in French and in Flemish. Although the chief Paris papers circulate all over Belgium, the Belgian press nevertheless enjoys a large sale, and the popular journals are highly prosperous. There are 17 daily papers published in Brussels and nine in Antwerp. There are several Socialist journals, the chief organ of the party being *Le Peuple*. The success of the Socialist press is due largely to its association with the co-operative movement. *La Libre Belgique*, which appeared regularly during the War in occupied Belgium in spite of the vigilance of the Germans, now exists as a daily newspaper. In Belgium, the press laws have not been changed for many years and the press enjoys almost unlimited freedom.

The Netherlands.—The Netherlands, with a population of over 7,000,000, possess a healthy press, including journals which enjoy a high reputation for their literary merits and as organs of opinion. The chief among these are the *Nieuwe Rotterdamsche Courant*, *De Telegraaf* and the *Algemeen Handelsblad*, of Amsterdam. There are eight daily papers in Amsterdam, seven in The Hague and five in Rotterdam, and these circulate throughout the country.

Spain and Portugal.—There is little progress to record in the Spanish press, and circulations are small. The illustrated *A.B.C.* is the most popular paper. The *Heraldo* and the *Liberal* are Madrid journals. *El Sol* was founded in 1917 by the Spanish Paper Trust. There are 20 daily papers in Madrid and 17 in Barcelona, and about 200 dailies of sorts in Spain. The principal Portuguese papers are the *Diaris Noticia* (founded 1820) and the *Jornaldo Commercio*, both published in Lisbon.

Switzerland.—Switzerland, owing perhaps to its small population, has few papers known outside the country. In 1926 there were 38 daily newspapers published in German, 19 in French and two in Italian. The best known are the *Journal de Genève*, read in France, the *Neue Zürcher Zeitung* and the *Zürcher Post*, which have a considerable circulation in Germany. (R. Don.)

IV. UNITED STATES

Among the professional writers of news-letters towards the close of the reign of Elizabeth and the beginning of that of James I., to whom reference has already been made in the discussion of the cradle days of English journalism the three most important were John Chamberlain, Thomas Locke and John Pory. The last of these three, when he was secretary of the Virginia Colony, sent news letters from "James Citty" as early as 1619 to his "good and gracious lord" in London for whom he had previously worked as a professional correspondent. The evolution of the newspaper in the United States, therefore, technically starts with John Pory. But he was not the only writer of news-letters. John Campbell, postmaster at Boston, wrote with some degree of regularity letters of news to the various colonial governors in New England. Later he printed his news-letters and thus established, in April 1704, the first American newspaper—*The Boston News-Letter*. As in other countries there had been stray sheets of news printed at various times, so in this country. Mention may be made of *The Present State of the New-English Affairs* (1689) and *Publick Occurrences* (1690). Both of these sheets were printed in Boston and the latter, brought out by Benjamin Harris, might technically be called a newspaper except for the fact that it had only one issue. Regularity in publication and continuity in the news are demanded by the term newspaper. Harris intended regularity of publication but because his sheet was thought to contain "reflections of a very high nature" it was suppressed by local authorities. Before the close of the century its publisher returned to England to become the publisher of *The London Post*.

Colonial Period.—Mortality of pioneer papers in the United States has been usually high. But *The Boston News-Letter* under various publishers survived until the declaration of independence by the 13 original Colonies. The honour of being the second newspaper is practically divided between *The Boston Gazette* (Dec. 1719), started by William Brooker when he succeeded Campbell as postmaster of Boston, and *The American Weekly Mercury* (Dec. 1719), brought out by Andrew Bradford, the local postmaster in Philadelphia. While technically there was a difference of one day, both papers are said to have been mailed to subscribers on the same day. The fourth paper, *The New England Courant*, started in Boston by James Franklin in Aug. 1721, was a flaming organ of dissent carried on by a group of contributors called by the Rev. Increase Mather "the Hell-Fire club." So radical was it in expression of opinion that an order was issued that James Franklin no longer print the newspaper. The situation was met by having a younger brother, Benjamin, become the publisher in name if not in fact. After a quarrel between the two brothers, Benjamin went to Philadelphia where he later purchased (1729) an interest in *The Pennsylvania Gazette*, started by Samuel Keimer (Dec. 1728). Franklin made this paper one of the most influential of all those that appeared in the colonial period. New York did not have a paper until Nov. 1725, when William Bradford started *The New York Gazette*. As "Printer to the Crown," Bradford was unable to record opposition to government measures and in this way provided for the appearance in Nov. 1733 of *The New York Weekly Journal*. The latter paper, nominally published by John P. Zenger, was really edited by the leaders of the opposition. Freedom in expression of popular rights brought a famous libel suit against Zenger that did much to establish the freedom of the press in America. The jury, in freeing Zenger, decided that it had the sole right to judge both the law and the facts and reversed the old tradition, "The greater the truth the greater the libel."

The first newspaper in the ten remaining Colonies of the original 13 was a gazette with the name of the Colony before it, with the single exception of *The Wilmington Chronicle* (1762) in Delaware. These gazettes appeared as follows: Annapolis, Maryland (1727); Charleston, South Carolina (1732); Newport, Rhode Island (1732); Williamsburg, Virginia (1736); New Haven, Connecticut (1755); New Bern, North Carolina (1755); Portsmouth, New Hampshire (1756); Wilmington, Delaware (1762); Savannah, Georgia (1763); and Burlington, New Jersey (1777). These pioneer papers were important because in their plants were trained the printers who went forth to establish others, either in the 13 original Colonies or along the frontier farther west. Colonial printers, often forced to accept wheat, wood, butter, corn, etc., in payment for subscriptions, continually faced censors who, clothed by the law with authority, annoyed publishers bold enough to print the critical debate going on in the community. Setting aside a little corner for original poetry and opening their columns to letters from contributors who furnished essays, they provided a means of literary expression that contributed no small part to the founding of American letters. Of the papers of this period special mention should be made of *The Boston Gazette* (1755), the third paper of that name in Boston and distinguished from the other two as being the "pet of the patriots." Among those who contributed to its columns were such political leaders as Samuel Adams, Joseph Warren, Thomas Cushing, etc. *The Massachusetts Spy* (1770), published first at Boston and then at Worcester, Mass., was a dynamic force under the able editorship of Isaiah Thomas, famous for his history of printing. Toward the close of the colonial period *The Pennsylvania Journal* (1742), under the editorship of William Bradford III., disputed supremacy in Philadelphia with Franklin's *Gazette*.

Early Political Organs.—After independence from Great Britain had been secured, papers became political organs of which *The Gazette of the United States* (1789), edited by John Fenno, and *The National Gazette* (1791), edited by Philip Freneau, were possibly the most important because the former was really controlled by Alexander Hamilton, the leader of the Federal Party,

and the latter by Thomas Jefferson, the leader of the then Republican Party—now the Democratic. So vitriolic and so vituperative were the papers that the era is known as one of black journalism. So bitter, for example, was the fight between the two *Gazettes* already mentioned that Washington had to request his two secretaries to put a stop to their bickerings in the interests of the struggling republic. Politics so promoted publication of papers that the number increased from 37 in 1776 to 359 in 1810.

Dailies.—As the cities on the Atlantic coast increased in size their papers began to appear more frequently: first semi-weekly, later tri-weekly and finally daily except Sunday. The first daily newspaper was an outgrowth of such a tri-weekly—*The Pennsylvania Packet and General Advertiser* which first appeared in Philadelphia in Sept. 1784. Just as the colonial weekly adopted *Gazette* as a part of its title so the daily seized upon the word *Advertiser*. The second daily, the outgrowth of a semi-weekly at Charleston, S.C., first appeared in Dec. 1784. New York city did not have a daily until March 1785, when Francis Childs started *The New York Daily Advertiser*. The New York daily beginning an independent existence faced a more difficult struggle to secure financial support both in circulation and in advertising. From the start the daily paper was more of an advertising sheet than it was a purveyor of news. Such news as was inserted was chiefly of a commercial character, such as the arrival and departure of vessels, quotations on produce, the transactions in real estate, etc. The paper itself went to the counting room instead of to the home. The oldest daily newspaper in the United States without change in name and with continuous publication is (1929) *The New York Evening Post* (Nov. 1801) which started as a Hamiltonian organ under the editorship of William Coleman. The oldest newspaper that has appeared regularly without suspension since its establishment is *The Hartford Courant* which began as *The Connecticut Courant* (Oct. 1764)—a weekly which did not become a daily until long after *The New York Evening Post* was started. Two men of letters are associated with these two papers: Charles Dudley Warner with *The Courant* and William Cullen Bryant with *The Post*. By 1812 New York had seven dailies but not one of them exceeded 2,000 in circulation.

News Gathering.—The weekly and daily newspapers in the United States showed nothing of that enterprise so characteristic of American journalism until Henry Ingram Blake, employed on *The Palladium* of Boston, stopped waiting for news to come to the office and went out in person after such items. At first he went to the coffee houses for such accounts of foreign events as sea captains might bring there. Still later he had his own skiff and rode out to meet incoming vessels to get the news. From this modest beginning came many innovations to facilitate quick publication. In New York the little rowboat soon gave way to the fast clipper ship owned and chartered by a newspaper. *The Journal of Commerce* (Sept. 1827), founded as a semi-religious newspaper by Arthur Tappan, not only had the fastest ships but even built a semaphore at Sandy Hook to relay the news from its own boat to Staten Island from which it was taken promptly to the publication office. In gathering the news on land *The Baltimore Sun* (May 1837), co-operating with other papers, established a pony express to facilitate the collection of news. But the American who really put the news in the newspaper was Prof. Samuel F. B. Morse of New York university, the inventor of the telegraph, who stretched a wire directly from news centres straight to the newspaper office. But other wires soon came through leases directly under the control of such organizations as the Associated Press, the United Press, etc. (*q.v.*).

While better facilities for collecting news were going on, the mulepack, the dugout and the prairie schooner were carrying presses and types farther and farther west to establish *The Kentucky Gazette* (1787) at Lexington; *The Mississippi Gazette* (1800) at Natchez; *The Indiana Gazette* (1804) at Vincennes; *The Missouri Gazette* (1808) at St. Louis; *The Arkansas Gazette* (1819) at Port Arkansas; *The Texas Gazette* (1820) at San Felipe—to mention the gazettes that were the first papers in various States. Among the last to have newspapers were Minnesota, *The Pioneer* (1849) at St. Paul; Utah, *The Deseret News* (1850), at Salt Lake; Colorado, *The Rocky Mountain News* (1859), at Denver; Wyoming, *The Leader* (1867), at Cheyenne; and North Dakota, the latest with its newspaper, *The Tribune* (1873), at Bismarck.

The Penny Press.—The daily newspapers which immediately followed the pioneers in this field soon developed to such size that they came to be called blanket sheets. Commercial in character, they had only limited circulation and usually sold at six cents per copy. For $30 a year a business man might not only have the paper for himself but also a square of advertising for his business. Early in the second quarter of the 19th century a new type of daily appeared, cheaper in price and smaller in size—the so-called penny press. The forerunner of this new journalism was *The Daily Evening Transcript* which Lynde M. Walter began in Boston, July 24, 1830, at the low subscription price of four dollars per annum. While the first daily to sell for a penny was *The Cent* (1830) started by Dr. Christopher Columbus Conwell, the first successful publisher and therefore the founder of penny journalism was Benjamin H. Day, whose *Sun* first rose in New York, Sept. 3, 1833, although Horace Greeley had made an unsuccessful attempt the first of the same year in New York to market *The Morning Post* at two cents. *The Sun* immediately met with remarkable success because it gave in condensed form to the mechanics and to the servant girls the tittle-tattle and the backstair gossip of the city; it gave more attention to the assault and battery cases of the police courts than to the attacks of President Jackson on the U.S. Bank. But *The Sun* was soon followed by other penny dailies not only in New York but also in other important cities, such as Philadelphia, Baltimore, Boston, etc. Similar both in size and in subject matter to *The Sun*, they were called penny trash by the sixpenny sheets. The latter in turn were spoken of by the penny papers as "our bedquilt contemporaries." A bitter war arose between the two types of dailies, but it was the penny press that met with popular favour and prospered financially, because it contained the heart throb and the human interest. In all its columns it stressed not what was important but what was interesting. Not until Charles Anderson Dana purchased *The Sun* in 1868 did that paper change its character and become one with a class appeal under his editorship.

Bennett and Greeley.—Possibly the man who most influenced American journalism at this period was James Gordon Bennett, who with $500, two wooden chairs and an old dry-goods box began *The New York Herald* in a cellar on May 6, 1835. Bennett was editor, publisher, advertising director, circulation manager and everything else down to the printer's devil. He reported the proceedings of the police court with a freedom that shocked his sixpenny contemporaries and soon found that scandal sold papers on the streets. To him nothing was sacred, not even the church or his own personal affairs. Often assaulted on the street, he reported the affair in his own paper in detail and announced his own engagement in what is considered one of the most interesting specimens of newspaper literature. Though full of malicious squibs and furious diatribes, *The Herald* was in some other respects conducted with remarkable skill and enterprise in being the first to print the news. To his son of the same name Bennett left one of the greatest money-making newspapers in the history of American journalism. The son continued many of the father's policies, but on a larger scale. Expense was not considered when he sent Stanley to Africa to find Livingstone and fitted out an Arctic expedition that had a most unfortunate outcome. In case of distress in any particular country he was among the first through his *Herald* to start a subscription campaign. He began that for the relief of the suffering in Ireland with a gift from *The Herald* of $100,000. Often regarded as eccentric and peculiar, he exerted a tremendous influence upon American journalism because of the emphasis which he placed upon international news without neglecting that which was local in character. He also set the style in the mode of treatment of news and in many ways established the yardstick by which it is measured.

After the arrival of the penny press there came many changes in the manufacture and in the marketing of newspapers. To secure speed in production Robert Hoe took the type from a flat bed

and put it on a revolving cylinder turned by steam. News boys, in addition to distributing papers among regular patrons, were given additional copies to sell in the streets. The printing of larger and larger editions brought many improvements in the manufacture of both presses and paper. The introduction of compulsory education contributed to an interest in the news.

Though starting as a penny paper in April 1841, as a Whig organ, *The New York Tribune* began its second volume in April 1842, at two cents a copy. Horace Greeley, one of the most picturesque figures in American journalism, was its editor and one of its proprietors down to shortly before his death after his defeat in 1872 for the presidency. Upon the completion of its 20th year (1861) it announced its circulation as 287,000. But this figure included both the daily and the weekly: the former was later given as slightly in excess of 55,000. In the same year *The Herald* had a daily distribution of over 75,000 copies—possibly the largest at that time in the world and about 25,000 in excess of *The Times* of London. The circulation of *The Sun* was about midway between that of *The Herald* and that of *The Tribune,* while *The Evening Post,* which from the start had addressed itself to a more cultured audience, had only 18,000. Greeley made his paper not only an organ of Whig politics, but also a purveyor of novel and new ideas in both social and political economy. Among the editorial contributors in the latter field was Albert Brisbane, father of Arthur Brisbane of the present day. In the Franco-Prussian war, *The Tribune* achieved considerable fame through the publication of dispatches sent by cable at enormous expense. In a way *The Tribune* was a sort of school of journalism in which the following distinguished journalists and publicists received their first training: Henry Jarvis Raymond, Charles Anderson Dana, George William Curtis, Carl Schurz, John Hay, Whitelaw Reid, Henry James, William Dean Howells, Bayard Taylor, George Ripley, Margaret Fuller, Edmund Clarence Stedman, Richard Grant White, Richard Hildreth, John Russell Young and Sidney Howard Gay—all of whom later held important positions in New York journalism.

The Times and The World.—The final success of *The Tribune* led Henry Jarvis Raymond to establish *The New York Times* on Sept. 18, 1851, but under different conditions than existed when Bennett started *The Herald.* For a mechanical equipment Raymond had to pay at least $50,000 and to his assistants he had to give much larger salaries than he received when he worked for Greeley. Over $100,000 was spent before the paper showed a profit. It was after Raymond's death, however, that *The Times* came into great prominence through its bold exposure of the robberies and frauds committed by the Tweed ring in the municipal government of New York.

In the three decades that followed the establishment of the penny press of New York some 30 daily newspapers were established but their names must remain blank except for one, which has had a most remarkable history, *The New York World.* Started as a religious daily newspaper on June 1, 1860, it was published at a heavy loss until a year later, when it merged with the *Courier-Enquirer,* practically defunct, though at one time, under the ownership of James Watson Webb, a powerful political organ. As a worldly *World* it passed through various ownerships until its purchase (May 1883) by Joseph Pulitzer, the penniless son of a Jewish father and a Catholic mother, who coming to America from Hungary in 1864, was already the owner of *The St. Louis Post Dispatch.* Under his control he transformed *The World* to one of the most fearless, dynamic campaign sheets in the United States. The Civil War brought about an increase in subscription price. In the North the customary price for a sheet of eight or more pages was four cents and farther west five cents. In the South newspapers sold much higher, were reduced in size and even in rare instances appeared printed on wallpaper. The daily demand for news brought forth the Sunday newspaper as that term is now understood.

Personalities in American Journalism.—Until several decades after the Civil War, newspapers not only in New York but in other large cities were closely associated with the names of those responsible for their management. In Springfield, Mass., Samuel Bowles was the personification of *The Republican* which his father, with the help of a small hand press, had started on Sept. 8, 1824, and which 20 years later, became a daily. In Philadelphia, *The Record,* started as a one cent daily (June 1877), was the outgrowth of *The Public Record,* founded seven years earlier: the latter paper was a losing venture until William M. Singerly purchased its Associated Press franchise for his new paper. *The Evening Bulletin,* founded in 1847 by Alexander Cummings, had a vicarious existence until it became the property of William L. McLean. The first number of *The News* appeared in Indianapolis, Ind., on Dec. 7, 1869. *The Evening Star,* which first shone in Washington, Dec. 16, 1852, has had a growth contemporaneous with that of the city in which it is published. Its contemporary, *The Post,* was established in the U.S. capital, Dec. 1877, by Stilson Hutchins. *The San Francisco Chronicle* was begun June 1865, by Charles de Young, as a playbill distributed free in theatres and in other places. On March 4, 1887, U.S. Senator George Hearst turned *The San Francisco Examiner,* which he had taken as a part of a bad debt, over to his son William Randolph Hearst, who used it as a starter for a famous chain of papers stretching across the country from San Francisco to New York. In Detroit, in Aug. 1873, James E. Scripps started his *Evening News* which became a rival of *The Free Press* (1831). Milwaukee saw *The Sentinel* established in June 1837, and *The Evening Wisconsin* in June 1847. Louisville, Ky., witnessed (Nov. 1830) the first appearance of *The Journal* under the editorship of George D. Prentice and had laid at its doorstep in Nov. 1868 a united sheet—*The Courier-Journal,* controlled by Col. Henry Watterson. In Chicago passing mention may be made that *The Daily News,* which made its first appearance in Dec. 1875, was started by Melville E. Stone, who later achieved distinction as general manager of the Associated Press; that *The Herald* first appeared March 1881; that *The Tribune,* the first edition of which (June 1847) was 400 copies printed on a hand press, passed, in 1855, into the control of Joseph Medill, whose editorials rivalled those of Horace Greeley. William Rockhill Nelson, a most picturesque figure among the makers of American newspapers, first let his *Star* shine in Kansas City, Mo., Sept. 1880, and Harrison Gray Otis, that dynamic editor, became owner, on Aug. 1, 1882, of *The Los Angeles Times,* a paper then only a year old. To supplement what has been written about the press in Boston, it may be added that *The Post* was started as a Democratic daily on Nov. 9, 1831, but only became a power in Boston journalism when it was purchased by E. A. Grozier, a protégé of Joseph Pulitzer; that *The Herald* came into existence on the afternoon of Aug. 31, 1846, with an edition of 2,000; that *The Globe* was started March 1872, to grace the breakfast table just as *The Transcript* adorned the tea table, and that its builder was Charles H. Taylor, who joined its staff in August of that year.

A catalogue of papers and their editors during the period when personalities were closely linked with papers would resemble the catalogue of ships in Homer's *Iliad* and would make about as interesting reading. But mention must in justice be made of Murat Halstead, of *The Commercial Gazette,* John R. McLean, of *The Inquirer* and Charles P. Taft, of *The Times-Star* in Cincinnati, Ohio; Edwin Cowles, of *The Leader,* William W. Armstrong and L. E. Holden, of *The Plain Dealer,* in Cleveland, Ohio; General J. M. Comley, of *The Commercial Telegram,* in Toledo, Ohio; W. D. Bickham, of *The Journal,* in Dayton, Ohio; J. S. Clarkson, of *The Register,* and John Watts, of *The Leader,* in Des Moines, Iowa; John Arkins, of *The Rocky Mountain News,* in Denver, Colorado; A. H. Belo, of *The News,* in Galveston, Texas; John H. Holliday, of *The News,* John C. New, of *The Journal,* and W. J. Craig, of *The Sentinel,* in Indianapolis, Indiana; J. M. Keating, of *The Appeal,* in Memphis, Tennessee; W. E. Haskell, of *The Tribune,* and J. S. McLain, of *The Journal,* in Minneapolis, Minnesota; A. S. Colyar, of *The American,* in Nashville, Tennessee; H. L. Pittock, of *The Oregonian,* in Portland, Oregon; O. H. Rothaker, of *The Republican,* in Omaha, Nebraska; William Hyde, of *The Republic,* and Joseph B. McCullagh, of *The Globe-Democrat,* in St. Louis, Missouri; J. A. Wheelock, of *The Pioneer-Press* and Lewis Baker, of *The Globe,* in St. Paul,

Minnesota. Sins of omission, if any, may be pardoned, for journalism in the United States, unlike that of England which revolves around London, has many centres in America.

To pass from personalities to statistics, it should be said that figures relating to journalism in the United States until after the census of 1880 are open to question; but the reports of the census for 1850, 1860, 1870 and 1880 still remain, however, the most authoritative information as to the increase in the number of newspapers. According to their tables there were in the United States 254 dailies in 1850, 387 in 1860, 574 in 1870, 971 in 1880; 31 semi-weeklies in 1850, 79 in 1860, 115 in 1870, 133 in 1880; 1,902 weeklies in 1850, 3,173 in 1860, 4,295 in 1870, 8,633 in 1880. Of all these classes, there were in 1850, 2,526; in 1860, 4,051; in 1870, 5,871; in 1880, 11,314.

Yellow Journalism.—Around 1880 the more important daily newspapers underwent great economic change as the result of small stores consolidating into huge department stores which took liberal space in the papers to advertise their so-called bargains. As store and other display advertising increased in amount, newspapers were continually forced to increase their size. This increase was possible without raising subscription rates because of the substitution of wood pulp paper for rag and a constant lowering in the price of the pulp stock. The newspaper became, consequently, a complicated economic product with two things for sale: to the reader it sold news, editorials and other interesting reading matter; to the advertiser it offered white space at so much per inch. Complications came from the fact that these two joint products had to be marketed in the same container—the white paper on which the news was printed and on which the advertising was displayed. More and more the advertiser paid the heavier burden in the cost of production. Because advertising rates were based on the number of papers distributed, there resulted a wild race for circulation. The rural weeklies remained about the same but the city dailies underwent a social change. In small communities where the editor knows personally many of his subscribers, the paper is forced to omit news that is unkindly or reflects upon the character of prominent citizens and to leave such news to circulate by word of mouth. In the larger cities where the next door neighbour is practically a stranger, exciting and emotional news does not circulate by gossip and the paper that prints it sells well on the streets. Recognition of this fact caused a wave of sensational—sometimes called yellow—journalism to sweep over the United States. Bennett had earlier discovered this fact but it remained for Joseph Pulitzer and William Randolph Hearst to run a race to see which could carry sensational journalism to its extreme. Hearst, who already owned *The San Francisco Examiner,* coming to New York in 1896, purchased *The New York Journal* which had been started by Albert, a brother of Joseph Pulitzer. According to the gossip of Park Row, the Fleet street of New York, Hearst "broke into New York with all the discreet secrecy of a wooden legged burglar having a fit on a tin roof." He brought with him the circulation schemes which he had found successful for his *Examiner* in San Francisco, and adopted many new ones furnished to him by newspaper men whom he won over from Pulitzer through larger salaries. He later called the morning edition of *The Journal, The American,* a favourite name with him for other papers of his chain, and in charge of *The Evening Journal* he placed Arthur Brisbane who by still more sensational methods rapidly advanced the circulation of the latter paper. The result of the Hearst influence was a change in character of news content for many papers and a more spectacular display of headlines that stretched across the page.

Welfare Activities.—In striking contrast with the sensational activities of certain newspapers was the adoption of extramural activities by the press in the interests of the public welfare. Among the earliest of these was the movement of *The New York Herald,* begun on May 29, 1892, to furnish free ice for the relief of mothers and babies in the tenement house districts of New York. Somewhat similar was the Fresh Air Fund, started by *The New York Evening Post* but later taken over by *The New York Tribune,* to provide outings for city children in homes and camps supported by the fund and in private homes offering to receive the children of the poor for periods ranging from one to two weeks. In Pittsburgh, Pa., *The Press* raised $40,000 with which to build a home for newsboys. In Chicago, *The Tribune* started two reforms that developed into national movements: one, a campaign for a "Sane Fourth of July"; and the other, a "Good Fellow Club" which aimed to give the children of the poor more than a bowing acquaintance with Santa Claus at Christmas time. *The News* of Indianapolis, Indiana, went out into the country and erected a Fresh Air village for the benefit of sick women and children. In San Francisco, *The Examiner* built the Little Jim Hospital for Incurables and the Free Eye and Ear infirmary for the treatment of unfortunate poor children. The One Hundred Neediest Cases of *The New York Times* was designed to relieve just that number but each year has seen a substantial increase in the number of persons helped. *The New York World,* to use another example, started a movement to supply radio without cost to "shut-ins." Smaller papers throughout the United States have followed the examples set by metropolitan dailies in this matter of service and aid to the community.

Practically simultaneous with the arrival of Hearst in New York was that of Adolph S. Ochs who assumed control of *The New York Times,* Aug. 1896. In spite of a proud past, *The Times* for various reasons had lost in circulation until it reached below 10,000 and its mechanical equipment had so deteriorated that it was only worth what it would bring for junk. Reorganized on a sound financial basis by Mr. Ochs, *The Times* quietly and unostentatiously began its campaign of appeal to thoughtful readers under a slogan, "All the News That's Fit to Print." Slowly but surely *The Times* gained momentum until its growth constituted an outstanding chapter in the annals of American journalism. Its remarkable achievements in reporting so fully the news of the World War were simply the culmination of a far-seeing campaign that had progressed steadily under the management of Mr. Ochs who, disclaiming all glory for personal achievement, says that his paper is simply a vindication of his judgment of newspaper readers in New York.

Consolidations.—But since 1900 the trend in journalism in the United States has been towards consolidations and extensions of chain newspapers. Those under publishers like Ochs of *The Times,* Nelson of *The Kansas City Star,* Lawson of *The Chicago Daily News,* etc., were simply the exceptions to the general tendency. Space does not permit mention of the amalgamations of smaller papers but some of the more important changes in metropolitan fields may be noted. Frank A. Munsey was sometimes called a dealer in dailies. In 1891 he purchased *The New York Star,* a daily established on Sept. 22, 1825, and on Feb. 1, 1891, changing the name of his paper he gave New York its first tabloid, *The Daily Continent,* which though it attracted favourable attention was not successful financially and so was discontinued on June 30. Before his death in 1925 he merged *The Press* with *The Sun* in 1916. Later, in 1920, he purchased *The New York Herald* and *The Evening Telegram.* Discontinuing *The Morning Sun,* he transferred that title to *The Evening Sun* with which, in 1923, he merged *The Globe,* then the oldest newspaper in New York city as it had been established Dec. 9, 1793, as *The Minerva,* under the editorship of Noah Webster, the lexicographer. At about the same time Munsey purchased *The Evening Mail* with which he consolidated *The Evening Telegram.* He then sold (1924) *The Herald* to *The New York Tribune,* now published under a joint title. In Boston *The Herald* (morning) took over (1912) *The Traveler* (evening) and continued it as its evening edition. Later (1917) *The Herald* absorbed *The Journal* (morning). In Kansas City W. S. Dickey bought (1921) *The Journal* (morning) and (1922) *The Post* (evening). He continued *The Journal* as a morning paper and *The Post* as an afternoon, with joint publication on Sunday, with a flat subscription price for both papers. In this he followed the example of *The Star* which since 1901 has been printing *The Times* as its morning issue, with both papers going to the same subscribers.

In Philadelphia Cyrus H. K. Curtis became on Jan. 1, 1913, the publisher of *The Public Ledger* which he purchased from Adolph S. Ochs. On Sept. 14, 1914, he started *The Evening Pub-*

lic Ledger with which he united (1918) *The Evening Telegraph.* In 1920 he purchased *The Press* to unite with *The Public Ledger* and in 1925 he did the same with *The Philadelphia North American.* In Chicago *The Record-Herald* purchased (1913) *The Inter-Ocean* and appeared as *The Herald* which later was purchased by W. R. Hearst and united with his Chicago *Examiner.* In Cleveland *The Plain Dealer* absorbed *The Leader* and in St. Louis *The Globe-Democrat* purchased *The Republic,* one of the oldest daily papers in Missouri.

Important Chain Groups.—Of the group-owned newspapers in the United States in 1928 the Hearst chain is the most important, both in number and in influence. His group includes *New York American, New York Journal, Boston Advertiser, Boston American, Chicago Herald & Examiner, Chicago American, San Francisco Examiner, San Francisco Call, Los Angeles Examiner, Los Angeles Herald, Seattle Post-Intelligencer, Atlanta Georgian-American, Oakland Post-Enquirer, Washington Herald, Washington Times, Baltimore American, Baltimore News, Milwaukee Sentinel, Albany Times-Union, San Antonio Light, Detroit Times, Rochester Journal, Syracuse Journal, Milwaukee News* and *Pittsburgh Sun-Telegraph.* Next in importance is the chain known as the Scripps-Howard string which consists of *New York Telegram, Cleveland Press, Pittsburgh Press, Cincinnati Post, Columbus Citizen, Baltimore Post, San Francisco News, Washington News, Indianapolis Times, Oklahoma City News, Toledo News-Bee, Knoxville News-Sentinel, Terre Haute Post, San Diego Sun, Covington Kentucky Post, Akron Times-Press, Birmingham Post, Memphis Press-Scimitar, Houston Press, Youngstown Telegram, Fort Worth Press, Denver Rocky Mountain News, Denver Evening News, Evansville Press, El Paso Post, Albuquerque New Mexico State Tribune.* The Scripps-Howard plan of organization, while providing for central control through stock ownership, does permit executives on individual papers to have substantial stock in the enterprise. The Frank E. Gannett group, which originally consisted of dailies in New York State outside the metropolitan area, has branched out to include, for example, *The Times* of Hartford, Conn. The James M. Cox group of papers in Ohio has been increased by *The News* of Miami, Florida. The Paul Bloch group, more highly scattered, added *The Brooklyn Standard-Union* in 1928. The tendency already noticed has been an increase not only in the number of strings but also a lengthening of the string. Adolph S. Ochs, since his sale of *The Philadelphia Public Ledger* to Cyrus H. K. Curtis, has been content with the ownership of his *Times* in New York and his *Times* in Chattanooga. Curtis, on the other hand, entered the New York field with the purchase of *The Evening Post.*

Mutualization Movements.—Another recent current in American journalism should not be overlooked—the passing of the control of important newspapers into the hands of those who edit and make them. In Chicago after the death of Victor A. Lawson, *The Daily News* passed into the control of Walter A. Strong and other executives of that paper through the assistance of a number of prominent citizens. In the same way *The Star* in Kansas City went to a group who had been associated with Nelson. In New York city William T. Dewart carried out the wishes of Frank A. Munsey and developed a mutualization plan by which employees shared in the profits. In Dallas, Texas, *The Morning News* and *The Evening Journal* passed into the control of George B. Dealey and other employees.

Tabloids.—Since 1925 critical articles have appeared in American magazines that, in political language, viewed with alarm the consolidations and amalgamations, the extensive use of syndicated material such as comic strips, the growth of standardization in the presentation of the news, as well as a lack of initiative in the gathering of news independent of the Associated Press, the United Press, etc. The introduction of tabloids may be explained, in part, by the passing remark of Lord Northcliffe, "If some American does not start one I shall have to come over to do it." The first in the field was *The Illustrated Daily News,* established in New York city, June 1919, by *The Chicago Tribune.* At the close of 1927 it had the largest circulation of any American newspaper, over a million copies daily. Its success doubtless led W. R. Hearst to establish *The Mirror* and make over his *Boston Advertiser* (est. 1813) into a tabloid. The third tabloid in New York was *The Graphic* (1924). Within the ranks, *The Christian Science Monitor* of Boston (Nov. 1908) has possibly been the most caustic critic of questionable standards and unethical tendencies in journalism.

Circulation Statistics.—Statistics make dull reading but some are necessary for the sake of completeness. At the close of 1927, the latest year for which figures are available, there were in the United States about 200 daily newspapers which might be called of the first rank, 2,000 daily newspapers all told and 20,000 rural or community weeklies. Morning dailies at the end of that year totalled 411, evening 1,538, Sunday papers 526. The total morning paper circulation averaged 14,145,823 a day, while the total evening paper circulation averaged 23,820,933 copies daily. The average Sunday circulation was 25,469,037. The amount of white paper consumed that year approximated 3,750,000 tons. For a metropolitan newspaper of the first rank the figures of *The New York Times* may be used. That paper for 1927 had a gross income of $27,424,829.55; it paid out weekly to employees $154,246.98; it consumed during the year 99,633·4 tons of paper; and used 4,491,593 lb. of ink. Its employees were distributed as follows: the editorial and news departments 525, business office 850, mechanical 1,869, executive 75—total 3,319. It paid out for welfare activities, such as pensions, sick benefits, etc., $352,000. Pages printed during the year totalled 13,526,481,200. The average number of pages in a daily issue was 46·3 and that for Sunday 225·6. To visualize these figures it may be said that if all the printed matter, including advertisements and illustrations of an entire Sunday edition of *The Times,* could be pasted on a ribbon a column wide this ribbon would circle the globe more than 12 times. On the advertising side, *The Times* in 1927 published 29,710,606 agate lines.

In the pioneer days of journalism in the United States the newspaper was an educational influence somewhat primary in character as a sign often posted in public taverns proved—"Persons learning to read will please use last week's *Gazette.*" To-day the American newspaper with an intelligent editorial page, with special articles worthy of place in the monthly review, with a book and dramatic department that is free from advertising puffs, with a wordless editorial in the shape of a cartoon, with a news department that can distinguish between news that has permanent value from that which has only passing interest, is a sort of liberal education for its readers—commercial as it often is in character because of economic and social pressure it cannot control.

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V. LATIN AMERICA.

To South America, rather than to its sister continent, belongs the honour of printing and circulating the first printed news sheets of the Western Hemisphere. Not only in contents but also in mechanical form they necessarily followed somewhat closely the style set by the journals of southern Europe.

Early News Sheets.—The first printed sheet of news to appear in South America was issued in 1594 at Lima, Peru, and de-

scribed the capture, off the Peruvian coast, of Richard Hawkins, the free-booter, and of his ship, "The Dainty." Like the earlier sheets of continental Europe, this *Relación* had a long descriptive title. But it was not until 1620 that one meets printed sheets dealing with more than one item of news. After that year their occasional appearance gives the title, Father of South American Journalism, to their printer, Jerónimo de Contreras, who had come to Lima from Seville, Spain. In 1641 José de Contreras succeeded his father as head of the printing house which remained in the family until about the beginning of the second quarter of the 18th century. The most successful of this family of printers was the grandson, José, who obtained the appointment of royal printer to the Spanish Crown in the colonies, and who gave special attention to the editing of news sheets which appeared with approximate regularity of about one a month.

After 1640, *Diario* was commonly used as a title of news sheets, although *La Relación* and *Noticia* appeared. For the most part, these news sheets from the Contreras's press consisted of four pages in small type. *Diario* was especially appropriate as the news was frequently printed in the form of a diary—day by day. After the press of de Contreras had suspended, there was a cessation of news sheets of regular publication. In 1744 there appeared, however, a newspaper with a definite title with consecutive numbers for successive issues. The first issue of this new paper bore the title *Gaceta de Lima, desde primero de diciembre de 1743 hasta 18 de enero de 1744*. This first number is particularly interesting because it prints the traditional origin of the word "gazette" and mentions the names of contemporaneous news sheets in Europe.

Colombia and Venezuela.—The first printing office in Colombia, then Nueva Granada, was established at Bogotá in 1737. At first it printed tracts on religious matters, but in 1785, when an earthquake occurred, it issued what is now considered the first attempt in that country to give the public a news sheet. This ill-printed and rudimentary gazette did not last, for its only aim was to spread abroad the news of the earthquake. In 1791 Don Manuel del Socorro Rodríguez, a Cuban, founded a newspaper, in which he printed mainly his poetical and literary works, its other contents being advertisements for runaway slaves, bits of European news, and essays on morals and religion. This newspaper, named *Papel periódico de la ciudad de Santa Fé de Bogotá* appeared irregularly, but lasted for some years.

Another country where a gazette was the first newspaper was Venezuela. The honour of introducing printing into that country is ascribed to Madeo Gallagher and Jaime Lamb in 1808. *Gaceta de Caracas* had its first issue on Oct. 24, 1808. It appeared when Venezuela was in that period of its history known as the colonial age. The first newspaper of what is known historically as the period of independence was *El Correo del Orinoco*. Its first date of publication was June 27, 1818, in Angostura. These two papers marked the beginning of the newspaper press in Venezuela.

The same year that saw the beginning of journalism in Venezuela marks also the beginning of journalism in Brazil. Obviously, the first printed newspaper in the latter country was in Portuguese but, like that of Venezuela, it was called a gazette.

The first newspapers, in the technical sense of that term, for the countries of South America may be listed as follows: Mexico, *Gaceta de México* (1679); Guatemala, *Gaceta de Guatemala* (1729); Peru, *Gaceta de Lima* (1744); Cuba, *La Gaceta de la Habana* (1764); Colombia, *La Gaceta de Santa Fé* (1785); Ecuador, *La Gaceta* (1785); Argentina, *El Telégrafo Mercantil* (1801); Haiti, *La Gaceta del Cabo* (1804); Uruguay, *La Estrella del Sur* (1807); Brazil, *Gazeta do Rio de Janeiro* (1808); Venezuela, *La Gaceta de Caracas* (1808); Chile, *La Aurora de Chile* (1812); Panama, *Miscelánea del Istmo* (1822); Bolivia, *El Condor de Bolivia* (1825); Paraguay, *El Paraguay Independiente* (1845).

Brazilian Journals.—The honour of being in 1928 the oldest newspaper in South America belongs to *O. Diario de Pernambuco* which was established in 1825. The next newspaper in point of age, founded two years later, is *Jornal do Commercio* of Rio de Janeiro. The latter is an extremely conservative paper of limited circulation, while the most popular in that city is the evening paper *A Noite* established in 1910 and credited at the close of 1927 with a circulation of 85,000. Possibly the most influential paper is *O Estado* (1876) of São Paulo. *Fanfulla* (1892), an Italian daily of the same city, wields considerable power through the State of São Paulo. Other influential morning papers are *O Paiz* (1884), *A Patria* (1920) and *Correio de Manha* (1902), all of which are published in Rio de Janeiro. Newspapers in Brazil are often the personal organs of owners to whom they are useful for political purposes. At the fall of the empire Brazilian journals numbered about 600. In 1910 the total exceeded 1,000; since then the increase has been about 100 to a decade.

Argentina and Chile.—The two leading newspapers, not only in Argentina, but also in South America, are *La Prensa*, founded on Oct. 18, 1869, by Dr. José C. Paz, and *La Nación*, founded on Jan. 4, 1870 by Gen. Bartolomé Mitre, of Buenos Aires. For 59 years (1929) both papers have remained in the families of their founders. Each compares favourably with any other newspaper in any country. Both specialize in printing foreign news; possibly *La Nación* pays more for cable tolls than any other newspaper in the world. Classified advertisements are usually a safe index as to character of newspapers because they represent local opinion. Judged by such a yardstick, *La Nación* resembles the *New York Times* and *La Prensa* the New York *World*. The editorial page of *La Nación* is always dignified in subject-matter and serious in mode of treatment. Its Sunday supplement contains contributions from the best writers, not only of Argentina but also of Spain. Much material later appears in book form. To campaign for civic righteousness seems to be the editorial policy of *La Prensa*. Its evening competitor, *La Razón* (1905), once spoke of it as being a safe and serene guide in the difficult task of creating a public conscience. *La Prensa* widens its influence through syndicating to some 175 provincial papers a weekly feature supplement for Saturday or Sunday editions. *La Prensa* operates a free clinic, offers free legal advice to the poor, pays for a free industrial and agricultural bureau, opens its library to the public and awards 1,000 pesos annually to the person teaching the largest number of illiterates to read. The oldest evening paper in Buenos Aires is *El Diario* (1881). The oldest of all is the English paper, *The Standard* (1861), which competes with *The Herald* (1876).

Crossing the Andes, one finds the newspapers of Chile next in influence. First comes *El Mercurio* (1827) of Valparaiso, with separate publication in Santiago and Antofagasta. Its chief competitor is *La Unión* (1885), which also publishes a paper of the same name in Santiago. In the last-mentioned city are the rather influential *La Nación* (1916), and *El Diario Ilustrado*. In Peru the three leading papers are *La Crónica* (1912), *La Prensa* (1903) and *El Comercio* (1839), of Lima.

The more influential newspapers in Mexico are practically limited to the capital city and frequently contain features obtained from American syndicates. They include *El Excelsior* (1919), *El Universal* (1916) and *El Universal Gráfico* (1922). Outside the capital city, mention may be made of *El Informador* (1917) of Guadalajara, *La Tribuna* (1926) of Guaymas, *El Correo de la Tarde* (1885) of Mazatlán and *Diaro de Yucatán* (1918) of Mérida.

See J. M. Lee, *Historia de la prensa periodística de la América del Sur;* A. Celso, *Historia da imprensa do Brazil;* R. Rojas, *La literatura argentina.* (J. M. Le.)

VI. OTHER COUNTRIES

China.—By no means the least result of the Chinese revolution of 1911 was the amazing expansion of the vernacular press. Actually the movement had begun some years earlier, but after the revolution it developed into a portent. Native newspapers sprang up in all parts of the empire in a night, as it were, and it is not surprising that the Chinese press exhibits most of the undesirable attributes of a mushroom growth. The general quality is poor. Most of the papers are run for political or personal ends, the news supplied by them is untrustworthy and their standard of journalistic ethics is low. This is the more to be regretted as their multitude testifies to the interest which awakened China

takes in affairs and their influence on public opinion is beyond doubt enormous; but little improvement is to be expected until political conditions become more settled. As things are it is only fair to say that, with all its irresponsibility and corruption, the Chinese press is on the whole liberal and patriotic in intention if not always in fact. It may be noted that Chinese periodical publications are on a much higher level than the newspaper press.

Between 20 and 30 European and American newspapers are published in China, more than half of them at Shanghai. The majority are British, including the *North China Daily News* of Shanghai which, founded in 1864, is the oldest foreign daily in China. Other British morning newspapers are: *The Shanghai Times, The Central China Post* (Hankow), *The Peking and Tientsin Times, The Hongkong Daily Press* and *The South China Morning Post* (Hongkong). The principal British evening papers are *The Shanghai Mercury, The North China Daily Mail* (Tientsin), *The Hongkong Telegraph* and *The China Mail* (Hongkong). There are three American morning dailies, *The China Press* (Shanghai); *The Peking Leader* and *The North China Star* (Tientsin)—and three French, *L'Echo de Chine* (Shanghai), *Le Journal de Pékin* and *L'Echo de Tientsin*. There are also a number of Chinese and Japanese-owned journals published in English.

Japan.—There has been a very remarkable development in the press of Japan during recent years, owing to the spread of popular education. Public opinion in Japan today is practically shaped by the press and while some old restrictions remain the tendency is towards complete freedom of discussion. There are about a dozen newspapers in Japan whose capital is about a million yen. The two centres of newspaper activity are Tokyo and Osaka. The *Osaka Mainichi* and the *Osaka Asahi*, the biggest newspapers in Japan, have a daily circulation of a million copies. The *Tokyo Nichinichi* and the *Tokyo Asahi* are subsidiaries of these newspapers. The *Tokyo Hochi*, the *Jiji*, the *Chugai* and the *Kokumin* are all important national newspapers and almost all are politically independent. There are a very large number of newspapers of the second class which penetrate into the country districts, and there are a number of first-class local newspapers. The Japanese press is influenced by American journalism and some of the popular newspapers display news in quite modern style. Every up-to-date method is employed. In the news columns there is a close network of correspondents and private long distance telephone lines, television, air transport, and pigeons are in use.

A great deal of capital is required to start new newspapers. Greater attention is being given to sport and a large space is given to foreign news.

The *Kokumin* is famous for its president, Mr. I. Tokutomi, who is one of the pioneers of the newspaper business, and is a great critic and author. Its tone is conservative. One of the present problems is the keen competition between the papers in the big cities and the local newspapers, the same tendency which is observable in England.

Newspapers for the English speaking residents in Japan are the *Japan Chronicle* (British), the *Japan Advertiser* (American), and the *Japan Times* (Japanese).

The organisations for newspapers in Japan are the Nohom Shimbun Kyokwai (The Japanese Press Association), and the Kokusai Kisha Kyokwai (International Pressmen's Association), both established in 1913.

During recent years there has been a surprising increase in magazines in Japan of an educational character. Seventy per cent of these are published by Seiji Noma, who is called the "Magazine King" of Japan. It is claimed that the magazines are read by ten million people. His list includes magazines for young men, for girls of the high-school grade, magazines for women, and others of an educational and entertaining character.

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(R. DON.)

NEWT, the name applied to the aquatic members of the family *Salamandridae* which constitute the genus *Molge* (*Triton*). The newts are closely related to the true salamanders, *Salamandra*, from which they differ in the shape of the tail, which is compressed, in relation to their more aquatic habits. They swim with their tails, holding the legs pressed into their sides. A marked sexual dimorphism prevails in most species, the males being more brilliantly coloured and provided with a dorsal crest during the breeding season, lasting through the spring and the early summer. Later in the season the males lose their nuptial ornaments, and the two sexes are more alike; they then retire on land, concealing themselves under stones, logs of wood, or in holes in damp earth, but leaving their retreat at night or in wet weather to search for earth-worms and slugs. In the water they eat tadpoles, insect larvae and crustaceans. Newts regenerate lost parts with facility, including whole limbs. One limb can be regenerated a number of times.

The male courts the female by placing himself before her, vibrating his tail and bending his body in a semicircle. He then emits in front of the female several conical spermatophores adhering to the ground and crowned by a spherical mass of spermatozoa, which the female gathers in the lips of her cloaca, whence they find their way into the lower part of the oviducts, where the eggs are fecundated.

The larvae are provided with three pairs of long, plum-like external gills. The fore limbs are developed before the hind limbs. In a few lakes and ponds, metamorphosis (*q.v.*) does not occur and the newt becomes sexually mature as an enlarged larva.

The genus *Molge* extends over Europe, north-west Africa, south-western Asia, eastern temperate Asia (China and Japan) and most of North America. Over 20 species are distinguished. The British species are the crested newt (*M. cristata*), the common newt (*M. vulgaris*) and the palmated newt (*M. palmata*). The first is the largest, and measures 4 to 6in. The skin is more or less rugose, with granular warts, a strong fold extends across the throat, and the male is provided with a high dentate dorsal crest which is interrupted over the sacral region; the upper parts are dark, with black spots; the sides are speckled with white, and the lower parts are yellow or orange, spotted or marbled with black; a silvery stripe adorns the side of the tail in the male. The common and the palmated newts are smaller, $2\frac{1}{2}$ to 4in. in length, with smooth skin. The dorsal crest of the male is high and festooned in the former, low and straight-edged in the latter.

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NEW TESTAMENT: *see* BIBLE.

NEWTON, ALFRED (1829–1907), English zoologist, was born at Geneva on June 11, 1829. In 1854 he was elected travelling fellow of Magdalene college, Cambridge, and subsequently visited many parts of the world, including Lapland, Iceland, Spitsbergen, the West Indies and North America. In 1866 he became the first professor of zoology and comparative anatomy at Cambridge, a position which he retained till his death on June 7, 1907. His services to ornithology and zoogeography were recognized by the Royal Society in 1900, when it awarded him a Royal medal.

He wrote many books, including *Zoology of Ancient Europe* (1862), *Ootheca Wolleyana* (begun in 1864), *Zoology* (1872), and a *Dictionary of Birds* (1893–96), an amplification of the numerous articles on birds which he contributed to the 9th edition of the *Encyclopædia Britannica.*

NEWTON, SIR CHARLES THOMAS (1816–1894), British archaeologist, was born on Sept. 16, 1816, at Bredwardine in Herefordshire, and educated at Shrewsbury Schools and Christ Church, Oxford. He entered the British Museum in 1840 as an assistant in the Antiquities Department. In 1852 Newton left the Museum to become vice-consul at Mitylene, with the object of exploring the coasts and islands of Asia Minor. Aided by funds supplied by Lord Stratford de Redcliffe, then British ambassador at Constantinople, he made in 1852 and 1855 important discoveries of inscriptions at the island of Calymnos, off the coast of Caria; and in 1856–1857 achieved the great archaeological exploit of his life by the discovery of the remains of the mausoleum of Halicarnassus, one of the "seven wonders" of the ancient world. He was greatly assisted by Murdoch Smith, afterwards celebrated

in connection with Persian telegraphs. The results were described by Newton in his *History of Discoveries at Halicarnassus* (1862–1863), written in conjunction with R. P. Pullan, and in his *Travels and Discoveries in the Levant* (1865). These works included particulars of other important discoveries, especially at Branchidae, where he disinterred the statues which had anciently lined the Sacred Way, and at Cnidos, where R. P. Pullan, acting under his direction, found the colossal lion now in the British Museum.

For 25 years, 1860–85, Newton was Keeper of Greek and Roman Antiquities in the British Museum. He was Yates professor of classical archaeology at University college, London, (1880–88). His collected *Essays on Art and Archaeology* were published in 1886. He died at Margate on Nov. 28, 1894.

NEWTON, SIR ISAAC (1642–1727), English natural philosopher, was born at Woolsthorpe near Grantham on Dec. 25, 1642. His father had died the previous October and his mother, Hannah, daughter of J. Ayscough of Market Overton, married again in 1645 Barnabas Smith, Rector of North Welham, Leicestershire.

After his mother's second marriage her son had lived with his grandmother Mrs. Ayscough at Woolsthorpe, but on his stepfather's death his mother returned to her former home and her boy rejoined her.

For some two years he had attended the Grammar School at Grantham, then kept by Mr. Stokes. He is said to have made little progress with his books until a successful fight with another boy aroused a spirit of emulation and led to his becoming head of the school.

At the age of fourteen on his mother's return (1656) he was taken from school to assist her on her farm. This, however, was not a success; he occupied himself with mathematics when he ought to have been attending to his work. His uncle Wm. Ayscough, Rector of Burton Coggles, was a member of Trinity College, Cambridge, and in 1660 by his advice Newton was sent back to school to prepare for Cambridge. On June 5, 1661 he was matriculated as a subsizar at Trinity College. Three years later he was elected as scholar and in Jan. 1665 proceeded in due course to the degree of Bachelor of Arts. In 1667 he was elected a Fellow of the College.

In the early part of 1665 he discovered what is now known as the binomial theorem, and a little later came the elements of the differential calculus which he called Fluxions. In May of the following year he writes "I had entrance into the inverse method of Fluxions" (in modern terms the principles of the Integral Calculus and the method for calculating the area of curves or the volume of solids) "and in the same year (1666) I began to think of gravity extending to the orb of the Moon . . . having thereby compared the force requisite to keep the Moon in her orb with the force of gravity at the surface of the Earth and found them to answer pretty nearly. All this was in the two years 1665 and 1666 for in those years I was in the prime of my age." The same period saw the commencement of his work on Optics and Colour.

The account of Newton's colour experiments was sent to the Royal Society in 1672. He had been elected a Fellow on January 11 of that year and soon got into correspondence with Oldenburg, the secretary. "I shall endeavour," he wrote, "to show my gratitude by communicating what my poor and solitary endeavours can effect towards the promoting of philosophical design." His *New Theory about Light and Colours* was read on Feb. 8th.

The experiments he described showed conclusively, he claimed, that "Light consists of Rays differently refrangible"; that "Colours are not qualifications of Light derived from refractions of natural bodies as is generally believed but original and connate properties which in divers Rays are divers . . . to the same degree of refrangibility ever belongs the same colour and to the same colour ever belongs the same degree of refrangibility." During the period covered by this work he had become Lucasian Professor of Mathematics. Barrow resigned in his favour in 1669, and Newton's first course of lectures dealt with Optics; hence his renewed interest in the subject, and the experiments with the prism bought at Stourbridge Fair in 1666, culminating in the Royal Society paper of 1672. But the paper led to controversy. The Royal Society solemnly thanked the author "for his ingenious discourse" and he was to be informed "that the society think very much of it."

Robert Hooke along with Ward, Bishop of Salisbury and Robert Boyle were desired to peruse the discourse and report. Hooke in his *Micrographia* (1664) had described an experiment which was fundamentally the same as Newton's with the prism, but he had made no use of it; the theory of colours he attempted to deduce was valueless; however, while admitting the truth of Newton's observations, he declined to accept any of the conclusions drawn from them. The paper, when published, at once attracted attention, and others abroad joined in the discussion, the most important issue of which was Newton's assertion that the length of the band of colours produced at a given distance from the prisms, was the same for prisms of any substance provided their angles were such that the deviation for the mean ray of the band was the same in all.

In this, as we know now, Newton was wrong; the length of the band, the spectrum, is not proportional to the average or mean deviation; it is possible to have two spectra of the same length in which the deviations are markedly different, thus if two such prisms are mounted with their vertices in opposite directions, the light emerging from the second will be achromatic, largely free from colour, but will be deviated from its original path.

Newton's experiments on colour, made in all probability in order to study a defect of the telescope, led him to the belief that the defect was incurable. By putting a divergence lens behind the converging lens of the object glass the colours could again be combined, but, so he concluded, his rays would all be made parallel to their original direction, and would no longer converge to form a real image, which could be magnified by the eyepiece; the telescope could not be made to give a colourless (achromatic) image. This belief he retained throughout his life, but it was wrong. Dispersion and the separation of the colours, are not proportional to deviation.

Shortly after Newton's death Chester Moor Hall invented an achromatic telescope and by 1733 had made several, and in 1758 Dolland the optician took up the matter and constructed satisfactory achromatic lenses.

But his mistake had important consequences; a real image, one, that is, through which the light actually passes, of a distant object can be formed by reflexion at a concave mirror, and since the laws of reflexion, unlike those of refraction through a transparent medium, are independent of colour, the reflected image is the same colour as the object, the rainbow band is there no longer; chromatic aberration, as it is called, is no more a disturbing factor. This then led Newton to make his reflecting telescope in which a concave mirror takes the place of the object glass; the first telescope was made in 1668; the second was sent by him to the Royal Society in December 1671 shortly before his election as a Fellow.

Discussions as to the Optics paper lasted until 1675. "I was so persecuted" he writes in December of that year "with discussions arising out of my theory of light that I blamed my own imprudence for parting with so substantial a blessing as my quiet to run after a shadow." But they had their advantage. They led him to investigate other effects of colour, to enquire how light was produced and to develop the emission or corpuscular theory of light, according to which light is due to the emission by a luminous body of a host of tiny particles travelling in empty space with a speed of 190,000 miles per second; the laws of reflexion and refraction were developed on mechanical principles, aided only by a supplementary hypothesis as to why, when falling on a transparent surface, some of the particles are reflected—bent back into the medium whence they have come—others are refracted, along a new path inclined to the old, into the medium towards which they are travelling. It is a consequence of this theory that light travels more quickly in a dense medium such as glass than in air. The theory was also applied to explain the colours seen when light is reflected from a thin film, a soap film, or the thin layer of air between a convex lens of large radius and a flat reflecting surface on which it rests; in this case when viewed in reflected light of a definite colour a series of dark and light rings

circling round a central black spot is seen. Newton determined the law connecting the radius of a bright ring and the colour of the light and since the radius depends on the colour, the bright rings for the various colours, when white light is used, will be different and the observer will see a series of coloured rings surrounding the black central spot.

Hooke was again a critic; in his *Micrographia* (1664) he had adopted the wave theory of light, due originally to Huyghens, according to which light is energy transmitted by wave motion through a medium pervading space, the universal ether, and had endeavoured to explain, but without success, rectilinear propagation, reflexion and refraction as well as dispersion and the colours of thin plates. Hooke's arguments were vague and carried no conviction to a mind like Newton's; the latter sought a mechanical explanation for all he observed. Newton in his explanation of the reflection and refraction of the corpuscles of a light centre made use of the idea of a wave in an ethereal medium; he rejected Huyghens' theory and thought little of Hooke's attempts at explanation, and so for a hundred years or more Newton's theory held the field. In 1804 Thomas Young, Professor at the Royal Institution, London, established the principle of interference by which he showed that under certain conditions two parcels of light from identical sources falling on a screen could produce a series of bright and dark bands. Along certain lines on the screen there is a maximum of brightness; along others intermediate between these there is darkness. From this and the brilliant work of the French genius Augustin Fresnel, a few years later, came the explanation on the wave theory of all the phenomena of light as then observed.

"In the fourth place," says Newton, writing in 1675, "I suppose light is neither aether nor its vibrating motion but something of a different kind propagated from lucid bodies. . . . Fifthly it is to be supposed that light and aether mutually act upon one another." Did he here build more truly than he knew? Who can say, but we must revert to other work, to other discoveries on which his fame will rest secure till time shall end.

In 1666, when at Woolsthorpe on account of the plague at Cambridge, he "began to think of gravity extending to the orb of the moon," though of this nothing was published for 18 years.

Discussions went on in London at the Royal Society or in the houses of the members, Wren, Seth Ward, Bishop of Salisbury, Robert Boyle, Hooke, Halley, and the others who were active in the Society, until one Wednesday in January 1684 Halley met Wren and Hooke and the latter declared "that he had demonstrated all the laws of the celestial motions." Halley confessed his ignorance and Sir Christopher "to encourage enquiry said he would give Hooke or me"—the quotation is from a letter of Halley to Newton—"two months to bring him a convincing demonstration." Sir Christopher offered to give "a book of 40 shillings" to the one who first found the solution. He was not convinced of Hooke's assertion that he had done it, but wished to conceal the result "that others trying and failing might know how to value it when he would make it public." So it remained till August, when Halley visited Newton at Cambridge and put the question, what would be the path of a body moving under the action of a central force which varied as the inverse square of the distance from the centre. "I then learned," writes Halley in the same letter, "that you had brought this demonstration to perfection." Newton promised to look for the old proof already mentioned but could not find it, "and not finding it did it again and reduced the work into the proposition," which he sent in November to Halley, who immediately returned to Cambridge and persuaded Newton to put them in form for the Royal Society.

On December 10th, 1684, Halley informed the Society that he had lately seen Mr. Newton at Cambridge who had showed him a curious treatise *De Motu* which, upon Mr. Halley's desire, was sent to the Society to be entered on their Register "and a tract, *Propositiones de Motu*" was registered in February 1685 with the date in the margin, 10 Dec. 1684.

But the early months of 1685 were fertile with a new discovery. Newton was away from Cambridge; hitherto his calculations had proceeded on the assumption that the sun and the planets could each be treated as though they were points, concentrated at their respective centres, through which the various forces were assumed to act; but was this true or was it merely an approximation due to the fact that the planetary distances were so immense that even a great sphere like the sun could in comparison be treated as a point? What will be the force with which the sun attracts an exterior particle?

Newton proceeded to work this out, on the assumption that each particle of the sun attracted the external particle with a force which was proportional to the product of the masses of the two and inversely proportional to the square of the distance between them and found (we know he had no expectation of the result until it emerged from his calculations), that if the sun were of uniform density, or consisted of a series of concentric shells each of uniform density, then the resultant force on the external particle was the same as that which would be exerted by the whole mass of that concentrated at the centre.

It was no approximation, the sun and the planets considered as spherical, really behaved as point centres of force.

In the opinion of Professor Adams it was the difficulty of solving this problem and not the uncertainty as to the moon's distance which caused Newton in 1665 to lay aside his astronomical calculations, which were now resumed with a more correct knowledge of the moon's distance. Newton returned to Cambridge and the writing of the *Principia* was begun in March 1686.

The work is entitled *Philosophiae Naturalis Principia Mathematica*. It is in three books, the first *De Motu Corporum* was finished on April 28, 1686 and exhibited to the Royal Society on that day. On June 20, 1687, Newton wrote that the second book was ready. "The third I now design to suppress. Philosophy is such an impertinently litigious lady that a man had as good be engaged in lawsuits as have to do with her." Halley was able to prevent this, and on Sept. 6, 1687 the third book described as *De Mundi Systemate* was presented; the whole was published about Midsummer 1687.

We owe much to Halley; at the time the Royal Society was in difficulties as to funds he took the whole cost on himself. Hooke, when the first book was presented, claimed that he had forestalled Newton in a great part of it, and in the correspondence which followed Halley did all he could to smooth over the difficulties and persuade Newton to continue his work. Newton's letter quoted above indicates his own feelings and in a letter to Halley of July 14, 1686 he had written, "I have considered how best to compose the present dispute, and I think it may be done by the enclosed scholium to the fourth proposition."

In a corollary to the fourth proposition Newton showed that Kepler's third law was a consequence of the elliptic path of a planet under an inverse square law; the scholium runs:

"The case of the sixth corollary applies to the heavenly bodies as our friends Wren, Hooke and Halley have already inferred and therefore I have decided to develope fully all the consequences of a force decreasing as the inverse square." The great work did this: the *Principia* established Newton's fame; some little time elapsed before it was fully accepted on the Continent but for more than 200 years it reigned supreme, and all theories of cosmogony were based on the principles laid down by Newton. His mechanics guided astronomers and men of science in their search for natural knowledge. And if in these last years Einstein has carried us some steps further, has picked up some few more of the jewels of truth, which Newton sought on the shore, Newton's laws remain, included it may be, in a more comprehensive statement of the truth.

In 1687 James II. tried to force the University to admit as a Master of Arts, Father Alban Francis, a Benedictine monk, without taking the oaths of allegiance and supremacy. Newton was one of those who led the resistance to the royal action, and appeared before Lord Jeffreys to argue the case for Cambridge. In the end the deputies were reprimanded, and Pechell the Vice Chancellor was deprived of his office. Newton's share in the affair led to his being elected member for the University in 1689, retaining the seat till the dissolution next year. He was elected again in 1701, but he never took any prominent part in

politics.

On the dissolution of Parliament in 1690 he returned to Cambridge and continued for a time his mathematical work; this was interrupted in 1692–94 by a serious illness. He was suffering from insomnia and nervous trouble. There was a report that he was going out of his mind. Huyghens in June 1694 wrote to Leibnitz "I do not know if you are acquainted with the accident to the good Mr. Newton, namely, that he has had an attack of phrenitis which lasted eighteen months and of which they say his friends have cured him by means of remedies and keeping him shut up." For some time his friends had been anxious to obtain for him some recognition of his work; this came in 1695. Wren, his friend Charles Montague, Lord Halifax, a former Fellow of Trinity who was Chancellor of the Exchequer, offered him the post of Warden of the Mint. This he accepted and four years later became Master. In the same year he was elected one of the eight Foreign Associates of the French Academy of Science.

In 1696 John Bernoulli addressed a letter to the mathematicians of Europe challenging them to solve two problems and giving six months for the solution. On January 29, 1697 Newton received from France two copies of the printed paper containing the problems and the following day sent the solution to Montague, then President of the Royal Society. They were transmitted anonymously to Bernoulli, who recognised the author in his disguise "tanquam ex ungue leonem."

As Warden of the Mint Newton had retained his Cambridge offices, but soon after his appointment as Master he named Whiston as Deputy, and in 1701 he resigned his Professorship and the Fellowship at Trinity. Whiston became Lucasian Professor. Newton had moved to London, and continued his duties as Master with marked efficiency until his death in 1727.

The remainder of his life calls for little notice; in 1703 he became President of the Royal Society and was re-elected annually until his death. Queen Anne visited Cambridge in 1705 as the guest at Trinity Lodge of the Master, Dr. Bentley, and on this occasion Newton was knighted. About the same time the controversy with Leibnitz as to the invention of the differential calculus began. In a review published anonymously of Newton's tract on quadrature, Leibnitz, in 1705, implied that Newton had borrowed from him the idea of Fluxions.

The controversy lasted many years. Leibnitz died in 1716 but it continued to affect English mathematics for more than a century. The matter is discussed very fully in the article "Newton" in the *Dictionary of National Biography* and in Ball's short *History of Mathematics*. Leibnitz had used the method in his note books of 1675, it occurs in a letter to Newton of 1677, and was published in 1684. Newton used his method of Fluxions in 1666, gave an account of it in manuscript to friends and among others to Collins, in letters from 1669 onwards but did not publish it until 1693. It was some of these letters which Leibnitz saw when in London in 1676, and previously to that, copies of one at least of Newton's letters to Collins had been sent to him. During this visit it appears probable that he saw Newton's tract on the subject. In the middle of 1708 Newton, at the urgent request of Dr. Bentley, consented to let Roger Cotes, a Fellow of Trinity, edit a second edition of the *Principia;* the volume was published in 1713, a third edition by Pemberton appeared in 1726.

Early in 1727 Newton whose health had been failing for some time was taken seriously ill; he died of stone on March 20, 1727, and was buried in Westminster Abbey on March 28th. There are portraits of him by Kneller and Thornhill in the possession of Lord Portsmouth and a second one by Kneller at Petworth. The Royal Society possesses three, one of which by Jervas was presented by Newton in 1617 and hangs over the president's chair, while at Trinity College there are a number. The statue by Roubillac was given to the College in 1750 by the Master, Dr. Smith.

BIBLIOGRAPHY.—*Bibliography of the Works of Sir Isaac Newton, with a List of Books illustrating his Works and Notes,* by G. J. Gray (second edition 1907); *Isaac Newton, 1642–1727* (bibl.) a collected edition of Newton's work was published at Lausanne and Geneva in 1744, which gives all the published works with the not unimportant exceptions of the *Arithmetica Universalis,* the *Principia,* the *Optics* and the *Methodus Fluxionum.* The fullest edition yet published is that issued by Samuel Horsley in 1779–85, under the title *Opera quae exstant omnia;* it is not complete, among notable omissions being the papers published in the *Philosophical Transactions,* and is moreover very scarce.

The standard biography is *Memoirs of the Life, Writings and Discoveries of Sir Isaac Newton,* by Sir David Brewster, 1855: it was reprinted in 1860. Brewster also wrote a short *Life of Sir Isaac Newton,* 1831, of which a new edition appeared in 1908. Valuable critical commentaries are to be found in *Essays on the Life and Works of Newton,* by Augustus de Morgan, edited with notes and appendices by P. E. B. Jourdain in 1914. A brief account of Newton's life and works is given in *Sir Isaac Newton,* by S. Brodetsky, 1927. Of great value to students of Newton is the *Catalogue of the Portsmouth Collection of Books and Papers written by or belonging to Sir Isaac Newton,* 1888 which describes the great mass of Newton's papers which came at his death into the hands of Mr. Conduitt. S. P. Rigaud, *Correspondence of Scientific Men of the 17th Century, etc., from the Originals in the Collection of the Earl of Macclesfield,* 1841, J. Edleston, Editor of the second edition of the Principia, *Correspondence of Sir Isaac Newton and Professor Cotes, including letters of other Eminent Men,* 1850, contain many Newton letters, and the letter volume includes a synoptical view of Newton's life. Among general commentaries must be mentioned:— H. Pemberton, *A View of Sir Isaac Newton's Philosophy,* 1728; Colin Maclaurin, *Sir Isaac Newton's Philosophical Discoveries,* 1775; and F. Rosenberger, *Isaac Newton und seine Physikalische Principien,* 1895.

Since the first issue in 1687 there have been many editions of the *Principia,* including two in Newton's lifetime. The Geneva reprint of 1739–42 contains a voluminous commentary by le Seur and Sacquier, and was long used. Lord Kelvin and H. Blackburn edited a very good edition, published at Glasgow in 1874. The first three sections of Book I. of the *Principia* have been edited by, among others, J. Carr, 1821; J. H. Evans, 1838; G. L. Cooke, 1850; P. Frost, 1883 (fourth edition). An English translation of the *Principia* was first published by Andrew Motte in 1729; the best edition is that of 1803. S. P. Rigaud, *Historical Essay on the First Publication of Sir Isaac Newton's Principia,* 1838; W. W. R. Ball, *Essay on Newton's Principia,* 1893; J. W. L. Glaisher, *Bi-Centenary of Newton's Principia,* 1888; P. G. Tait, *Newton's Laws of Motion,* 1899; *Isaac Newton, 1642–1727, A Memorial Volume edited for the Mathematical Association by W. J. Greenstreet* (1927); *Sir Isaac Newton, 1727–1927, A Bi-centenary Evaluation of His Work* (1928). *The Opticks,* first published in 1704, went through three editions in Newton's lifetime; the last (fourth) edition appeared in 1730. Of great importance for the controversy with Leibnitz is the report drawn up by order of the Royal Society, published under the title *Commercium Epistolicum,* 1712, of which editions appeared in 1722 and 1725. (R. T. GL.)

NEWTON, JOHN (1725–1807), English divine, the friend of William Cowper, was born in London on July 24, 1725 (O.S.). His father, who for a long time was master of a ship in the Mediterranean trade, became in 1748 governor of York Fort, Hudson Bay, where he died in 1751. The lad had little education and served on his father's ship from 1737 to 1742; shortly afterwards he was impressed on board a man-of-war, the "Harwich," where he was made a midshipman. For an attempt to escape while his ship lay off Plymouth he was degraded, and treated with so much severity that he exchanged into an African trader. He made many voyages as mate and then as master on slave-trading ships, devoting his leisure to the improvement of his education. He left the sea in 1755, when he was appointed tide-surveyor at Liverpool. He began to study Greek and Hebrew, and in 1758 applied to the archbishop of York for ordination. This was refused him, but, having had the curacy of Olney offered to him in April 1764 he was ordained by the bishop of Lincoln. In October 1767 William Cowper settled in the parish. An intimate friendship sprang up between the two men, and they published together the *Olney Hymns* (1779). In 1779 Newton left Olney to become rector of St. Mary Woolnoth, London, where he laboured with unceasing diligence and great popularity until his death on Dec. 31, 1807.

Like Cowper, Newton held Calvinistic views, although his evangelical fervour allied him closely with the sentiments of Wesley and the Methodists. His fame rests on certain of the *Olney Hymns* (*e.g.,* "Glorious things of Thee are spoken," "How sweet the name of Jesus sounds," "One there is above all others"), remarkable for vigour, simplicity and directness of devotional utterance.

His prose works include an *Authentic Narrative of some Interesting and Remarkable Particulars in the Life of John Newton* (1764), *Omicron* (a series of letters on religion, 1774), and *Cardiphonia* (1781). His *Letters to a Wife* (1793) and *Letters to Rev. W. Bull*

(posthumous, 1847) illustrate the frankness with which he exposed his most intimate personal experiences. A *Life* of Newton by Richard Cecil was prefixed to a collected edition of his works (6 vols., 1808; 1 vol. 1827). *See* also T. Wright, *The Town of Cowper.*

NEWTON, JOHN (1823–1895), American general and engineer, was born in Norfolk, Va., on Aug. 24, 1823, and graduated at the U.S. Military Academy in 1842. From 1842 to 1861 he was engaged in coast defence constructions and waterway improvements; he was assistant professor of engineering in the Military Academy from 1843 to 1846, became a captain in 1856, and was chief engineer in the Utah expedition of 1857–58. He served in the Virginian campaign of 1861, and was promoted brigadier-general, U.S. volunteers. He distinguished himself in the Seven Days' battle and at Antietam, and after the battle of Fredericksburg was made major-general, U.S. volunteers. In the Chancellorsville campaign Newton took part in the storming of Marye's heights at Fredericksburg, on May 3, 1863, and at the battle of Gettysburg he was for a time in command of the I. Corps. Later in Sherman's army, as a division commander under Gen. Oliver O. Howard, he took part in the Atlanta campaign. For gallant conduct at Peach Tree creek he was made brevet brigadier-general, and at the close of the war was made brevet major-general, U.S. army. In 1884, he became chief of engineers, and held this position until his retirement in 1886. In 1887–88 he was commissioner of public works in New York, and from 1888 until his death on May 1, 1895, was president of the Panama railway.

See Gustavus Smith, *In Memoriam of General John Newton* (1895).

NEWTON, a city of Iowa, U.S.A., on Federal highway 32, 35 m. E. by N. of Des Moines; the county seat of Jasper county. It is served by the Minneapolis and St. Louis and the Rock Island railways, and by several motor bus lines. Pop. (1920) 6,627 (93% native white); 1928 local estimate 12,000. It is an important manufacturing centre, with an output in 1927 valued at $61,986,481. Three of the large washing-machine companies have their factories here, making nearly 400,000 machines in a year. Other distinctive products are trenching machines, show cases and advertising novelties. The city was founded in 1846 and incorporated in 1857.

NEWTON, a city of Kansas, U.S.A., 160 m. S.W. of Kansas City, in the fertile Arkansas river valley, on Federal highways 50S and 81, and served by the Missouri Pacific and the Santa Fe railway systems; the county seat of Harvey county. Pop. 9,781 in 1920 (84% native white); estimated locally at 10,500 in 1928. It is the seat of Bethel college, founded (1887) and still supported by the Mennonites; a division point on the Santa Fe, which furnishes employment to over 1,200 persons; a supply centre for the Fred Harvey system of hotels and restaurants along the Santa Fe route; and a shipping point for grain, fruit and other agricultural products. Its principal manufactures are flour (800,000 bbl. a year), threshing machines, brooms, ice, butter and poultry products. Newton was founded in 1871 and chartered in 1872. For several years, beginning in 1873, it was the focus of a large immigration of German Mennonites from Russia and various parts of the United States, who played an important part in building up the city and developing the surrounding country. Each family from Russia brought over a bushel or more of Crimean wheat for seed, from which was grown the first crop of hard winter wheat in Kansas. Since 1927 Newton has had a commission-manager form of government.

NEWTON, a city of Middlesex county, Massachusetts, U.S.A., 10 m. W. of Boston, on the southern bank of the Charles river and the Boston and Albany railroad. Pop. (1920) 46,054 (20% foreign-born white), 53,003 in 1925 (State census); 1928 local estimate 63,000. The city has 11 m. of river front and an area of 18 square miles. Within its boundaries are 11 villages and 34 parks, including parts of the metropolitan park system. It is primarily a residential suburb, but it has a variety of manufacturing industries, with an output in 1925 valued at $16,491,932. The assessed valuation for 1927 was $140,071,600. Newton was incorporated as a separate town in 1688 and received its present name in 1691. In 1873 it was chartered as a city. A monument marks the site of Waban's wigwam, where John Eliot, on Oct. 28, 1646, founded the first Indian church. At Newton Centre is the Newton Theological Institution, the first Baptist theological seminary established in America (1825).

NEWTON ABBOT, a town and seaport of Devonshire, England, 20 m. S. by W. of Exeter by G.W.R. Pop. (1921) 13,837. Newton Abbot was given to the abbot of Tor by the founder of the monastery (1196). Situated at the head of the Teign estuary, the town grew rapidly in the 19th century. The two parish churches, St. Mary's in Wolborough, and All Saints' in Highweek, are Perpendicular in style. St. Mary's contains a Norman font. Of the 14th century chapel of St. Leonard, only a tower survives. The Jacobean Forde House was visited by Charles I. and William of Orange, who first read his declaration to the people of England at Newton Abbot market-cross. The portion of Newton Abbot in the parish of Highweek was formerly a separate town known as Newton Bushel.

NEWTON-IN-MAKERFIELD or Newton-le-Willows, an urban district in Lancashire, England, 15½ m. W. of Manchester by the L.M.S. railway. Pop. (1921) 18,772. Newton-in-Makerfield gave its name in Saxon times to one of the hundreds of Lancashire. The barony was held by the Banastres from the Conquest to 1286 and passed successively to the Langtons, Fleetwoods and Leghs. The barons were not summoned to Parliament, and the title has fallen into disuse since the abolition of feudal tenures. The courts-baron and courts-leet are held twice annually. Near the town is a moated Elizabethan half-timbered house, and also an ancient barrow. The industrial establishments include foundries, printing and stationery works, paper mills and glass works. Coal abounds in the neighbourhood.

NEWTOWN, a market town of Montgomeryshire, Wales, situated on both banks of the Severn in a narrow portion of the valley near the eastern border of the county. Pop. of urban district of Newtown and Llanllwchaiarn (1921) 5,666. It now shares with Welshpool the privilege of being the administrative capital of the shire. We first hear of it as a Llan (church settlement) known as Llanfair Cedewain, in the 13th century. The presence of water-power was probably a factor in the origin and growth of the settlement at this time. The Norman Mortimers established here the market of their new territories on the border. In the 15th century the New Town received a municipal charter with a constitution modelled upon that of Hereford and Breteuil, but the corporation was abolished in the days of Charles I. Through the early 19th century the flannel factories of the town were of great importance but the flannel industry is no longer carried on, though there are still distributing warehouses. In the days of coach roads Newtown was a route centre, for the old road from Ludlow via Bishops' Castle and Kerry had to drop in to the Severn valley and so reached Newtown.

The old church, now in ruins, is superseded by the modern St. Mary's, with the font and rood-screen of the old building.

NEWTOWNARDS, a town of co. Down, Ireland, near the northern extremity of Strangford lough, on a branch of the Belfast and co. Down railway, 9½ m. E. of Belfast. Pop. (1921) 9,587. The town owes its origin to a Dominican monastery founded in 1244 by Walter de Burgh. It received a charter from James I. The ruined abbey of Moville, 1½ m. N.E., is attributed to St. Finian (*c.* 550). The town is sheltered by the Scrabo hills on the west and north.

NEW ULM, a city of southern Minnesota, U.S.A., on the south bank of the Minnesota river, 88 m. S.W. of Minneapolis; the county seat of Brown county. It is on Federal highway 14 and is served by the Chicago and North Western and the Minneapolis and St. Louis railways. Pop. (1920) 6,745 (22% foreign-born white); estimated locally at 8,000 in 1928. It is an important trading centre in a rich agricultural region, has a large milling industry and is the seat of Dr. Martin Luther college (1884). New Ulm was settled about 1853. During the Sioux uprising of 1862 it was twice attacked and almost destroyed.

NEW WASHINGTON, a municipality (with administration centre and 43 *barrios* or districts) of the province of Capiz, island of Panay, Philippine Islands, on the north coast about 17 m. west of Capiz, the provincial capital. Pop. (1918) 24,453.

The cultivation of rice, sugar, abacá and corn, and the breeding of cattle and horses are the principal industries. This place is the port for the municipality of Calivo, which is the market town for the Aklan valley. In 1918, it had 119 household industry establishments with output valued at 20,400 pesos. Nine of the 13 schools were public. The language spoken is a dialect of Bisayan.

NEW WESTMINSTER, city on the north bank of the Fraser river, 17 m. from the mouth, and third port of British Columbia. Pop. (1921) 14,495. Founded in 1859, it was the capital of British Columbia when the British possessions on the Pacific coast formed two colonies—*i.e.,* British Columbia (the mainland portion) and Vancouver island. The city has a fine harbour with 30 to 40 ft. of water, which is managed by a harbour commission and has a large trade, particularly in timber. New Westminster is a manufacturing centre, fish, fruit and vegetable canning, iron-founding, shingle and lumber mills and shipbuilding being among the industries; and fruit-growing, dairying and mining are carried on in the district. The city is on the Canadian Pacific, Great Northern and Canadian National railways, and is connected with Vancouver, 12 m. distant, by electric railway. The Columbian Methodist college is here.

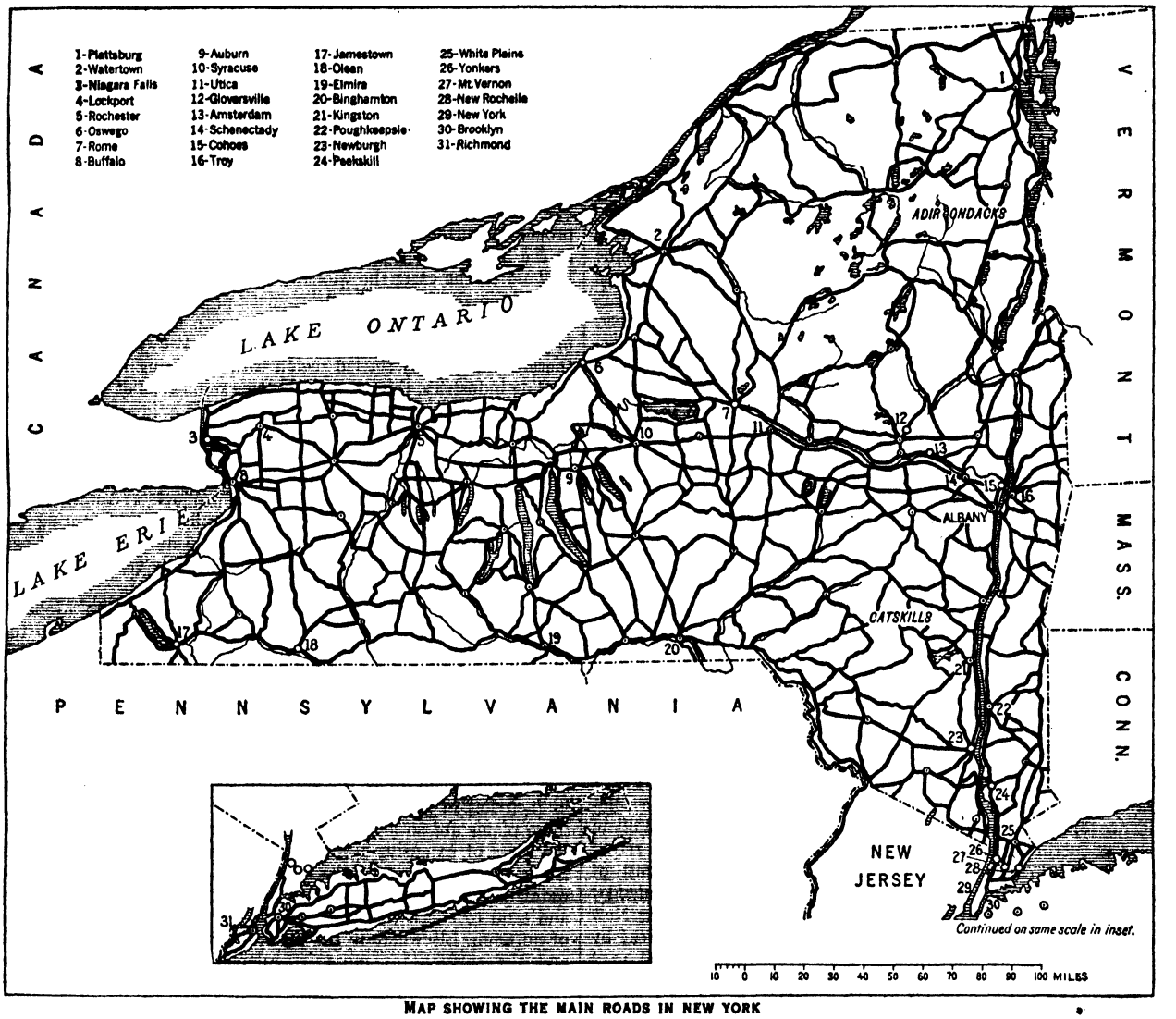
NEW YEAR'S DAY, the first day of the year. In the Gregorian calendar this date occurs twelve days earlier than in the Julian; thus New Year's Day is the English 13th of January.

The ancient Egyptians, Phoenicians and Persians began their year at the autumnal equinox (Sept. 21) and the Greeks until the 5th century B.C. at the winter solstice (Dec. 21). The ancient Romans once celebrated the beginning of the year on the 21st of December, but Caesar by the adoption of the Julian calendar postponed it to the 1st of January. The Jews have always reckoned their civil year from the first day of the month of Tishri (Sept. 6–Oct. 5), but their ecclesiastical year begins at the spring equinox (March 21). The 25th of March was the usual date among most Christian peoples in early mediaeval days. In Anglo-Saxon England, however, the 25th of December was New Year's Day. At the Norman Conquest owing, it is believed, to the coincidence of his coronation being arranged for that date, William the Conqueror ordered that the year should start on the 1st of January. But later England began her year with the rest of Christendom on the 25th of March. The Gregorian calendar (1582), which restored the 1st of January to its position as New Year's Day, was accepted by all Catholic countries at once; by Germany, Denmark and Sweden about 1700, but not until 1753 by England.

NEW YORK, one of the original 13 United States of America, situated between 40° 29′ 40″ and 45° 0′ 2″ N. and between 71° 51′ and 79° 45′ 54·4″ W. Although one of the smaller States in the Union, being 29th in area, New York ranks first in population and in wealth, and has won for itself the name "Empire State." Its northern boundary is, for the most part, formed by Lake Ontario and the St. Lawrence river, which separate it from the Province of Ontario, Canada; but north of the Adirondacks the boundary line leaves the St. Lawrence, extending in a due east direction to the lower end of Lake Champlain. Thus the boundary between New York and the Province of Quebec, Canada, is wholly artificial. Vermont, Massachusetts and Connecticut bound New York on the east; the Atlantic ocean, New Jersey and Pennsylvania on the south; and Pennsylvania, Lake Erie and the Niagara river on the west. The State has a triangular outline, with a breadth from east to west of 326·46 m. and from north to south, on the line of the Hudson, of 300 miles. In addition, it includes Long island and Staten island on the Atlantic coast. Its land area is 47,654 sq.m. and the area of the inland waters is 1,550 sq.m., giving a total area of 49,204 sq. miles. In addition to this, New York includes 3,140 sq.m. of water in Lakes Ontario and Erie.

Physical Features.—The most notable topographic feature is the roughly circular mountain area of north-eastern New York, known as the Adirondack mountains (*q.v.*). This is a very ancient mountain mass of crystalline rocks resembling more the Laurentian mountains of Canada than the Appalachians. Indeed, it is commonly considered to be an extension of the Canadian mountains. Parts of the crystalline area are worn down to a condition of low relief, but in the main mountain mass, although greatly worn, there are still elevations of truly mountainous proportions. The highest peak is Mt. Marcy (5,344 ft.), though associated with it are several other peaks with an elevation from 4,000 to 5,000 feet. Even the higher summits are worn to a rounded condition, and are therefore for the most part forest-covered up to the timber line which, on Mt. Marcy, is at an elevation of about 4,900 feet. From the crest of the dome of the Adirondacks proper the surface slopes in all directions to surrounding lowlands; to the St. Lawrence valley on the north; the Champlain-Hudson lowland on the east; the Mohawk valley on the south; and Lake Ontario on the west. The Adirondack area proper, and much of the surrounding ring of more recent rocks, is either too rugged, or has a soil too thin and rocky for extensive agriculture. It is therefore a sparsely settled region with lumbering for one of the leading industries, though there is some mining, as of iron. Owing to the varied and beautiful scenery, this is a favourite summer resort; the game of the forest and the fishing in the streams and in the multitude of lakes serve as further attractions. In the peripheral ring farming increases, especially dairying; and manufacturing industries connected with the products of forest, farms and mines are developed. These and other manufacturing industries are greatly aided by the extensive water-power furnished by the mountain streams which flow out radially from the central area.

South of the Adirondack region, and south of the Mohawk valley, rises a high-level plateau which extends westward to the Pennsylvania boundary. Here the rocks are all essentially horizontal and of the Palaeozoic age, mainly Devonian. This plateau province, which includes more than half the State, differs greatly from place to place. Its elevation decreases toward the north by a series of steps, the lowest elevation being on the Ontario plain which skirts the southern shore of Lake Ontario. Similar to this is a narrow plain along the southern shore of Lake Erie, which, in fact, lies in a shallow depression in this Erie plain. Both of these plains are so level, and have so fertile a soil that they are the seats of extensive agriculture, especially fruit raising, which is further encouraged by the influence of the large bodies of lake water that moderate the heat of summer and the cold of winter, and tend to check the late frosts of spring and the early frosts of autumn. Elsewhere in the plateau province the land is higher and the surface far more irregular, increasing in ruggedness toward both the south and the east. Elevations of 1,500 and 2,000 ft. are common in this region all the way from Chautauqua county in the extreme west to the Catskill mountains in the east; and in places the surface becomes so rugged as to simulate the features of mountains and locally to win the name of mountain. Valleys are deeply sunk in the plateau, the largest with bottom lands of sufficient width to give rise to strips of fertile farmland. The valley walls rise to undulating and often fairly level uplands, which are, in large part, cleared of forest. In the main they are grazing lands—the seat of important dairy and sheep-raising industries. This is the region of abandoned farm houses. Since the plateau region is a northward extension of the Alleghany plateau, which skirts the western base of the Appalachian mountains, it rises as the mountains are approached. Thus, in south-east New York, where the Appalachians enter the State, the plateau becomes much higher than in the west, reaching its culmination in the Catskills. Here, partly because of elevation, and partly because of the resistant nature of the Catskill sandstone, dissection has so sculptured the plateau as to carve it into a mountainous mass generally known as the Catskill mountains (*q.v.*). In this part of the plateau, summit elevations of from 3,000 to 4,000 ft. are common, the highest point being Slide mountain (4,205 ft.). Like the Adirondacks, this region is largely forest covered, and is a favourite summer resort; but it is far less a wilderness than the Adirondacks, and in places is cleared for farming, especially for pasturage. In the plateau province there are other areas known as mountains, of which the Helderberg mountains are the most conspicuous. This formation is really an escarpment facing



MAP SHOWING THE MAIN ROADS IN NEW YORK

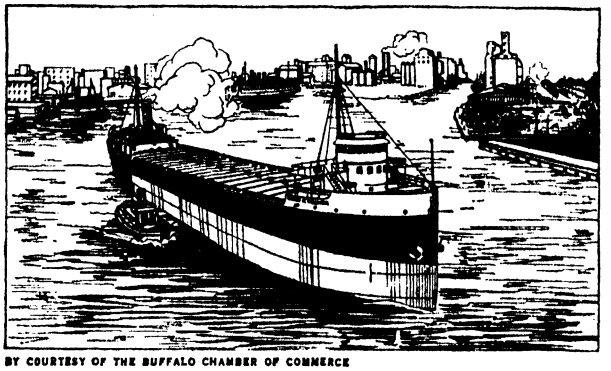
the lower Mohawk and the Hudson river, south of Albany, where there is a downward step in the plateau. The steeply rising face of the plateau here is due to the resistance of a durable layer of limestone, known as the Helderberg limestone. Of other lower escarpments the most notable is the Niagara which extends eastward from Canada, past Lewiston and Lockport—a downward step from the Erie to the Ontario plain.

South and south-east of the Catskills, although including only a small portion of the State, there are a number of different topographic features, due to the belts of different rock structure which cross the State from south-west to north-east. The most pronounced of these upfolded strata in New York form the low Shawangunk mountains, which descend, toward the south-east, to a lowland region of folded strata of limestone, slate and other rocks in Orange and Dutchess counties. This lowland area, due to the non-resistant character of the strata, is a continuation of the Great Valley of the Appalachians, and extends north-east into Vermont and south-west across New Jersey, Pennsylvania, Maryland and Virginia. It is bounded on its south-east side by the Highlands, a belt of ancient crystalline rocks which extends north-east into Connecticut and Massachusetts, and south-west into the highlands of New Jersey and thence to the Blue Ridge. South of the Highlands, in New Jersey, but extending to the very banks of the Hudson, is a belt of Triassic sandstone with intrusions of trap rock, which, on account of its peculiar columnar jointing, has developed a palisade structure—the famous Palisades of the lower Hudson. Long Island, though modified by extensive glacial deposits, may be considered a north-east extension of the coastal plains which attain a much more perfect development in New Jersey and the States farther south.

The entire surface of New York, with the exception of a very small area in the extreme west, in Chautauqua and Cattaraugus counties, was covered by the continental glacier. It broadened and deepened many of the valleys; rounded the hills; turned aside many streams, causing changes in drainage and giving rise to innumerable waterfalls and rapids; and it formed the thousands of lakes, large and small, which dot the surface. As the ice receded, it halted at various points, forming moraines and other glacial deposits. Thus the soil of almost the entire State has been derived by glacial action.

The drainage of New York finds its way to the sea in various directions. The St. Lawrence system receives most, mainly from short streams from the plateau province and from the Adirondacks. A small part of the State, in the west, drains to the Ohio, and thence, by way of the Mississippi, to the Gulf of Mexico; and a much larger area drains into the Susquehanna, entering the head of Chesapeake bay. A part of the Catskills, and the region farther south, drains into Delaware bay through the Delaware river. Thus New York is pre-eminently a divide region, sending its drainage, by various courses, into widely separated parts of the

ocean. Only the Hudson (*q.v.*) and a few streams in the extreme south have independent courses to the sea within the State itself. The Hudson is by far the most important river in the State, for, owing to the sinking of the land, which has admitted the tide as far as Troy, it is navigable for 151 m. from the sea. It is noted for its remarkable scenery, especially where it crosses the Highlands. Westward from Troy, the Mohawk valley furnishes a



BY COURTESY OF THE BUFFALO CHAMBER OF COMMERCE

ENTRANCE TO BUFFALO HARBOUR, ONE OF THE TEN GREATEST PORTS IN THE WORLD

Buffalo is situated at the foot of the Great Lakes, where navigation for the big lake carriers ends. It ranks fourth among United States ports and seventh among the industrial cities of America

highway which is followed by canal, railway and motor road. Thus there is here a gap, easily traversed, across the Appalachian mountains and plateaux to the more level and fertile plains beyond.

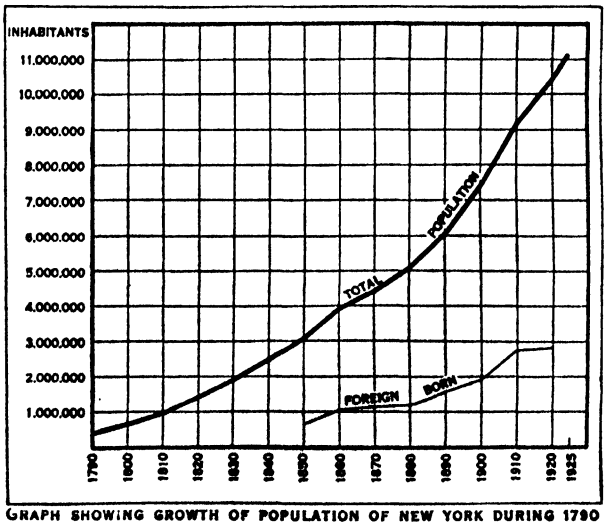
There are thousands of lakes and ponds in the State, most of them very small and all, even including Lakes Erie and Ontario, the result of glacial action. The largest lake apart from Erie and Ontario is the beautiful Lake Champlain, which lies on the eastern boundary. The largest lake entirely within the State is Lake George. In the central part of the State area is a series of peculiar elongated lakes, extending in a nearly north-south direction, known as the Finger lakes. The largest of these are Cayuga, Seneca, Keuka, Canandaigua, Owasco and Skaneateles. Here too is Watkins Glen acquired by the State for a park. In the extreme western part of the State is Chautauqua lake, beautifully situated in the plateau of western New York. New York is noted for its many falls and rapids, some of them of great beauty. Of these the largest is the cataract of Niagara, about 1 m. wide and 165 ft. high. The American fall is entirely within the State; but the Canadian boundary-line passes down the centre of the Horseshoe or Canadian fall. Other notable falls are those of the Genesee at Portage and at Rochester, the falls in the Cayuga and the Seneca valleys, Trenton falls, the Falls of Ticonderoga, and a multitude of falls and rapids in the Adirondack region.

New York has an extensive coast-line along the Great Lakes, 75 m. on Lake Erie and over 200 m. on Lake Ontario. The largest of the lake ports is at Buffalo at the head of Niagara river, where, owing to the Niagara cataract, lake boats from the west must transfer their goods to rail or canal. Buffalo lies at the lower end of natural lake navigation, though by the building of a ship canal in Canada, lake steamers can proceed into Lake Ontario and thence to the St. Lawrence. The ocean coast-line, though of limited extent, is by far the most important in the United States. The greater part of the sea-coast is on Long island—a low, sandy coast, the seat of numerous summer resorts and of some fishing. The mainland, opposite the western end of Long Island, is traversed by the lower Hudson and other channels—submerged valleys—which form a branching bay with several islands, the largest of which are Staten and Manhattan islands. This bay makes an excellent protected harbour, with an immense water front, at the outlet of the chief natural highway from the east to the interior of the country.

Climate.—In general the climate of New York is typical of that of northern United States, a climate of extremes, hot in summer, and cold in winter, and yet healthful, stimulating, and, on the whole, not disagreeable. The average mean annual temperature is not far from 45° though it varies from over 50° near New York city, and 48° near the Lake Erie shore, to less than 40° in the high Adirondacks. The average maximum summer heat is about 93°, a temperature of 100° being rarely reached. In the winter the temperature descends below zero during exceptionally cold spells. Most of the rivers and smaller lakes freeze over completely in winter. The average rainfall is between 40 and 45 in. but it is less than 30 in. in the Lake Champlain valley and over 55 in. north of New York city. In the Adirondack region the snowfall is heavy, the winter long and severe. In central New York it is not uncommon for snow to accumulate to the depth of 3 or 4 ft. and yet this is not persistent. About New York city, and on Long Island, the snow rarely exceeds 1 ft. in depth. The climate is variable owing to the frequent passage of cyclonic storms from the west and south-west, bringing warmer weather with rain and snow in winter, and causing days of great heat and humidity, with thunder-storms, in summer. About New York city, and on Long Island, the ocean softens the rigours of winter, and through the influence of cold surface waters off the coast, tempers the heat of summer.

Soil.—The soil is mostly glacial drift, but its depth and composition often vary greatly even within small areas. The most widely distributed soil, especially in the west half of the State, is mainly a clay which was formed by the glacial pulverizing of limestone and shale and is still forming from the decomposition of fragments of these substances. In the larger valleys and along the shores of lakes alluvium is mixed with this clay.

Population.—New York outstripped Pennsylvania in population in the first decade of the 19th century, and Virginia in the second decade, and since 1820 it has been the most populous State in the Union. The population at certain selected censuses was as follows: 340,120 in 1790; 1,372,812 in 1820; 3,880,735 in 1860; 5,082,871 in 1880; 7,268,894 in 1900; 9,113,614 in 1910; and 10,385,227 in 1920, a gain of 14% in the last decade. In 1928, according to United States census bureau estimate, the population was 11,550,000. The native white population in 1920 was 7,385,915, of whom 3,668,266 were of native parentage; 2,844,083 of foreign parentage; and 873,566 of mixed parentage. The foreign-born white population was 2,786,122, including 545,173 natives of Italy, 529,240 of Russia, 295,650 of Germany, 284,747 of Ireland, 247,519 of Poland, 151,172 of Austria, 135,305 of England and 111,974 of Canada. The negro population was 198,483, or only 1·9% of the total. The average population per square mile in 1920 was 217·9. The urban population (in cities with 2,500 or more inhabitants), was 82% in 1925 (State census). Of the State's population 52·6% lived in New York city. In 1925 there were 20 cities with a population over 30,000; those with a population exceeding 100,000 were:



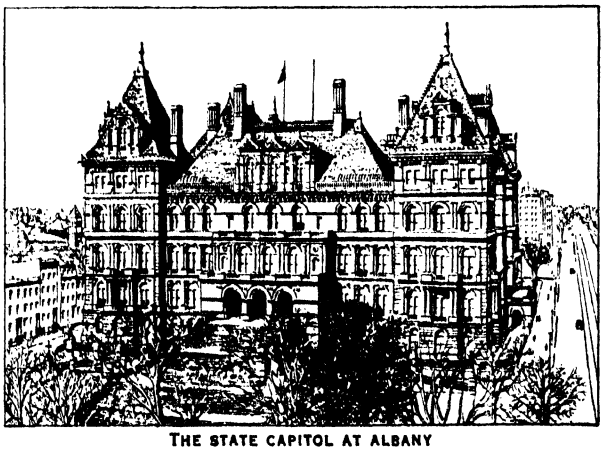
GRAPH SHOWING GROWTH OF POPULATION OF NEW YORK DURING 1790 TO 1925 (THE FIGURE FOR 1925 IS THAT OF THE STATE CENSUS)

	1925	1927 Estimate
New York	5,873,356	5,970,800
Bronx Borough	872,168	926,100
Brooklyn „	2,203,991	2,274,400
Manhattan „	1,945,029	1,814,600
Queens „	713,891	809,100
Richmond „	138,277	146,600
Buffalo	538,016	550,000
Rochester	316,786	324,500
Syracuse	182,003	197,000
Albany	117,820	119,500
Yonkers	113,647	118,800
Utica	101,604	103,400

Government.—Since becoming a State, New York has been governed under four constitutions, adopted in 1777, 1821, 1846 and 1894 respectively. A Constitutional Convention met and proposed a new Constitution in 1915, but it was rejected by the people. The present Constitution may be amended by a majority vote of the members of two successive legislatures and approval by the electorate.

Suffrage is bestowed on all citizens who have attained the age of 21 years and have been inhabitants of the State for one year, but for the protection of the ballot, citizenship for 90 days, residence in the county for four months, and in the election district for 30 days next preceding the election are required. An absentee voting law, subsequently amended, went into operation in 1919.

The executive and administrative department of New York State is functioning under a reorganization plan, authorized by a constitutional amendment approved in Nov. 1925, which became effective Jan. 1, 1927. Under this system there are 18 major departments to which have been allocated the duties of more than 180 commissions and bureaux. Only the governor, lieutenant governor, comptroller and attorney general are now elected. They are elected biennially (in even-numbered years). The office of secretary of State is now appointive; the duties of the State treasurer were transferred to the division of finance in the department of taxation and finance; while the duties of the State engineer and surveyor were transferred to the division of engineering in the department of public works. The 18 State departments now consist of the executive department, the departments of audit and control, of taxation and finance, of law, of state, of public works, of conservation, of agriculture and markets, of labour, of education, of health, of mental hygiene, of charities, of correction, of public service, of banking, of insurance and the department of civil service.



THE STATE CAPITOL AT ALBANY

The governor submits to the legislature, not later than Jan. 15 (except in the case of a newly elected governor, when the date is extended to Feb. 1), a budget containing a complete plan of proposed expenditures and estimated revenues for the next fiscal year. The budget also contains recommendations of the governor for new taxes, loans or other appropriate actions to meet any estimated deficiency for the ensuing fiscal year. A bill or item of an appropriation bill that has been vetoed by the governor can become a law only with the approval of two-thirds of the members elected to each house of the legislature. The salary of the governor and of the lieutenant governor, as fixed by an amendment of the Constitution in 1927, is $25,000 and $10,000 respectively. The legislative power is vested in a senate of 51 members elected biennially and an assembly of 150 members elected annually. Since 1846 both senators and assemblymen have been elected by single districts, and ever since the State Government was established they have been apportioned according to population, but the present Constitution limits the representation of New York city in the senate by declaring that no county shall have more than one-third of all the senators, nor any two adjoining counties more than one-half of them. The legislature meets in annual sessions, beginning on the first Wednesday in January. Money bills may originate in either house, but at the final vote on such a bill in either house three-fifths of the members elected to that house must be present and the yeas and nays must be recorded; bills entailing appropriations for local or private purposes must receive a two-thirds majority to pass. The legislature appoints the board of regents of the University of the State of New York. The judicial system comprises a supreme court of 112 justices, four appellate divisions of the same, a court of appeals, a court of claims and local courts. The highest judicial court in the State is not, as in most States of the Union, the supreme court, but the court of appeals. This court consists of a chief judge and six associate judges elected from the State at large for a term of 14 years. Its jurisdiction is limited, except where judgment is of death, to a review of questions of law. Vacancies are temporarily filled from among the justices of the supreme court by the governor. To expedite business, at the request of the court, the governor may designate not more than four justices of the supreme court to act temporarily as additional associate judges of the court of appeals. The salary of the chief judge is $22,500, of the associate judges $22,000 a year. The justices of the supreme court are elected for 14 years from the nine districts into which the State is divided. The jurisdiction of each justice extends over the entire State. Vacancies are temporarily filled by the governor. The supreme court has general jurisdiction in law and equity, including all actions both civil and criminal. The salary of the justices in the first district and in Kings county of the second district is $17,500 a year; in the remainder of the second district it is $16,300 a year; in the other districts it is $15,000 a year. The State is divided into four departments for each of which there is an appellate division consisting of seven justices in the first and second departments and five in each of the others. The justices and presiding justices are designated from among the justices of the supreme court by the governor; the presiding justice and a majority of the other justices of each department must be residents of the department. The court of claims consists of three judges, one presiding, appointed by the governor for a term of nine years. It has jurisdiction to hear and determine private claims against the State. New York city (*q.v.*) has an extensive judiciary system of its own.

Local Government.—The State is divided into 62 counties, each (unless wholly included in a city) having a county board of supervisors elected for two years, one from every town or city ward. This board has certain administrative and legislative powers. Other county officers are a county judge and a county surrogate elected for a term of six years, except in New York and Kings counties where the term is 14 years, a treasurer, a clerk, a district attorney, a sheriff and from one to four coroners elected for a term of three years. Cities are of three classes, those having a population of: (1) 175,000 or more; (2) between 50,000 and 175,000; and (3) less than 50,000. The classification is according to the latest State enumeration. All city elections are held in odd-numbered years. The organization of cities and villages is provided by the legislature, which may restrict their powers of taxation and of contracting debts and may fix salaries. Town (or township) Government in New York somewhat resembles that

of New England; the chief executive officer of the town is a supervisor, who represents his town in the county "board of supervisors."

Finances.—The aggregate valuation of real and personal property in 1926 was $22,924,821,772, and on this amount the State levied a tax of one mill on each dollar of valuation. From the State tax on property, for the year ending June 30, 1926 (based on the 1925 valuation and levy), a revenue of $28,460,191 was collected. The principal sources of State revenue, however, were various special taxes, the chief of which were corporation taxes ($48,805,970), inheritance taxes ($22,222,748), motor vehicle licences ($21,031,569), transfers of shares of stock ($15,801,074), personal income taxes ($14,405,068), mortgage taxes ($6,819,518), corporation organization tax ($3,573,795) and an insurance premium tax ($1,811,990). The chief expenditures during the same period were as follows: education, $48,437,223; construction, $35,836,335; curative, $20,166,005; State debt, $15,758,569; regulative, $13,525,053; charitable, $6,626,419; protective, $4,145,643; and administrative, $4,036,232. The total general revenue receipts for the year ending June 30, 1926 amounted to $175,251,768, and the disbursements to $173,192,425. On the same date the total debt of the State was $316,825,000. The sinking funds, however, amounted to $94,959,357, leaving a net State debt of $221,865,643. Of the total bonded debt, $152,120,000 were incurred for canals, $98,000,000 for highways, $41,400,000 for World War veterans' bonus, $12,000,000 for the State institutions building fund, $7,000,000 for forest preserves and $5,000,000 for the Palisades Interstate park.

In 1851 a State banking department was created, and at the head of this is a superintendent of banks appointed by the governor, with the consent of the senate. This office was continued under the reorganized administrative system which became effective on Jan. 1, 1927. The superintendent—or examiner appointed by him from a civil service list—is required to examine every bank, trust company and other financing institution within the State; national banks excepted. There were 1,144 commercial and savings banks operating within the State on June 30, 1926, and of this total 542 were national banks. These banks had resources of $17,373,910,000 or 26.9% of the total resources of all banks in the United States. Of the 61 banking institutions in the United States having deposits of $100,000,000 or more, 33 were in the State of New York.

Education.—The first school was established by the Dutch at New Amsterdam (now New York city) as early as 1633, and at the close of the Dutch period there was a free elementary school in nearly every settlement. King's college was founded in 1754; and from 1704 to 1776 the other schools were principally those maintained by the Society for the Propagation of the Gospel in Foreign Parts. Hardly any schools remained in operation throughout the Revolutionary War. In Jan. 1784 Governor George Clinton recommended legislation for the "revival and encouragement of seminaries of learning," with the result that the legislature passed an act establishing a State university of which Columbia college, formerly King's, was the "mother" portion. In 1787 a second university act was passed which restored to Columbia college the substance of its original charter and made the University of the State of New York an exclusive executive body with authority to incorporate new colleges and academies and to exercise over them the right of visitation. The functions of the university were extended to include an oversight of the professional, scientific and technical schools, the administration of laws relating to admission to the professions, the charge of the State library at Albany, the supervision of the local libraries, the custody of the State museum and the direction of all scientific work prosecuted by the State. This dual system was consolidated by the Educational Unification Act of 1904, in conformity with which the university regents have become a legislative body, subordinate to the State legislature, for determining the general educational policy of the State, and a commissioner of education acts as the chief executive, advisory and supervisory, officer of the whole educational system.

The regents of the university are chosen by the legislature, one retiring each year; and an act of 1909 requires that their number shall at all times be three more than the number of judicial districts. The commissioner of education is chosen by the regents and continues in office during their pleasure. The commissioner (subject to approval of the regents) appoints three assistant commissioners for higher, secondary and elementary education respectively. The elementary schools are under the general control of district superintendents. The number in a county ranges from five to eight. Any two or more adjoining school districts may unite to form a union free school district, and in any village or union free school district having a population of 4,500 or more the board of education may appoint a superintendent of schools. The total public school enrolment in 1925 was 1,951,160, and the total school expenditures were $283,506,175. Of the total public school enrolment, 1,641,511 were enrolled in the elementary and kindergarten schools and 309,649 were enrolled in secondary schools. The public schools of the State employed 64,542 teachers. In 1924 there were 125,289 pupils enrolled in the private and parochial schools within the State. School attendance has long been compulsory.

For the training of teachers the State maintains teachers colleges at Albany and Buffalo, and normal schools at Brockport, Cortland, Fredonia, Geneseo, New Paltz, Oneonta, Oswego, Plattsburg and Potsdam. The State controls professional and technical schools through the regents' examinations of candidates for admission to such schools and to the professions, determines the minimum requirements for admission to college by the regents' academic examinations, maintains the large State library and the valuable State museum, and occasionally makes a gift to a college or university for the purpose of maintaining courses in practical industry. Under such an arrangement are maintained the State college of Agriculture and the State college of Home Economics both connected with Cornell university (*q.v.*), at Ithaca; the State agricultural experiment station, at Geneva; the State school of Agriculture at St. Lawrence university, at Canton; the State school of Agriculture at Alfred university at Alfred; the State school of Agriculture at Morrisville; the State school of Agriculture at Cobleskill; the State school of Agriculture at Delhi; the State Institute of Applied Agriculture on Long Island at Farmingdale, L.I.; the State school of Forestry at Syracuse university, Syracuse; and the State school of Clay Work and Ceramics at Alfred university, at Alfred.

Among the institutions of higher learning in the State, besides Columbia university (*q.v.*) and Cornell university (*q.v.*), are: Union university at Schenectady; Hamilton college at Clinton; Colgate university at Hamilton; Hobart college at Geneva; Rensselaer Polytechnic Institute at Troy; New York university in New York city; Alfred university at Alfred; Fordham university in New York city; College of the City of New York; University of Rochester at Rochester; Polytechnic Institute of Brooklyn at Brooklyn; Niagara university at Niagara Falls; St. Lawrence university at Canton; St. Bonaventure's college at Alleghany; Long Island university at Brooklyn; Manhattan college at New York city; Vassar college (*q.v.*), at Poughkeepsie; St. John's college at Brooklyn; Canisius college at Buffalo; Syracuse university at Syracuse; Adelphi college at Brooklyn; Clarkson college of Technology at Potsdam; St. Rose's college at Albany; Wells college at Aurora; St. Francis college at Brooklyn; D'Youville college at Buffalo; St. Joseph's college for Women at Brooklyn; University of Buffalo at Buffalo; Elmira college at Elmira; Houghton college at Houghton; Keuka college at Keuka Park; College of New Rochelle at New Rochelle; College of Mount St. Vincent at New York city; College of the Sacred Heart at New York city; Cooper Union at New York city; Hunter college of the City of New York; Skidmore college at Saratoga Springs; Marymount college at Tarrytown; Russell Sage college at Troy; and Good Counsel college at White Plains. The United States Military academy (1802) is at West Point.

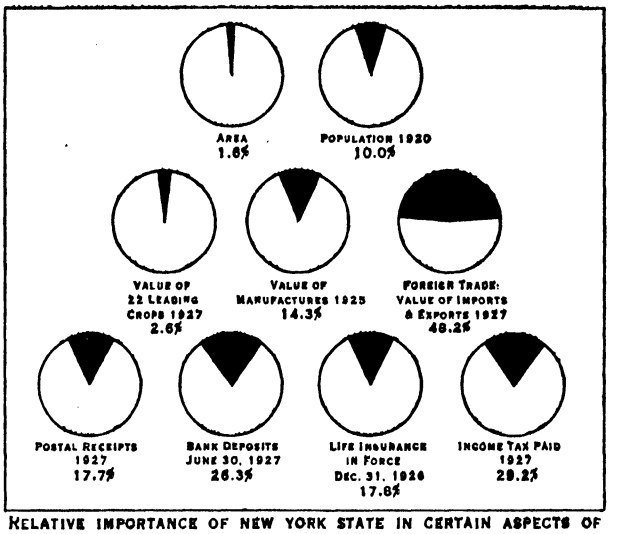
Charities and Corrections.—Penal institutions are under the supervision of the department of correction; schools for mental defectives and hospitals for the insane, except for the criminal insane, are under the supervision of the department of mental hygiene; and all other charitable and correctional institutions,

maintained wholly or in part by the State, except the State camp for veterans at Bath which is under the control of the executive department, are under the supervision of the department of charities. At the head of the department of corrections is the commissioner of correction, appointed by the governor with the consent of the senate for a term equal to that of the appointing governor. The division of parole consists of the commissioner of correction and of two members appointed by the governor for a term of five years. The duties of visitation and inspection are vested in the State commission of correction composed of seven members appointed by the governor for four years and the commissioner of correction. The institutions under this department in 1927 were as follows: Auburn prison at Auburn; Clinton prison at Dannemora; Great Meadow prison at Comstock; Sing Sing prison at Ossining; hospitals for the criminal insane at Dannemora and Matteawan; New York State reformatory at Elmira; the State training school at Albion; New York State reformatory for women at Bedford Hills; and the Institute for defective delinquents at Napanoch.

At the head of the department of mental hygiene is the commissioner of mental hygiene appointed by the governor with the consent of the senate. He holds office during the term of the appointing governor, and receives an annual salary of $12,000. In 1927 the department of mental hygiene had supervision over the following institutions: State schools for mental defectives at Newark, Rome, Syracuse, Letchworth Village (Thiells); the Craig Colony (epileptics) at Sonyea; and hospitals for the insane at Binghamton, Brooklyn, Buffalo, Central Islip, Helmuth (the Gowanda Homoeopathic), Wingdale (the Harlem Valley), Poughkeepsie, Kings Park, New York (the Manhattan), Middletown (Homoeopathic), Rochester, Ogdensburg (St. Lawrence), Utica and Willard.

The State department of charities consists of a State board of charities of 12 members, one member from each of the nine judicial districts and three additional members for the City of New York, all appointed by the governor with the consent of the senate for a term of eight years. The board appoints a chief executive officer with the title of director of State charities. In 1927 the State charitable institutions were as follows: State training school for girls, Hudson; State agricultural school, Industry; Thomas Indian school, Iroquois; State Woman's Relief Corps Home, Oxford; Hospital for Treatment of Incipient Pulmonary Tuberculosis, Raybrook; and Orthopaedic hospital for children, West Haverstraw. The House of Refuge, Randalls Island, is supported in part by the State and is subject to visitation by the department of charities. The State Institute for the Study of Malignant Diseases, located at Buffalo, is under the control of the department of health. Facilities for educating the blind are provided by the State school for the blind at Batavia and by private institutions where pupils are maintained on a *per caput* basis. The deaf and dumb are educated in private institutions, exclusively. Such pupils as are appointed by the commissioner of education, are maintained by the State. The condition of several of these State institutions was so unsatisfactory that in the spring of 1929 Governor Roosevelt advocated an issue of $50,000,000 bonds to provide for their renovation.

Agriculture and Stock-raising.—Although New York has lost in the competition with the Western States in the production of most of the grains, especially wheat, barley and Indian corn, and in the production of wool, mutton and pork, it has steadily progressed in the dairy business and continues to rank first as a hay producing State. It has made great advances, too, in the production of flowers, ornamental plants, nursery products, fruits, vegetables, poultry and eggs. The farm acreage in 1925 was 19,269,926 or 63·2% of the State's total land area. Of this total, 9,087,663 ac. were classified as crop land, and 8,290,335 ac. produced crops for harvest. The number of farms steadily decreased from 226,720 in 1900 to 188,754 in 1925. The average acreage per farm, in the latter year, was 102·1, a slight increase from the 99·9 ac. in 1900. More than 85% of the farms were operated by owners or part owners. The total value of all farm property decreased between 1920–25 from $1,908,483,201 to $1,706,929,770. Of the total acreage of all farm crops in 1926, 4,915,000 (59·3%) were of hay and 2,376,000 (28·6%) were of cereals. In the amount of the hay crop (6,469,000 tons) and in value ($96,708,000), New York ranked first among the States of the Union. In 1926 4,887,000 bu. of wheat; 23,450,000 bu. of Indian corn; 34,578,000 bu. of oats; 5,066,000 bu. of barley; 3,837,000 bu. of buckwheat; 434,000 bu. of rye; 1,145,000 bu. of dry beans; 29,016,000 bu. of potatoes; 2,200,000 lb. of tobacco; 40,375,000 bu. of apples; 2,300,000 bu. of peaches; 2,088,000 bu. of pears; 9,571,000 qt. of strawberries; and 106,700 tons of grapes were



RELATIVE IMPORTANCE OF NEW YORK STATE IN CERTAIN ASPECTS OF THE NATIONAL LIFE

produced. New York ranked first among the States in the production of buckwheat; second in the production of grapes and of commercial apples; third in the production of dry beans; and fourth in the production of potatoes and of pears. It has a larger acreage of vegetables than any other State of the Union. The State is a large producer of onions, green peas, green (snap) beans, cauliflower, celery, cabbages, carrots, lettuce, tomatoes, turnips, sweet corn, cucumbers, rhubarb and parsnips. The culture of small fruit and vegetables is widely distributed throughout the western half of the State and in the valley of the Hudson, and the greater part of Long Island under cultivation is devoted to market gardening, floriculture and nurseries. The total value of the fruit crop in 1926 was second only to that of California. The greater orchards are in the tier of counties bordering the south shore of Lake Ontario and in Dutchess and Ulster counties in the Hudson valley. Chautauqua county is the chief producer of grapes, but this fruit is grown extensively in the region west of Seneca lake in the vicinity of Lake Keuka, and in parts of the lower valley of the Hudson. The dairy business and the production of hay are especially prominent in the upper valley of the Hudson, in the rugged regions west of the Adirondack mountains and in the rugged portions of the counties in the southern half of the State. According to the 1925 census of agriculture, 741,983,208 gal. of milk were produced in 1924, and all dairy products had a value of $118,303,772. In 1924 there were 370,970 sheep shorn, and the wool production was 2,699,164 lb., worth $1,174,698. The egg production (87,167,262 dozen) and the number of chickens raised (14,940,905) had a total value of $48,453,508. The value of all live stock within the State, according to the 1925 census of agriculture, was $170,419,127.

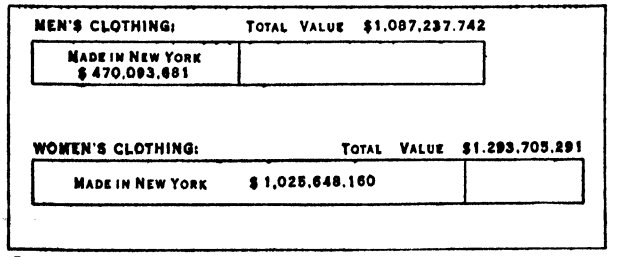
Minerals.—More than 30 mineral substances are obtained in commercial quantities from the mines, quarries and wells of New York, but, because of the absence of coal and of petroleum in large quantities, it produced only 2·05% of the mineral wealth of the United States in 1925. New York then ranked 14th among the States of the Union. The total value of the mineral products in 1925 was $102,035,557. The table below shows the principal products and their values in that year.

Product	Quantity	Value
		$
Clay products	..	24,550,751
Gypsum, short tons	1,731,254	16,219,966
Cement, barrels	8,534,089	14,967,642
Stone, short tons	8,869,200	12,358,238
Sand and gravel, short tons	14,966,616	9,750,433
Salt, short tons	2,053,970	7,133,244
Petroleum, barrels	1,695,000	6,270,000
Natural gas, M. cu. ft.	6,210,000	3,778,000
Iron ore, long tons	413,517	1,988,735
Lime, short tons	104,829	1,030,960
Talc, " "	85,109	993,913
Zinc, " "	5,158	784,016

New York ranked first among the States in the production of gypsum, talc, sand and gravel, emery, abrasive garnet and magnesium; second in salt; fourth in cement; and fifth in clay products.

Manufactures.—The establishment of a great highway of commerce through the State from New York city to Buffalo by the construction of the Erie canal, opened in 1825, and later by the building of railways along the line of the water route, made the State's manufactures quite independent of its own natural resources. Thus it happens that from Buffalo to New York city there is a chain of busy manufacturing centres; but away from the great natural route of commerce New York is not especially noteworthy either for its density of population or for extensive manufacturing and commerce.

New York State has ranked first in the Union in the value of its manufactures since 1830, and this value rose to $8,968,547,839 in 1925. The value ($5,324,413,612) of the products of the manufactures of New York city alone represented approximately 60% of the total. The manufacture of clothing, begun in New York city about 1835, was not only the city's chief product but was also the principal product of the State. The value of the clothing produced within New York city was $1,388,305,548 in 1925. New York city, also, ranked first among the American cities in printing and publishing ($463,838,101); fur goods ($194,803,213); millinery and lace goods ($194,494,559); bakery products ($181,173,270); knit goods ($86,212,313); jewellery ($57,415,232); and confectionery and ice cream ($51,239,959). Buffalo, the city second in manufactures, shares largely with New York city the business of slaughtering and meat-packing, the refining and smelting of copper, and the manufacture of foundry and machine-shop products. It is the principal centre for the manufacture of flour and grain-mill products and for the motor vehicle industry. Rochester, the city third in manufactures, was first among the cities of the United States in the manufacture of photographic materials and apparatus and optical instruments. Niagara Falls and New York city manufactured a large part of the chemicals. Cities, other than those already mentioned, with products valued at more than $100,000,000 in 1925 were: Syracuse, Yonkers and Schenectady.



PROPORTION OF TOTAL U.S. OUTPUT OF MEN'S CLOTHING AND WOMEN'S CLOTHING MANUFACTURED IN NEW YORK, 1925

The number of industrial establishments, which reported products over $5,000 in 1925, was 33,393. The 1,066,202 wage-earners in 1925 received $1,533,893,390 in wages. The industries with products valued at more than $100,000,000 in 1925 were: clothing, $1,495,741,841; printing and publishing, $548,304,377; foundry and machine shop, $257,655,999; bread and bakery products, $248,166,437; furniture, $155,826,177; motor vehicles, $155,647,161; flour and grain mill products, $151,599,561; paper and wood pulp, $141,396,762; electrical machinery, $239,262,117; slaughtering and meat packing, $233,901,277; fur goods, $197,437,970; millinery and lace goods, $197,324,664; boots and shoes, $191,375,288; knit goods, $183,233,931; sugar refining, $164,515,037; chemicals, $132,658,955; cigars and cigarettes, $122,613,390; silk, $112,156,313; food preparations, $111,134,193; steel works and rolling mills, $107,059,150; motor vehicle bodies and parts, $105,798,733; gas, manufactured, $102,859,050.

Transport and Commerce.—From the very beginning of the occupation of New York by Europeans, commerce was much encouraged by the natural water-courses. The Erie canal was opened to boats of about 75 tons burden in 1825. The Champlain canal, connecting the Erie with Lake Champlain, was completed in 1823. The Oswego canal, connecting the Erie with Lake Ontario, was begun in 1825 and completed in 1828. Several other tributary canals were constructed during this period, and between 1836 and 1862 the Erie was sufficiently enlarged to accommodate boats of 240 tons burden.

The first railway in the State and the second in operation in the United States was the Mohawk and Hudson, opened from Albany to Schenectady in 1831. The first great trunk line in the country was that of the Erie railway, opened from Piermont, on the Hudson river, to Dunkirk, on Lake Erie, in 1853. The New York Central railway, nearly parallel with the water route from New York city to Buffalo, was formed by the union, in 1869, of the New York Central with the Hudson River railway. In 1886 the New York Central Railroad company leased the West Shore railway for a term of 475 years, and this company operates another parallel line from Syracuse to Buffalo, a line following closely the entire north border of the State, and several cross lines. Other important railways are the Lehigh Valley, the Delaware, Lackawanna and Western, and the Pennsylvania in the central and western sections, the Delaware and Hudson, the Rutland, the Boston and Maine, the Central New England and the New York, Ontario and Western in the east, and the Long Island on Long Island. In 1925 the operated steam railway mileage in New York was 8,373. In the same year there were 5,428 m. of electric railways operated by 86 companies. The road mileage in the State highway system on Dec. 31, 1926 was 14,068, of which 9,854 were surfaced. In the mileage of surfaced road, New York ranked first among the States. In competition with the railways, traffic on the existing canals suffered a marked decline. As this decline was accompanied with a considerable decrease in the proportion of the country's export which passed through the port of New York, interest in the canals revived, and in 1903 the electorate of the State authorized the issue of bonds to the amount of $101,000,000 for the purpose of increasing the capacity of the Erie, the Champlain and the Oswego canals, to make each navigable to barges of 1,000 tons burden.

The project adopted by the State for the enlargement of the Erie provided for a new route up the Hudson from Troy to Waterford and then to the Mohawk river above the Cohoes falls. The improvement projects were completed in 1918. In addition to the canalized rivers and lakes (382 m.) the State has a canal mileage of 525. Of the total tonnage (2,369,367) moved on the State's barge canals in 1926, 1,935,278 tons were on the Erie division. The water-borne commerce of New York State in 1926 consisted of 15,584,288 cargo tons in imports and 12,242,446 cargo tons in exports. Of this total, the Great Lakes contributed 3,993,220 tons in imports and 1,691,207 tons in exports. The imports to the port of New York decreased from $2,892,621,000 in 1920 to $2,224,964,000 in 1926, while the exports decreased in value from $3,283,873,000 to $1,662,538,000. Buffalo was by far the most important of the Great Lakes ports.

HISTORY

The aboriginal inhabitants of New York had an important influence on its colonial history. Within its limits from the upper Hudson westward to the Genesee river was the home of that powerful confederacy of Indian tribes the Mohawks, Oneidas, Onondagas, Cayugas and Senecas, known to the French as the

Iroquois and to the English as the Five (later Six) Nations. When supplied with firearms by Europeans they reduced a number of other tribes to subjection and extended their dominion over most of the territory from the St. Lawrence to the Tennessee and from the Atlantic to the Mississippi. They were at the height of their power about 1700. Of much less influence in New York were several Algonkin tribes in the lower valley of the Hudson and along the sea coast.

Early Dutch Traders and Colonists.—New York bay and the Hudson river were discovered by Giovanni da Verrazano in 1524, and were probably seen by Esteban Gomez in 1525; for many years following, French vessels occasionally ascended the Hudson to trade with the Indians. The history of New York really begins, however, in 1609. In July of that year Samuel de Champlain discovered the lake which bears his name and on its shores led his Algonkin Indian allies against the Iroquois, thus provoking against his countrymen the hostility of a people who for years were to hold the balance of power between the English and the French in America. On Sept. 3 Henry Hudson, in the employ of the Dutch East India company, entered New York bay in the "Half Moon" in search of the "northwest passage." He conceived that a vast trade with the Iroquois for furs might be established. His report aroused great interest in Holland, and the United Netherlands, whose independence had been acknowledged in the spring, claimed the newly discovered country. In 1610 a vessel was despatched with merchandise suitable for traffic with the Indians, the voyage resulted in profit, and a lucrative trade in peltries sprang up. Early in 1614 Adriaen Block explored Long Island sound and discovered Block island. The merchants of Amsterdam and Hoorn soon formed themselves into the New Netherland company, and on Oct. 10, 1614, received from the States-General a three years' monopoly of the Dutch fur trade in New Netherland; *i.e.*, that part of America between New France and Virginia or between latitudes 40° and 45° north. Late in the same year or early in 1615 a stockaded trading post called Ft. Nassau was erected on Castle Island, now within the limits of Albany, and a few huts were erected about this time or earlier on the southern extremity of Manhattan island; but no effort at colonization was as yet made. On the expiration of the charter of the New Netherland company (1618) the States-General refused to grant a renewal, and only private ventures were authorized until 1621. When the West India company was first chartered for a term of 24 years, to it was given a monopoly of Dutch trade with the whole American coast, authorized to plant colonies and to govern them under a very limited supervision of the States-General. In June, 1623, however, New Netherland was formally erected into a province and the management of its affairs assigned to the chamber of Amsterdam, which in March, 1624, despatched the "New Netherland," with the first permanent colonists (30 families mostly Walloon), under Cornelis Jacobson Mey, the first governor or director of the colony. Arriving at Manhattan early in May, a few of the men remained there, but more than one-half of the families proceeded up the Hudson to Ft. Orange, and there founded what is now Albany. Three more vessels arrived in 1625, and when in that year Mey was succeeded as director by William Verhulst the colony had a population of 200 or more. The Government of the province was fully established in 1626 and was vested mainly in a director general and council. Peter Minuit, the first director general, arrived with more colonists in May, 1626, and soon afterwards Manhattan island was bought from the Indians, Ft. Amsterdam was erected at its lower end, and the settlement here was made the seat of Government.

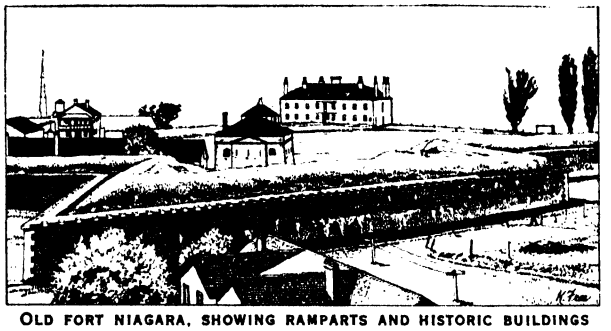
In 1629, mainly to promote agriculture, the company issued its famous charter of privileges and exemptions, which provided that any member might have anywhere in New Netherland except on Manhattan island his choice of a tract of unoccupied land extending 16 m. along the seacoast or one side of a navigable river, or 8 m. along the river on both sides "and so far into the country as the situation of the occupyers will permit" by purchasing the same from the Indians and planting upon it a colony of 50 persons, within four years from the beginning of the undertaking, and that any private person might with the approval of the director general and council take up as much land as he should be able to improve. The founder of a colony was styled a *patroon*, and, although the colonists were bound to him only by a voluntary contract for specified terms, the relations between them and the patroon during the continuance of the contract were in several important respects similar to those under the feudal system between the lord of a manor and his vassals. The single colony of Rensselaerwyck established by Kilian van Rensselaer on both sides of the Hudson and extending in all directions from Ft. Orange (Albany), was the only one that prospered under the patroon system. In the meantime the patroons had claimed unrestricted rights of trade within the boundaries of their estates. These were stoutly denied by the company. Director-general Minuit was recalled in 1632 on the ground that he had been partial to the patroons; and Wouter van Twiller, who arrived in 1633, endeavoured to promote only the selfish commercial policy of the company; at the close of his administration (1637) the affairs of the province were in a ruinous condition.

William Kieft was appointed director-general late in 1637, and in 1638 the company abandoned its monopoly of trade in New Netherland and gave notice that all inhabitants of the United Provinces, and of friendly countries, might trade there subject to an import duty of 10%, an export duty of 15%, and to the requirement that the goods should be carried in the company's ships. At the same time the director-general was instructed to issue to any immigrant applying for land a patent for as large a farm as he required for cultivation and pasturage, to be free of all charges for ten years and thereafter subject only to a quit-rent of one-tenth of the produce. Two years later, by a revision of the charter of privileges and exemptions, the prohibition on manufactures was abolished, the privileges of the original charter with respect to patroons were extended to "all good inhabitants of the Netherlands," and the estate of a patroon was limited to four miles along the coast or a navigable river and eight miles back into the country. These inducements encouraged immigration not only from the Fatherland but from New England and Virginia. But the freedom of trade promoted dangerous relations with the Indians, and an attempt of Kieft to collect a tribute from the Algonkin tribes in the vicinity of Manhattan island and other indiscretions of this officer provoked Indian hostilities (1641–45), during which most of the outlying settlements were laid waste.

Out of this warfare arose an organized movement for a Government in which the colonists should have a voice. In Aug. 1641, Kieft called an assembly of the heads of families in the neighbourhood of Ft. Amsterdam to consider the question of peace or war. The assembly chose a board of 12 men to represent it, and a few months later this board demanded certain reforms, but Kieft later denied its authority to exact promises from him, and dissolved it. At another crisis in 1643, he was obliged to call a second assembly of the people. This time a board of eight men was chosen to confer with him. It denied his right to levy certain war taxes, and when it had in vain protested to him against his arbitrary measures it sent a petition, in 1644, to the States-General for his recall, and this was granted. Peter Stuyvesant (*q.v.*), his successor, arrived at Ft. Amsterdam in May, 1647. Under his rule there was a return of prosperity; from 1653 to 1664 the population of the province increased from 2,000 to 10,000. Stuyvesant was, however, extremely arbitrary. Although he permitted the existence of a board of nine men to act as "tribunes" for the people he treated it with increasing contempt.

English Occupation.—Notwithstanding the good claim to their province which the Dutch had established by discovery and occupancy, the Government of Great Britain, basing its claim to the same territory on Cabot's discovery (1498), the patent to the London and Plymouth companies (1606), and the patent to the Council for New England (1620), contended that the Dutch were intruders, and by the Treaty of Hartford (1650), the commissioners of the United Colonies of New England forced Stuyvesant to agree to a boundary which on the mainland roughly determined the present boundary between New York and Connecticut and on Long Island extended from Oyster bay to the Atlantic ocean. In

1653, the Dutch, fearing an English attack, built a wall, from which the present Wall street was named, across Manhattan island at what was then the northern limits of New Amsterdam. In March 1664, Charles II. formally erected into a province the whole territory from the west side of the Connecticut river to the east side of Delaware bay together with the whole of Long Island and granted it to his brother James, the duke of York and



OLD FORT NIAGARA, SHOWING RAMPARTS AND HISTORIC BUILDINGS
Fort Niagara, located a short distance from Niagara Falls, was a gateway to the West in frontier days. In the right background is the French castle, built in 1726. The bakehouse, beside it, was erected by the English in 1762. In the foreground is the English blockhouse, dating from 1771–73

Albany, as its lord proprietor. The duke appointed Col. Richard Nicolls governor and placed him in command of an expedition to effect its conquest. Nicolls won over the burgomaster of New Amsterdam and other prominent citizens by the favourable terms which he offered, and Stuyvesant was forced, without fighting, into a formal surrender on Sept. 8. The duke's authority was proclaimed and New Netherland became New York. Among numerous changes from Dutch to English names was that from Ft. Orange to Ft. Albany. A treaty of alliance with the Mohawks and Senecas procured for the English the same friendly relations with the Iroquois that the Dutch had enjoyed. The transition from Dutch to English institutions was effected gradually and the private rights of the Dutch were carefully preserved. The introduction of English institutions into settlements wholly or largely English was begun in 1665 by the erection of Long Island, Staten Island and Westchester into an English county under the name of Yorkshire, and by putting into operation in that county a code of laws known as the "Duke's Laws." It gave the freeholders of each town a voice in the government of their town by permitting them to elect a board of eight overseers and a constable. The board sat as a court for the trial of small causes. Nicolls resigned the governorship in 1668, but his successor, Francis Lovelace, continued his policy—autocratic government, arbitrary in form but mild in practice, and progressive in the matter of religious toleration.

In Aug. 1673, Holland and England being at war, a Dutch fleet surprised New York, captured the city, restored Dutch authority and the names of New Netherland and New Orange. But by the Treaty of Westminster, Feb. 1674, the Dutch title to the province was finally extinguished, and in November the English again took possession. In 1675 Governor Andros established at Albany a commission for Indian affairs which long rendered important service in preserving the English-Iroquois alliance. The imperious manner of Andros made him many enemies. Some of them preferred charges against him relating to his administration of the revenue. He was called to England in 1681 to answer these, and during his absence the demand for a representative assembly was accompanied by a refusal to pay the customs duties and so much other insubordination that the duke appointed Col. Thomas Dongan to succeed Andros, and instructed him to call the desired assembly. It met at Ft. James in the City of New York on Oct. 17, 1683, was in session for about three weeks, and passed 15 acts. The first, styled a charter of liberties and privileges, required that an assembly elected by the freeholders and freemen should be called at least once every three years; vested all legislative authority in the governor, council and assembly; forbade the imposition of any taxes without the consent of the assembly; and provided for religious liberty and trial by jury.

The king, in an attempt to strengthen the imperial control over New England as well as to erect a strong barrier against the French, in 1688 consolidated New York and New Jersey with the New England colonies into the Dominion of New England and placed it under the viceregal authority of Sir Edmund Andros as governor-general. The news of the English revolution of 1688, however, caused an uprising in Boston, and in April 1689 Andros was seized and imprisoned. The fall of Andros encouraged a number of the restless spirits, especially in the City of New York and on Long Island to take matters into their own hands. They found a leader in a German merchant, Jacob Leisler (*q.v.*). On May 31, 1689, the militia captains seized Ft. James and Leisler assumed command later. In the following month Nicholson, the lieutenant-governor, deserted his post and sailed for England, and Leisler easily gained possession of the city. He called an assembly which conferred upon him the powers of a dictator. Some time after a copy of the order of the new monarchs (William and Mary) to continue all Protestants in their offices in the colonies had been received, Leisler falsely announced that he had received a commission as lieutenant-governor. Albany defied his usurped authority until his recognition was necessary to present a united front against the French and their Indian allies, who, in Feb. 1690, had surprised and burned Schenectady. French attacks had at the same time been directed against New England, and to meet the dangerous situation Leisler performed the one statesmanlike act of his public career, notable in American history as the first step toward the union of the colonies. At his call, delegates from Massachusetts, Plymouth, Connecticut and Maryland met in New York city with delegates from New York on May 1, 1690 to consider concerted action against the enemy, although the expedition which they sent out was a failure. Leisler had proclaimed the new monarchs of Great Britain and had declared that it was his purpose only to protect the province and the Protestant religion until the arrival of a governor appointed by them, but he was enraged when he learned that he had been ignored and that Col. Henry Sloughter had been appointed as the new governor. Leisler refused to give up the fort, and after some bloodshed was arrested and executed. The execution was regarded by many as an act of revenge, and for many years the province was rent by the Leislerian and anti-Leislerian factions.

Governor Sloughter, as his commission directed, re-established in 1691 the assembly which James II. had abolished in 1686, and throughout the remainder of the colonial era the history of the province relates chiefly to the rise of popular Government and the defence of the northern frontier. Until Gov. Cornbury's administration (1702–08) both the Leislerians and the anti-Leislerians repeatedly bid for the governor's favour by supporting his measures instead of contending for popular rights. But Cornbury's embezzlement of £1,500, appropriated for fortifying the Narrows connecting upper and lower New York bay, united the factions against him and started the assembly in the important contest which ended in the establishment of its control over the public purse. In 1706 it won the right to appoint its own treasurer to care for money appropriated for extraordinary purposes, and in 1737 the custom of continued revenue acts was replaced by annual appropriations.

The first newspaper of New York, the *New York Gazette*, was established in 1725 by William Bradford, as a semi-official organ of the Administration. In 1733 a popular organ, the *New York Weekly Journal*, was established under John Peter Zenger (1697–1746), and in 1735 both the freedom of the press and a great advance towards the independence of the judiciary were the outcome of a famous libel suit against Zenger. He was arrested for libel in Nov. 1734 for printing criticisms of the administration. When his counsel, James Alexander (1690–1756) and William Smith (1679–1769), took exception to the commissions of the chief justice, James de Lancey (1703–60) and one of his associates, because by these commissions the justices had been appointed "during pleasure" instead of "during good behaviour," the chief justice disbarred them. Their places, however, were taken by Andrew Hamilton, speaker of the assembly of Pennsyl-

vania and a lawyer of great reputation in the English colonies. The jury quickly agreed on a verdict of not guilty, and the acquittal was greeted by the populace with shouts of triumph. The further independence of judges became a leading issue in 1761 when the assembly insisted that they should be appointed during good behaviour, and refused to pay the salaries of those appointed during pleasure; but the home Government met this refusal by ordering that they be paid out of the quit-rents.

The Defence of the Northern Frontier was a heavy burden to New York, but by its problems the growth of the union of the colonies was promoted. The main effort of the French, however, was, by diplomacy, to destroy the English-Iroquois alliance. To counteract the influence of French priests dwelling among the Iroquois, the English, in 1701, prevailed upon the chiefs to deed their territory, said to be 800 m. in length and 400 m. in breadth, to the king of England. The English, also, frequently distributed presents. But the success of the French at the close of the 17th century and the early portion of the 18th was prevented only by the ceaseless efforts of Peter Schuyler (1657–1724) whose personal influence was for years dominant among all the Iroquois except the Senecas. When they had assumed a neutral attitude, he persuaded a number of them to join troops from New York, New Jersey and Connecticut in the unsuccessful expeditions of 1709 and 1711 against the French at Montreal. In order to regulate the trade with the Iroquois, Governor Burnet established a trading post at Oswego in 1722 and fortified it in 1727 and thereby placed the Iroquois in the desirable position of middlemen in a profitable fur trade with the "Far Indians." In King George's war New York was left alone to protect its own frontier and while the assembly was wrangling with Governor Clinton for the control of expenditures the French and their Indians were burning farm houses, attacking Saratoga (Nov. 17, 1745), and greatly endangering the English-Iroquois alliance. A reconciliation was effected, however, by Col. (later Sir William) Johnson (*q.v.*), a former agent of Indian affairs. Largely to secure the co-operation of the Iroquois the home Government itself now called the most important assembly of colonial deputies that had yet gathered to meet at Albany (*q.v.*). This body, consisting of 23 commissioners and representing seven colonies, met in June 1754, and, besides negotiating successfully with the Iroquois, it adopted, with some modifications, a plan of colonial union prepared by Benjamin Franklin; the plan was not approved, however, either by the home Government or by any of the colonies. In the first year of the French and Indian war (1755) Maj.-Gen. William Johnson defeated a French and Indian force under Baron Dieskau in the battle of Lake George. In Aug. 1756 Montcalm took Oswego from the English and destroyed it, and in 1757 he captured Ft. William Henry; but in the latter year the elder Pitt assumed control of affairs in England, and his aggressive, clear-sighted policy turned the tide of war in England's favour. Victory followed victory. Ticonderoga, Crown Point and Niagara were wrested from the French and New York was freed of its foes.

The Revolutionary War.—England's attempt to make the colonies pay the expenses of the war by means of the stamp tax thoroughly aroused the opposition of commercial New York, already chafing under the hardships imposed by the Navigation Acts and burdened with a war debt of its own exceeding £300,000. The assembly authorized its committee, which had been appointed to correspond with the New York agent in London, to correspond also with the committees in the other colonies and this committee represented New York in the Stamp Act Congress, which met in New York city in Oct. 1765. In the series of events which followed important changes were made in party lines. The court party and propertied classes became the Loyalist Party, standing for law as against rebellion, monarchy and the union of the empire as against republicanism; the popular party became the Patriot Party, determined to stand on its rights at any cost. The Stamp Act was repealed in March 1766, but the Townshend acts were met in New York by fresh outbursts of the Sons of Liberty and, by an association of merchants, the members of which pledged themselves not to import anything from England until the duties were repealed. New York had also been requested to provide certain supplies for the British troops quartered in the city. This the assembly refused to do but parliament answered (1767) by forbidding it to do any other business until it complied. It was under these conditions that the Loyalists, in the elections of 1768 and 1769, gained control of the assembly and in the latter year passed an act granting the soldiers' supplies. The moderate Loyalists joined in the election of delegates to the first Continental Congress; but the great body of Loyalists in New York strongly disapproved of the "dangerous and extravagant" measures adopted by that body, and the assembly, in Jan. 1775, refused to approve its acts or choose delegates to the second Continental Congress. The Patriots met this refusal by calling a provincial convention to choose the delegates. Scarcely had they done this when news of the encounter at Lexington produced a strong reaction in their favour, and in May 1775 they called a Provincial Congress which usurped the powers of the assembly. Still, conditions were such in New York that a fight for independence was not to be lightly considered. In the south the chief city was exposed to the British fleet, and the northern border was exposed to attack from the British and their Iroquois allies. In various sections, too, considerable numbers of Loyalists were determined to aid the British. When, in June 1776, a vote on the Declaration of Independence was pending in the Continental Congress, the New York Provincial Congress refused to instruct its delegates in the matter; but a newly elected Provincial Congress, influenced by a Loyalist plot against the life of Washington, adopted the Declaration when it met, July 9.

It was a settled point of British military policy throughout the war to hold New York city, and from it, as a base, to establish a line of fortified posts along the Hudson by means of which communication might be maintained with another base on Lake Champlain. Such a scheme, if successfully carried out, would have driven a wedge into the line of colonial defence and cut off communication between New England and the southern colonies. A few days after the fight at Lexington and Concord, Connecticut authorized an expedition under Ethan Allen which surprised and captured Ticonderoga and Crown Point. In the following year (1776) the British began their offensive operations for the control of the Hudson. Sir William Howe, with a force of British and Loyalists vastly superior in equipment and numbers to Washington's untrained militia, landed in July on Staten Island and late in August defeated Washington at the battle of Long Island within the present limits of Brooklyn borough. In the following month Washington withdrew from New York city which the British entered and held until the close of the war. Washington prepared to withstand the British behind fortifications on Harlem Heights, but discovering that Howe was attempting to outflank him by landing troops in the rear he retreated to the mainland, leaving only a garrison at Ft. Washington, and established a line of fortified camps on the hills overlooking the Bronx river as far as White Plains. This brought on the battle of White Plains late in October, in which Howe gained no advantage; and from here both armies withdrew into New Jersey, the British capturing Ft. Washington on the way. In 1777 General John Burgoyne succeeded in taking Ticonderoga, but in the swampy forests southward from Lake Champlain he fought his way against heavy odds, and in the middle of October his campaign culminated disastrously in his surrender at Saratoga. Col. Barry St. Leger led an auxiliary expedition from Oswego against Ft. Stanwix on the upper Mohawk, and on Aug. 6 he fought at Oriskany one of the most bloody battles of the war, but a few days later, deserted by his terror-stricken Indian allies, he hastened back to Montreal. Early in October Howe sent an expedition up the Hudson under the command of Sir Henry Clinton. Clinton met with little difficulty from the principal American defences of the Highlands, consisting of Fts. Montgomery and Clinton on the western bank, together with a huge chain and boom stretched across the river to a precipitous mountain (Anthony's Nose) on the opposite bank, and ascended as far as Esopus (now Kingston) which he burned, but he was too late to aid Burgoyne. The year 1778 saw the bloody operations of the Tory Butlers and their Loyalist and Indian allies in the Mohawk and Schoharie valleys and notably the massacre at

Cherry valley. In retaliation a punitive expedition under Generals John Sullivan and James Clinton in 1779 destroyed the Iroquois towns, and dealt the Indian confederacy a blow from which it never recovered. The American cause was strengthened this year also by several victories along the lower Hudson of which General Anthony Wayne's storming of the British fort at Stony Point was the most important. The closing episode of the war as far as New York was concerned was the discovery of Benedict Arnold's attempt in 1780 to betray West Point and other colonial posts on the Hudson to the British. On Nov. 25, 1783, the British forces finally evacuated New York city, but the British posts on Lakes Erie and Ontario were not evacuated until some years later.

New York ratified the Articles of Confederation in 1778, and when Maryland refused to ratify unless those States asserting claims to territory west to the Mississippi agreed to surrender them, New York was the first to do so. But under the leadership of George Clinton, governor in 1777–95, the State jealously guarded its commercial interests. This led to determined opposition to the new Federal Constitution. In support of the Constitution, however, there arose the Federalist party under the able leadership of Alexander Hamilton. When a majority of the Constitutional Convention of 1787 had approved of the new Constitution, Hamilton alone of the three New York delegates remained to sign it; and when, after its ratification by eight States, the New York Convention met at Poughkeepsie (June 17, 1788) to consider ratification, two-thirds of the members were opposed to it. But others were won over by the news that it had been ratified by New Hampshire and Virginia or by the telling arguments of Hamilton, and on July 26 the motion to ratify was carried by a vote of 30 to 27.

Elections and Legislation.—The Constitution having been ratified, personal rivalry among the great families—the Clintons, the Livingstons and the Schuylers—again became dominant in political affairs. The Livingstons, piqued at Washington's neglect to give them the offices they thought their due, joined the Clintons, but the Federal patronage was used against the anti-Federalists or Republicans with such effect that in 1792 John Jay received more votes for the governorship than George Clinton, although the latter was counted in on a technicality. Jay was elected in 1795 and re-elected in 1798, but in 1801 the brief Federalist *régime* in the State came to an end with the election of George Clinton for a seventh term. The Republican leaders straightway quarrelled among themselves, thus starting the long series of factional strifes which have characterized the party politics of New York State. The leaders of the several Republican groups were Chancellor Robert R. Livingston, Aaron Burr, then vice-president, Governor George Clinton and his nephew, De Witt Clinton, who in 1802 was elected United States senator. The first break came in the spring of 1804 when Burr, who had incurred the enmity of his Republican colleagues in 1800 by seeking Federalist votes in the electoral college at Jefferson's expense, became an independent candidate for the office of governor against Morgan Lewis. Hamilton's action in counselling Federalists not to vote for Burr just as he had counselled them not to support Burr against Jefferson in 1800, was one of the contributary causes of Burr's hostility to Hamilton which ended in the duel (July 1804) in which Burr killed Hamilton. Hamilton's death marked the end of the Federalists as a power in New York. New York, whose growing shipping interests had suffered by the Embargo of 1807, was as a commercial State opposed to the war of 1812 with Great Britain. Politically this opposition had the effect of temporarily reviving the Federalist Party, which secured control of the legislature, and gave the electoral vote of the State in 1812 to De Witt Clinton, whom the Federalists had accepted as a candidate to oppose Madison for re-election on the war issue. During the war New Yorkers served with the regular troops at Niagara, Plattsburg and other places on the western and northern frontiers of the State. For some years after the war political contests in New York State as in the rest of the country were not on party lines. De Witt Clinton was elected governor and, largely through his efforts, the Erie canal was begun.

The election of Martin Van Buren as governor in 1828 marked the beginning of the long ascendancy in the State of the "Albany Regency," a political coterie in which Van Buren, W. L. Marcy, Benjamin Franklin Butler (1795–1858) and Silas Wright were among the leaders. Thurlow Weed, their bitterest opponent and the man who gave them their name, declared of them that he "had never known a body of men who possessed so much power and used it so well." Thurlow Weed owed his early political advancement to the introduction into State politics of the anti-Masonic issue (*see* ANTI-MASONIC PARTY), which also brought into prominence his co-worker W. H. Seward. As the anti-Masonic wave subsided, its leaders and most of its adherents found a place in the newly organized Whig Party which was powerful enough in New York to elect William H. Seward governor in 1838, and to re-elect him and to carry the State for W. H. Harrison against Van Buren in 1840. It was during the first administration of Governor Seward that the anti-rent agitation in the Hudson river counties began. Vast estates in Albany, Rensselaer, Columbia, Schoharie, Delaware, Sullivan and other counties were the seats of disturbance. Besides rent, many of the tenants were required to render certain services to the proprietor, and in case a tenant sold his interest in a farm to another he was required to pay the proprietor one-tenth to one-third of the amount received as an alienation fine. Politically, the anti-rent associations which were formed often held the balance of power between the Whigs and the Democrats, and in this position they secured the election of Governor John Young (Whig) as well as of several members of the legislature favourable to their cause, and promoted the passage of the bill summoning the Constitutional Convention of 1846. In the new Constitution clauses were inserted abolishing feudal tenures and limiting future leases of agricultural land to a period of 12 years. The courts pronounced the alienation fines illegal. Under the pressure of public opinion the great landlords rapidly sold their farms. Up to the election of Seward as governor, New York had usually been Democratic, largely through the predominating influence of Van Buren and the "Albany Regency." After the defeat of Governor Silas Wright in 1846, however, the Democratic Party split into two hostile factions known as the "Hunkers," or conservatives, and the "Barnburners," or radicals. The factions had their origin in canal politics, the conservatives advocating the use of canal revenues to complete the canals, the radicals insisting that they should be used to pay the State debt. Later when the conservatives accepted the annexation of Texas and the radicals supported the Wilmot Proviso the split became irrevocable. Only once between 1846 and the Civil War did the Democratic Party regain control of the State—in 1853–55 Horatio Seymour was governor for a single term. A succession of Republican governors held office until 1862 when the discouragement in the north with respect to the Civil War brought a reaction which elected Seymour governor.

With the exception of New York city the State was loyal to the Union cause during the war and furnished over half a million troops to the Federal armies. Certain commercial interests of New York city favoured the Confederate cause, but Mayor Wood's suggestion that the city (with Long Island and Staten Island) secede and form a free-city received scant support, and after the sanguinary draft riots of July 1863 (*see* NEW YORK CITY), no further difficulty was experienced.

After the Civil War the State began to reassume the pivotal position in national politics which has always made its elections second only in interest and importance to those of the nation, and the high political tension emphasized the evils of the "spoils system." In 1868 John T. Hoffman, a favourite of Tammany Hall, was chosen governor on the Democratic ticket. Tammany and Hoffman were again victorious in 1870; but in 1871 the New York *Times* disclosed the magnitude of the Tweed "Ring's" thefts, amounting in the erection of the New York county court house alone to almost $8,000,000, and Tweed and his "Ring" were crushed in consequence. The Republicans carried the State in 1872, but in 1874 Samuel J. Tilden, a Democrat and the leading prosecutor of Tweed, was elected governor. The Republican legislature had in 1867 appointed a committee to investigate the management of the canal system, but the abuses were allowed to con-

tinue until in 1875 Governor Tilden disclosed many frauds of the "Canal Ring," and punished the guilty. In 1876, Tilden having been nominated for the presidency, New York cast its electoral vote for him. In 1880 it was cast for Garfield, the Republican nominee. Two years later the Republicans, having split over a struggle for patronage into the two factions known as "Half-breeds," or the Administration Party, and "Stalwarts" of whom the leader was Roscoe Conkling, were defeated, Grover Cleveland being chosen governor. In 1884 Cleveland as the Democratic presidential nominee received the electoral vote of his State. In 1888 Benjamin Harrison, the Republican candidate, the factional quarrels being settled, carried New York, but in 1892 Cleveland again carried the State. Hostility to free silver and "Bryanism" in the large financial and industrial centres put the State strongly in the Republican column in the State and national elections from 1894 to 1910. In the election of Nov. 1910 the Democrats carried not only the State but also the legislature, and John A. Dix was elected governor.

The Democrats again carried the State and the legislature in Nov. 1912, and Sulzer became governor. In the presidential contest, the Democrats carried the State for the first time in 20 years.

In April 1913, Governor Sulzer sent a special message to the legislature urging a direct primary law that would abolish party conventions. The legislature refused to enact the primary bill, and the governor vetoed the legislative substitute. When the legislature recessed on July 23 the governor declared the special session adjourned, but the legislature reassembled on Aug. 11. Two days later the assembly voted to impeach the governor; on Oct. 17 he was removed from office and Martin H. Glynn, lieutenant-governor, succeeded.

The Republicans were successful in the elections of Nov. 1914, and Whitman became governor, and in 1916 was re-elected. In the November election, 1918, Alfred E. Smith (Democrat) was elected governor by a small plurality of about 15,000. Most of the other State officers and the legislature, however, remained Republican. One of the most important laws of the year was the one providing for an income tax of from 1% to 3%. Shortly after his inauguration Governor Smith appointed a non-partisan reconstruction commission to investigate the problem of a fundamental reorganization of the State Government, and to consider other important problems of reconstruction resulting as an aftermath of the World War. This commission in its report of Oct. 10, 1919, recommended an executive budget and the consolidation of the numerous administrative agencies.

In 1920, a presidential election year, the Republican candidate, Nathan L. Miller, won over the Democrat, Alfred E. Smith, by 74,066 votes. The direct primary was abandoned and the convention system restored for the nomination of State and judicial officers.

The 1922 legislature authorized life-insurance companies to invest 10% of their assets in new buildings for dwelling purposes; extended the emergency rent laws to 1924 and fixed assessments as the basis for determining the reasonableness of rents. Women were given representation on county party committees. A home rule amendment was adopted. The 1922 election resulted in the selection of Alfred E. Smith as governor by an absolute majority of 269,609 votes.

In the autumn elections (1923) the voters approved an amendment extending to cities a large measure of home rule. The referendum on a bond issue for $50,000,000 for new hospitals was likewise approved. An important measure of the session was the Home Rule Enabling Act, designed to carry out the amendment adopted the previous year. This law, drafted by the State home rule commission, was adopted unanimously by both houses of the legislature. The New York amendment differs from constitutional provisions in some other States in that it grants powers in general terms. In the presidential election of 1924 the Republicans carried the State by a majority of 383,813. Gov. Smith, however, was re-elected but the Republican candidates for the other six elective State offices were successful, and the legislature became more strongly Republican. In the fall election of 1925 the voters approved four constitutional amendments. The most important provided for the governor's plan of consolidating the numerous State administrative agencies into 19 departments. Another amendment provided for a reorganization of the judicial system. In 1926 the Democrats were again successful in re-electing Governor Smith for a fourth term, and, as well, elected their candidates to all the other State offices, except that of attorney-general. The legislative houses remained Republican. A referendum on a question favourable to the modification of the National Prohibition Act was carried by approximately a three-to-one vote. In the election of 1927 the voters approved the constitutional amendment providing for an executive budget, thus carrying out the programme for the reorganization of the State Government one step further. In the 1928 election, though the State was Republican in its choice for president, Franklin D. Roosevelt, a Democrat, was elected to succeed Smith as governor.

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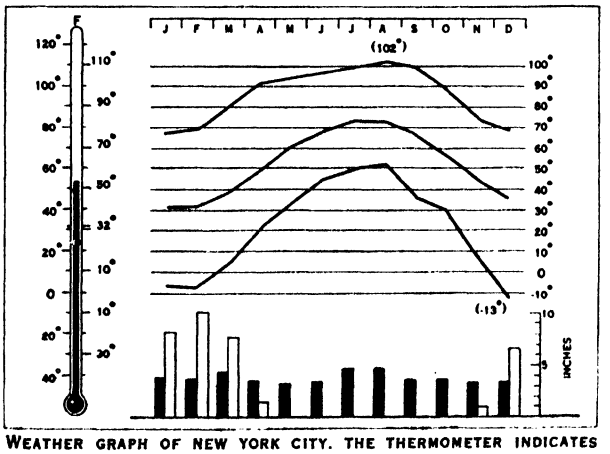
NEW YORK (CITY), the largest city in the United States, is situated at the mouth of the Hudson river, here sometimes called the North river. The five boroughs comprising the city are: the Bronx (Bronx county), 42·74 sq.m., on the south-eastern-

most part of the mainland adjoining Westchester county and separated from the borough of Manhattan by the Harlem river (a canalized waterway connecting the Hudson and East rivers); Manhattan (New York county), 22·20 sq.m., on Manhattan island between the Hudson and East rivers; Queens (Queens county), 109·88 sq.m.; Brooklyn (Kings county), 74·14 sq.m., on the western end of Long island, adjoining Nassau county and separated from the Bronx and Manhattan by the East river; and Richmond (Richmond county), 59·99 sq.m., on Staten island south-west of Brooklyn and separated from it by the Narrows (a strait connecting Upper and Lower bays) and from the mainland of the State of New Jersey by tidal estuaries known as Kill van Kull and Arthur Kill. The City Hall, near the southern end of Manhattan island, is in lat. 40° 42′ 43″ N., and long. 74° 0′ 29″ W. The greatest width of the city, east and west, is 24 m. and the greatest length, north-east and south-west, is 35 miles. Its area, including small islands of 13·09 sq.m., is 308·95 sq.miles. The more important of the small islands are: North and South Brother, Riker's, City, Hunter, Hart, Governor's (occupied by a U.S. military reservation), Welfare (formerly Blackwell's), Ward's, Randall's (the latter three occupied by State and city institutions) and numerous islands in Jamaica bay. Bedloe's island (on which stands the Bartholdi statue of Liberty) and Ellis island (occupied by the Federal Government as an immigrant station) are in Upper bay, within the bounds of New Jersey. The total water front is 578 m., of which Manhattan has 43 m.; Brooklyn, 201 m.; the Bronx, 80 m.; Queens, 197 m.; and Richmond, 57 miles.

Population.—In 1626 there were fewer than 200 inhabitants, 1,000 in 1656, and but 14,000 in 1760. About 1783 New York began its rapid growth as the leading port. Between 1786–96 the population had nearly doubled, and by 1871 it was 1,000,000. In 1926 the total population was 5,924,138 and the estimate for 1928 was 6,017,702 divided as follows: Manhattan, 1,752,018; Bronx, 951,945; Brooklyn, 2,308,631; Queens, 854,449; Rich-



WEATHER GRAPH OF NEW YORK CITY. THE THERMOMETER INDICATES NORMAL ANNUAL MEAN TEMPERATURE. THE CENTRE CURVE SHOWS NORMAL MONTHLY MEAN TEMPERATURE: THE CURVES ABOVE AND BELOW, THE HIGHEST AND LOWEST EVER RECORDED IN EACH MONTH. THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION: THE SHADED COLUMN, TOTAL PRECIPITATION (INCLUDING MELTED SNOW); THE WHITE COLUMN, SNOWFALL

mond, 150,659. In 1898 the five boroughs were united to form Greater New York.

The negro population (estimated at 248,000) is centred in the Harlem district, between 116th and 150th streets, in an area bounded on the east by Fifth avenue and on the west by St. Nicholas avenue. The Chinese quarter is in the neighbourhood of Chatham square, on Mott, Pell and Doyers streets. The greatest density of population, according to information made public by the Regional Plan of New York and its Environs, occurs on the lower east side in the district bounded by Avenue B, Avenue D, East Ninth street and East Third street. Here there are 650 persons to the acre. On the upper east side the maximum density is in the district bounded by First avenue, Third avenue, East 99th street and East 104th street, where there are 565 persons to the acre. In Brooklyn the maximum density occurs near the terminal of the Williamsburg Bridge, where there is an average density of 445 persons to the acre. A high percentage of the population in these areas is foreign-born. New York has more Jews than any other city, now numbering 1,700,000; the centre of the Jewish population has recently shifted from Manhattan to Brooklyn.

Harbour.—The harbour is naturally divided into several parts. At the entrance from the Atlantic is the outer harbour (about 122 sq.m.), known as Lower bay. Raritan bay lies adjacent to the Lower bay on the west and Raritan river and Kill van Kull flow into the west side of Raritan bay. The Ambrose Channel is the chief of several channels crossing the broad bar at the entrance to the outer harbour. It leads north-westward and then northward into the inner harbour, through the Narrows, a neck about 1 m. wide between Long Island and Staten island. The inner harbour consists of the Upper bay, 4 m. long and 4 m. wide, lower Hudson river, East river, Long Island sound and tributary waterways. The tributary waterways to the east are Gowanus creek, Newtown creek, Harlem river, Bronx river, Westchester creek, Flushing bay and creek and Eastchester creek. Tributaries to the west are Kill van Kull, Arthur Kill, Newark bay, Passaic river, and Hackensack river. Anchorage channel, an extension of Ambrose channel, extending through the Upper bay to the mouth of the Hudson river at the Battery and marking the southern extremity of Manhattan island, affords a depth of 40 ft. at mean low water for a width of 2,000 feet. The direct water frontage of the port of New York is 771 m. and the developed frontage measured around piers and the heads of slips is 346·5 miles. The total frontage measured around piers and along shore line is 994·8 miles. The mean tidal range is 4·6 ft. in the Lower bay and 4·5 ft. in the Upper bay. The harbour also has two northern entrances: the north-east entrance from Long Island sound by the East river, principally used by New England coasting vessels; and the North (lower Hudson) river, by which the inland water-borne traffic of the Hudson river and the Erie canal is brought to the port of New York.

I. METROPOLITAN DISTRICT

The New York metropolitan district, as defined in 1927 for the U.S. Bureau of the Census, includes a land area of 3,768 sq.m. lying in the States of New York, New Jersey and Connecticut, and had an estimated population, as of July 1, 1926, of 9,472,500. In addition to New York city, it includes such important centres of industry and population as Newark, Paterson, Elizabeth, Bayonne, Hoboken, Passaic, Union City, East Orange, Perth Amboy, Orange and New Brunswick, in New Jersey; Yonkers, Mount Vernon, New Rochelle and White Plains, in New York; and Stamford and Norwalk in Connecticut. Altogether the district contains 373 independent, self-governing municipalities lying within a radius of approximately 40 m. from New York City Hall.

II. COMMERCE AND INDUSTRY

In 1926, the tonnage cleared from the port amounted to 20,427,000. The tonnage for foreign trade amounted to 21·6% and the value to 42·1% of that of all United States ports.

The area of the port of New York district within the jurisdiction of the port authority is about 1,500 sq.m. extending from below Sandy Hook on the south to Tarrytown on the north, a distance of approximately 48 m. and east and west to an average approximate width of 32 miles. About 200 distinct municipalities are included in this area. Serving the area of the port authority, the first of the belt lines (No. 13), a consolidation of short transfer lines, was established in 1925. It extends a distance of 17½ m. along the west bank of the Hudson river and affords a connection with all of the rail trunk lines entering the New Jersey side of the port. A vehicular tunnel connects New York and New Jersey. By special direction of the two States, the port authority undertook in 1925 a programme of highway bridge construction involving an aggregate expenditure of approximately $100,000,000. Two bridges have been built across the Arthur Kill, one from

Perth Amboy, N.J., to Tottenville, S.I., and the other from Elizabeth, N.J., to Howland Hook, S.I. A third bridge started by the port authority promises to be one of the most important of all bridges. It will connect the northern part of Manhattan island with the borough of Fort Lee, N.J., and will have a suspension span measuring 3,500 ft. in length or more than twice as long as any other suspension span heretofore constructed. The cost of opening this bridge for traffic is estimated at $60,000,000. A bridge over the Kill van Kull and the one across the Hudson are expected to be ready for traffic by 1932.

Banking, Exchange and Insurance.—Since the beginning of the city's history, the financial district of New York has been at the end of Manhattan island, below Fulton street. Here are the largest banks and trust companies, the exchanges, and many insurance headquarters. In 1784, Alexander Hamilton wrote the constitution for the Bank of New York, the first bank to be established in the city, in operation five years before the U.S. Constitution was adopted. This bank was originally at 67 Saint George's square, now Pearl street, and was later moved to 11 Hanover square. The first bank of the United States was established in 1791, and a branch known as the office of discount and deposit was opened in New York in the same year. The Bank of the Manhattan company was the third bank to be organized in the city and its charter is notable as being the first to enable a public utility company to engage in banking. The Manhattan company furnished New York with water for 43 years. The Bank of the Manhattan company is still at its original location at 40 Wall street. It continues to operate under its original charter, through the expedient of maintaining a water-tower. The Merchants and Mechanics and Metals National banks, the Bank of America, the Phenix and City (now the National City bank), all date from the early 19th century. When the Chemical National Bank was organized in 1823, there were already 12 others, having an aggregate capital of over $15,000,000.

The Sub-Treasury of the United States, formerly on Wall street, was abolished when the Federal Reserve system went into operation in 1914. A part of the functions of the Sub-Treasury are carried on by the U.S. assay office at 32 Wall street. The New York Clearing House, now located at Cedar street, between Broadway and William street, was established in 1853. The bank clearings for the year ending on Sept. 30, 1927, were $307,158,631,043.07. New York is the centre of the Federal Reserve district No. 2 (*see* BANKING). On Sept. 30, 1927, there were 33 State banks in the borough of Manhattan with total resources of $1,307,450,362 (*see* TRUST COMPANIES). The New York Stock Exchange (*q.v.*) occupies a building designed by James Rennick and has 1,100 members. The New York curb market was formerly an open-air market for selling unlisted securities. It is now housed in its own building at 78 Trinity Place, completed in 1921. (For insurance companies, *see* INSURANCE.)

Wholesale Trade.—The clothing market is chiefly centered in Broadway, Manhattan, between 34th street and Canal street, and in cross streets between Third and Seventh avenues. Silk establishments have two principal centres, one bounded roughly by 23rd and 34th streets and Third and Fifth avenues; the other, on or adjacent to Broadway between Canal and 8th streets. Fur establishments are now sharply localized between Broadway and Eighth avenue and 23rd and 34th streets. The millinery business, formerly chiefly along Broadway, between Canal and 14th streets, is now moving to a centre between Broadway and Fifth avenue above 34th street. Boot and shoe establishments are almost exclusively in lower Manhattan between Broadway and West Broadway below Canal street. Jewellery, formerly concentrated in and about Maiden lane, has now become distributed in smaller groups between Maiden lane and 50th street along Broadway and Fifth avenue, with a large and growing centre at and about the intersection of Canal street and the Bowery. Fruit and produce markets are centralized in Manhattan between Canal and Cortlandt streets, and West Broadway and the North river. The fish, butter, egg and cheese markets, are highly concentrated on the lower west side between Harrison and Greenwich streets and meat establishments centre at West 14th street and the North river. The coffee, tea and spice markets are mainly in a small area on the lower east side about Water and Front streets. Hardware houses are around Warren and Chambers streets, west of Broadway; paper and stationery are much more widely scattered now than formerly, largely owing to the uptown movement of printing and publishing establishments, one great centre being now at or near Park Row and the other in the neighbourhood of the new post-office about 34th street. Drug establishments are chiefly in lower Manhattan, on the east side of Broadway and below Chambers street, while leather dealers are just below Brooklyn bridge.

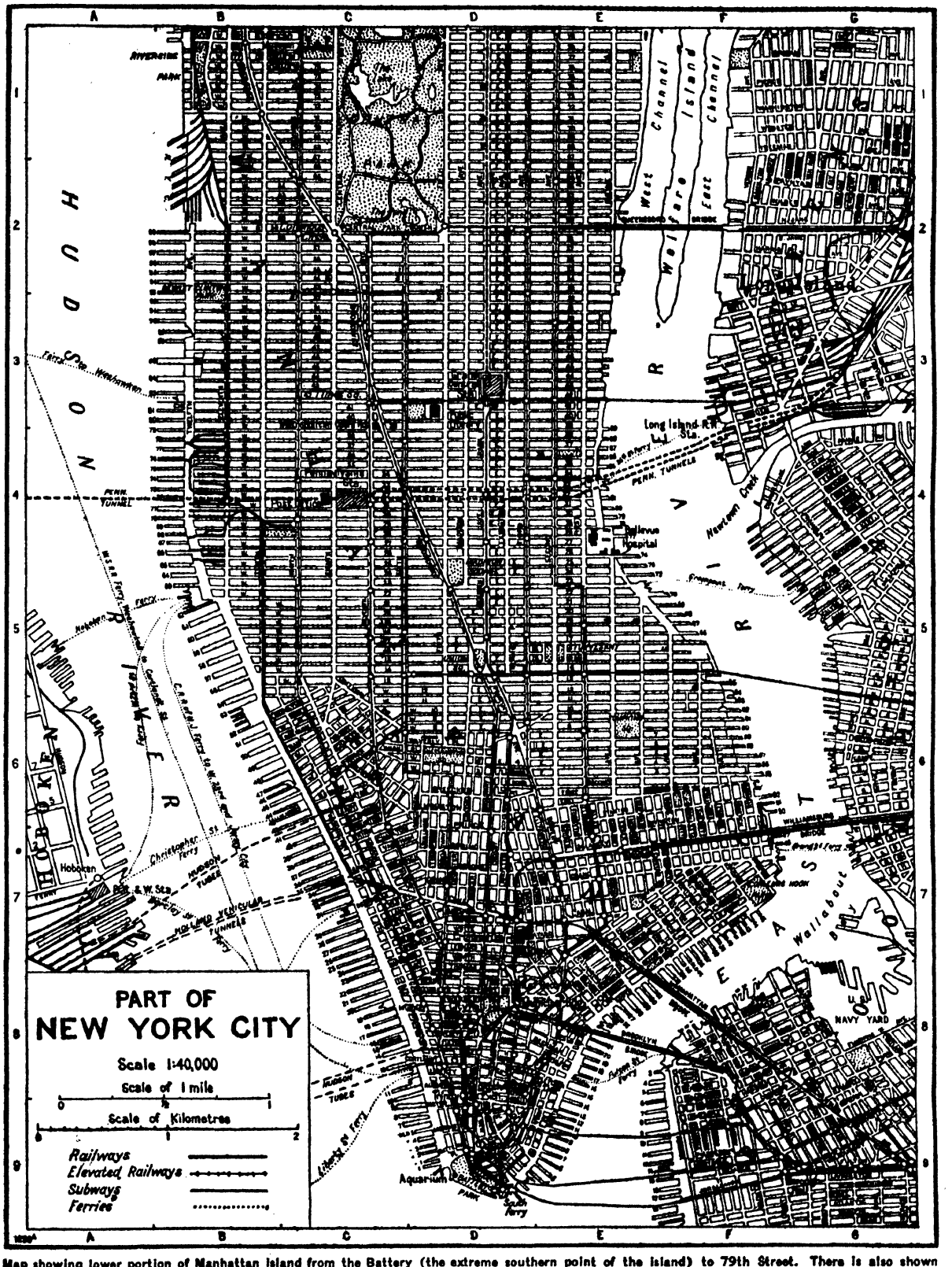
Retail Trade has followed the northward movement of population of Manhattan. In 1850, it was at Canal and by 1880 at 14th street. It now lies between 31st and 59th streets, and Third and Eighth avenues.

Fifth avenue was formerly exclusively residential but is now given up to retail trade as far north as 59th street. Beyond that a zoning ordinance reserves it for residence. Some of the largest department stores are still on 34th street, and the greatest volume of trade is done there. One store on this street receives more than a million dollars a week from purchasers. But the northward trend of the residential section has affected the character of the trade and the more expensive shops, including some of the oldest retail firms, are farther up Fifth avenue continually pressing on toward the most exclusive residential quarters of the city which are now on Park and Fifth avenues, above 60th street. The dressmakers, milliners and tailors for this district are in the side streets leading off Fifth avenue. Madison avenue, because of its situation between Park and Fifth avenues, is rapidly taking on the aspect of the latter, and is lined with shops from 42nd street to the Eighties. The art and antique dealers are on 57th and adjacent streets, and on Madison and Lexington avenues. There are a number of small antique shops on 8th street. Automobile houses are near Columbus circle and up Broadway from 55th street for more than ten blocks. Brooklyn and the Bronx now have important local shopping districts of their own with department stores and banking and financial districts.

Building Construction.—In 1927 there were 644,692 buildings in the five boroughs, having a total assessed valuation of $6,896,518,364. In 1927, to Oct. 1, 38,381 buildings were erected, valued at $667,493,895. Six buildings completed during 1926–27 were valued at from 5 to 14 millions each.

Modern building construction in New York dates from the erection of the ten-storey Tower building in 1889. Much higher structures have since been made possible by the increased knowledge of steel and concrete and the perfection of passenger elevators. The razing and rebuilding process, however, is carried out under the strict regulations of a building code. It is frequently amended to meet the demand of economic and social changes as well as the advances in the technical phases of construction methods. A further regulation of building construction is effected by the Tenement House law of 1901, which provides especially for better lighting, ventilation and sanitary conditions; the building Zone resolution of 1916, which regulates and limits the location, height and bulk of buildings (*see* CITY PLANNING AND ZONING); and the Housing Act (1927) which permits the legislature to authorize counties to acquire by condemnation more land and property than is needed to widen, extend or relocate parks, public places, highways or streets. In 1927 was passed a new municipal housing law which grants local tax exemption for 20 years to buildings constructed as substitutes for old, unsanitary tenements.

Manufacturing.—The total value of the products manufactured in the factories of New York City in 1925 was $5,324,413,612. The average factory in 1925 employed 22 wage earners and manufactured $224,526 worth of goods. The ten leading industries in 1925 were: women's clothing, $1,008,966,387; men's clothing, $379,339,161; printing and publishing, newspapers and periodicals, $303,788,130; fur goods, $194,803,213; millinery and lace goods, $194,404,559; bread and other bakery products, $181,173,270; slaughtering and meat-packing, $163,485,321; printing and publishing, book and job, $160,049,971; tobacco, cigars and cigarettes, $111,970,571; boots and shoes, $86,408,059.



Map showing lower portion of Manhattan Island from the Battery (the extreme southern point of the island) to 79th Street. There is also shown the network of bridges, ferries and tunnels which connect Manhattan with Brooklyn and Queens county (right) and with New Jersey (left). North of about 14th Street the island is laid out in a rectangular street plan, the numbered streets running east and west, and the avenues north and south, with Broadway running obliquely from south-east to north-west. Below 14th Street and especially in the financial district of lower New York the streets, which date from Dutch and English Colonial days, are irregular and narrow. The many piers on both river-fronts accommodate the ocean, coastal and river shipping

III. TRANSPORTATION AND COMMUNICATION

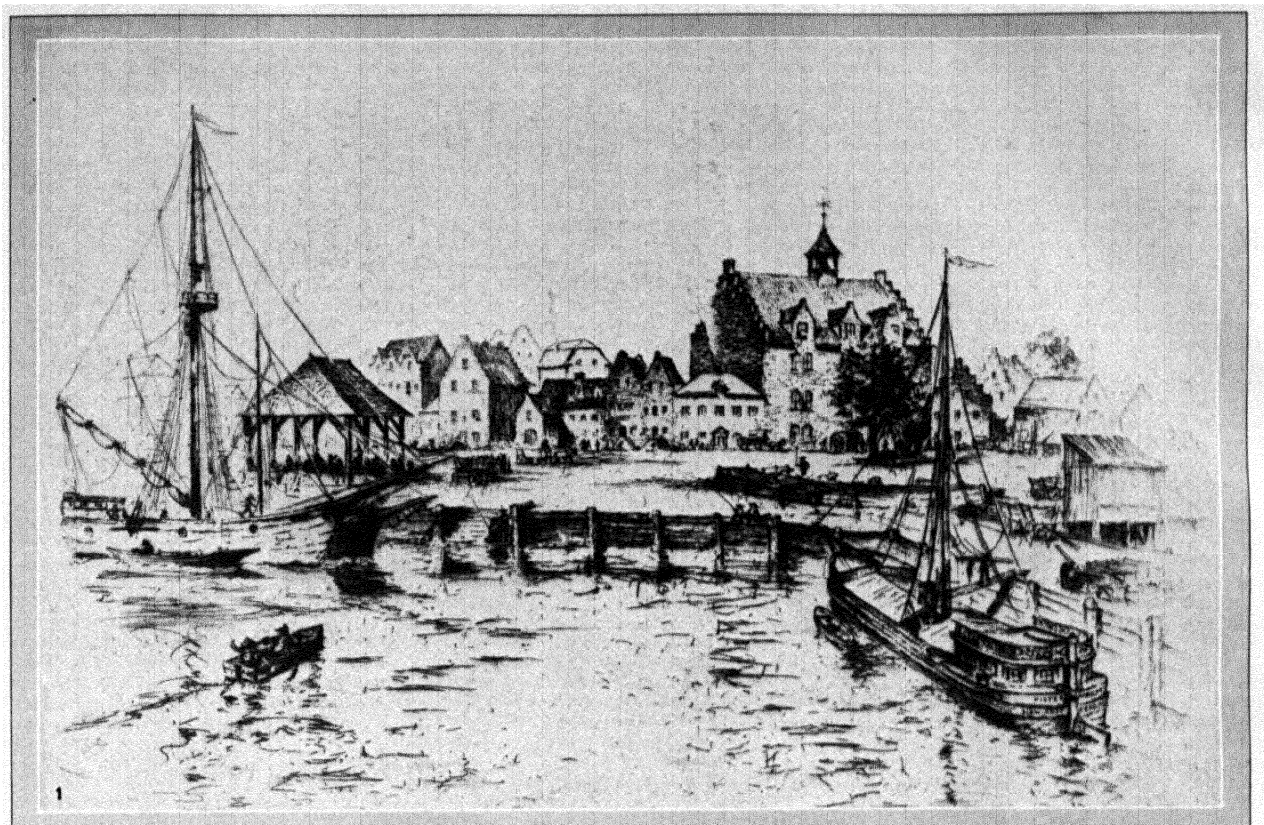
Railroads and Rapid Transit.—The problem of transportation and communication in New York City is unique because of the extraordinary concentration in certain regions. The New York Central and Hudson river and West Shore railways follow closely the Erie canal route to Buffalo. The Erie, the Lehigh Valley, the Pennsylvania and the Delaware, Lackawanna and Western railways reach Buffalo by routes across New Jersey, Pennsylvania and western New York. The New York, New Haven and Hartford railway affords communication with New England; and the Pennsylvania, and the Baltimore and Ohio railways, with the middle-western and south-eastern parts of the country. The Central railroad of New Jersey and the Long Island railway (belonging to the Pennsylvania), are primarily local. The New York Central and the New York, New Haven and Hartford railways have a common terminal in Manhattan (Grand Central station), at 42nd street and Park avenue, and the Pennsylvania has its great terminal at 32nd street and Seventh avenue, with tunnels to Long Island and New Jersey. The Pennsylvania terminal is used also as a terminal by the Long Island railway which has another terminal at Atlantic and Flatbush avenues in the borough of Brooklyn. The other railway terminals are on the New Jersey bank of the Hudson and are reached either by tunnel, ferries or subways under the river. The Interborough Rapid Transit Company, and the New York Municipal Railways Corporation operate subway and elevated lines. The former were built mostly since 1913. Steam locomotives were used on the first elevated railroad, which forms that part of the present Ninth avenue elevated railway extending from Battery Place near the southerly end of Manhattan to 30th street. This piece of construction was opened for traffic in 1870, and was slightly over 3 m. in length. The next decade witnessed its growth to 32·5 route miles of track forming four separate transit lines extending north and south on Manhattan; three reached the Harlem river and one ended at 59th street. These lines were entirely private enterprises, built and operated over the public streets under perpetual franchises granted by the State legislature. For the next 20 years, there were no extensions to the rapid transit lines on Manhattan, but some progress was made in other boroughs—the Third avenue "L" in Manhattan was extended across the Harlem river as far as 169th street by 1888, to 177th street by 1891, to Fordham road by 1901 and to its terminus at Bronx park by 1902. In the Borough of Brooklyn, the first elevated, the Lexington avenue line, having a route length of about 6 m. was opened in 1885. This line was extended and other lines built until by 1900 the Brooklyn system had a route length of 62 miles. In 1902, the motive power of these elevated lines was changed from steam to electricity. In 1900 the first "subway" was planned and finally extended from the Bronx, through Manhattan, to Brooklyn, under the East river. This rapid transit system was a municipal undertaking, its construction cost being entirely defrayed by the sale of bonds issued by the City of New York. Between 1908–10 two tubes under the Hudson river connecting Manhattan with Hoboken (terminus of the Delaware, Lackawanna and Western), and Jersey City (terminus of the Erie, Pennsylvania and Central of New Jersey railways) and a connecting tube which extends up Sixth avenue from Cortlandt street to 33rd street were completed. In 1913 the city entered into contracts to create two interborough rapid transit systems, each comporting extensions to the existing lines; the one provided for a new Lexington avenue line and the extension of the west side subway down Seventh avenue to lower Manhattan and thence by tunnel to Brooklyn, which, with other extensions, brought the track mileage up to about 334 m. of which 119 are owned by the company and 215 by the city. Another contract included a four-track subway on Broadway and Seventh avenue, Manhattan, extending through tunnels to Brooklyn and Queens. The operating contracts made with the two companies run for 49 years, dating from Jan. 1, 1919, and from Aug. 1, 1920, respectively. In 1925, the City of New York began building an independent subway system, which when completed will comprise about 60 route m. and 185 track miles.

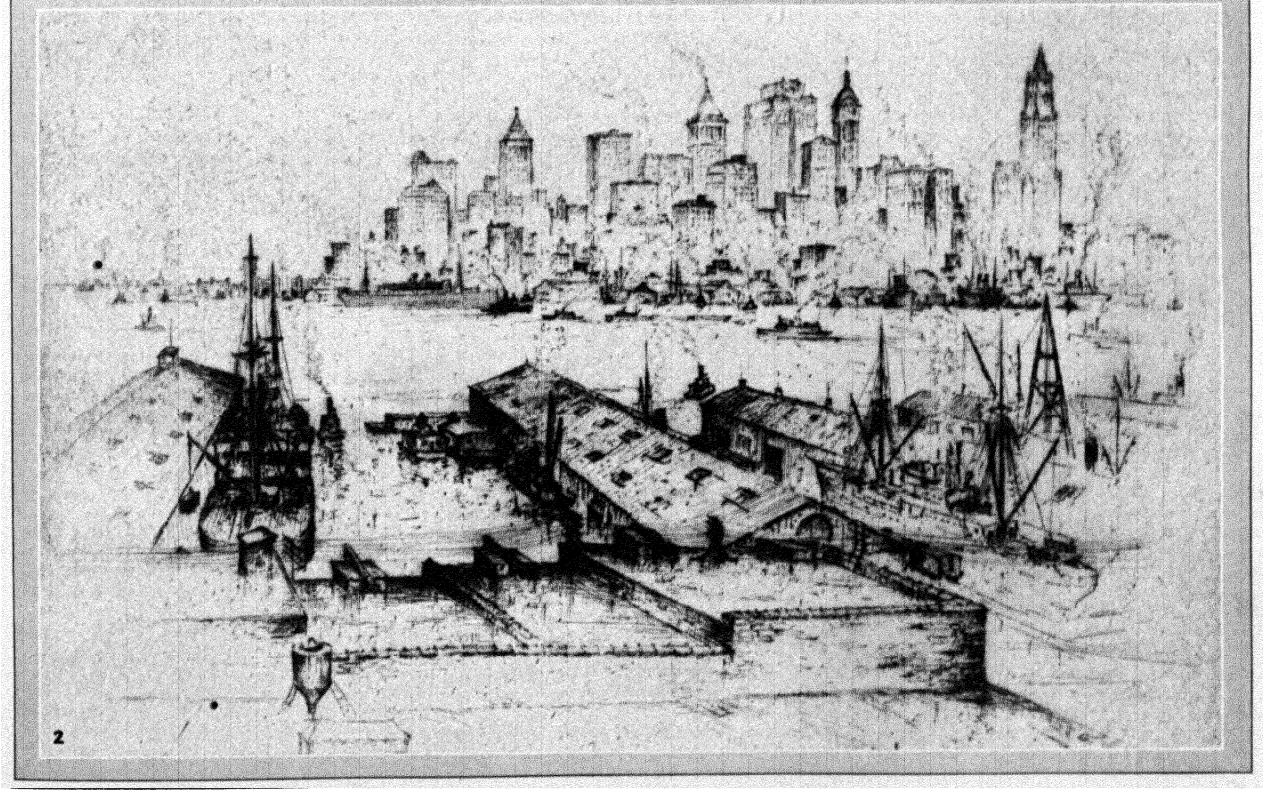
Streets.—The first comprehensive street plan was made in 1811; with few changes, notably the laying out of Madison avenue, midway between Fourth and Fifth avenues, north of 23rd street, and Lexington avenue between Third and Fourth avenues, north from 21st street, it is the street plan of Manhattan to-day as far north as 155th street. The 120,000 population at that time was concentrated south of Houston street. The plan provided straight line "avenues," with a uniform width of 100 ft. extending longitudinally along the island and separating block lengths ranging from 610 to 920 feet. At right angles thereto, "streets" usually 60 ft. wide were laid out, but 15 were made 100 ft. wide. These streets were separated by a block depth of 200 feet. The plan included the extension of Broadway, which has a general direction diagonally across Manhattan to 79th street, whence it parallels the other avenues. This system has been called upon to perform duties hardly foreseen at that time, and it has been overtaxed by permitting elevated railroads over portions or all of six of the avenues and railways on parts of four more. The streets of Greater New York have a total mileage of 4,700. Manhattan has 490 miles, practically all of which are paved. The rapid growth of the city, the sky-scraper, and the use of motor vehicles have produced serious traffic congestion in some sections of the city, and this has necessitated extensive street widening and the development of new thoroughfares. Notable recent examples are the Varick street extension of Seventh avenue, the Lafayette street improvement and the southerly extension of Sixth avenue in Manhattan, the extension of Flatbush avenue, and the widening of Kings highway in Brooklyn, the construction of Jamaica bay, Queens and Conduit boulevards in Queens, and the construction of the Grand Concourse in the Bronx.

The more notable streets include Wall street, on lower Manhattan, the heart of the financial district; Fifth avenue with its fine shops, residences, clubs, library and museum; Riverside drive, overlooking the Hudson, Park avenue, which continues Fourth avenue above 32nd street to the Grand Central terminal and thence from 45th street to the Harlem river, and is lined with fine apartment houses in the middle section above 45th street; the Bowery, which runs diagonally through the east side of lower Manhattan from Brooklyn bridge to intersect Fourth avenue at 8th street; and Broadway, which extends over 18 m. from the southern tip of Manhattan to the northern limits of the city. In its middle part, from 10th to 79th streets, it cuts through the heart of the business and amusement centre. This street owes its name to the Dutch, who called it the "breede weg." It is no longer a "broad way," but quite narrow, particularly in the lower downtown section. From 34th street to Columbus circle at 59th street it forms the centre of the automobile, theatre, moving picture, restaurant and night life district. Subways follow the course of Broadway for the greater part of its extent.

Practically every avenue in the borough of Manhattan except Fifth avenue, Park avenue and Riverside drive has surface cars, and there are crosstown lines about every sixth block, from 8th to 42nd streets, and on 59th, 86th, 116th, 125th and 145th streets. These now act mainly as "feeders" for the rapid transit lines and, to a less extent, for ferries between Manhattan, New Jersey and Staten island. In other boroughs street railways form a larger and more important part of the transportation system. In 1927 there were 36,592 omnibuses, including the taxicabs. In that year the Fifth Avenue Coach company (the largest private omnibus company) carried 74,931,000 passengers with about 400 buses operating a total distance of 13,026,000 miles. Licences were issued for the operation of 464,225 pleasure cars and 111,776 commercial vehicles which made a total of over 600,000 motor vehicles registered in 1927. In sections unserved by regular or private omnibus companies, the municipal department of plant and structures operates 35 emergency omnibus lines.

Bridges and Tunnels.—There are at present five bridges spanning the East river and one under construction over the Hudson river which will, when completed, extend from a point near 178th street, Manhattan, to Fort Lee, N.J. The Brooklyn, Manhattan and Williamsburg bridges have their Manhattan terminals at Park Row, Canal, Clinton and Delancey streets, respectively. All are suspension bridges and connect Manhattan island





NEW YORK HARBOUR, IN 1690 AND 1928

1. The town of New Amsterdam in 1690, first beginnings of the present port of New York; an etching by Anton Schutz

2. New York Harbour as seen to-day from Brooklyn Heights, showing the sky-scrapers of lower Manhattan Island. From an etching by Anton Schutz

NEW YORK (CITY)

PHOTOGRAPH, AIRMAP CORPORATION OF AMERICA

MANHATTAN ISLAND

An air view of Manhattan Island, showing the Hudson (North River) at the left, and East River at the right. In the upper left hand corner of the picture a portion of the New Jersey shore is seen, while on the right is Long Island

with Brooklyn. Brooklyn bridge, the first to span the East river, was opened to traffic on May 24, 1883. The Manhattan bridge was opened to traffic on Dec. 31, 1909, the Williamsburg bridge on Dec. 19, 1903 and the Queensboro bridge on March 30, 1909. All of these are municipally owned and operated for highway, trolley, elevated railways and pedestrian traffic. The fifth bridge to span the East river, called the Hell Gate bridge, is owned by the New York Connecting railroad company and is exclusively for railway traffic.

The Harlem river is crossed by 13 bridges of various types and designs. The most notable is the famous High bridge (1848) which carries an aqueduct of the city water-supply. This was rebuilt in 1928 to improve navigation.

Transportation of passengers by rail between the boroughs of Manhattan, Brooklyn, the Bronx and Queens, and New Jersey is provided by means of tunnels constructed well below the beds of the East, Hudson and Harlem rivers. Vehicular transportation between Manhattan and Jersey City was made possible by the opening to traffic of the Holland vehicular tunnel (*q.v.*) in Nov. 1927, a twin-tube highway, 9,250 ft. in length. The Pennsylvania railroad has four tubes across the East river and two across the Hudson. The Hudson and Manhattan railroad company has two systems, each comprising two single track tubes from Jersey City, one to the down-town section of Manhattan looping around Fulton and Cortlandt streets at Church street, the other entering at Morton street and extending to 33rd street. The Brooklyn-Manhattan Transit Corporation has six rapid transit tubes under the East river, these are laid in pairs leaving Manhattan at Whitehall, East 14th and East 60th streets. The Interborough Rapid Transit Company also has three pairs of transit tubes leaving Manhattan at Whitehall street, Old Slip and East 42nd street. Practically all of the present railroad and rapid transit tunnels were completed between 1900 and 1920. In connection with the new independent subway system, the board of transportation has designed five new tunnels, one of which is now being constructed under the East river between 53rd street, Manhattan, and Mott avenue, Queens, and will form the connection between the Sixth and Eighth avenue trunk lines and those from Jamaica and central Brooklyn at Union station in Long Island City. Two other tunnels under the East river will connect Fulton street, Manhattan, with Cranberry street, Brooklyn, and Rutgers street, Manhattan, with Jay street, Brooklyn. Under the Harlem river will be a track tunnel connecting the Washington Heights line with the subway under the Grand Concourse in the Bronx. This will extend from the Polo grounds at 156th street and Eighth avenue, Manhattan, to the Yankee Stadium at 161st street and Jerome avenue, the Bronx. The fifth under-river tunnel will be under Newtown creek, which separates Brooklyn and Queens.

Ferries.—The city department of plant and structures, the railroads with terminals in New Jersey, and many private companies operate ferries in and about New York harbour.

Airports.—Among commercial flying fields in operation in 1929 which serve the city should be mentioned Curtis Field at Garden City, Long Island, and Roosevelt Field at Mineola, Long Island, Teterboro Airport at Hasbrouck Heights, N.J., and the Newark Airport at Newark, N.J.

Telephone and Telegraph.—The New York Telephone Company has some 1,600,000 telephones, and in 1927 daily calls averaged 7,150,862. Telegraph and cable service is supplied mainly by the Western Union and Postal Telegraph companies. The former maintains 229 offices and the latter 116 in New York city. These 345 offices handled approximately 70,000,000 messages in 1927. Twenty-six cables touch New York, 13 owned by the Western Union, seven by the Commercial, three by the French, two by the All America and one by the United States and Haiti cable companies.

Postal Service.—The post-office of New York city in 1827 was located in a small two-storey frame building on Garden street (now Exchange place), and the entire force consisted of some eight clerks and six letter carriers. Fifty years later the present City Hall station at Park Row and Broadway was the general post-office. In 1914, the present General Post-Office building was opened on Eighth avenue from 31st to 33rd streets, containing a half million square feet of floor space. There are in addition, 48 carrier stations, six financial stations, and 265 contact or substations, and nine independent post-offices. The transportation of mails is expedited by means of an underground pneumatic tube system consisting of 27 m. of double line 8 in. tubes, with a carrying capacity of over 200,000 pieces of mail per hour. In 1827, the postal receipts amounted to about $125,000; in 1927 they exceeded $75,000,000. Sixteen million pieces of ordinary mail are handled daily.

IV. GOVERNMENT

The present form of government was inaugurated by the Greater New York charter of 1897. This provides for a mayor elected at large, five borough presidents, chosen by the voters of their respective boroughs, a board of aldermen of 65 elective members, one from each aldermanic district, with a president of the board of aldermen, elected at large. A controller, elected at large, is also provided to be the head of the department of finance. The mayor, controller, president of the board of aldermen and the five borough presidents are designated as members of the board of estimate and apportionment. In this body, the mayor, controller, and president of the board of aldermen have three votes each, the presidents of the boroughs of Manhattan and of Brooklyn, two votes each, and the presidents of the boroughs of the Bronx, Queens and Richmond, one vote each. The board of estimate and apportionment is the general policy-making and finance-controlling branch of the government. The board of aldermen, in which each of the borough presidents has a seat and one vote, is chiefly concerned, as an independent body, with the enactment and repeal of local ordinances. By virtue of the City Home Rule Act of the State in 1924, the board of estimate and apportionment and the board of aldermen were combined as the municipal assembly which consists of two branches with the above titles, but having much broader legislative powers with respect to the property, affairs and government of the city. The municipal assembly functions in much the same way as bicameral legislatures elsewhere. When the board of aldermen is functioning as a branch of the municipal assembly, the borough presidents are not, however, entitled to sit as members of this body. A local law may originate in either branch of the municipal assembly, and if passed by one branch may be amended by the other. A majority affirmative vote of the total voting power of each house of the municipal assembly is necessary for enactment of law. The mayor may veto the ordinances and resolutions of the board of aldermen or a bill passed by the municipal assembly, which veto, in either case, may be overridden, by a three-fourths vote of the board of aldermen or a two-thirds vote of each branch of the municipal assembly. Before signing a bill passed by the municipal assembly the mayor must hold a public hearing after five days' notice. The board of aldermen has also many powers which it exercises independently of the municipal assembly. It may make, amend, and repeal all ordinances, initiate the issue of special revenue bonds for emergency expenditures, authorize purchases in excess of $1,000 without public letting, exercise general legislative control over water rates, street traffic and public markets, and reduce or eliminate, during the 20 days allowed for consideration, any item of the budget as passed by the board of estimate and apportionment.

The mayor as chief executive of the city is responsible for the administration and appoints the heads of all departments of the city government except the department of finance, which is under the elective controller, and those departments which are under the exclusive direction of the borough presidents. The borough presidents are responsible for highways, sewers and topographical work in their respective boroughs, the care of public buildings and offices, and the enforcement of the building code. In the boroughs of Richmond and Queens, the borough presidents are also in charge of street cleaning and waste disposal.

There are in all 83 permanent government agencies in the combined city-county jurisdiction. The major departments of gov-

ernment which are specified as "administrative departments" in the city charter are the departments of finance, law, police, water-supply, gas and electricity, street cleaning, plant and structures, parks, public welfare, correction, fire, docks, taxes and assessments, education, health, tenement house and purchase.

There are five county governments within Greater New York, namely, New York, Bronx, Kings, Queens and Richmond. The officers of these are practically independent of those of the city and are mainly elected by the people.

Regular officers and employees of the greater city for 1928 totalled about 121,500, not including several thousand in temporary or emergency services. Civil service regulations apply to all officers and employees of the city except officers elected by the people, legislative officers, and staffs of educational institutions which have special professional standards. The civil service commission consists of three members appointed by the mayor —not more than two of whom may be of the same political party.

In 1920, the New York city employees' retirement system was put into effect. All persons in city service whether appointive or elective, who entered or re-entered the city service after Oct. 1, 1920, and who have completed six months of city service are eligible to the benefits of this retirement system, except those entitled to share in the police pension fund, the fire department relief fund, the teachers' retirement system, or the department of street cleaning relief and pension fund.

V. FINANCE AND TAXATION

In the year 1928 the total budget of the city amounted to the sum of $512,528,831.49, of which $484,827,295.35 was for the city government exclusive of the county governments and the State tax. Of the total the amount to be raised by taxation was $429,021,155.18. Principal and interest of the city's long-term debt requires $104,284,902.73; and for instalment on account of four year rapid transit corporate stock for the new independent subway system, and for all other purposes, except State tax, $394,117,081.75. The chief items of the present budget are: legislation, $664,787; city and county administration, $19,300,895.41; borough government, $26,664,449.07; educational and recreational services (including department of education, $84,347,196.13), $105,735,799.24; protection of life and property (including police department, $44,903,708.40, and fire department, $19,957,678.30), $67,104,627.70; health, sanitation and care of dependents (including health department, $6,342,960; department of public welfare, $10,277,974.58; board of child welfare, $6,126,946; Bellevue and Allied hospitals, $4,053,439.25; tenement house department, $1,026,532; department of water-supply, gas and electricity, $13,706,176.05; department of street cleaning, $27,302,644.33; payments to nonmunicipal charitable institutions, $8,430,669.75), $77,441,943.60; correction, $2,755,716.25; facilitating commerce and traffic (including department of plant and structures, $9,139,508.91, department of docks, $1,613,974.64, board of transportation, $6,000,000), $16,753,483.55; courts, $12,363,696.38; central purchase, printing and publicity, $2,141,775.50; debt service and tax deficiencies, $154,474,902.73; miscellaneous (including pensions, salary adjustments, repaving and resurfacing streets, public improvements, snow removal, anticipated claims, etc.), $12,567,284.58; State tax, $14,126,847.01.

The assessed valuation of real estate (including corporation estates and franchises) and personal property of the city (1928) is: real estate, $15,845,505,899; personal estate, $308,440,050; total, $16,153,945,949. The basic tax rate for 1928 was $2.66 for each $100 of assessed valuation. The assessments for local improvements in the various boroughs give a combined tax rate for the boroughs as follows: Manhattan, $2.73; the Bronx, $2.71; Brooklyn, $2.74; Queens, $2.76; and Richmond, $2.73.

The budget-making period runs from June to December. Not later than Aug. 1 the various bodies submit their estimates to the board of estimate and apportionment. The board of aldermen may reduce or eliminate items (except those exempted by law). The mayor may veto the action of the board of aldermen, which in turn may override his veto by a three-fourths vote.

After the adoption of the budget, the board of taxes and assessments prepares the assessment rolls. These must be delivered on March 1 to the board of aldermen, which must meet not later than the first Monday in March to fix the annual tax rates. When this has been done and the amounts to be collected from the various taxpayers have been extended upon the rolls, the board of aldermen must deliver them not later than March 28, to the receiver of taxes or city collector directing him to collect the taxes as set forth, and to pay them to the city chamberlain. The city collector is chief of the bureau of city collections in the department of finance.

Fiscal affairs are in general under the control of the controller, who is the head of the department of finance. The functions of this office are, mainly, the collection of revenues, the audit of accounts, the maintenance of the general accounting system, investigation of all matters involving finances, the preparation of accounting statistics, and the adjustment of claims. The treasurer is, however, the city chamberlain, who is appointed by the mayor. Although under the charter the chamberlain is in the department of finance, he is actually quite independent of this department. Other officers, boards and commissions exercising functions of fiscal control or collection of revenues are the sinking fund commission, the commissioners of accounts and of purchase, the departments of licences and of taxes and assessments, the board of assessors and the banking commission. The sinking fund commission consists of the mayor, controller, president of the board of aldermen, city chamberlain and chairman of the finance committee of the board of aldermen, *ex officio*. The department of licences, under a commissioner appointed by the mayor, is responsible for the licensing and supervising of about 35 different businesses, including public amusements. The licensing of public hacks is, however, vested in the police department, and a number of other forms of licence are under supervision of departments particularly concerned with inspection, as the health and fire departments. The board of aldermen determines the general conditions of licensing. Collection of licence fees is commonly made by the department issuing the licence.

Police.—The police department has about 18,000 officers and employees, of whom about 300 are not uniformed. It is under the direction of a civilian commissioner, who receives $10,000 a year and serves also as *ex officio* member of the city ambulance board, the board of health, and the parole commission. He is appointed by and removable at the pleasure of the mayor. The headquarters of the police department is in Manhattan. There are 40 precinct station houses in Manhattan, 32 in Brooklyn, 10 in Queens and 3 in Richmond. The administrative activities of the department are carried on through the commissioner and five deputy commissioners, while the uniformed force is under the supervision of a chief inspector. A significant feature of the police department is its academy, through which all recruits must pass. The total appropriation for the police department for 1928 was $44,903,708.40, of which $41,186,320.40 was allotted for personal service.

Fire.—A fire commissioner at $10,000 a year, appointed by and removable at the pleasure of the mayor, heads the fire department, which has a personnel of about 7,200, of whom about 6,200 are in the uniformed force. At the head of the uniformed force and in charge of fire-fighting is the chief of the department, who receives $12,500 a year. The department is divided into several bureaux, namely, fire extinguishment, prevention and investigation, and hazardous trades. Ninety-five engine and 50 hook and ladder companies are maintained in Manhattan and the Bronx; Brooklyn and Queens have 111 engine and 61 hook and ladder companies; Richmond, 11 engine and 6 hook and ladder companies. In addition, there are two special rescue companies. In the fire extinguishment service, third and fourth grade firemen receive $1,769 a year, first grade firemen $2,500 a year. In these classes there are approximately 5,000 men at all times. The total appropriation for the fire department was $19,957,678.30 in 1928, of which $18,677,818.30 was for personal service. The latest available statistics (1926) put the annual fire loss of the city at $21,671,755. A fire college is conducted by the department.

Health and Hospitals.—In 1925 the general death rate was

11·49 per 1,000 population. The lowest rate was 11·08 per 1,000 in 1921. In 1898 the general death rate was 20·26. New York was the first American city to undertake health inspection of school children when it appointed a physician for this work in 1892, and in 1905 it inaugurated another health service for children, namely, the appointment of school nurses to assist physician inspectors. In 1908 the first American division of child hygiene was

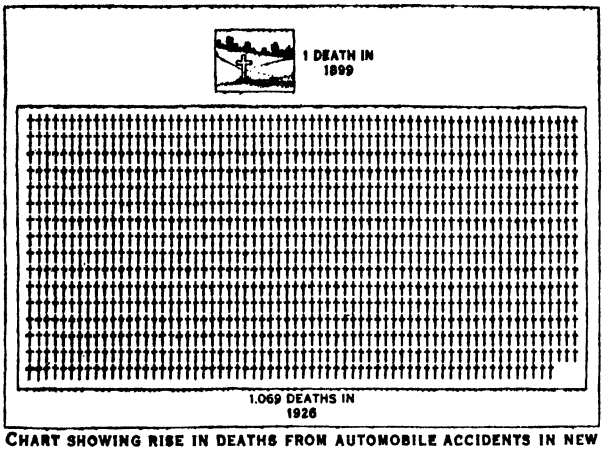


CHART SHOWING RISE IN DEATHS FROM AUTOMOBILE ACCIDENTS IN NEW YORK CITY. FIGURES FROM THE REGISTRAR OF RECORDS, DEPARTMENT OF HEALTH, NEW YORK CITY

established in the city health department to co-ordinate, under a single director, all of the various activities for the promotion of child health. Infant mortality in the city has been reduced since 1910 by half. In 1925, the birth rate was 20·60 per 1,000 population, the lowest on record.

The health department is under the administration of a board of health, comprising the commissioner of health and one physician, both appointed by the mayor, and the police commissioner, *ex officio*. The health commissioner is the executive head at a salary of $10,000 a year. There is an advisory board of 18 unpaid physicians appointed by the mayor. Borough health offices are maintained under the direction of assistant sanitary supervisors. The professional and technical services are divided among eight major bureaux; *i.e.*, foods, sanitation, records and statistics, field medical service, nursing, hospitals, research and laboratories, and health education. All employees are appointed through civil service. As a part of general preventive and educational work, the department conducts 70 baby health stations. It also maintains 21 dental clinics and 11 eye clinics for children, and two advisory clinics for venereal disease patients. Its personnel, including all hospital, baby health station and clinic employees, numbers about 2,000. Its appropriation for 1928 was $6,408,276, of which $5,103,341 was for personal service. The U.S. Public Health service manages the Quarantine station at Rosebank, S.I., where incoming vessels are inspected for quarantinable diseases; and units are provided on Hoffman island in the Lower bay for the care of incoming passengers suspected of having contracted these. The medical inspection of immigrants at the Ellis island immigration station is also made by this service which is also in charge of three U.S. marine hospitals in the New York zone. Among the great number of unofficial agencies chiefly concerned with health betterment within the city and its environs, the following deserve special mention: the New York Tuberculosis and Health Association, New York Diet Kitchen Association, Henry Street Settlement, Maternity Center, Committee for Health Service among Jews, New York Child Welfare Committee, Committee on Maternal Health, Judson Health Centre, East Harlem Health Center and Public Health Committee of the New York Academy of Medicine. The Catholic Charities of the Archdiocese of New York, the Association for Improving the Condition of the Poor, the Charity Organization Society, the Children's Aid Society, and the Jewish Social Service Association also concern themselves with public health.

Not including proprietary hospitals, of which there are about 50, New York has 134 general and special hospitals which are available for the care of the sick of all classes. Of these 27 are municipal hospitals and 114 are maintained as tax-free institutions by private agencies. Recent estimates place the total number of hospital beds in the city at about 32,000 or five beds per 1,000 population not including beds in hospitals for the insane. The 27 municipal hospitals account for about one-half of the total number of beds. In addition to the municipal and private hospital services, there are two hospitals for the insane under the direction and control of the New York State department of mental hygiene; *i.e.*, the Brooklyn State hospital of 1,589 beds, and the Manhattan State hospital of 6,516 beds. The municipal hospitals beginning Feb. 1, 1929, are now administered by a newly created department of hospitals headed by a commissioner appointed by the mayor. Among the more important city hospitals are the Bellevue, Harlem, and Gouveneur general hospitals, in the borough of Manhattan; Fordham, a general hospital in the borough of the Bronx; and Neponsit Beach, a hospital for bone tuberculosis in the borough of Queens, the city and metropolitan hospitals on Welfare Island and five hospitals for communicable diseases. There is also the Reception hospital for classification. Although the municipal hospitals are free to indigent patients, all except the communicable disease hospitals conducted by the city health department have fixed charges for service, varying from 80 cents to $2.25 per day. Of the total days' service rendered by the 56 hospital members of the United Hospital Fund in 1925, 47% was free.

Among the chief private general hospitals are Mount Sinai, St. Luke's, Presbyterian, New York, Roosevelt, Lenox Hill and the Post Graduate. All of these hospitals are in the borough of Manhattan. In Brooklyn are the Long Island College hospital, Jewish, Brooklyn and Methodist Episcopal. Of the private special hospitals for women and children, the Lying-in, Sloane Maternity, Nursery and Child's, Woman's and Misericordia are the largest. Other special hospitals of note are the Orthopaedic, Ruptured and Crippled, Joint Diseases, New York Eye and Ear infirmary, Manhattan Eye, Ear and Throat hospital, Skin and Cancer hospital and Neurological institute.

Forty of the general hospitals, municipal and private, operate about 100 public ambulances. This service is under the control of a board of ambulance service. Among the recent events of interest in connection with the private hospital services of the city is the establishment of the Presbyterian-Columbia Medical centre. New buildings on an extensive scale are now partly completed on a site at the northern end of Manhattan, with the view of bringing together in close physical and administrative relationship the Presbyterian hospital, the College of Physicians and Surgeons of Columbia university, and a group of other special hospital services including the Babies hospital, the Neurological institute, and the Sloane Maternity. Funds have been appropriated by the State to establish a State psychiatric institute and hospital at the Medical centre.

Charities.—The department of public welfare is under the direction of a commissioner appointed by the mayor at a salary of $10,000 a year. It is responsible for inquiry and disposal of all cases of applications for public relief, the care of the dependent sick, mentally defective and epileptic; the relief of veterans and their families; the distribution of funds for the relief of the poor adult blind of the city; the receipt and disbursement of funds for the support of children of unmarried mothers; the inspection of private institutions for adults and children; the regulation of public solicitation of funds; and the collection of money from parents and relatives in part payment for the support of public charges. The department of public welfare also maintains the Municipal lodging house.

The city board of child welfare comprises ten members appointed by the mayor, three of whom must be women. The members of this board receive no compensation. The board grants allowances to needy and worthy widows whose husbands were citizens of the United States and residents of the State of New York at the time of their death. Allowances are also made to mothers whose husbands are confined in prisons or are otherwise incapaci-

tated for earning. For these purposes the city appropriated $6,126,946 for 1928.

The work of the official agencies above described represents only a small part of the charitable services available to dependent or handicapped persons. A major share of the institutional care of dependent sick and otherwise incompetent is provided by unofficial agencies and institutions, many of which are in part reimbursed for their services in the care of persons properly public charges. The city appropriated for the current year (1928) $8,430,669.75 for the care of dependents in private hospitals, homes and other institutions. The burden of outdoor relief and family welfare work of the poor is borne by private agencies. In all, there are several hundred organizations dealing with one phase or another of relief and family welfare not including the many semi-social, fraternal, or mutual benevolent organizations. Several of the more important charitable and benevolent organizations work in close association at the United Charities building. To bring about a more general co-operation of charitable and benevolent organizations, the Welfare council of New York city was established in 1925 by the voluntary association of about 500 public and private social agencies, which for purposes of co-operative action were grouped in four divisions: family welfare; child welfare; health; recreation, education and neighbourhood activities.

Corrections.—The department of corrections is under the direction of a commissioner of corrections appointed by the mayor at a salary of $10,000 a year. It supervises the three city prisons of Manhattan (The Tombs), Brooklyn and Queens, the 11 district prisons, and New York County penitentiary and the Correctional hospital; the Municipal Farm and the Reformatory prison; the New York City Women's Farm colony; the Warwick Dairy farm; and the New York City reformatory.

The city parole commission consists of the commissioner of corrections and the police commissioner, *ex officio*, with three members appointed by the mayor, one of whom is chairman of the commission at a salary of $7,500 a year. It supervises persons released from city correctional institutions prior to the expiration of their sentences, and while still in the custody of the State. A probation bureau is maintained under the general direction of the chief magistrate of the magistrates' courts of the five boroughs. A chief probation officer directs this bureau. The probation officers conduct, at the direction of the magistrates, investigations of defendants prior to sentence and receive on probation and supervise delinquents. The five borough children's courts supervise juveniles on probation. Many charitable associations receive aid from the city to care particularly for delinquent women and children. Other correctional agencies, several of which also receive public funds and furnish special services to the city in dealing with correctional problems, are the Societies for the Prevention of Cruelty to Children; the House of Refuge; New York Society for the Suppression of Vice; Salvation Army; Volunteers of America; Woman's Prison Association; Prison Association of New York; House of Good Shepherd; New York Catholic Protectory; Society for the Prevention of Crime; Jewish Board of Guardians; Joint Committee on Methods of Preventing Delinquency; Big Brother Movement and Big Sisters.

Public Water Supply.—In the early days, the water-supply of New York was derived from wells and from streams and ponds. In 1799, the Manhattan company was incorporated ostensibly to supply the city with water, but under a clause in its charter, devoted itself primarily to the banking business. In 1834 the legislature authorized the city to begin the necessary works to bring water from the Croton watershed more than 30 m. north, and the first Croton water was delivered to the city in 1842 through the Croton aqueduct. In 1883 the new Croton aqueduct was authorized and thus additional water became available in 1890. In 1905 the board of water-supply was created and work was begun immediately on a new system to bring water from the Catskill mountains, more than 100 m. north. This commission developed an additional water-supply from the Esopus and Schoharie watersheds with a total dependable yield of about 600 million gallons daily flowing through the Catskill aqueduct. In the year 1927 an average of about 570 million gallons of Catskill water was used daily.

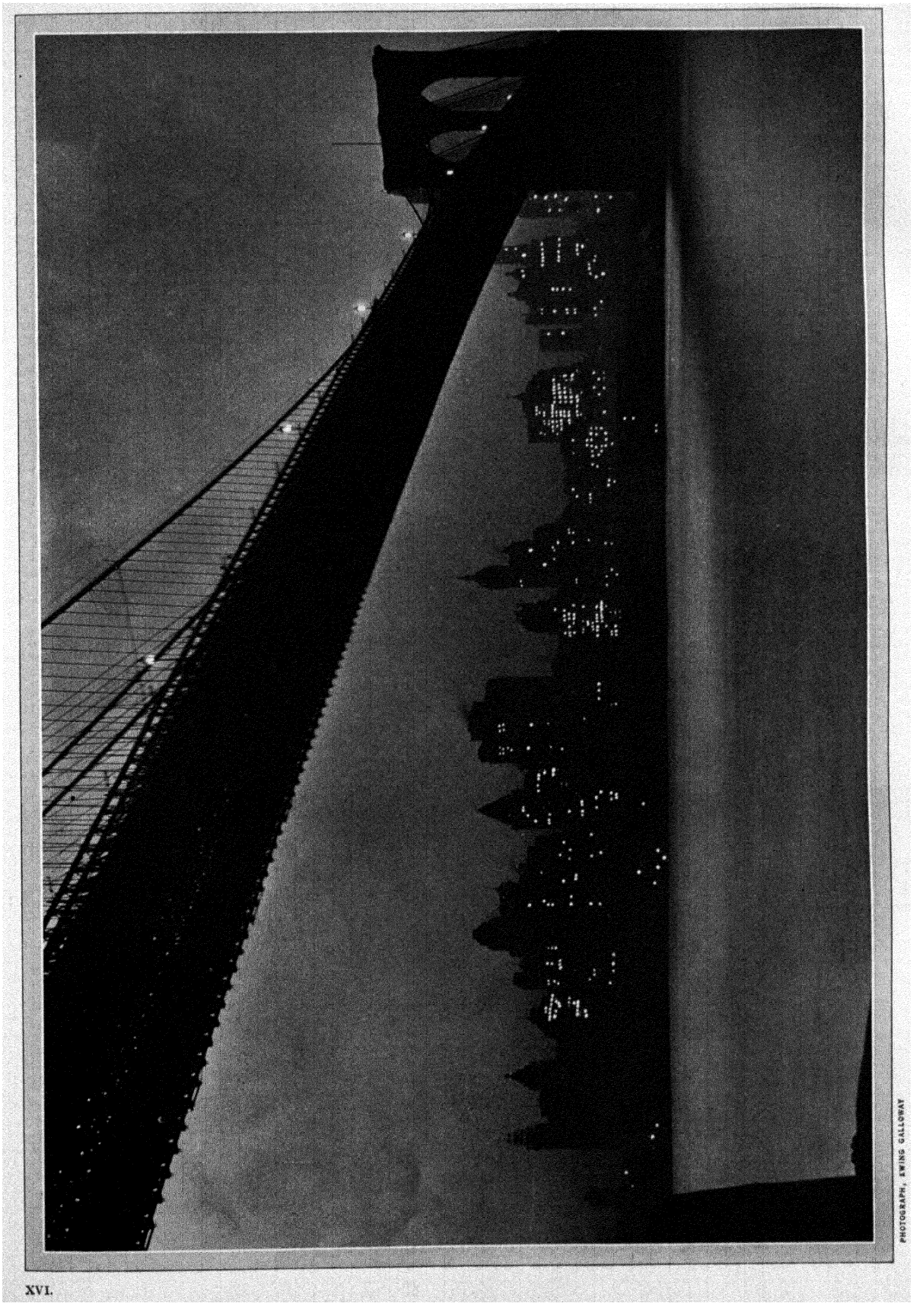
The Catskill aqueduct delivers its water just north of the city line into Hill View reservoir, which has a storage capacity of 900 million gallons. From the Hill View reservoir, Catskill water is delivered into the five boroughs of the city by a circular tunnel in solid rock at depths varying from 200 ft. to 750 ft. below the street level, and reducing in diameter from 15 ft. to 11 feet. The total cost of the Catskill water-supply system was about $185,000,000. The average daily consumption of water in New York city for 1927 was about 875 million gallons. The present public water-supply systems provide a dependable yield of about 1,050 million gallons per day.

Sewers.—There are more than 2,800 m. of sewers, over one-third of which lie in the borough of Brooklyn. The sewers in the older and more densely settled sections are generally on the combined plan, serving for storm water as well as for domestic and industrial waste. In Manhattan many of the sewers are egg-shaped, with a minimum size sufficient to enable them to be entered and cleaned by hand. In Brooklyn, the Bronx and Queens, the extensive low-lying areas have required the construction of large trunk sewers which have generally been of concrete. The older sewers were of brick or vitrified pipe, although for many years cement pipe was employed for the smaller sizes in Brooklyn. There are approximately 840 m. of concrete sewers, 570 m. of brick sewers, 1,400 m. of vitrified clay pipe, and 25 m. of cast iron pipe sewers in the city, which, in the main, empty into the rivers and tidal waters. With the growth of population, the pollution of the harbour has increased, with the result that fine screening has been resorted to where this will suffice, and at those points where a higher degree of purification is considered necessary, land has been secured for the establishment of activated sludge treatment plants. Plans are now being prepared for the first of these plants on Ward's island.

Public Works.—The commissioners of public works control the bureaux of audits and accounts, design and survey, sewers, highways, public buildings and offices and the bureau of buildings. There are in addition 24 local improvement districts; for each district there is a local improvement board.

The work of the street cleaning department includes the collection and disposal of all municipal waste. Snow removal is one of the most costly and difficult problems; in the winter of 1924–25, when there was a total snow-fall of 27 in., its removal cost over $5,000,000. For the collection and disposal of garbage, ashes and rubbish (about 15 million cubic yards annually), over 9,000 persons are regularly employed. Garbage is disposed of by incineration in the boroughs of Queens and Richmond, but that of the other and larger boroughs is loaded on scows and towed to the open sea about 30 m. beyond Scotland lightship, where it is dumped. Ashes and rubbish are in the main utilized for land fills in the several boroughs. The total appropriation for the department of street cleaning for 1928 was $27,302,644.33, of which $20,128,374.33 was for personal service.

City Planning and Zoning.—The Greater New York charter adopted in 1898 provided that the responsibility for laying out street systems should be primarily vested in the borough presidents with specific approval resting on the board of estimate and apportionment, and independent approval by the mayor for changes in plan. In 1903 the board of aldermen created an improvement commission which reported in 1907. In 1913 a heights of buildings commission was created. This led to the building zone resolution of July 25, 1916, which regulated the height and bulk of buildings thereafter erected and the boundaries for trades and industries. This resolution divided the city into "use," "height" and "area" districts. The "use" districts are: (1) "residence," where no building can be erected other than for specified uses, such as dwellings, clubs, hotels, etc.; (2) "business" where specified trades considered as either offensive or dangerous are prohibited; and (3) "unrestricted," where no zoning regulations or restrictions are provided. The "height" districts provide for "setbacks" in buildings erected in excess of certain heights, the height and extent of the "setbacks" depending on the



PHOTOGRAPH, IRVING GALLOWAY

NEW YORK AT NIGHT

The skyline of lower New York at dusk as seen from the East River above Brooklyn Bridge

NEW YORK (CITY)

WALL STREET AND LOWER BROADWAY

1. Wall Street looking west toward Trinity Church. From an etching by Anton Schutz

2. Lower Broadway near Trinity Church, with the towers of the Singer Building and the Woolworth Building in the background. From an etching by Anton Schutz

width of the adjoining streets. There are five "area" districts designated as A, B, C, D and E, and the size of court and rear yard required bears a definite ratio with the height of the building. Changes in the zoning resolutions of 1916, and amendments thereto are vested in a standing committee of the board of estimate and apportionment, called the City Plan and Public Improvements Committee. Appeals from the actions and decisions of the different superintendents of buildings and officers of the fire department who are charged with the enforcement of zoning regulations are made to the board of standards and appeals.

Public Markets.—The commissioner of public markets, who is appointed by the mayor, has jurisdiction over all public markets, market-places and lands, and all auctioneers of foods and permits and leases for business. He also supervises the manufacture and sale of ice. The chief markets for foodstuffs are the Washington, West Washington, Gansevoort, Harlem, Westchester and Wallabout market and the Bronx Produce house. A terminal market is under construction in the Bronx. A picturesque feature of the city's congested foreign districts is the open air push-cart market. There are 58 of these and their yearly business amounts to millions of dollars.

Parks and Recreation.—Administration of the parks of the city is vested in a park board of five members, who are the park commissioners appointed by the mayor for the five boroughs. The total park area of the 117 city parks, not including unimproved acreage and parked streets, is 9,312 acres. The largest of the parks are the Pelham Bay (Bronx), 1,756 ac.; Van Cortlandt (Bronx), 1,132 ac.; Marine park (Brooklyn), 1,099 ac.; Central (Manhattan), 840 ac. and Bronx, 719 ac.

Central park extends from 59th to 110th streets, between Fifth and Eighth avenues. It was purchased in 1856 for about $5,500,000, and laid out and developed by the architects Frederick Law Olmstead and Calvert Vaux, under the direction of a board of 11 commissioners, the first committee of construction including William Cullen Bryant, Washington Irving and George Bancroft. Van Cortlandt, Pelham Bay and Forest parks are the largest generally devoted to outdoor sports and recreation. In Van Cortlandt park is the Van Cortlandt mansion built in 1748, and now maintained as a museum. The Bronx park is noted for its zoological and botanical exhibits and Prospect park for its beauty. Riverside park, in Manhattan, extends along the east bank of the Hudson river from 72nd to 129th streets, a distance of about three miles. Battery park was the site of "The Battery" in the early days of the city. The aquarium occupies the old Castle garden in this park. City Hall park constitutes a part of what was called "The Common Lands" in the middle of the 17th century. Roger Morris park is the site of the Jumel mansion, the home of Mme. Jumel, wife of Aaron Burr, and here Gen. Washington made his headquarters during the battle of Harlem heights. In Audubon park was the home of the naturalist John James Audubon. Poe park, in the Bronx, is the site of the Edgar Allan Poe cottage. In Fort Greene park, Brooklyn, is a vault containing the remains of a few of those who died in the British prison ships in 1776 and after.

Courts.—The judicial system of the city is composed of the following courts: magistrates' (minor offences); homicide; municipal term; night; family; traffic; woman's; probation; municipal (civil actions involving not more than $1,000); city (civil actions involving $1,000 to $3,000); county (in New York this is the court of general sessions and in Richmond the county and surrogate's court are combined; major crimes); special sessions (chiefly misdemeanors); children's (children under 16, except murder in the first degree); and surrogate's (estates of infants and deceased persons). The mayor appoints about 70 city marshals.

VI. EDUCATION

Public School System.—The free public school system is administered as the department of education by an unpaid board of seven, appointed by the mayor, for terms of seven years. The school system comprises 662 public schools with an enrolment of over 1,000,000. There are 604 elementary, 37 high schools, 3 teacher training, 4 vocational and 14 compulsory continuation schools. For each school district there is a local board of five appointed by the borough president for five years. Members receive no compensation and may be removed by the borough presidents after a hearing.

The chief executive officer of the board of education is the superintendent of schools who is elected by the board of education and sits with this body though without vote. He receives a salary of $25,000 a year and holds office for six years. There are eight associate superintendents of schools. The superintendent and associate superintendents of schools constitute the board of superintendents. Teachers are chosen by the board of education from eligible lists of those who have qualified before a board of examiners of seven members appointed by the board of education. The total personnel of the department of education is estimated as 42,000. The appropriation (1928) was $84,347,196.13, of which $74,152,350.14 was for personal service. In addition it was estimated in that year that $40,197,681.42 would be received from the State, making in all $124,544,877.55, available for the department. A teachers' retirement system is administered by the teachers' retirement board of seven unpaid members.

Higher Educational Facilities.—The city provides such facilities in the College of the City of New York (co-educational), and Hunter college (women). The College of the City of New York, or City college, was established as the Free academy in 1847. The name was changed to the present one in 1866. The college occupies buildings of English Gothic style, constructed at a cost of over $5,000,000. It has about 11,000 students, and $2,169,855.24 were appropriated for it in 1928. Hunter college for women, originally intended as a teacher training school was established by the board of education in 1869 as the "Normal and High School." It has over 3,000 students. For this and its "annexes" $2,199,605.96 were appropriated in 1928. In addition, New York is the seat of Columbia university (*q.v.*), and New York university, which was founded in 1831. In 1835, it moved to Washington square, and in 1891 added a site of about 48 ac. on University heights in the Bronx. It enrols about 23,000 students. Fordham university (6,000 men students) was founded in 1841 as St. John's college. In 1846 it was turned over to the Jesuits and incorporated as Fordham university. It is situated in the Bronx. Long Island university (1928) in Brooklyn has facilities for about 400 students, chiefly in schools of law and medicine. The year 1928 also witnessed the opening of Yeshiva college (Jewish), which occupies new buildings of Ancient Semitic architecture situated in upper Manhattan. It has facilities for 1,500 students. Among the more important of the professional schools are: the General Theological seminary (Protestant Episcopal); Union Theological seminary (Presbyterian); Jewish Theological Seminary of America; Cornell university medical college; College of Physicians and Surgeons in the City of New York (Columbia university); University and Bellevue hospital medical college (New York university); New York Post Graduate Medical school and hospital; Homeopathic Medical college; Long Island university medical college in Brooklyn; Columbia university law school (Columbia university); Fordham university law school; New York law school; New York university law school; Brooklyn law school of St. Lawrence university; Brooklyn college of pharmacy; College of pharmacy of Columbia university; Fordham university college of pharmacy; School of Dental and Oral Surgery of Columbia university; Teachers' college of Columbia university; New York school of social work; the National Institute of Public Administration; and the New School of Social Research. The chief technical institutions are the Mechanics Institute school, founded in 1820; Cooper Union (*q.v.*); the Peoples institute for the promotion of adult education; and Pratt and Polytechnic institutes, both in Brooklyn. The New York State Nautical school is conducted on board the U.S.S. "Newport."

Libraries.—The first public library in New York was the Corporation library, established at the City Hall (1697–1701). Up to 1795 it remained at the City Hall and was the Library of Congress when New York was the nation's capital. It is now called the Society library. Other older libraries are: the Columbia university library (1754), that of the American Historical

Society (1804), and the Mercantile library, founded in 1820 by merchants' clerks. The municipal library system consists of the New York public library, serving Manhattan, the Bronx and Richmond; the Brooklyn public library and the Queens public library. (For the numerous and important special libraries in New York see *American Library Directory*, 1927.)

Art.—Most of the principal American sculptors have at some time resided in New York and it is here, frequently in inconspicuous places, that one finds their masterpieces. St. Gaudens is represented by his "Peter Cooper," the equestrian statue of Sherman, the Admiral Farragut statue, the bronze relief of the Rev. Henry W. Bellows and other works; John Quincy Adams Ward, by the "Pilgrim," "Shakespeare," "Indian Hunter," and a monumental bronze Washington; Frederick W. MacMonnies by his "Nathan Hale," "Civic Virtue," "Horse Trainers and a Quadriga"; Daniel Chester French by the "Alma Mater"; and George Gray Barnard by a fountain at Columbia; Karl Bitter by an "Abundance" and an equestrian statue of Franz Sigel; Anna Hyatt by a "Jeanne D'Arc"; Kirke Brown by an equestrian Washington; F. Auguste Bartholdi, the French artist, by a "Lafayette"; H. P. Proctor by a bronze group of panthers; and Edward Kemeys by a "Still Hunt." On the front of the Public library is Paul Bartlett's statue, and a group by Albert Weinter depicting the purchase of Manhattan island is in the City Hall of Records. The bronze "Statue of Liberty" of Bartholdi, the gift of France to commemorate the 100th anniversary of American independence, rises from Bedloe's Island 300 ft. above the harbour.

Central and Prospect parks are adorned with many examples of fine statuary, and unfortunately, also, with many which are lacking in merit. Many sculptors are represented in the busts of great Americans in the Hall of Fame at New York University.

A few striking examples of 18th and early 19th century architecture still remain, notably St. Paul's chapel, designed by MacBean and built in 1764, the old church of St. Mark's-in-The-Bouwerie, completed in 1799, and City Hall, the work of Mangen and Macomb, completed in 1811. Renwick designed the Gothic Grace church, completed in 1845, and St. Patrick's cathedral, which was built between 1858 and 1879. After the Civil War Richard M. Hunt, a graduate and teacher in the Paris School of Fine Arts, began his American career. Among his first works were the recently demolished French chateau of William K. Vanderbilt, the Astor and Gerry houses and the Tribune building. George B. Post designed many beautiful residences, the Times and World buildings and the Produce and Cotton exchanges. Charles F. McKim, William R. Mead, and Stanford White were designers of the old Madison Square Garden, the Washington arch and the Metropolitan club. R. H. Robertson is known for his work on the American Tract Society and United Charities buildings and the Corn exchange bank. Carrère and Hastings planned the National Academy of Design and the New York public library; H. I. Hardenburg the Waldorf, Savoy and Manhattan hotels, and the American Fine Arts building; and Ernest Flagg the Singer building, St. Luke's hospital and the Scribner building. The chief collection of art objects in America is in the Metropolitan Museum of Art.

The art commission of the City of New York was established in 1898, being the first American municipal organization designed to protect a city against inferior structures and memorials. It passes judgment upon designs for buildings, bridges, statuary, gates, etc., and upon all alterations in existing works of art.

Music.—In the first quarter of the 19th century, the Park theatre became a famous stage for dramatic and musical art. In the '40s and '50s the musical centre was Tripler hall on lower Broadway, which became Metropolitan hall in 1854 and then, following its destruction by fire shortly after, was rebuilt and rechristened the New York theatre and Metropolitan opera house. Later its name was changed to the Winter Garden. The present Metropolitan opera house was built in 1883. In the latter half of the 19th century several other large halls for musical recitals were opened, notably, Steinway, Chickering, Hardman and Carnegie halls, the last named being the largest auditorium available in this period. It was in the middle and latter part of the 19th century, however, that the musical history of New York really began (*see* MUSIC: *United States*).

Literature.—Cadwallader Colden, author of the *History of the Five Nations* (1730) was perhaps the first New York author of general reputation. The first authors' club, the Ancient club of New York, was founded in the latter part of the 18th century and later included among its members Washington Irving, Fitz-Greene Halleck, James Kirk Paulding and Joseph Rodman Drake. A little later John James Audubon, Richard Henry Dana, James Fenimore Cooper, Edgar Allan Poe, William Cullen Bryant, John Bigelow, Julia Ward Howe and Robert Bonner were members of New York's literary life. In the 19th century the Bread and Cheese club brought together a most creditable group of writers. As the country expanded, however, the influence of New York upon letters declined somewhat although it is the centre of American printing and publishing. The chief society of authors having headquarters in New York is the American Academy of Arts and Letters. Other notable literary organizations are the Society of Arts and Letters, Authors' Guild, Catholic Writers' Guild of America, New York Drama League, American Dramatists, Grolier Club, Century Association and League of American Penwomen.

Scientific Collections and Learned Societies.—Chief of the scientific collections is that of the famed American Museum of Natural History. The Aquarium at Battery park and the Zoological park in Bronx park are both under the control of the New York Zoological Society (*see* AQUARIUMS, U.S.).

The Botanical garden in Bronx park occupies about 400 ac. The museum contains a library, collections with about 1,500,000 specimens and research laboratories; $230,000 were appropriated for the Botanical garden in 1928. The Brooklyn Institute of Arts and Sciences maintains another large botanical garden. (For the Museum of the American Indian [Heye foundation] *see* MUSEUMS.)

The Hispanic Society of America, founded by Archer M. Huntington, maintains an excellent museum of Spanish and Portuguese paintings, manuscripts, maps, coins and antiquities. Other interesting collections are in the Museum of the American Numismatic Society, containing exhibits of medals and coins of all countries and of all periods, and the American museum of Safety (industrial safety appliances).

The New York Historical Society, founded in 1804, is the most important for material on New York State History. The Long Island Historical Society of Brooklyn and the New York Geneological and Biographical Association, founded in 1869, are notable in this field. The Quadrangle at Broadway and 156th street is the location of the American Numismatic Society, the Geographical Society of New York, the Museum of the American Indian and Hispanic Society of America. The New York Academy of Medicine, established in 1847, and the Academy of Political Science at Columbia University, founded in 1880, also deserve mention. (*See* SOCIETIES, LEARNED.)

(For New York city press data *see* PUBLISHING; PRESS; NEWSPAPERS. For foundations *see* CARNEGIE TRUSTS; ROCKEFELLER FOUNDATION, etc.)

VII. THEATRES, CLUBS AND CHURCHES

Theatres, Arenas and Exhibitions.—The first dramatic performances in New York were probably those given in a building in Pearl street by a company of actors from London in 1732. Another company from London came to New York in 1749. The real beginning of the permanent theatre in New York was, however, in 1750, when a company under the management of Kean and Murray came from Philadelphia and established themselves in a house on Kip street (now Nassau), between John street and Maiden Lane. Lewis Hallam arrived in 1753 from Virginia and erected a theatre in Nassau street, the first building constructed for theatre purposes, and opened it in 1753 with *The Conscious Lovers* and *Damon and Phelleda*. The first performance of *Romeo and Juliet* was given at this theatre in 1754 with Mrs. Hallam as Juliet. This theatre was abandoned the same year and was converted into a church by a society of Calvinists. The next

theatre was at Crugers wharf on the East river and was opened by David Douglass in 1758 with *Jane Shore*. Douglass also opened another theatre at the corner of Nassau and what is now Beekman street in 1761 with *The Fair Penitent* and later gave the first performance of *Hamlet* in New York; he also established the John Street theatre, in 1767. This theatre flourished until the Revolution and during the British occupancy of the city was used for amateur theatricals. After the British evacuation, Washington and his generals were frequent patrons of this theatre.

In 1798 was created a three storey stone theatre "The Park," between Ann and Beekman streets on Park Row, for Hallam and Hodgkinson. This building was a very magnificent one for its time, costing about $180,000. The story of the theatre in New York for the next 50 years is largely the story of the Park theatre (*see* DRAMA: *United States*). In 1837 New York had five theatres, the Park, Bowery, Olympic, Chatham and Richmond Hill. Palmer's opera house was built in the '40s as was also the Astor Place opera house, where the Astor Place riot occurred as the result of a dispute between friends of the American actor Forrest and his English rival Macready. Twenty-two persons were killed and about 40 were wounded by the militia called to quell the disturbance. In 1847, P. T. Barnum brought Jenny Lind to America for a series of concerts which began at Castle Garden at the Battery. Similar "pleasure gardens," as Niblo's, the New York, Cold Spring, East River, Vauxhall and Ranleagh, were utilized for concerts and other performances for which the capacity of theatres was inadequate. The Crystal Palace in Murray Hill was also a great amusement centre in the early '50s. By the middle of the century the theatrical district was well established in the neighbourhood of Union square, which was also the shopping centre. The Academy of Music, the Union Square, Irving Place and Wallack's were the chief theatres in this area. By 1870 23rd street had become the upper limit of the theatrical and shopping centre, with the Fifth Avenue theatre and Booth's. Ten years later the theatres had invaded the lower '30s with Daly's, the Standard, Wallack's and the Casino. In 1883 the erection of the Metropolitan opera house at 39th street started an invasion of the '40s and by the end of the century, 42nd street had become the real centre of the theatrical district as it is to-day. The present theatre district comprises roughly a strip of Manhattan extending from 14th to 59th streets, and from Fifth to Eighth avenues. Broadway cuts diagonally across the strip and in the language of the district is the "main stem" to which the cross streets are tributary. In this area there are to-day about 200 theatres, including those in which moving pictures are a part of the programme. According to the best available data, there are in all 414 theatres in Greater New York, including those exhibiting moving pictures as part of their entertainments. Among the largest are: Roxy (5,920), the Hippodrome (5,190), the Capitol (4,624), the Academy of Music (3,600), Paramount (3,528), and the Metropolitan opera house (3,305). Most of the theatres exhibiting the "legitimate" drama or musical comedies only are of less than 2,000 capacity (*see* STADIUM). It is estimated that in the theatre district alone, approximately 300,000 people attend the theatres daily. (*See* THEATRES; DRAMA.)

Clubs.—Club life in New York is less significant now than in the earlier part of the present century before the development of the apartment house hotels, the change in social habits and customs coincident with the expansion of business and trade into former residential districts, and the exodus from the city into suburban areas of so many of the leisured class who formerly sought city clubs for recreation and entertainment. The first social organizations of importance were the authors' Bread and Cheese club (1824), and the artists' sketch club (1829). It was not until 1836, however, that club life in New York really began with the founding of the aristocratic Union and Hone clubs. The Knickerbocker (1871), was also the resort of the descendants of original New York settlers. The St. Nicholas was formed a little later for those whose ancestors were early residents of the colonies. The Metropolitan (1891), with its costly house, was in fact a protest against the exclusiveness of many of the older clubs. The Union League (1863) was established for the purpose of aiding the Union, and its first work was the organization of regiments of coloured troops. To offset this Republican influence, the Manhattan was organized in 1864 to advance Democratic ideals, although this is not now greatly emphasized.

The chief sport and athletic clubs are the New York Yacht (1844), the New York Athletic (1868) and the Racquet and Tennis. Other important clubs with more or less specialized interests are the Advertising Club of New York, Automobile Club of America, the India House, Army and Navy, Architects, City, Colony, Engineers, Friars, Lambs, Players, Lotos, Century and Salmagundi clubs. A score or more of the great office buildings in down-town New York contain luncheon clubs, such as the Down-town Association, the Lawyers, Bankers and Whitehall.

Churches.—The Dutch Reformed Church (1628) was the first church in the city and is to-day known as the Collegiate Church of New York city. The Presbyterians organized here as early as 1638 and were tolerated by the Reformed Church, but it was not until the English occupancy that they made their influence felt. In 1719, the first Presbyterian church was built in Wall street; there are about 100 to-day. It was not until 1847 that a Congregational church attained great prominence in New York, when the Plymouth Church of Brooklyn was founded with Henry Ward Beecher as pastor. The Congregationalists now number about 50 active churches. In 1664, the Lutherans obtained permission from the English Governor Nicolls to establish a church. The first Lutheran church was at Broadway and Wall street, the site of the present Trinity church; they grew rapidly and now number over 200 churches and chapels. The Protestant Episcopal Trinity church was built in 1697 at Broadway and Wall street where the present Trinity (1790) now stands. St. Paul's chapel (1776), at Broadway and Vesey street is the oldest church edifice in the city; Grace, St. Thomas's, the Church of the Transfiguration, familiarly known as "The Little Church Around the Corner," and the great Cathedral of St. John the Divine, at 110th street and Morningside avenue, are other notable Episcopal churches. The first Methodist church (1768) was erected in John street. African Methodist Episcopal churches for negroes have a large membership. The first Baptists in New Amsterdam (1657), received little consideration at official hands and met in a private house in Broad street in 1715. In 1762 they built a church in Gold street. At present, they have about 120 churches, some of the largest being for negroes. St. Peter's (1785) was the first Roman Catholic church and in 1808, New York was made the seat of an Episcopal see. In the years prior to the Civil War the Catholic Church grew rapidly. In 1858, the present St. Patrick's cathedral at Fifth avenue and 51st street was begun, and in 1879 it was dedicated. It is the eleventh in size among cathedrals and seats about 18,000 persons. There are about 400 Catholic churches. Besides other Christian groups there are numerous flourishing Jewish congregations, some of them of considerable age. There is also a number of undenominational churches and missions.

VIII. HISTORY

New York bay and Hudson river were probably first discovered by Giovanni da Verrazano, an Italian navigator, in 1524, and seen also by Estéban Gómez, a Portuguese, in 1525. It is commonly stated that the first competent exploration of New York bay and its environs was made by Henry Hudson in the "Half Moon" in Sept. 1609. But there is in Paris a map dated (1570) which shows in considerable detail the topography near the mouth of the Hudson. In 1611 Adrien Block came to Manhattan island and returned to trade for furs with the Indians. In 1614 he explored the harbour of Manhattan and its adjacent waters and was probably the first European to enter Long Island sound. The States-General of Holland granted a charter to the New Netherland Company giving it the exclusive right to trade in New Netherland for four voyages, to be made within three years from Jan. 1, 1615. In 1615 the company built a storehouse and fort on the south end of Manhattan and a few huts sprang up around it. On Jan. 1, 1618, the charter expired. In June 1623 New Netherland was formally established as a province of the West India company.

The next year a party of about 30 Protestant Walloon families arrived. Of these colonists only about eight men remained on Manhattan, the remainder going to establish Ft. Orange where Albany now is. The next year more colonists came, and when director May gave way to director Van der Hulst, the colony numbered almost 200 persons. The government of the New Netherland province was vested in a director general and a council.



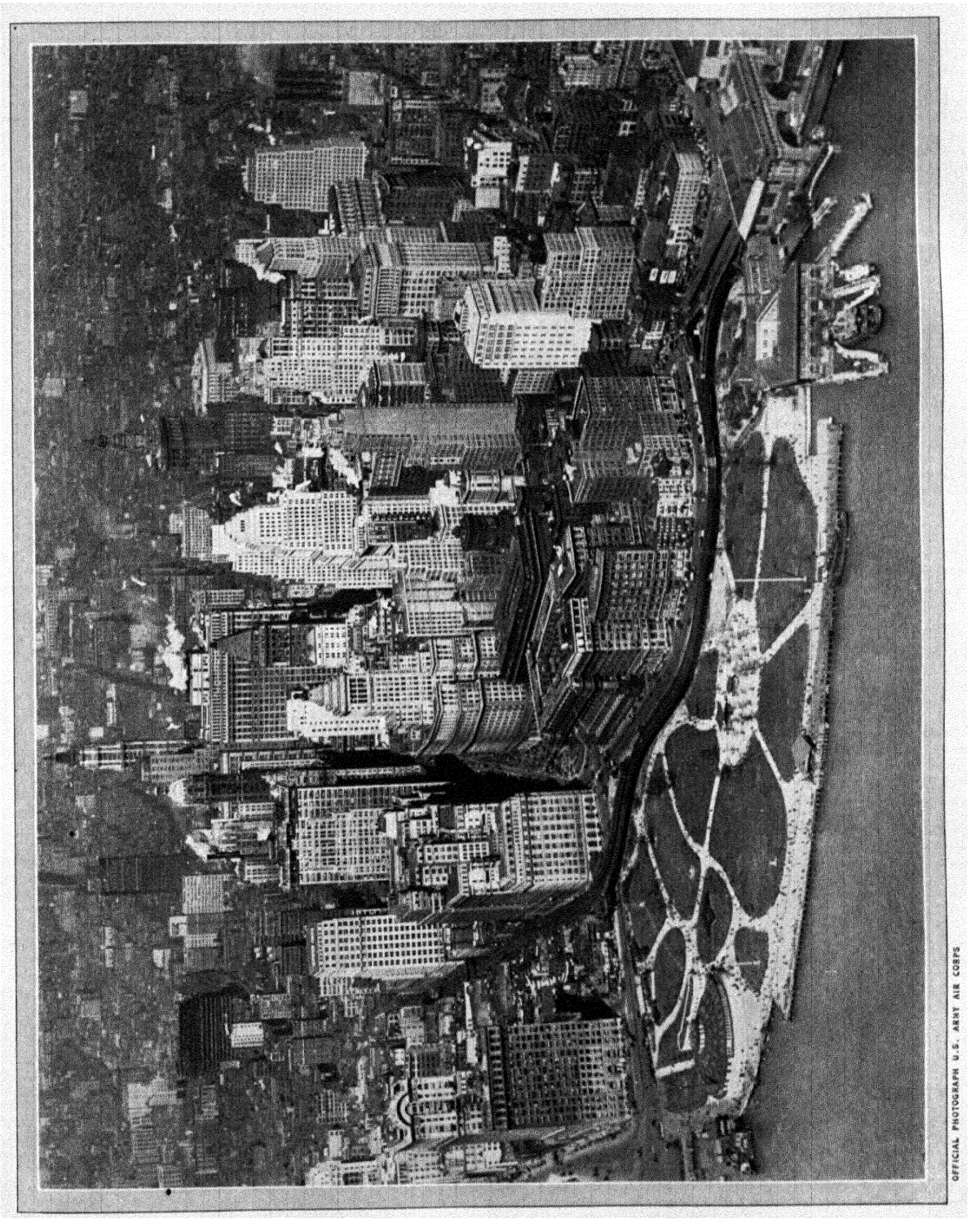
PETER MINUIT NEGOTIATING THE PURCHASE OF MANHATTAN ISLAND FROM THE INDIANS, 1626. AFTER THE PAINTING BY ALFRED FREDERICH

These officers, though formally appointed by the company, were subject to the approval of the States-General. The first director-general, Peter Minuit, arrived with additional colonists in 1626, purchased Manhattan island from the Indians with pieces of bright cloth, beads and other trinkets to the value of 60 guilders or about $24, erected Ft. Amsterdam at the lower end of the island, and made New Amsterdam the seat of government. Wouter Van Twiller, who succeeded him in 1633, was recalled in 1637 because of his mismanagement. Under the wise rule of Peter Stuyvesant (*q.v.*) the province prospered and, at the time of the transfer of New Netherland to English control, the population stood at about 10,000 (*see* NEW YORK: *History*). In 1658 Stuyvesant established a "Rattle Watch" of eight men which may properly be called New York's first police force. The strife between the English and Dutch went on until 1664, when Col. Richard Nicolls took possession of the city without bloodshed on Sept. 8, 1664. The English flag was raised over the fort, which was renamed Ft. James, and New Amsterdam became New York.

The rights of the Dutch settlers were carefully maintained at first, and established institutions changed only gradually. The English reorganized the city government (1665) with a mayor, aldermen and sheriff to be appointed by the governor of the province for a term of one year, and also extended the city limits to include all of Manhattan island. The Dutch reoccupied the city from July 30, 1673, to Nov. 9, 1674, when Colve surrendered to Sir Edmund Andros, the new English governor. Andros restored the English form of city government. The next hundred years is in the main a record of continuous struggle for control of the city government between the royal agents and the inhabitants. There were good and bad governors, but none was capable of stemming the tide of popular demand for greater freedom of self-determination. The first serious break in English resistance came with the refusal of the merchants of New York and other parts of the province to pay certain duties exacted by the "Duke's Laws." Governor Thomas Dongan called the first New York assembly on Oct. 17, 1683, and to this body freemen were permitted to elect representatives. Dongan's régime is notable also for "Dongan's Charter," which was granted the city in April 1686 and whereby sources of income were vested in the city corporation, all previous rights and privileges being confirmed and conveyed to the corporation, including the proprietorship of the City Hall, the market houses, bridges, wharves, docks, cemeteries, ferries, unoccupied lands, and the waters within the city. The city seal presented to the corporation the same year is that which it now employs with its motto *Sigillum Civitatis Novi Eboraci,* except that an eagle was substituted for the royal crown in 1784. Under the rule of Jacob Leisler (1689–91) the people were permitted, for the first time, to elect their own mayor, Peter De Lanoy, a privilege that lapsed until 1834. Sloughter, Leisler's successor, appointed as mayor Abraham DePeyster, a young, cultured and popular man of irreproachable character. He was effective in conciliating the warring factions, and responsible for many public improvements. The old "rattle watch" or police of the city was reorganized by DePeyster in 1697, and placed again under civil control. DePeyster built new wharves, provided the first system of poor relief, and instituted sanitary betterments. Business prospered in spite of the unrest in the province as a whole. Pirates in and about New York were a source of constant irritation, and Governor Benjamin Fletcher, who had succeeded Sloughter, was even suspected of being in league with them. They were finally dispersed by Bellomont, Fletcher's successor, and a measure of confidence in the government restored. But the incompetence of governors Cornbury and Lovelace increased resentment against English government; and its appointed mayors, though in the main men of good standing, were so frequently changed that none except William Peartree (1703–1709) made noticeable impressions upon municipal affairs. Peartree established the first free grammar school and a school for negro slaves. He also improved the jail and provided a debtor's prison in the City hall. Governor Robert Hunter, a cultured gentleman, who took office in June 1710, was more tactful than his predecessors; but his régime was ten years of turmoil. In April 1712, insurgent negroes massacred nine white men and wounded many more. Twenty-one negroes were legally executed, some in a most barbaric manner, and a large number of others, innocent as well as guilty, were imprisoned. Broadway was graded from Maiden Lane to the Commons, under Mayor Caleb Heathcote, and a new Presbyterian church was built. In 1725 under Governor William Burnet, William Bradford established the first New York weekly paper, the *New York Gazette.* In 1731 the city imported a fire engine from London. In 1733, John Peter Zenger, proprietor of the *New York Weekly Journal,* was charged with libelling Governor William Cosby and was brought to trial, but was so ably defended that the jury exculpated him almost without deliberation. This was regarded as establishing the freedom of the press. A "negro plot" against the whites was "revealed" by an irresponsible servant girl in 1741. Thirty-four negroes were killed, 24 whites thrown into jail, and suspicion fell upon many prominent people. In 1742 the paid civil patrol was abandoned and an unpaid citizens' watch established. This was so unsatisfactory that in 1747 a military watch was reinstated and continued until 1762, one year after the inauguration of street lighting.

IX. INDEPENDENCE

By the middle of the 18th century New York city was regarded as the focal point of resistance to royal authority. A majority of its leading citizens were descendants of the Dutch patroons, intelligent men and women who, though loyal to the English Government, were fully aware of its incompetency in America. Governor George Clinton, who returned to England in 1753 after a stormy rule of ten years, turned over the government to Sir Danvers Osborne on Oct. 7. The next day, Osborne's body was found hanging in the garden of his home. Chief Justice DeLancey took oath as lieutenant governor and became acting governor. On Oct. 31, 1754, DeLancey signed the charter of King's college (now Columbia university, *q.v.*), which had been established in 1753 in the vestry room of Trinity church. News of the capture of Quebec by Montcalm in 1759 was hailed in New York with great enthusiasm, and causes of resentment against English rule were soon supplied by the imprisonment of New York sailors by British men-of-war in the very harbour of the city. When copies of the Stamp Act reached New York, it was denounced by the newspapers. On Oct. 7, 1765, the Stamp Act Congress was called at the City Hall, with representatives from all provinces. While the congress was still in session on Oct. 23, a British ship arrived loaded with stamps, and in the face of the resistance of the people



OFFICIAL PHOTOGRAPH U.S. ARMY AIR CORPS

SKYSCRAPERS OF NEW YORK CITY

Aerial view of Battery Park and the skyscrapers of lower Manhattan, looking northwards

NEW YORK (CITY)

TWO VIEWS OF THE FINANCIAL DISTRICT

1. The New York Stock Exchange at Wall and Broad Streets. From an etching by Anton Schutz
2. Looking up Broadway from Bowling Green. From an etching by Anton Schutz

the fort prepared itself for defence. On Nov. 1, 1765, a band of the Sons of Liberty hanged Governor Colden in effigy at the very door of the fort, and then burned the houses of several prominent officials. Mayor John Cruger finally induced Colden to turn over the stamps to the city corporation; but the Sons of Liberty were firm in their resistance to the enforcement of the Stamp Act and it was finally repealed on March 18, 1766. New York went wild with excitement and the Sons of Liberty on June 4 erected a liberty pole in "The Fields" (City Hall park), where a replica now stands. Rioting between the Sons of Liberty and the British soldiers was of almost daily occurrence and finally, in 1770, Mayor Hicks issued a proclamation forbidding soldiers to leave the barracks unless accompanied by an officer. The liberty pole, which had been erected and cut down several times, was finally put up on the Commons and inscribed "Liberty and Property." But with the arrival of Sir William Tryon as governor, in July 1771, it became apparent almost at once that the temporary peace would shortly end. News that a tea ship was on its way to New York to carry out Lord North's purposes of taxation was received with violent expressions of defiance throughout the city. The Sons of Liberty reorganized to stir up resistance. When the ship reached New York, on April 7, 1774, its landing was refused, a few chests of tea were thrown into the bay by a committee of the Sons of Liberty previously appointed, and the ship sent home to England. The closure of the port of Boston was the signal for the calling of a meeting at Fraunces' tavern and the election of a Committee of Fifty-one, which issued the call for the first congress of the Colonies. The Committee of Fifty-one was dissolved with the election of a new committee of observation to enforce in New York the Nonimportation Act of the First Congress. From this time on events moved swiftly. On April 23, 1775, news of the Battle of Lexington reached New York. A mob took possession of City Hall and seized munitions stored there. Two British ships in the harbour were seized and their cargoes unloaded. The Committee of Sixty called for the election of a new Committee of One Hundred to arrange for calling a war congress of deputies from all New York counties. The provincial congress met in New York and declared obedience to the Continental Congress, while reserving their right of internal control. On June 25, Gen. Washington arrived in New York with his staff on the way to Boston and the same day Governor Tryon returned from England. Each was received with official ceremony, but Washington's reception as he passed up Broadway was an ovation. On April 4, 1776, New York was put under military rule by Gen. Israel Putnam, and batteries were installed along the East river and other strategic points. On the evacuation of



FROM PHELPS STOKES COLLECTION

NEW AMSTERDAM C. 1650, FROM A VIGNETTE ON THE N.J. VISSCHER MAP OF NEW BELGIUM, 1651–55

At the southern extremity is the fort; the building with the spire is the church and directly behind it is the general's house

Boston, Washington moved his headquarters to New York. The news of the Declaration of Independence came to New York on July 9, 1776, and was read to the soldiers who immediately thereafter tore down the equestrian statue of George III. in Bowling Green, an act denounced by Washington in the next day's general orders. On July 12, Admiral Howe appeared with his fleet in the harbour, but not until Aug. 22 were troops landed at Gravesend bay. On Aug. 27, the advance of British troops toward the American lines on Brooklyn Heights was begun and by 2 o'clock the same day, the heights were taken by the British. On the evening of the 29th Washington withdrew all his troops from Long island without interference and reorganized in New York. The British then undertook to cut off the American army, on Sept. 15, by throwing a line of troops across Manhattan at about 34th street. But the Americans got to Harlem Heights, where Washington again reorganized. On Sept. 16, the British attacked unsuccessfully at Harlem Heights. About a week later, a fire broke out at Whitehall Slip and almost completely destroyed the lower part of the city. Trinity church was burned but St. Paul's and King's college were miraculously saved by a shifting of the wind. On this same evening, Nathan Hale, a spy for the American army, was captured on Long island and tried in New York by Gen. Howe. He admitted that he was a spy and was condemned and hanged at a spot near 45th street and First avenue. New York was held by the British troops for the remainder of the war. During British occupancy, it was used largely as a prison camp. Churches, warehouses, jails and stores were packed with men sick and well. On the site of the fire, a village of huts and tents had sprung up which was called "Canvas Town," and occupied by bandits and "roughs." Robberies were a daily occurrence and citizens could expect no relief from the British soldiers. In Wallabout bay, on the East river, an old hulk, the "Jersey," was used by the British as a prison ship and there over 11,000 men died. The city was in desperate straits for want of supplies, and sickness ravaged the people. There was no government except military rule, and the oppression of civilians by the soldiery was the cause of frequent riots. Justice was not to be had and the revenues of the city corporation were appropriated by the military for their private uses. After the surrender of Cornwallis at Yorktown, however, Sir Guy Carleton, a humane and honest officer, succeeded the intolerant Sir Henry Clinton in May 1782, and immediately undertook the restoration of law and order. By the time of the evacuation, Nov. 25, 1783, confidence in government was in a fair way to restoration.

The parting of Washington with his troops came on Dec. 4, 1783, at Fraunces' tavern. After the departure of Washington, James Duane was appointed mayor by Governor Clinton. Business slowly revived with freedom from restrictions of trade. King's college, by act of legislature, May 1, 1784, became the State university, and its name was changed to Columbia college. At this time, the population of the city was about 24,000. Congress made New York the capital in Dec. 1784; on April 30, Washington was inaugurated at Federal hall at the corner of Broad and Wall streets, and a day of celebration followed. There was still intense feeling against the loyalists, but commercial interests soon erased the memories of personal conflict. The rise of commerce and wealth drew many people to New York, and it began to take on the appearance of a metropolis. As capital, the city was continually gay with festivities, public and private. But on Aug. 12, 1790, Washington made his last official visit to Federal hall and went to the new capital, Philadelphia. Edmond Charles Genet, on his arrival with the secret purpose of embroiling America in a war with England, was received in New York at first with great enthusiasm, but with his recall, interest in French affairs grew cool. Men were too busy with their own affairs. Since 1786, the population had doubled and new streets and public utilities had been laid out. Collect pond, now the site of the Tombs (city prison), was the scene of the first trials of John Fitch's steamboat in 1796. New York ceased to be State capital in 1797. On July 11, 1804, the death of Alexander Hamilton in his duel with Aaron Burr threw the city into mourning and Burr was so execrated he left in the night of July 21. This year the New York Historical Society was founded. With the help of Mayor DeWitt Clinton and of several of the founders of the society, there was organized, in 1805, the Society for Establishing a Free School in the City of New York. Under Clinton schools were built and Columbia college improved, philanthropic organizations increased in number, and arts and letters were stimulated. In 1807 there were 19 newspapers, of which eight were dailies. Although the Embargo Act of that year struck New York trade a serious blow, it was not without benefit in stimulating home industry. Finally, the Non-intercourse Act relieved the situa-

tion somewhat. The City Hall was completed in 1812, and there was at this time a very considerable advance both in architecture and building construction. Many new buildings, chiefly churches, were built, new streets were graded, and swamps were filled in along the water front. Collect pond was filled in and the hills and valleys of lower Manhattan were rapidly leveled for homes and other structures. In the midst of this prosperity, war was declared against Great Britain. The toll exacted from New York was tremendous; the burning of Washington by the British resulted in a great concentration of troops in New York. New fortifications were thrown up along the water front and the old ones strengthened. But on Feb. 11, 1814, the ship "Favorite" arrived at New York under flag of truce with British and American messengers and the treaty of peace. A jubilee followed and Sunday was a day of fervent thanksgiving. New York was then transformed almost over night. DeWitt Clinton was again mayor, and under his guidance the services of government were everywhere improved. Cadwallader D. Colden succeeded Clinton and likewise advanced all governmental and private services for public welfare. Great numbers of immigrants from Europe arrived and the problems of dealing with this great mass of new residents taxed the city to its limits. Yellow fever broke out in 1819, 1822 and 1823, and hundreds died daily until the epidemics were checked with the coming of cold weather; others occurred ten years later with similar loss of life, but the city continued to grow with amazing rapidity. The opening of the Erie canal on Nov. 4, 1825, began a three days' celebration. At this date, the modern history of New York begins.

Under Mayor Philip Hone (1826) fine dwellings, public buildings and mercantile establishments multiplied; wealth increased and the continuing influx of immigrants made evident the need for greater educational opportunities. The University of the City of New York was established in a splendid new building opened in 1835. There were now over 200,000 people in the city, and transportation was a pressing problem, only partly solved by the horse-drawn street cars. Another great fire broke out below Wall street on Dec. 16, 1835, and the succeeding months were a period of great distress. Croton water was furnished the city on July 4, 1842. Blackwell's island, purchased in 1828 for $50,000, was made the site of the city's correctional institutions and hospitals. The New York *Sun*, whose issue by Benjamin H. Day was begun in 1833, sold for a penny. The *Herald* of James Gordon Bennett appeared in 1835, the *Tribune* of Horace Greeley in 1841, Henry J. Raymond's *Times* in 1851. The theatre was thriving, business was rapidly spreading uptown, and Union square was the residential centre. Beyond Union square, there was little but open fields at the middle of the century. The World's Fair at the Crystal palace on Murray Hill was the outstanding event of 1853; in 1856 Central park was purchased. But in 1857 business was paralysed, thousands thrown out of work, and over 900 merchants failed; riots and disturbances of all kinds ensued. The same year, the State legislature laid the basis for the modern metropolitan police force, and a new régime of law and order was begun. The city recovered quickly from the depression of 1857, and at the outbreak of the Civil War was again thriving; it authorized a loan of $1,000,000 for defence of the Union, and hundreds of thousands more were privately pledged. New York was again filled with soldiers. Rioting broke out in July 1863 as a protest against army drafts and for five days there was turmoil. More than 50 buildings were burned and several hundred people killed or wounded. Mayor Opdyke, in 1863, reported that the people of New York had contributed up to that time $300,000,000 for war purposes, and had furnished over 80,000 men. During the war, the establishment of schools, scientific and literary associations, libraries, museums, and clubs went on apace, and at its end New York was still able to find resources for great public works. Brooklyn bridge was begun in 1870, and sanitary conditions, which in 1865 had been thoroughly studied by a citizens' committee and found deplorable, were on their way to betterment. New public improvements opened fresh opportunities for "graft" by public officials. Under the Tammany mayor, A. Oakey Hall, in 1872, a gigantic conspiracy for looting the city, known as the "Tweed Ring," was exposed by the New York *Times* and a citizens' committee. The thefts of the "ring" ran into hundreds of millions, the "graft" in the erection of the county court-house alone amounting to about $8,000,000. "Boss" Tweed and many of his followers were tried and sent to prison, and Tweed died there. Then followed a reform administration, but in 1874 Tammany regained control. The corporate limits of the city were extended in 1874 to include about 13,000 ac. across the Harlem river, in the Bronx, and in 1895, a still further extension in the same county was made which brought the city limits to the southern boundaries of Yonkers and Mount Vernon. In this same year, Col. George E. Waring, representing a reform administration under Mayor William L. Strong, was made commissioner of street cleaning and with his "white wings" inaugurated the modern system of street cleaning and refuse collection. The city was still further increased in 1898 by the annexation of Kings, Richmond, and a part of Queens, counties, and a new charter was enacted for the Greater New York. During all this period of administrative reconstruction, Tammany Hall continued the great political power, although occasionally defeated for the mayoralty. In 1897, Tammany again got control of the mayor's office by the election of R. A. Van Wyck, but was defeated in 1901, because of its abuse of power. Seth Low, a reform mayor, served during 1902 and 1903 when Tammany regained control. During the past 25 years Tammany has generally maintained its political power. Mayors George B. McClellan (1904–10) and William J. Gaynor (1910–14) were both elected by Tammany and both were able men and strove to give the city good government, even under the handicaps of the Tammany political system. In Mayor McClellan's administration, however, a citizens' civic agency, the New York Bureau of Municipal Research (organized in 1906), disclosed and published a report on irregularities in the administration of the office of Borough President Ahearn of Manhattan. Mayor McClellan appointed as a special counsel, John Purroy Mitchel, who secured sufficient evidence of these irregularities to warrant Governor Hughes in removing Borough President Ahearn for incompetency. In Mayor Gaynor's administration, a police lieutenant was arrested, tried and later found guilty of complicity with gangsters in the murder of a New York merchant, who was on the point of making disclosures of police corruption to the district attorney. Mayor Gaynor, wounded in an attempt upon his life, failed in health and died Sept. 10, 1913, almost at the end of his term. The police scandals of Gaynor's administration swung popular sympathy against Tammany, and John Purroy Mitchel, candidate for mayor on a "fusion" ticket, was elected and took office in 1914. In Sept. 1914, a special aldermanic committee of investigation undertook a complete survey of police administration and methods. The facts finally brought out by this committee furnished clear evidence of police incompetency and corruption. Mayor Mitchel's administration from 1914 to 1918 is now regarded as the most efficient in the last quarter century because of the administrative reforms which he instituted. Yet in the next election, he was defeated for re-election by an overwhelming vote, and John F. Hylan, another Tammany mayor, took office in 1918, on a platform of outspoken repudiation of the Mitchel administration. Mayor Hylan held office for two terms during which time there was continuous wrangling among the superior officers of administration to the extent that little of importance for the city's betterment was accomplished. One of the outstanding features of government in the period covered by the administrations of Gaynor, Mitchel and Hylan, was the enormous increase of budget from $163,130,270.37 in 1910, to $345,530,039.77 in 1921. In 1925, Mayor Hylan, denounced by many of his own Tammany supporters, was refused party support, and James J. Walker, a representative of the "new" Tammany," who had made a good record in the State senate, received the Democratic nomination. He was well supported by Governor Alfred E. Smith who was everywhere recognized as the actual leader of Tammany Hall, and, without much opposition from the Republican candidate Frank D. Waterman, Walker was elected with the endorsement of a great popular vote and the enthusiastic good will of a public tired of the constant wrangling of administrative officials

under his predecessor. The great issues of the Hylan administration were rapid transit and subway fares. The same issues have been paramount during the administration of Mayor Walker, but as yet no satisfactory solution has been reached. In other respects, Mayor Walker's administration has contributed materially to betterments in police, fire, health and hospital administration, and has undertaken many notable improvements in highways and traffic control.

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NEW YORK CENTRAL LINES, an important system of railway, serving the northern and eastern portions of the United States. Its chief termini are New York, Boston, Chicago and St. Louis, and it serves also the cities of Detroit, Buffalo, Cleveland, Cincinnati, Montreal, Ottawa. The most important railroad of the system is the New York Central Railroad Company, a consolidated corporation formed of different companies operating railroads between New York and Chicago. The first railroad of this company was chartered in 1826 and opened for traffic in 1831. The company's important subsidiaries, controlled by stock ownership or by lease, are the Michigan Central Railroad Company; the Cleveland, Cincinnati, Chicago and St. Louis Railway Company, known as the Big Four; the Boston and Albany railroad; and the Pittsburgh and Lake Erie Railroad Company. The mileage of the system is 11,847 m. of road and 28,078 m. of track. A large percentage of the trackage is protected by automatic signals, and by automatic train control. The system is the owner of 5,867 locomotives, 282,119 freight cars and 5,143 passenger and other cars. The total funded debt, as of Dec. 31, 1927, of the system was $930,487,904 and of the New York Central Railroad Company, $684,629,139. The gross amount of capital stock of the system was $562,600,000, of which the New York Central had outstanding, $421,285,000. The lines transport over 238,000,000 tons of freight per year, of which 44% is coal, 26% manufactured articles and the remainder general traffic, such as products of agriculture, animals and products, etc. It is over the line of the New York Central that the train known as the 20th Century Limited is operated between New York and Chicago. General offices of the system are in New York city. (C. C. PAU.)

NEW YORK, CHICAGO AND ST. LOUIS RAILROAD, popularly known as the Nickel Plate Road, operated, in 1928, 1,695 m. of railway between Buffalo and the mid-western gateways of Chicago, Peoria and St. Louis. The track was originally planned as a line between St. Louis and Ft. Wayne, Ind. Its promoters changed their plans and determined on a route between Chicago and Buffalo. The first construction was between Arcadia, O., and McComb, O., in 1881. The first train was operated over the line on Oct. 22, 1882.

The New York Central controlled the road for many years. In 1916 control was acquired by the Messrs. O. P. and M. J. Van Sweringen, who, after largely rebuilding the property, consolidated it with the Lake Erie and Western and the Toledo, St. Louis and Western (Clover Leaf). Through this consolidation, the mileage was more than tripled, and the road's strategic position was enhanced as a result of additional gateways reached by its rails. Total revenue freight ranges yearly from 22 to about 25 million tons. The capital structure, on June 30, 1928, included 337,061 shares (par $100) of common and 360,355 shares (par $100) of preferred stock outstanding. Operating revenues, since the consolidation, have ranged approximately from $54,000,000 to $57,000,000 annually, with net income ranging approximately from $6,000,000 to $8,000,000 a year. (W. L. RO.)

NEW YORK FERN (*Dryopteris noveboracensis* or *Thelypteris noveboracensis*), a beautiful North American fern of the shield-fern group. While named after New York, it is native to a much greater region, occurring in moist woods from Newfoundland to Minnesota and southward to Virginia, Georgia and Arkansas. The delicate fronds, 1 to 2 ft. high, rise on slender stalks (stipes) from widely creeping rootstocks. (*See* SHIELD-FERN.)

NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY, THE, is a comprehensive transportation system serving Southern New England and New York with rail, highway and water transportation. It operates 2,168 m. of railroad, the network of lines being the result of consolidation and merger of 137 separate rail lines. The New England Transportation Company, a subsidiary, operates 267 motor coaches over more than 2,200 m. of highway. Steamships are operated through two subsidiary companies, The New England Steamship Company and The Hartford and New York Transportation Company. Through The Connecticut Company, the Berkshire Street Railway Company, and The New York and Stamford Railway Company, the "New Haven" is also engaged in street car and bus transportation.

The territory served comprises the most densely populated territory in the United States. The four States in which it operates, Rhode Island, Massachusetts, Connecticut and New York, rank respectively first, second, third and fifth in density of population per mile of railroad. The New Haven was the first steam railroad in the country to adopt electrification, and in 1928 its four-tracked line between New York and New Haven, a distance of approximately 72 miles, was entirely electrified. The capitalization of the parent company as of Dec. 31, 1927, was $217,253,997. (E. J. PE.)

NEW YORK STATE BARGE CANAL SYSTEM consists of the Erie canal, the Champlain canal, the Oswego canal, the Cayuga-Seneca canal, Black river canal, Cayuga Lake Inlet at Ithaca, the Glens Falls Feeder and the lakes, reservoirs, feeders, harbour basins and terminal docks facilities. The total length of the system is about 575 miles. The Shinnecock-Peconic canal, located in the county of Suffolk on Long Island, connecting the waters of Shinnecock and Peconic bays is also officially a part of the canal system.

The total number of locks on the main channels of the

improved canals, exclusive of the U.S. Government lock at Troy, is 56. There are 34 locks on the Erie, 11 on the Champlain, 7 on the Oswego canal and 4 on the Cayuga and Seneca canal. In addition, there are two junction locks and two guard locks.

Navigation is free and the usual navigation season is seven months from May 1 to Dec. 1. The canals are available for use 24 hours of the day. Boats about 300 ft. long, 42 ft. wide, with a draft of 10 ft. and a cargo capacity of 2,800 tons are generally used.

The Erie Barge canal is the main waterway, connecting the Hudson river at Albany and Troy with Lake Erie at Buffalo. It has a total length of 340 m. and serves as the main route of transporting grain from the west to New York. It is 150 ft. wide and 12 ft. in depth. The cost of construction and improvement was $139,214,929.

The Cayuga and Seneca canal connects Montezuma, N.Y., with the Cayuga and Seneca lakes and affords communication between these lakes and the Erie canal. Including the lakes the length of the canal is 92 m.; exclusive of the lakes, it is approximately 24 miles. It is 200 ft. wide and 12 ft. in depth. The cost of construction was about $8,154,000.

The Black river canal connects Black river and the Erie canal and affords communication between Rome, N.Y., and Lyon Falls, N.Y. Elevation is gained by four locks. It is 35 m. long, 42 ft. wide, 4 ft. in depth. The cost of construction with improvements was $3,481,954.

The Champlain canal connects Whitehall, N.Y., at the head of Lake Champlain with the Erie canal at Waterford, providing a waterway between the Atlantic seaboard and the navigable St. Lawrence. It is 60 m. long, 125 ft. wide and 12 ft. in depth. The cost of construction was about $21,691,000.

The Oswego canal connects Lake Ontario at Oswego with the Erie canal at Syracuse and provides communication between Syracuse and Oswego, and by the use of the Welland canal, with the other Great Lakes. The cost of construction and improvement was about $12,000,000.

NEW ZEALAND, a British dominion (1907), consisting of a group of islands lying in the south Pacific between 34° 25′ and 47° 17′ S., and between 166° 26′ and 178° 36′ E. The group is situated eastward of Tasmania and Victoria, and Wellington, its capital and central seaport, is 1,204 m. distant from Sydney. Of certain outlying clusters of small islands included in the dominion group proper (and for statistical purposes), the Chathams (356 m. E. of Cook strait), Aucklands and Campbell island are alone of any value. The Chathams are chiefly inhabited by sheep-farming colonists. The Aucklands contain two of the finest harbours in the Pacific. Six hundred miles north of the Aucklands, the volcanic Kermadecs, covering 8,208 ac., are picturesquely clothed with vegetation. In Polynesia a number of inhabited islands were brought under New Zealand control by proclamation in 1901. Rarotonga and Mangaia, in the Cook group, and Niué or Savage island are the largest of these; Penrhyn and Suwarrow, though but small coral atolls, contain excellent harbours. Rarotonga is hilly, well watered, and very beautiful. By mandate of the League of Nations, New Zealand also administers the former German possession of Western Samoa, and has joint control in the phosphate island of Nauru. In 1923, at the desire of the British Government she became responsible for the administration of the Ross sea, and in 1926 of the Tokelau, or Union group. Apart from these dependencies New Zealand has an area of 103,285 sq.m., of which its two important islands, called North and South, contain 44,131 and 58,120 respectively, while, divided from South island by Foveaux strait, Rakiura or Stewart island, mountainous and forest-clad, contains 662 sq.m. These three form a broken chain, North and South islands being cut asunder by Cook strait, a channel varying in width from 16 to 90 miles.

North island is 515 m. long and varies in breadth from 6 to 200 miles. It is almost cleft in twain where the Hauraki gulf penetrates to within 6 m. of Manukau harbour. From the isthmus thus formed a narrow, very irregular peninsula reaches out northward for some 200 m., moist and semi-tropical, and beautiful rather than uniformly fertile.

South of the isthmus aforesaid, the North island rapidly broadens out. Its central physical feature is the series of unbroken mountain chains running north-east from Cook strait to East cape on the Bay of Plenty, ranges seldom under 3,000 ft., but never attaining 6,000 ft. in height. Ikurangi, their highest summit, though a fine mass, does not compare with the isolated volcanic cones which, rising west of the main mountain system and quite detached from it, are among the most striking sights in the island. Ruapehu (9,175 ft.) is intermittently active and Ngauruhoe (7,515 ft.) emits vapour and steam incessantly. Egmonth (8,260 ft.) is quiescent; its symmetrical form and dense clothing of forest make it the most beautiful of the three. North of the two first-mentioned volcanoes Lake Taupo spreads over 238 sq.m. in the centre of a pumice-covered plateau from 1,000 to 2,000 ft. above the sea; and round and beyond the great lake the region of the thermal springs covers 5,000 sq.m. and stretches from Mount Ruapehu to White island, an ever-active volcanic cone in the Bay of Plenty. The most uncommon natural feature of the district, the Pink and White terraces, was blown up in the eruption of Mt. Tarawera in 1886, when for great distances the country was buried beneath mud and dust, and a chasm 9 m. long was opened. Fine lakes and waterfalls, innumerable pools, in temperature from boiling-point to cold, geysers, solfataras, fumaroles and mud volcanoes still attract tourists in large numbers. The healing virtue of many of the springs is widely known. The Government maintains a sanatorium at Rotorua and Te Aroha, and there are private bathing establishments in other places, notably near Lake Taupo. In South island there are hot pools and a State sanatorium at Hanmer Plains. The most remarkable cures effected by the hot waters are in cases of gout, rheumatism, diseases of the larynx and in skin disorders. Though the overlying porous pumice reduces the fertility of the Taupo plateau, except under treatment, it has a good rainfall and is drained by unfailing rivers running through deep terraced ravines. The Waikato and Waihou flow north, the Rangitaiki north-east, and Mokau, Wanganui, Rangitikei, and Manawatu west or south-west. The first named, the longest river in the colony, though obstructed by a bar like all western—and most eastern—New Zealand rivers, is navigable for some 70 miles. The Mokau and Wanganui run between ferny and forest-clad hills and precipices, often of almost incomparable beauty.

East of the Taupo plateau and south of Opotiki on the Bay of Plenty are steep thickly-timbered ranges. On the southern frontier of this mountainous tract Waikaré Moana extends its arms, the deepest and most beautiful of the larger lakes of the island.

From the mouth of the Waikato southward to about 25 m. from Cape Terawhiti on Cook strait, and for a distance of from 20 to 40 m. inland, the western coast skirts fertile grazing and dairy-farming country. On the east coast the same fertility is seen and, round Hawkes bay, a hotter and drier summer. In the south centre, the upland plain of the Wairarapa has a climate adapted for both grazing and cereals. The butt-end of the island, of rather poor, rough, though well-grassed wind-beaten hills, is redeemed by the fine harbour of Port Nicholson, which vies with the Waitemata in utility to New Zealand commerce. Everywhere the settler may count on a sufficient rainfall, and—except on the plateau and the mountain highlands—mild winters and genial summers. To pass Cook strait and land in the middle province of South island is to pass from Portugal to Switzerland, a Switzerland, however, which has long fertile plains extending to the coast and giving the highest yield of cereals in New Zealand. As a rule the shores of South island are high and bold enough. They are not too well served with harbours, except along Cook strait, in Banks peninsula, and by the grand but commercially useless fjords of the south-west. In the last-named region some 15 salt-water gulfs penetrate into the very heart of the mountains, winding amid steep, cloud-capped ranges, and tall, richly-clothed cliffs overhanging their calm waters. The dominating features of south New Zealand are not ferny plateaux or volcanic cones, but stern chains of mountains. There the Southern alps rise range upon range, filling the whole centre,

almost or quite touching the western shore, and stretching from end to end of the island. West of the dividing crest they are forest clad; east thereof their stony grimness is but slightly softened by growths of scrub and tussock grass. The rivers are many, even on the drier eastern coast. But, as must be expected in an island but 180 m. across at the widest point and yet showing ridges capped with perpetual snows, the rivers, large or small, are mountain torrents, now swollen floods, anon half dry. The largest river, the Clutha, though but 80 m. long in its course to the south-east coast, discharges a volume of water estimated at nearly 2,000,000 cu.ft. a minute. On the west the only two rivers of importance are the Buller and the Grey, the former justly famous for the grandeur of its gorges. Te Anau and Wakatipu (54 m. long) are the chief lakes in the South though Manapouri is the most romantic. Mt. Cook is easily first among the mountain peaks. Its height, 12,349 ft., is especially impressive when viewed from the sea off the west coast. On the north-east a double range, the Kaikouras, scarcely fall short of the Southern alps in height and beauty. Apart from the fjords and lakes the chief beauties of the Alps are glaciers and waterfalls. The Tasman glacier is 18 m. long and has an average width of 1¼ m.; the Murchison glacier is 10 m. in length. To the west of Mt. Cook the Franz Joseph glacier crawls into the forest as low as 400 ft. above sea-level. Among waterfalls the Sutherland is 1,904 ft. high, but has less volume than the Bowen and others. The finest mountain gorge, the Otira, is also the chief railway route from the east to the west coast. Generally the open and readily available region of South island extends from the Kaikouras along the east and south-east coast to the river Waiau in Southland. It has a mean breadth of some 30 miles. In compensation the coal and gold, which form the chief mineral wealth, are found in the broken and less practicable west and centre.

Climate.—New Zealand, stretching through over 11° of latitude, would present more contrasts of climate were it not for the fact that oceanic influences penetrate everywhere. Most of it is in or near the northern border of the westerlies with their cyclones though the north end feels the trade winds in summer. The only really large mass of high land is in the southern half of South island and even here maritime influences prevent winter cold from lasting continuously for long.

The following table resumes some important data:—

	Jan. Mean t°	July Mean t°	Total rainfall	
Auckland	66·3	51·7	43·8	Greater in winter
Rotorva	63·7	45·7	53·8	,, ,, ,,
Napier	66·1	49·0	32·3	,, ,, ,,
Wellington	62·5	47·7	48·1	,, ,, ,,
Nelson	64·5	46·1	37·6	,, ,, ,,
Hokitika	60·2	44·9	116·5	Spring often wettest
Lincoln, near Christchurch	61·6	43·1	25·3	Generally distributed
Dunedin	57·9	42·3	36·8	,, ,,
Queenstown, on Lake Wakatipu	60·1	37·5	30·4	Spring often wettest
Invercargill	56·9	41·4	40·5	,, ,, ,,

The range of mean temperatures is small, the rainfall moderate save on the west slopes of the Southern alps. (*See* Hokitika above.) The snowline reaches down to 3,000 ft. on the eastern side of the Southern alps which has rather lower temperatures than other parts (*see* Queenstown above) but on the western side it is at 3,700 feet. Nelson, sheltered from the west, is famed for its sunny climate with cool bracing nights.

The winter maximum of rainfall in the north follows naturally from the régime of the winds, the all-the-year round distribution of the light rainfall on the east side of South island contrasts with the tendency to a spring maximum on the western and southern fringes of the Southern alps. The heavy rainfall on the west has permitted glaciers to exist and to reach down into the lowlands in some places in spite of the general mildness. The mountainous Stewart island has 65·2 in. of rainfall. The mildness and rainfall permit widespread evergreen vegetation and the healthiness of the islands is attested by the death rate of 8·74 per 1,000 in 1926, the lowest death rate known.

Flora.—There are about 1,000 species of flowering plants, of which about three-fourths are endemic. Most of those not peculiar to the country are Australian; others are South American, European, Antarctic; and some have Polynesian affinities. Ferns and other cryptogamic plants are in great variety and abundance. The New Zealand flora, like the fauna, has been cited in support of the theory of the remote continental period. In appearance the more conspicuous flora differs very greatly from that of Australia, Polynesia, and temperate South America, and helps to give to the scenery a character of its own.

The early colonists found quite half the surface of the archipelago covered with dense, evergreen forest, a luxuriant growth of pines and beeches, tangled and intertwined with palms, ferns of all sizes, wild vines and other parasites, and a rank, bushy, mossed undergrowth. Though much of the timber is of commercial value—notably the kauri, totara, puriri, rimu, matai and kahikatea—this has not saved the forests from wholesale, often reckless, destruction for settlement purposes. In late years active operations by the State, private companies and the settlers themselves, in re-afforestation with European, Californian and Australian soft woods are doing much to restore the earlier ravages. These improvements are mainly in the naturally open and grassy regions of the east and south-east.

Fauna.—In their natural state the islands had no land mammals. The Polynesians brought a dog, now extinct, and a black rat, now rarely seen. The wild dogs and pigs in outlying districts are descendants of domestic animals which have escaped into the bush. There are no snakes. There are bats, one belonging to a peculiar genus and one related to Australian and South African forms. New Zealand was very rich in birds, the tui and makomako being famed as songsters, while the flightless and weak-winged birds were numerous; the kiwi (*Apteryx*), kakapo (*strigops*), takahe (*Notornis*) cannot fly. The last named is very rare and has not been seen since 1898. New Zealand formerly possessed the gigantic running bird called the moa (*Dinornis*), a huge rail (*Aptornis*) and other bird types now extinct. The earlier destruction of the forests had disastrous effects on bird-life. In the Alps a hawk-like green parrot, the rea, which has been known to kill sheep, holds its ground. The pukeko, a handsome rail, abounds in swamps.

Bush and grass fires, cats, stoats and weasels, introduced in the 19th century, have reduced the bird population; and deer, pheasants, trout and salmon have been introduced by sportsmen. The most famous New Zealand animal, scientifically, is the Tuatara, the sole survivor of the reptilian order of the Rhynchocephalia, otherwise extinct since Mesozoic times so far as is known. The butterflies are few and moths numerous; there is a native beach-spider (*katipo*) now extinct. An organism named *Peripatus* has a New Zealand species; it is intermediate in structure between the earthworms and the myriapods and species occur in various isolated regions, mostly in southern lands.

Resolution, Kapiti and little Barrier islets have been set aside as sanctuaries for the native fauna.

Tidal waters furnish minute whitebait, and the mud-flats of salt or brackish lagoons and estuaries flounders. Oysters, both mud and rock, are good and plentiful. Sharks are found everywhere, and are common around the north; they rarely attack man. The albatross is the most conspicuous sea-bird. Penguins are found, confined to the islets of the far south. (H. J. B. D.)

GEOLOGY

New Zealand is part of the Australasian festoon on the Pacific edge of the Australasian arc. Owing to its critical position it has had a particularly varied geological history, and includes, for its size, an unusually complete series of marine sedimentary rocks. It is still a matter of doubt whether pre-Cambrian rocks constitute any portion of the islands. The oldest rocks, however, extend at intervals down the western side of the South island. They include a complex of gneisses, schists and dioritic igneous rocks in Fiordland, and sillimanite gneisses on Stewart island.

Main Divisions.—The first evidence of life appears in rocks of Lower Ordovician age, forming a folded belt in the south at Preservation Inlet and in the extreme north-west at Collingwood. They comprise graptolitic slates, quartzites and marbles, and are characterized by an Arenig fauna including *Tetragraptus, Bryograptus, Dichograptus* and *Didymograptus.* According to the Geological Survey the metamorphic rocks already referred to form a Pre-Ordovician series below these fossiliferous sediments, but it is to be noted that no clear line of separation between the two series has yet been discovered. An alternative view regards the Ordovician rocks as passing gradually into mica schists, which are invaded, as in Fiordland, by gneissic diorites. The strike of these ancient rocks ranges from west-north-west to north-north-east, but is not very different from the associated Ordovician sediments.

Between the Ordovician sediments and the succeeding Silurian series a strong unconformity is probable. The latter are known only in the north-west of the South island, on the Baton river and at Reefton. The rocks include argillaceous limestones and shales on the Baton river, and a littoral facies of quartzite, greywacke and limestone at Reefton, both with a Wenlock fauna.

Nothing is known of the geological history of New Zealand between the Upper Silurian and the close of the Palaeozoic period, from which time the stratigraphic record in the islands is particularly complete. Much of the highlands are built up of folded greywackes, slates and some limestone, with a volcanic horizon recognized near the base of this folded series. The whole is divided into a Permian (Maitai) series and a Mesozoic (Hokonui) series. The nature of the junction between the two is still little understood, various authorities claiming a complete conformity, much regression, or marked diastrophism with plutonic (dioritic) intrusions.

In the type locality (Nelson district) the Maitai series (limestones, shales and slates) contain *Platyschisma, Strophalosia, Martiniopsis* and *Spirifer bisulcata,* a fauna characteristic of the Permian beds of eastern Australia. An extensive series of basic breccias (Te Anau series) forms the base of the Maitai series and upon which the fossiliferous sediments rest. The top of the series is formed of greywackes, in places containing annelid tubes (Terebellina). These are referred to a Lower Triassic age. This Permian series has a wide distribution in the South island. The succeeding events are not clear. Probably there followed a regression of the sea, succeeded in turn by a transgression when the Hokonui beds were laid down. The base of this series is of Middle Triassic age, these beds being followed by Upper Trias. They include the Carnic, Noric and Rhaetic stages, the sediments being greywackes, limestones, an horizon of basic tuffs (Noric) and Rhaetic plant beds. The sequence or portions of it are recognized from both the South and North islands.

The Noric beds, characterized by an abundance of *Pseudomontis,* have a very wide distribution, extending throughout the Southern Alps in Canterbury, along the Hokonui hills, in the Nelson district, and in the Mokau district of North Taranaki. The series extending from the Middle Trias to the Rhaetic is of great thickness, of the order of 10,000 feet. These beds are followed conformably by Jurassic felspathic sandstones, conglomerates, plant beds and some thin coal seams. Liassic, Bajocian and also Upper Jurassic marine faunas have been described. A widespread series of sediments containing *Inoceramus* occurs in the east of the North island, probably, in part, of Upper Jurassic age, but extending into the Lower Cretaceous. The problematical schists of the South island, well developed in the Otago region, and referred to as the Otago schists, are perhaps of Mesozoic age, though they have been referred to horizons from the Archaean to the Jurassic. They appear to pass outwards into sediments indistinguishable from Ordovician or Mesozoic strata.

At the close of this sedimentation, in Lower Cretaceous times, a strong orogenic movement supervened, in which the Hokonui system was folded along meridional lines, the earth movements being accompanied by widespread plutonic intrusions throughout the length of New Zealand. The dunite sills of the Dun mountain region, and the gabbros and norites of North Cape belong to this epoch, as perhaps do also some of the diorites of the south-western district of the South island. The intensest folding in the North island is developed in the east; in the west the flexures become more open and undulating strata predominate. In the Otago region, the Otago schists have recently been interpreted as a flat lying series forming a packet of recumbent folds, the participating rocks being referred to members of the Maitar and Hokonui series.

Sequence of Formations.—Following the Hokonui diastrophism a series of sediments ranging from Middle Cretaceous to Upper Pliocene was deposited, but the record has received diverse interpretations, particularly in regard to the structural relations of the beds and the correlation of formations in neighbouring regions. According to the view of Marshall, the whole series is conformable throughout, a difference in age of the basal strata in different districts being ascribed to overlap over an irregular surface of the older rocks. Summarily, the sequence of formations is as follows:

Middle Cretaceous (Albian) .	Marine beds (in Kaikoura ranges)
Upper Cretaceous { Senonian .	Greensands, basal coal measures
Upper Cretaceous { Danian .	Limestones (partly foraminiferal)
Eocene	Marine beds and coal measures
Oligocene } Miocene }	Marine beds
Pliocene	Marine beds and gravels

The oldest rocks of this sequence are developed in the Karkoura mountains of Marlborough, where a thickness of from 3,000 to 9,000 ft. of sandstones and mudstones, with conglomerates and some coal measures were deposited. These Albian beds are followed by the Amuri limestones (2,500 ft.), but in Canterbury and the coast of Marlborough Senonian strata underlie the limestone series. In the succeeding Eocene period the coal measures of the south-western district of the South island were formed and constitute the most valuable coal seams of New Zealand. The transgressions of Oligocene and Miocene times submerged much of both South and North islands, but in the central region of Otago the land remained emergent. Fluviatile and lacustrine deposits, however, covered large parts of this area. They are frequently auriferous. A general retreat of the sea from the South island took place in Pliocene times, but the North island remained largely below sea-level. In the Wanganui area a wonderful development of clays, 3,500 ft. thick, was deposited, apparently without break. The present topography of New Zealand developed as a result of important crust warpings and block faulting. The faults are not simple tensional movements, but involved strong lateral pressure, in which overthrusting and overfolding are developed. The isoclinally folded Tertiary rocks of the Lake Wakatipu region show particularly well the extreme effects of this movement. The earliest development of vulcanicity after the Post-Hokonui orogeny is seen in the Middle Cretaceous basalts of the Clarence region and the Upper Cretaceous rhyolites near Christchurch. Vulcanicity became more widespread in Mid-Tertiary times. To this period belong the pillow lavas and tuffs of the Oamaru district and the rhyolites, andesites and dacites of the Coromandel peninsula. Propylitization of these andesitic rocks gave rise to the auriferous deposits of this latter area. Somewhat later came the alkaline eruptions of the Dunedin district and the basalts forming Banks peninsula. The alkaline rocks of the former area include a varied succession of alkaline trachytes, phonolites, trachydolerites and basalts.

Volcanic activity of Upper Tertiary time extending to the present day led to extensive eruptions of andesites and rhyolites in the North island. Mt. Egmont consists largely of andesite. The main centres of activity lie on a north-east line of crustal weakness extending from Ruapehu to Mt. Edgecumbe, and the great rift of the Tarawera eruption extending to Lake Rotomahana has a similar trend. In the Pleistocene, the present system of glaciers had a great extension, and they undoubtedly reached sea-level in the south-west of the South island. On the east they appear to have been confined to the mountain valleys.

Study of the fossil fauna and flora of the New Zealand region

points from many lines of evidence to intimate connection, in Mesozoic times, between this land, Australia and Malaysia. In the later Cretaceous period the connection between Australia and New Zealand was severed, though the latter was directly associated with Antarctica. In the Upper Cretaceous only one species of mollusc (*Natica variabilis*) is known to be common to Australia and New Zealand. The complete isolation of the New Zealand region seems to have been accomplished by Middle Tertiary time, by a gradual break up of the circum-Pacific connections.

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POPULATION AND LAND SETTLEMENT

Population.—In Jan. 1840 there may have been 2,000 whites in New Zealand. By 1861 the number was still slightly under 100,000. During the next 20 years the gold discoveries, the public works expenditure, and the development of agriculture, multiplied the number of colonists five times to 498,000 in April 1881. Then increase slackened for many years, and was slowest between 1886 and 1891, when the addition was but 48,000 in five years. In 1901 the whites numbered 773,000; and between that year and the census computation in April 1906 the increase, 115,859. In 1911 the white people had increased to 1,008,468, and in 1916 to 1,099,449. The census figures for 1916, 1921, 1926 and the estimated population at June 30, 1928, were as follows:—

	1916	1921	1926	1928
Europeans	1,099,449	1,218,913	1,344,384	1,389,076
Maoris	49,776	52,751	63,670*	65,004*

*Prior to the census of 1926 half-castes living as Europeans were counted as Europeans. (All half-castes are now classed with Maoris.)

The gain in population in the two last census periods was:—from 1916–21, 119,464 or 10·87%, and from 1921 to 1926, 129,792 or 10·69% (the last figure, of course, excludes half-castes). The average annual increment of population is less than 2½%. The number of males in 1926 was 686,384, and females 658,085. The number of females to 1,000 males has risen from 622 in 1861 to 959 in 1926.

In 1916 the birth rate per 1,000 was 25·94 and in 1926, 21·05. In the same periods the death rates per 1,000 were 9·64 and 8·74 respectively. The population is chiefly centred in the North island and the drift that way, largely due to the development of the dairy industry, is growing. In 1926, 61·87% of the people resided in the North island. The Maoris, who are not included in this percentage reside chiefly in the North island. The census statistics of 1926 classed 51·62% of the population as urban. The total population of North island in 1926 was 831,738; the total population of South island (including Stewart island and Chatham islands) was 512,636. Of the entire population, 559,068 lived in the rural districts and 785,316 in boroughs.

In 1921, 98·43% of the inhabitants (exclusive of Maoris) had been born in the British empire. Of the total in 1921, 74·39% were born in New Zealand, 19·54% in the United Kingdom, and 3·94% in Australia. A certain number of those born in foreign countries were of British parentage or nationality, and including these the proportion owning British nationality, in 1926, was 99·35%.

The number of aliens steadily diminished—from 12,050 in 1911 to 7,901 in 1921. Certain restrictions are placed upon the entry into the dominion of "race aliens," a classification implying persons of other than Europeans. Of the total population in 1925, 43·66% were members of the Church of England, 25·42% Presbyterian, 13·93% Roman Catholics, and 9·53% Methodists.

The Maori race increased from 49,844 in 1911 to 54,768 in 1925. The census of 1926 and subsequent estimates, already given, include half-castes, and for that reason show a greater increase. There are 130 native schools with an average daily attendance of 5,947 scholars.

Immigration.—In normal times the immigration policy of New Zealand has been to provide assistance, by free or reduced passage rates, to desirable immigrants from Great Britain. About June 1927, however, the policy was suspended (except in the case of domestic servants and a few parties of youths to undertake farming) owing to unemployment in the dominion. The date of the resumption of the policy is uncertain. Under the New Zealand scheme assistance was restricted, except in the case of domestic servants, to persons nominated by permanent residents of the dominion, provided such persons were healthy and under 50 years of age. The nominator must undertake to make provision for the maintenance and employment of the nominee, and guarantee that residence shall extend to at least five years. The quota of such assisted new arrivals is fixed from period to period. From shortly after the World War of 1914–18 until 1925 the quota was 10,000 per annum, but early in 1926 it was extended to 13,500. A large section of the sheep owners of the dominion also have a fund of over £200,000, allocated out of wool profits of the period 1914–18, for training sons and daughters of sailors of the navy and mercantile marine who were killed or incapacitated during the World War, the lads in farming at a special institution in New Zealand, and the girls in domestic and light farming work at another. Free passages are provided by the Government of New Zealand, and the children are provided with suitable employment after training. Both schemes are under the scrutiny of the minister for immigration and both have operated with entire success and satisfaction. The British Government co-operates with the dominion in its assisted migration and provides a share of the passage money.



BY COURTESY OF CANADIAN PACIFIC S.S. CO.
A MAORI WARRIOR BESIDE A TOTEM POLE

The following table shows the number of assisted immigrants entering the Dominion of New Zealand for each year of the 16-year period, 1911–1926 inclusive, immediately preceding the suspension of the policy of governmental aid:—

Year	Number	Year	Number
1911	3,070	1919	3,569
1912	3,535	1920	7,615
1913	5,151	1921	8,085
1914	3,716	1922	7,773
1915	1,300	1923	6,181
1916	695	1924	8,091
1917	231	1925	8,230
1918	421	1926	10,766

Land Settlement.—The total area of the dominion is 66,390,262 ac., and the following is the condition of the land in 1927:—

	Acres
Held on freehold	21,214,818
Reserved for public purposes	14,597,746
Crown lands leased	18,175,179
Crown lands yet available for disposal	2,721,488
Lands held by the native race	5,798,093
Unfit for settlement (including rivers, lakes, roads, etc.)	3,882,938
	66,390,262

Of the 43,587,698 ac. of occupied land in 1927, 18,830,436 ac. were in cultivation as follows:—

	Acres
Grain and pulse	671,804
Grasses and clover (for hay and seed) and green and root crops	1,098,058
Fallow	124,003
Grasses and clover (permanent pasture)	16,680,348
Vineyards and orchards	25,686
Market gardens, etc.	5,566
Private gardens and grounds	64,783
Plantations	160,188
	18,830,436
Unimproved land	24,757,262
	43,587,698

The unimproved land was divided up into 69,420 ac., under flax; 14,197.853 ac. of tussock and native grasses; 4,123,743 ac. of fern, scrub, etc.; 4,009,032 ac. of standing virgin bush; and 2,267,214 ac. of barren land. The Wellington and Auckland provinces possess the greatest flax areas, and Canterbury and Otago the tussock land (used for sheep grazing); the fern and scrub areas are well distributed; Westland and the Auckland provinces contain the chief forest lands; the barren lands mainly consist of the mountain areas of South island. The remaining Crown lands are being thrown open as rapidly as possible. In the 1924–25 financial year 456,590 ac. were selected under the various tenures provided by the Land Act, 1924, Land for Settlements Act, 1908, and Education Reserves Amendment Act, 1910. There is legislative provision for the prevention of aggregation in large areas and for sub-division if desirable.

The advances to Settlers Act, 1894, was embodied in the State Advances Act, 1913, under which money is lent to settlers on first mortgage of lands and improvements held under certain specified classes of tenure. The Government has authority under the act to borrow money for these advances. The scheme has proved very successful and from 1917–21 repayments exceeded advances. In 1923 its application was widened to enable larger amounts to be borrowed and increased advances to be made; as a result the loans authorized in the two succeeding years were greatly increased. In 1926–27, 1,853 loans amounting to a total of £1,980,795 were authorized. (H. J. B. D.)

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ADMINISTRATION AND FINANCE

Political Organization.—New Zealand was not colonized in the ordinary manner around one centre. There were in its early years six distinct settlements—Auckland, Wellington, Nelson, New Plymouth, Canterbury and Otago—between which communication was for several years irregular and infrequent. To meet their political needs the Constitution Act of 1852 created them into provinces, with elective councils and superintendents respectively, subordinated to one colonial legislature. In 1876 the provincial system was abolished. The General Assembly, as it is called, is composed of the governor-general, the legislative council, and the House of Representatives. The governor-general is appointed by the Crown and is assisted by an executive council of 11 members in addition to himself. The Legislative Council consists of members appointed for seven years by the governor-general in council. The number on the roll (1928) is 38. The House of Representatives consists of 80 members elected by universal suffrage, 76 Europeans and four Maoris. Members of both houses are paid. An elector must have resided for one year in the dominion and for three months in the electoral district in which he claims to vote. A system of compulsory registration of electors was introduced at the end of 1924. The duration of the house is for three years. Executive administration is conducted on the principle of the English parliamentary system. The Government is represented in England by a high commissioner. Since 1907 the colony has been known officially as "The Dominion of New Zealand," and in 1917 the designation of "governor and commander-in-chief" was altered to "governor-general and commander-in-chief."

Local administration is vested in local elective bodies with power to levy rates. The Counties and Municipal Corporations Acts of 1876 reorganized the local administration after the abandonment of the "provincial" system. (H. J. F.)

Education.—Under the Education Act of 1877 State education in New Zealand is free, secular and compulsory, between the ages of seven and 14. In 1914 the whole of the law relating not only to primary, but to secondary, technical, and special schools was recast. By an act of 1915 nine education districts were created from the existing 16. A council of education was also constituted to report to the minister and advise on any matters referred to it. By the Education Amendment Act, 1921–22, the registration of all private schools was made compulsory, and teachers in all schools were required to take the oath of allegiance. The number of scholars in all educational institutions in 1911 was 194,325, and in 1926, 297,751. The following table shows the advance in the State primary schools (including district high schools):—

Year	No. of schools	Pupils at end of year	Average attendances %
1913	2,255	172,168	89·2
1918	2,365	194,934	88·7
1926	2,601	219,969	89·9

The number of teachers in public schools in 1913 was 4,262; and in 1926, 6,183. In 1915 there were 11,958 children receiving secondary and technical instruction at all classes of schools; in 1926 there were 27,110. Free places at secondary schools are granted to suitably qualified pupils. There are also national scholarships. Control of higher education is vested in the New Zealand university, which by royal charter, is entitled to grant degrees. There is a liberal scholarship system in connection with the universities.

The following table shows the increased expenditure on education:—

	Expenditure from public funds	Expenditure per head of mean population
	£	s. d.
1900	980,000	19 7
1915	1,378,000	24 1
1921	3,224,000	51 6
1926	3,814,434	54 10
1927	3,910,241	55 1

Finance.—The gross national debt, which at March 31, 1910, stood at £74,890,645 (£72 6s. 10d. per head of population), at March 31, 1927, amounted to £245,850,889 (£170 19s. 5d. per head). This is the gross amount, and against it are accumulated sinking funds. With the exception of that portion incurred for war purposes, the greater portion of the borrowings has been for productive and developmental purposes, resulting in revenue-producing assets such as railways, hydro-electrical installations, telegraphs and telephones. The war debt to the Imperial Government had been funded and repayment is already well advanced.

The following table shows the revenue and expenditure for financial year periods from 1910 to 1925:—

Year ending March 31	Revenue	Expenditure	Excess of revenue over expenditure
	£	£	£
1910	9,238,917	8,990,922	247,995
1915	12,451,945	12,379,803	72,142
1920	26,081,340	23,781,524	2,299,816
1925	28,643,000	27,399,200	1,243,800
1927	24,943,107	24,355,965	587,142

The details of revenue and expenditure for the same years were:—

Chief Sources of Revenue

Year ending March 31	Taxation	Railways	Post and telegraphs	Crown lands	Other sources
	£	£	£	£	£
1914 .	5,918,034	4,028,739	1,269,922	262,846	750,120
1921 .	22,184,414	6,918,492	2,478,532	319,641	2,359,882
1925 .	16,172,306	7,105,106	2,706,882	211,749	2,446,957
1927 .	16,899,556	*2,043,433	3,226,558	202,186	2,571,374

*Under the new system of railway finance the figures for 1927 represent interest on railway capital liability only.

Principal Expenditures

Year ending March 31	Working railways	Post and telegraphs	Education	Interest etc., on public debt	Other expenses
	£	£	£	£	£
1914 .	3,004,181	1,170,883	1,206,678	2,887,981	3,556,141
1921 .	6,211,011	2,588,360	2,633,977	7,831,593	8,803,789
1925 .	5,636,583	2,413,436	2,777,271	8,862,644	7,709,266
1927 .	429,068	2,343,438	3,070,096	9,745,932	8,767,431

These tables show that revenue from taxation increased very considerably from 1914 to 1921, but fell heavily from 1921 to 1925. The public services (chiefly railways and post and telegraphs) increased their revenue after 1921, while the costs of their administration were reduced, the results of severe economies.

The movement of direct and indirect taxation from 1914 to 1927 is shown in the following table:—

Direct and Indirect Taxes

Year ending March 31	Customs and excise	Land tax	Income tax	Death duties
	£	£	£	£
1914 . .	3,553,785	767,451	554,271	613,751
1917 . .	4,037,628	713,118	4,262,126	570,040
1921 . .	8,769,251	1,688,979	8,248,945	1,106,925
1922 . .	5,554,334	1,637,816	6,002,987	1,512,754
1927 . .	9,016,862	1,229,067	3,422,216	1,690,374

Banking.—There are six banks of issue operating in the dominion, two of them, the Bank of New Zealand and the National Bank of New Zealand, being incorporated by special acts of the general assembly of the dominion. In 1927 the Bank of New Zealand had branches and agencies numbering 223, and the other five between them 281, making a total of 504.

Development of Banking, 1910-26

	Deposits	Advances	Assets	Liabilities
	£	£	£	£
1910 . .	24,968,761	18,439,999	26,398,927	26,742,081
1920 . .	59,405,341	38,241,932	56,111,433	67,818,469
1921 . .	49,397,411	50,607,541	68,701,282	58,808,439
1922 . .	45,913,394	44,768,178	61,779,570	53,868,834
1924 . .	49,502,499	44,559,661	61,325,865	57,131,235
1926 . .	50,135,114	49,149,260	65,765,297	58,008,161

The number of open accounts in the Post Office Savings Bank at the end of 1910 was 380,585; at the end of 1915, 509,085; and at March 31, 1927, 783,827. In 1910 (calendar year) the proportion of open accounts to the total population was 1 in every 2·76; in 1927 (March 31) the proportion was 1 in every 1·82. The deposits and withdrawals in the calendar year 1910 were £10,708,939 and £9,695,515 respectively; and in 1927 (March 31) £29,456,383 and £30,149,629 respectively. The amount standing to credit of all accounts in 1910 (Dec. 31) was £14,104,990, and in 1927 (March 31) £48,985,502.

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DEFENCE

Military.—A strong force of New Zealand mounted infantry took part in the Anglo-Boer War of 1899–1902. In the World War, 128,525 New Zealanders joined the New Zealand military forces and 98,950 of them served overseas in the campaigns in Gallipoli, Egypt, Salonika, France and Belgium, and Palestine, suffering 58,501 casualties, without counting those who died in the United Kingdom. The total included over 2,500 officers. The total of those who volunteered or were called up under an Act of August 1916 numbered 231,439, of which number about 102,000, obtained by ballot, had not yet joined training camps in November 1918. The military forces of New Zealand now (1928) include a permanent force to administer and train the forces, a territorial force, reserve, cadets, and nursing service, with provision for raising additional military forces on mobilization.

Recruiting Service and Organization.—The permanent force is filled by voluntary enlistment for 5 years' service with the colours, followed by 3 in the reserve. All male resident British subjects who have resided in New Zealand for 6 months between the ages of 18 and 30 years are liable to training in the territorial force, and if between the ages of 14 and 18 to be trained as senior cadets. There are also rifle clubs, in which those not in the defence forces learn to shoot. Service in the territorial force is for 3 years with 6 days' annual training in camp besides parades and drills. The signal corps, instead of attending camp, do four courses, each of one week, of 3 hours' training daily. The total strength of the permanent force is about 500, including about 120 officers but excluding the air force of about 16. The territorial force (limited by law to 30,000) numbers (1927) about 22,500, including about 1,240 officers. About 14,000 cadets are posted annually for training. The organization of the permanent force includes a staff corps, artillery, air force, permanent staff, ordnance, pay, medical and army service corps. The territorial force is organized in 3 mounted rifle brigades, 3 field artillery brigades, 2 pack or light brigades (howitzers), 4 medium batteries, 2 coast batteries, 3 signal and 3 engineer companies, 3 infantry brigades, and a corresponding number of companies of army service and medical corps. Other auxiliary units are formed on mobilization.

Higher Command and Distribution.—The government of the forces is vested in the Crown. The minister of defence is charged with administration, his decisions and instructions being issued by the general officer in active command, through the three local commanders in the northern (Auckland), central (Wellington), and southern (South Island) commands. Military headquarters are at Wellington. There is a ministry of defence with the usual departments and a general staff. Also an advisory air board. Each command is divided into 4 regimental districts which provides a battalion and a proportion of the other units mentioned above.

The training establishments include a general headquarters school for officers and others both of the permanent and territorial forces. Also schools for equitation, small arms, artillery, signals, education, and machine-guns. Some of the harbours are provided with coast defences. A small air force has recently been established with permanent personnel for instruction and charge of a new aerodrome at Christchurch, and territorial personnel with previous experience in air forces of the British Empire. The above-mentioned air board includes 3 naval and military and 5 civilian officials. The present permanent establishment of the New Zealand air force numbers only 5 officers and 19 other ranks.

(*See* also the League of Nations *Armaments Year-book* (Geneva 1928). (G. G. A.)

Naval.—Until 1895 New Zealand had made no contribution towards the cost of naval defence, but in that year the Colony agreed to pay £20,000 annually towards the upkeep of the squadron in her waters and in 1903 the yearly contribution was doubled. Five years later the contribution of the Dominion was again increased to £100,000 for a period of ten years, and

the New Zealand people patriotically presented to the Imperial Government, the battlecruiser "New Zealand." This ship visited the Dominion in 1913 and her visit resulted in the inauguration of the New Zealand Royal Naval Reserve. This force, voluntarily recruited for twelve years service commenced the building up of a naval *personnel*, to be at the disposal of the Imperial Government in war time. The cruiser "Philomel" was commissioned as a training ship but before training could commence, war broke out, and she was returned to the Admiralty and employed in the Indian Ocean. In 1919, the "Philomel," refitted as a training ship, returned to New Zealand and, following the visit of Lord Jellicoe to the Dominion as Naval Adviser, the "New Zealand Division of the Royal Navy" was constituted, under the direction of a navy board and legislation placed the New Zealand Royal Navy and Royal Naval Volunteer Reserves upon a permanent footing. The battlecruiser "New Zealand" was scrapped under the Washington Treaty. The cruiser "Chatham" was lent to the New Zealand Government and in 1924–5 her place was taken by the two more modern cruisers "Dunedin" and "Diomede." These ships, which are manned chiefly by *personnel* lent from the Royal Navy, are lent free of charge by the Imperial Government to New Zealand, the Dominion bearing all expense of the *personnel* and the upkeep of the ships. In addition to the "Philomel" a trawler is maintained for training the Royal Naval Reserve and two sloops, at the charge of the Imperial Government, police the South Pacific Islands. At Auckland, a small naval base, fuelling and training establishment provides the needs of the New Zealand Division, the upkeep of which, in 1926–7 cost the Dominion £616,400. (S. T. H. W.)

AGRICULTURE AND INDUSTRY

Agriculture.—New Zealand is primarily a grazing country, largely because better financial returns are obtained from the pastoral industries. Grain crops, principally oats and wheat, are chiefly grown in the eastern and southern districts of the South island; barley is also grown, but to a very much smaller extent. Before the 1915–16 season agricultural statistics were rarely correct, owing to the unsatisfactory methods of collecting returns.

Pastoral Industry.—The number of dairy cows in the dominion in 1910 was 804,078, while in 1928 it had risen to 1,352,398. The dairy industry is largely conducted upon a co-operation basis, and the most up-to-date mechanical aids are used. In 1927, 17,090 milking plants were in operation, milking 753,751 cows each day, and 45,246 cream separators were in use on the farms. There were 243 butter, 269 cheese, and 68 dual (butter and cheese) factories. Over 76,000 persons were employed in the industry.

Pastoral products comprised over 90% of total exports in 1928. The dairy industry is rapidly developing. The same may also be said of the sheep-rearing industry. Farmers are more generally than ever before applying artificial, top-dressing manures to their pastures. More attention, especially in the dairy industry, is being given to the breeding and selection of the animals. During the post war period two important branches of the dairy industry were developed: the manufacture of casein and of dried milk. In 1927, 10,865,290 lb. of dried milk, valued at £308,101 were exported, and 46,763 cwt. of casein valued at £141,388. Preserved milk was exported of a value of £38,170. Honey production is another rapidly developing industry; and the export of apples increased from 400,000 cases in 1927 to 1,000,000 in 1928.

The number of sheep and lambs in the dominion in 1928 was 27,133,810. This is the highest figure yet reached. In 1879 the number was 11,570,000; and from then on there was a steady annual increase to the year 1894 when the 19,000,000 mark was reached, after which the figure remained stationary to 1907. It then again gradually went up to 26,000,000 in 1918, and fell to 23,000,000 until 1925. In 1927 the number had increased to 25,649,000; and 1928 saw a further increase of 1½ millions, notwithstanding heavier mutton and lamb exportations than ever before. Only a comparatively small proportion of the frozen meat exported from New Zealand is beef, for the price of frozen beef on the British market is low owing to competition with the chilled article from South America. As a result of this competition markets other than Britain are being sought. Shipments of frozen pork are rapidly increasing. In 1927 there were 43 meat freezing and preserving works in the dominion, employing 5,798 hands.

Acreage and Yield of Principal Crops, 1917–27

Season	Wheat		Oats		Barley		Maize		Peas and beans	
	Area thous. ac.	Quantity thous. bu.	Area thous. ac.	Quantity thous. bu.	Area thous. ac.	Quantity thous. bu.	Area thous. ac.	Quantity thous. bu.	Area thous. ac.	Quantity thous. bu.
1917–18	281	6,808	156	4,943	19	569	8	368	12	313
1918–19	208	6,568	173	6,885	19	711	10	414	18	506
1919–20	140	4,560	180	6,968	23	816	9	406	14	369
1920–21	220	6,872	148	5,225	47	1,587	15	501	14	355
1921–22	353	10,565	171	6,753	33	1,152	11	488	13	339
1922–23	276	8,395	143	5,688	17	598	20	506	24	698
1923–24	174	4,175	64	1,964	21	597	8	406	19	363
1924–25	167	5,448	147	5,797	25	798	9	427	14	411
1925–26	152	4,617	102	4,116	26	947	9	424	12	288
1926–27	220	7,952	117	4,998	30	1,243	10	491	15	455

The table shows the variability of the wheat acreage and grain imports are often necessary; in 1926 Australia sent New Zealand 1,697,385 bushels. About 14,000 persons were employed in agriculture in 1928. The area under potatoes in 1925–26 was 24,616 ac., yielding a return of 116,771 tons. Other root crops are grown on a large scale for winter feed and for stock fattening purposes.

The Department of Agriculture, under a director-general with divisional heads controlling chemistry, live stock, dairy fields and horticultural sections, is concerned mainly in advancing the interests of primary production. The sum allocated to this department in 1927–28 was £365,610. While the service is mainly educational, it is also responsible for the inspection and grading of all produce exported from the country. Experimental farms and horticultural stations are maintained in various localities, and farmers are assisted by visits and letters of advice. A Board of Agriculture was established in 1913 to advise the minister for agriculture upon matters relating to the development of agricultural and other rural industries.

Co-operation.—One of the greatest aids to the development of the primary industries has been the application of the principle of co-operation, particularly in the case of the dairy industry. The farmers have their co-operative companies, arrange their own finance, and receive monthly cheques—based on a percentage of the prices current on the British market, any surplus over the amounts paid out being subsequently distributed proportionately as a bonus. This system largely obviates the necessity for extensive capital.

After 1922 co-operative marketing in a modified form was put into operation by the meat producers. Under the Meat Export Control Act, 1921–22, the meat industry obtained powers to set up a board, elected by all the sheep and cattle farmers in the dominion, to supervise the industry, shipment and marketing of the produce. The board consists of eight members, five representing the producers and one the stock and station agents, while two are appointed by the Government. Since its inception much useful work has been done, chiefly in regard to the marking of parcels, grading of meat, loading and discharging, regulation of shipments

and in arranging satisfactory rail and sea freights and freezing charges. The dairy producers obtained power under the Dairy Produce Export Control Act, 1923, to set up a somewhat similar board. Both bodies have representation in London by managers. The fruit and honey producers also have similar organizations governing their export affairs.

Afforestation.—A very active and progressive policy is pursued in reafforestation. The first organized attempt with imported trees, chiefly European larch, Austrian pine, Corsican and western yellow pine and a variety of eucalypti, was made in 1896, when an afforestation section of the Lands Department was formed. This work continued with more or less progress until 1919, when a separate forestry department was set up, and was reorganized in 1920 as the State Forest Service. Then in 1921–22 the Forests Act was passed defining the forest authority as the minister of forestry, the Director of Forestry, with a secretary, five conservators, a milling expert, an engineer in forest products, and various sub-officials. The total personnel in 1927 was 111. At March 31, 1927, the area dedicated to forestry and conservation was 7,656,844 acres. The total expenditure on State afforestation up to March 31, 1927, was £848,453, the area of State plantations being 98,891 acres; in the year 1924 and subsequently local bodies, owners of private lands, tree and planting companies, etc., developed great afforestation activities, and to these the State has supplied some 23,000,000 trees.

Fisheries.—Although New Zealand possesses a most valuable asset in the great quantities of edible fish in the seas around her coasts, very little had been done up to 1925 in the systematic exploitation of the industry. In the year ending March 31, 1927, 327,562 cwt. of fish, valued at over £400,000, were brought in from the fishing grounds. In addition, the produce of the oyster fisheries was valued at £27,824, and of the whale fisheries at £7,000. Exports in 1926 totalled £71,568 in value. In 1926, 3,217 persons were employed in the fishing industry.

Minerals and Mining.—The gold-mining industry has declined in importance: up to 1926 the total value of gold exported was £92,403,399, the value for 1926 being £516,207. Gold is now almost solely obtained by dredging and sluicing. Silver is obtained in small quantities: up to 1926 total exports were valued at £3,016,660. The exploitation of iron ore and iron sand, of which there are plentiful deposits of the best quality, has not greatly progressed, though enterprise is reviving. During the World War, tungsten ore mining became very active, but the fall in prices during the post-war period caused a collapse in the industry; the export of sheelite (tungsten ore) fell from 266 tons in 1916 to 15 tons in 1926. Copper, manganese ores, platinum, cinnabar, tin and sulphur are also found. Coal is mined for local consumption. The deposits are very extensive, the proved resources amounting to 660,000,000 tons; in 1910 2,197,362 tons were produced, and in 1926, 2,239,999 tons. Kauri gum, the fossilized resin of the Kauri tree, is classed as a mineral, and during 1926, 4,877 tons of gum valued at £332,765 were exported. The total quantity of gum exported to the end of 1926 was 399,299 tons, valued at £21,855,751.

Secondary Industries.—Manufacturing industry had been but little developed up to 1908. The principal branches of industry, however, advanced considerably after 1910, with a tendency to greater diversity in production as the population increased. Owing to changes in system of collecting industrial data, and in the classification of industries made in various periods, together with the fact that the statistical data available include the dairy produce and meat handling establishments, it is not possible to give accurate tables to indicate the progress made. Including small-scale establishments, the dominion had about 100 distinct manufacturing industries in 1928. Woollen factories supplied a large proportion of the internal requirements: much ready-made clothing is manufactured locally, and also furniture and footwear as well as other commodities.

Engineering and the manufacture of metal products are increasing in importance. Motor and cycle engineering, motor body building and the manufacture of chemicals, brushware and glassware are comparatively new industries which are making rapid headway. The Government, through an Industries and Commerce Department, encourages and assists secondary manufacture, and the customs tariff is scientifically arranged to foster such industries as are capable of development. The total number of employees engaged in factories in 1925–26 was 81,700. The value of the products of manufacturing industries in 1926 was £85,000,000. This sum includes semi-primary industries engaged in the preparation of agricultural and pastoral produce for export with products valued at £35,000,000.

Water Power.—The Public Works Act, 1908, vested in the Crown the sole right to use the water power of the dominion, subject to any existing rights, and gave the government the right to develop such power. The Aid to Water Power Works Act, 1910, empowered the State to establish hydro-electric supply installations. The Lake Coleridge scheme to supply Christchurch was the first undertaking and was completed in 1915; in 1925 it was extended to supply up to 36,000 kilowatts. At the close of the World War a policy of concentration on works to supply the whole dominion was adopted. The Mangahao system to supply Wellington and the Wellington province came into operation in 1925. Work is proceeding on the Arapuni scheme to supply Auckland and the Auckland province and is well advanced. Under legislation passed in 1918, and later amendments, 43 districts were constituted to administer and finance the supply of power in created districts. The full development of the schemes in progress in 1927 will give the following results:—

North Island	*H.P.*
Mangahao (Wellington province)	24,000
Waikaremoana (East Coast)	40,000
Arapuni (Auckland)	96,000
South Island	*H.P.*
Coleridge (Canterbury)	36,000
Waipori (Otago)	25,000
Monowai (Southland)	16,000

The progress of development (in H.P.) was as follows:

1915	*1921*	*1925*	*1927*
43,016	51,114	70,143	148,979

The total cost to March 31, 1927, including capital outlay, stocks and debit balances on trading accounts, was £6,428,397; statutory authorizations existed for £10,830,000. In 1925 there were 56 power distributing stations. The total water power resources are estimated at 4,109,950 horsepower.

TRADE AND COMMUNICATIONS

Trade.—The external trade of New Zealand rapidly developed after the World War and, to a lesser degree, in the years immediately preceding, as is shown in the following table:

Year	Exports	Imports	Total Trade
	£	£	£
1909	19,661,996	15,674,719	35,336,715
1914	26,261,447	21,856,096	48,117,543
1918	28,516,188	24,234,007	52,750,195
1922	42,726,249	35,012,561	77,738,810
1923	45,967,165	43,378,493	89,345,658
1924	52,612,711	48,527,603	101,140,314
1926	45,275,575	49,889,563	95,165,138
1927	48,496,354	44,782,946	93,279,300

The years 1924, 1925 and 1926 were periods of abnormal prices, and there was also over-heavy importing. The present production is greater than in those years and the volume of exports is heavier, and economy in buying abroad is exercised.

The *per capita* value of exports in 1910 was over £21, and in 1927 £33. The imports *per capita* in the same years were £16 and £31 respectively. (Imports are valued at the current domestic value in the country of export plus 10% to cover "charges, freight and insurance"; exports are valued f.o.b.)

The tables on the following page show the values in thousands of pounds and quantities in thousands of hundredweight or pounds, of the principal exports for certain years:—

Exports: Values and Quantities (000's omitted)

Year	Wool		Frozen Meat		Butter		Cheese		Skins, Hides and Pelts
	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	£	lb.	£	cwt.	£	cwt.	£	cwt.	£
1910	8,308	204,369	3,851	2,654	1,812	357	1,195	452	1,129
1914	9,318	220,473	5,863	3,230	2,339	434	2,564	864	1,318
1922	11,882	321,533	8,387	3,518	9,042	1,120	4,087	1,161	2,054
1924	15,268	206,190	9,490	3,159	11,642	1,269	7,023	1,594	3,144
1926	11,830	213,154	8,656	3,034	8,695	1,168	5,939	1,461	3,204
1927	12,961	*	9,080	3,236	10,915	1,456	5,582	1,492	3,140

*Not available.

The successful application of refrigeration to the sea-carriage of apples and eggs opened up great possibilities, and the volume of exports is rapidly increasing. In the 1926 season some 600,000 cases of apples were shipped to Britain; in 1925 the quantity was only 200,000 cases, the value of which was £116,101. In 1928, one million cases were exported but the value of the export is not available. Honey exported in 1925 totalled 1,822,043 lb.

Other exports of minor importance and their values in 1927 were: hemp, £473,221; sawn timber (chiefly to Australia), £425,316; kauri gum, £278,632; gold, £534,639. The following table shows the value of goods exported to each of the chief markets in 1927:

	Value	Per cent of total
To Great Britain	£36,877,887	76·04
To United States of America	2,748,313	5·53
To Australia	3,670,462	8·07
To Germany	1,139,654	2·35

The principal import groups are: clothing and textiles, metals and machinery, sugar, tea, alcoholic liquors, tobacco, paper and stationery, oils, motor vehicles and accessories, chemicals, drugs and timber. Imports of motor-vehicles and oils (including motor spirits) have increased very rapidly: before 1911 their value was less than £300,000 annually, but in 1927 the amount was £4,706,000. The following table shows the imports for 1910 and 1927 classified as to origin:

Year	Great Britain	Other British countries	Foreign countries
	£	£	£
1910	10,498,771 (61·57%)	3,967,053 (23·27%)	2,585,759 (15·16%)
1927	21,462,077 (47·93%)	9,254,070 (20%)	14,065,899 (31%)

In 1910 the figures represent the countries of shipment, whereas those for the second period are of the countries of origin. In 1910 imports from Australia were valued at £1,520,000, and in 1927, £3,870,636; imports from the United States were £1,399,737 and £8,596,275 respectively.

Customs Duties.—In 1915 changes were made in the rates of duty levied on certain articles to meet the extraordinary expenses of the year, and in 1917 additional war impositions were made, these rates remaining in force until the coming into operation of the 1921 revised tariff. The revenue from customs duties in 1910 was £2,954,989, and in 1927, £8,252,575. The dominion's system of imperial preference extends to all British countries. The principle was extended in 1921 and again in 1928. Under the last revision the excess duty payable on foreign goods became, in general, 20% as compared with 15% under the 1921 tariff, and 10% prior to that year. Australia has a special reciprocal tariff agreement with New Zealand, arranged in 1922, and does not come under the general British preferential provision. In 1928 about one-half the total imports from the British empire were admitted free of duty.

Communications and Transport.—The railways from the earliest days have been owned, built and operated by the State. Their construction, to provide access to all parts of the country, has ranked always in the forefront of public enterprise. Progress in recent years is shown in the following table:

	Length open (miles)	Revenue (gross)	Expenditure
		£	£
1910	2,717	3,249,790	2,169,474
1920	2,996	5,752,487	4,105,067
1925	3,085	7,112,524	5,545,416
1928	3,200	8,034,970	6,085,123

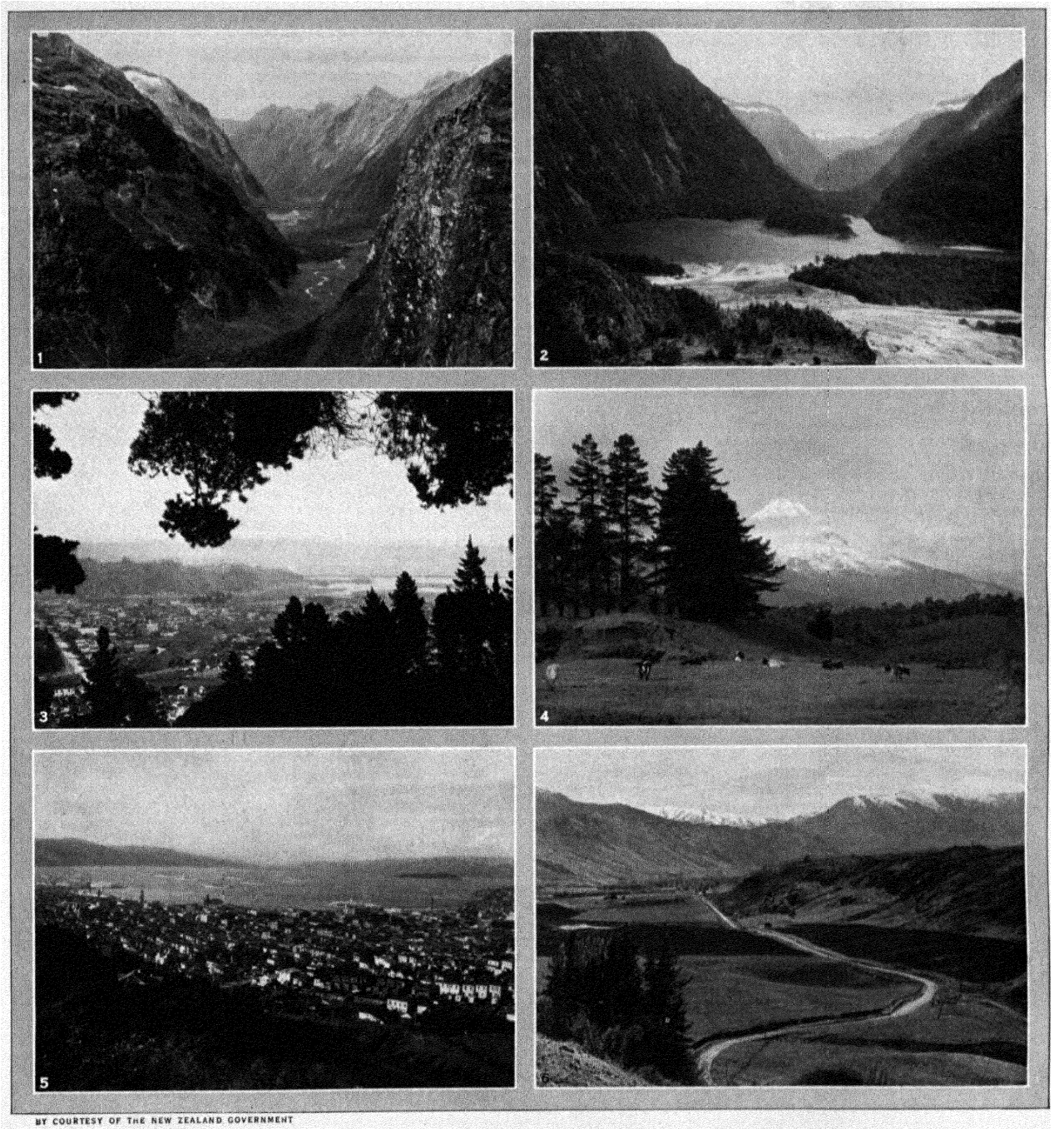
The capital value of the railways (including unopened lines and assets) was (1927) £56,028,477. The state builds its own rolling stock and locomotives, and is providing extensive new railway workshops. In 1924 the whole control of managerial organization was changed, the affairs being placed under the control of a board responsible to the minister, but a further change was made in 1928 and a general manager placed in charge.

Important railway works were carried out during the post 1914–18 period. The North Main Trunk was extended from Auckland to beyond Whangarei; sections were constructed on the east coast of North island, and a tunnel (5¼ m.) through the Southern alps at Arthur's pass, to link up the railheads in the Westland and Canterbury provinces, was completed and electrified in 1923. Railway extension work has been slow and costly, as the sections of country requiring linking-up are of a mountainous character. Duplications have been made in city suburban areas, and works are in progress to obviate the heavy grades running out of Wellington city.

In 1925 there were 64,625 m. of roads in the dominion, 28,553 m. of which were metalled. By the Main Highways Act (1922) main highways are under the administration of a highways board. This step has been rendered necessary by the heavy increase that has taken place in motor traffic. (H. J. B. D.)

HISTORY

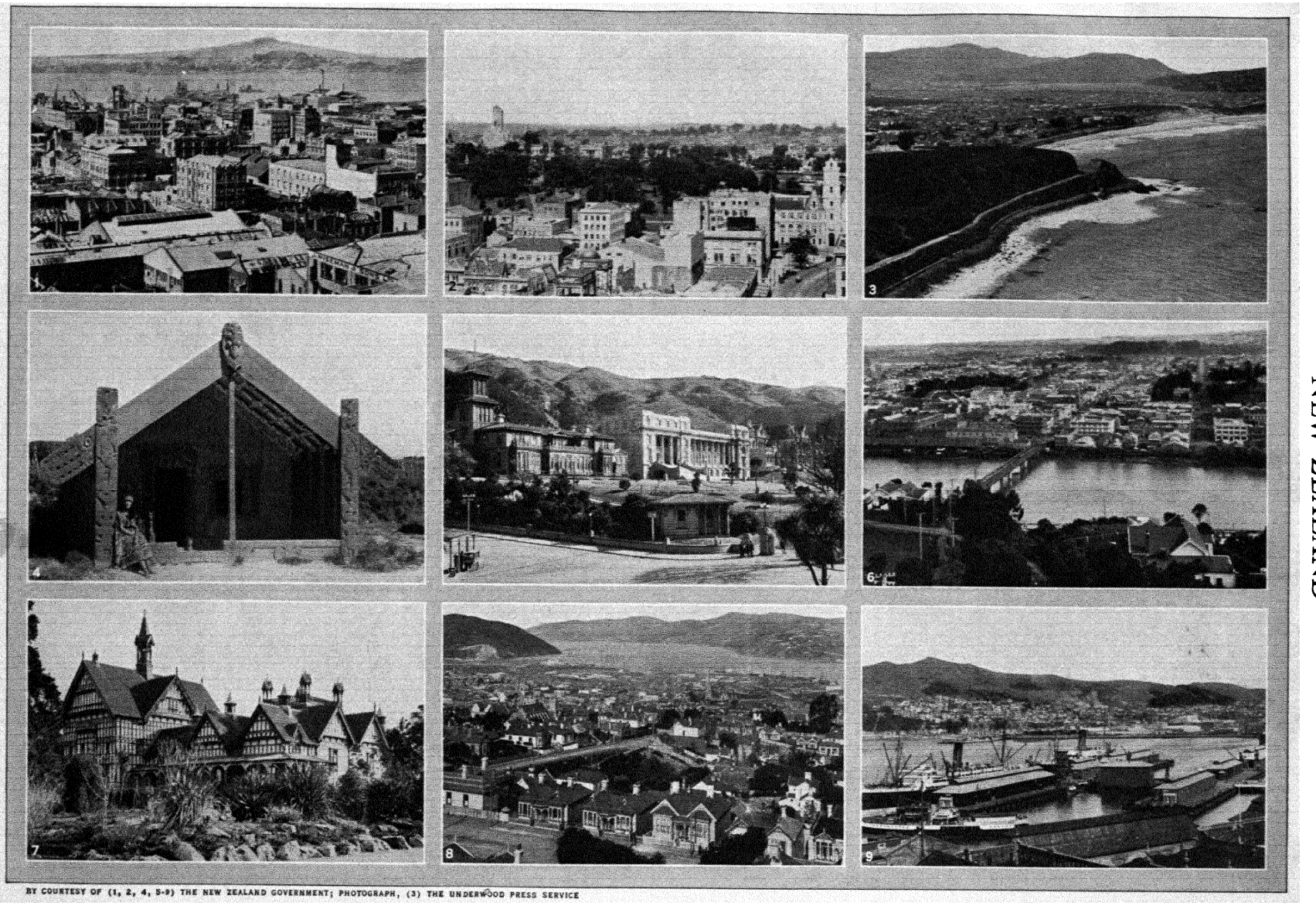
The date, even the approximate date, of man's arrival in New Zealand is uncertain. All that can be safely asserted is that by the 14th century A.D. Polynesian canoe-men had reached its northern shores in successive voyages. By 1642 they had spread to South island, for there Abel Jansen Tasman found them when, in the course of his circuitous voyage from Java in the "Heemskirk," he chanced upon the archipelago, coasted along much of its western side, though without venturing to land, and gave it the name it still bears. One hundred and thirty-seven years later, Cook, in the barque "Endeavour," gained a much fuller knowledge of the coasts, which he circumnavigated, visited again and again, and mapped out with fair accuracy. He annexed the country, but the British Government disavowed the act. After him came other navigators, French, Spanish, Russian and American; and, as the 18th century neared its end, came sealers, whalers and trading-schooners in quest of flax and timber. English missionaries, headed by Samuel Marsden, landed in 1814, to make for many years but slow progress. They were hindered by murderous tribal wars in which muskets, brought in first by the chief Hongi, more than decimated the Maori. Still, cruel experience and the persevering preaching of the missionaries gradually checked the fighting, and by the year 1839 peace and Christianity were in the ascendant. So far the British Government had resisted any pres-



BY COURTESY OF THE NEW ZEALAND GOVERNMENT

MOUNTAIN AND HARBOUR SCENES OF NEW ZEALAND

1. Clinton Cañon on Milford Track, South Island, the famous scenic trail of New Zealand. The canyon is a glacial-carved valley with mountain cliffs rising on either side
2. Lake Ada, South Island, showing Deepwater Basin hemmed in by mountains. The lake is on Milford Track which terminates at Milford Sound
3. General view of Nelson, South Island. The city is situated on a bay almost completely surrounded by hills
4. Mount Edgemont, 8,260 ft. high, in the province of Taranaki, North Island. The mountain, which is an extinct volcano, is nearly always capped with snow
5. Harbour of Wellington, capital of New Zealand situated on Port Nicholson, North Island
6. View of the agricultural country near Arrowtown, in the Wakatipu district, South Island



BY COURTESY OF (1, 2, 4, 5-9) THE NEW ZEALAND GOVERNMENT; PHOTOGRAPH, (3) THE UNDERWOOD PRESS SERVICE

CITIES AND WATERWAYS OF NEW ZEALAND

1. View of Auckland and the harbour. 2. Another view of Auckland. 3. Anderson's Bay with view of St. Clair, left, St. Hilda, right, and Dunedin midway between. 4. Maori Meeting House, Rotorua. 5. General view of the Parliamentary grounds in Wellington. 6. A view of the Wanganui river. 7. Main bath building in Rotorua. 8. General view of Dunedin. 9. The wharves of Wellington, an important seaport city of New Zealand

sure brought to bear in Downing street in favour of annexation. In vain Edward Gibbon Wakefield, organizer of colonizing associations, prayed and intrigued for permission to repeat in New Zealand the experiment tried by him in South Australia. Lord Glenelg, the colonial minister, had the support of the missionaries in withstanding Wakefield's New Zealand company, which at length resolved in desperation to send an agent to buy land wholesale in New Zealand and despatch a shipload of settlers thither without official permission. Before, however, the "Tory" had thus sailed for Cook strait, it had become known to the English Government that a French colonizing company—*Le Compagnie Nanto-Bordelaise*—was forming, under the auspices of Louis Philippe, to anticipate or oust Wakefield. With the assent of the Protestant missionaries the British authorities reluctantly instructed Captain Hobson, R.N., to make his way to northern New Zealand with a dormant commission of lieutenant-governor in his pocket and authority to annex the country to Australia by peaceful arrangement with the natives. Hobson landed in the Bay of Islands on Jan. 22, 1840, hoisted the Union Jack, and had little difficulty in inducing most of the native chiefs to accept the queen's sovereignty at the price of guaranteeing to the tribes by the treaty of Waitangi possession of their lands, forests and fisheries. Some French settlers, convoyed by a man-of-war, reached Akaroa in South island in the May following. But Hobson had forestalled them, and those who remained in the country became British subjects. Meanwhile, a week after Hobson's arrival, Wakefield's colonists had sailed into Port Nicholson, and proposed to take possession of immense tracts which the New Zealand company claimed to have bought from the natives, and for which colonists had in good faith paid the company. Other bands of company's settlers in like manner landed at Nelson, Wanganui and New Plymouth, to be met with the news that the British Government would not recognize the company's purchases. Then followed weary years of ruinous delay and official inquiry, during which Hobson died after founding Auckland. His successor, Fitzroy, drifted into an unsuccessful native war. A strong man, Captain Grey, was at last sent over from Australia to restore peace and rescue the unhappy colony from bankruptcy and despair. Grey, much the best of the absolute governors, held the balance fairly between the white and brown races, and bought large tracts of land for colonization, including the whole South island, where the Presbyterian settlement of Otago and the Anglican settlement of Canterbury were established by the persevering Wakefield.

SELF-GOVERNMENT

In 1852 the mother-country granted self-government, and, after much wrangling and hesitation, a full parliamentary system and a responsible ministry were set going in 1856. For 20 years thereafter the political history of the colony consisted of two long, intermittent struggles—one constitutional between the central Government (first seated at Auckland, but after 1864 in Wellington) and the powerful provincial councils, of which there were nine charged with important functions and endowed with the land revenues and certain rating powers. The other prolonged contest was racial—the conflict between settler and Maori.

The Maori Wars.—The native tribes, brave, intelligent and fairly well armed, tried, by means of a league against land-selling and the election of a king, to retain their hold over at least the central North Island. But their kings were incompetent, their chiefs jealous and their tribes divided. Their style of warfare, too, caused them to throw away the immense advantages which the broken bush-clad island offered to clever guerrilla partisans. They were poor marksmen, and had but little skill in laying ambuscades. During ten years of intermittent marching and fighting between 1861 and 1871 the Maori did no more than prove that they had in them the stuff to stand up against fearful odds and not always to be worsted. Round Mount Egmont, at Orakau, at Tauranga and in the Wanganui jungles, they more than once held their own against British regiments and colonial riflemen. The storming of their favourite positions—stockades strengthened with rifle-pits—was often costly; and a strange anti-Christian fanaticism, the Hau-Hau cult, encouraged them to face the white men's bullets and bayonets. But even their fiercest fighting leaders, Rewi and Te Kooti, scarcely deserved the name of generals. Some of the best Maori fighters, such as the chiefs Ropata and Kemp, were enlisted on the white side, and with their tribesmen did much to make unequal odds still more unequal. Had Gen. Pratt or Gen. Cameron, who commanded the imperial forces from 1860 to 1865, had the rough vigour of their successor, Gen. Chute, or the cleverness of Sir George Grey, the war might have ended in 1864. Even as it was the resistance of the Maori was utterly worn out at last. After 1871 they fought no more. The colonists too, taught by the sickening delay and the ruinous cost of the war to revert to conciliatory methods, had by this time granted the natives special representation in parliament. A tactful native minister, Sir Donald McLean, did the rest. Disarmament, roads and land-purchasing enabled settlement to make headway again in the North island after 12 years of stagnation. Grey quarrelled with his masters in Downing street, and his career in the imperial service came to an end in 1868. His successors, Sir George Bowen, Sir James Ferguson, the marquess of Normanby and Sir Hercules Robinson, were content to be constitutional governors and to respect strictly the behests of the Colonial Office.

Sheep-farming and the Discovery of Gold.—Meanwhile the industrial story of New Zealand may be summed up in the words wool and gold. Extremely well suited for sheep-farming, the natural pastures of the country were quickly parcelled out into huge pastoral Crown leases, held by prosperous licensees, the squatters, who in many cases aspired to become a country gentry by turning their leases into freeholds. So profitable was sheep-farming seen to be that energetic settlers began to burn off the bracken and cut and burn the forest in the North island and sow English grasses on the cleared land. In the South artificial grassing went on for a time hand in hand with cereal-growing, which by 1876 seemed likely to develop on a considerable scale, thanks to the importation of American agricultural machinery, which the settlers were quick to utilize. Even more promising appeared the gold-fields. Gold had been discovered in 1853. Not, however, until 1861 was a permanent field found—that lighted upon by Gabriel Read at Tuapeka in Otago. Thereafter large deposits were profitably exploited in the south and west of South island and in the Thames and Coromandel districts of the Auckland province. Gold-mining went through the usual stages of alluvial washing, deep sinking, river-dredging and quartz-reef working. Perhaps its chief value was that it brought many thousand diggers to the colony, most of whom stayed there. Pastoral and mining enterprise, however, could not save the settlers from severe depression in the years 1867 to 1871. War had brought progress in the north to a standstill; in the south wool-growing and gold-mining showed their customary fluctuations. For a moment it seemed as though the manufacture of hemp from the native *Phormium tenax* would become a great industry. But that suddenly collapsed, to the ruin of many, and did not revive for a number of years.

In 1870 peace had not yet been quite won; industry was depressed; and the scattered and scanty colonists already owed seven millions sterling. Yet it was at this moment that a political financier, Sir Julius Vogel, in that year colonial treasurer in the ministry of Sir William Fox, audaciously proposed that the central Government should borrow ten millions, make roads and railways, buy land from the natives and import British immigrants. The House of Representatives, at first aghast, presently voted four millions as a beginning. Coinciding as the carrying out of Vogel's policy did with a rising wool market, it for a time helped to bring great prosperity, an influx of people and much genuine settlement. Fourteen millions of borrowed money, spent in ten years, were on the whole well laid out. But prosperity brought on a feverish land speculation; prices of wool and wheat fell in 1879 and went on falling. Faulty banking ended in a crisis, and 1879 proved to be the first of 16 years of almost unbroken depression. Still, eight prosperous years had radically changed the colony. Peace, railways, telegraphs (including cable connection with Europe), agricultural machinery and a larger population had carried New Zealand beyond the primitive stage. The provincial councils had been swept away in 1876, and their functions divided

between the central authority and small powerless local bodies. Politics, cleared of the cross-issues of provincialism and Maori warfare, took the usual shape of a struggle between landed wealth and radicalism. Sir George Grey, entering colonial politics as a Radical leader, had appealed eloquently to the work-people as well as to the Radical "intellectuals," and though unable to retain office for very long he had compelled his opponents to pass manhood suffrage and a triennial parliaments act. A national education system, free, non-religious and compulsory, was established in 1877. The socialistic bent of New Zealand was already discernible in a public trustee law and a State life insurance office. But the socialistic labour wave of later years had not yet gathered strength. Grey proved himself a poor financier and a tactless party leader. A land-tax imposed by his government helped to alarm the farmers. The financial collapse of 1879 left the treasury empty. Grey was manoeuvred out of office, and Sir John Hall and Sir Harry Atkinson, able opponents, took the reins with a mission to reinstate the finances and restore confidence.

Politics.—Roughly speaking, both the political and the industrial history of the colony from 1879 to 1928 may be divided into three periods. The dividing line, however, has to be drawn in different years. Sixteen years of depression were followed, from 1895 to 1921, by 26 years of great prosperity and in turn by six years of depression again until 1927. In politics nearly 12 years of Conservative government, or at least capitalistic predominance in public affairs, were succeeded by 20 years of radicalism. Only in 1912 did the Conservatives regain the office they still retain (1928). Up to Jan. 1891, the Conservative forces which overthrew Sir George Grey in 1879 controlled the country in effect though not always in name, and for 10 years progressive legislation was confined to a mild experiment in offering Crown lands on perpetual lease, with a right of purchase (1882), a still milder instalment of local option (1881) and an ineffective Factories Act (1886). In Sept. 1889, however, Sir George Grey succeeded in getting parliament to abolish the last remnant of plural voting. Finance otherwise absorbed attention; by 1890 the public debt had reached £38,000,000 against which the chief new asset was 1,300m. of railway, and though the population had increased to 650,000, the revenue was stagnant. A severe property-tax and an increase of customs duties in 1879 only for a moment achieved financial equilibrium. Although taxation was seconded by a drastic, indeed harsh, reduction of public salaries and wages (which were cut down by one-tenth all round) yet the years 1884, 1887, and 1888 were notable for heavy deficits in the treasury. Taxation, direct and indirect, had to be further increased, and as a means of gaining support for this in 1888 Sir Harry Atkinson, who was responsible for the budget, gave the customs tariff a distinctly protectionist complexion.

During the years 1879–90, the leading political personage was Sir Harry Atkinson. He, however, withdrew from party politics when, in Dec. 1890, he was overthrown by the progressives under John Ballance. Atkinson's party never rallied from this defeat, and a striking change came over public life, though Ballance, until his death in April 1893, continued the prudent financial policy of his predecessor. The change was emphasized by the active intervention in politics of the trade unions. These bodies decided in 1889 and 1890 to exert their influence in returning workmen to parliament, and where this was impossible, to secure pledges from middle-class candidates. This plan was first put into execution at the general election of 1890, which was held during the industrial excitement aroused by the Australasian maritime strike of that year. It had, however, been fully arranged before the conflict broke out. The number of labour members thus elected to the general assembly was small, never more than six for over 20 years and no independent labour party of any size was formed. But the influence of labour in the progressive or, as it preferred to be called, Liberal Party, was considerable and the legislative results noteworthy. Ballance at once raised the pay of members from £150 to £240 a year, but otherwise directed his energies to constitutional reforms and social experiments. These did not interfere with the general lines of Atkinson's strong and cautious finance, though the first of them was the abolition of his direct tax upon all property, personal as well as real, and the substitution therefor of a land-tax of 1d. in the £ on capital value, and also of a graduated tax upon unimproved land values, and an income-tax also graduated, though less elaborately. The graduated land-tax, which has since been stiffened, rises from nothing at all upon the smaller holdings to about 7¾d. in the £ upon the capital value of the largest estates. Buildings, improvements, and live stock are exempted. In the case of mortgaged estates the mortgagor is exempted from ordinary land-tax in proportion to the amount of his mortgage. In 1896 municipal and rural local bodies were allowed to levy rates upon unimproved land values if authorized to do so by a vote of their electors, and by the end of 1926 some 200 bodies, amongst them the city of Wellington, had made use of this permission. The income-tax is not levied on incomes drawn from the cultivation of land. In practice the smaller farmers pay neither land-tax nor income-tax. In 1891 the tenure of members of the legislative council or nominated upper house, which had hitherto been for life, was altered to seven years. In 1892 a new form of land tenure was introduced, under which large areas of Crown lands were leased for 999 years, at an unchanging rent of 4% on the prairie value. Crown tenants under this system had no right of purchase and did not obtain it until 1913. In 1892 a law was also passed authorizing Government to repurchase private land for closer settlement.

On Ballance's sudden death in April 1893, his place was taken by Richard Seddon, minister of mines in the Ballance cabinet, whose first task was to pass the electoral bill of his predecessor, which granted the franchise to all adult women. This was adopted in Sept. 1893, though the majority for it in the upper house was but two votes. In 1893 was enacted the Alcoholic Liquor Control Act, greatly extending local option. In 1894 was passed the Advances to Settlers Act, under which State money-lending to farmers on mortgage of freehold or leasehold land was at once begun. The money is lent by an official board, which deals with applications and manages the finance of the system. Borrowers must repay ½% of their principal half-yearly, and may repay as much more as they choose. Profits are paid over to an assurance fund. Very large sums—nearly 37 millions—have thus been lent while profits placed to reserve have far more than met losses. The sum out on loan in 1928 was about 19 millions. The same year also saw the climax of a series of 14 laws passed in five years affecting the relations of employers and workmen. These laws deal with truck, employers' liability, contractors' workmen, the recovery of workmen's wages, the hours of closing in shops and merchants' offices, conspiracy amongst trade unionists, and with factories, mines, shipping and seamen. In 1895 a law controlling servants' registry offices was added. In 1897 all shipowners engaging in the coasting trade of the colony were compelled to pay the colonial rate of wages.

Meanwhile the keystone of the regulative system had been laid by the passing of the Industrial Conciliation and Arbitration Act, under which disputes between employers and unions of workers are compulsorily settled by State tribunals; strikes and lock-outs are prohibited in the case of unions of work-people when registered under the act and the conditions of employment in industries may be, and in most cases are, regulated by public boards and courts. The years 1896, 1897 and 1898 were marked by struggles over the Old Age Pensions bill, which became law in Nov. 1898. In 1898 the divorce law was amended on the lines of the Stephen Act of New South Wales, a change which helped to treble the number of petitions for divorce in the next seven years. In 1898 also the municipal franchise, hitherto confined to ratepayers, was greatly widened; in 1900 the English system of compensation to workmen for accidents suffered in their trade was adopted with some changes, one of the chief being that contested claims are adjudicated upon cheaply and expeditiously by the same arbitration court that decides industrial disputes. In 1895 borrowing on a larger scale was begun, and in 12 years twice as many millions were added to the public debt. Before this the Ballance ministry had organized two new departments, those of labour and agriculture. The former supervised the labour laws and endeavoured to deal with unemployment; the latter has done

much practical teaching, inspection, etc. Meat, butter, cheese and New Zealand hemp were thenceforth graded and branded by departmental inspectors before export. For many years the Government has worked two coal-mines profitably, chiefly to supply its railways. The continued success of the Government life insurance office led in 1899 to the setting up of an accidents insurance office, and, in 1903, of a State fire insurance office.

The outbreak of the South African War in Oct. 1899 was followed in New Zealand by a prompt display of warlike enthusiasm; politics ceased to be the chief topic of interest; the general election of 1899 was the most languid held for 15 years. The desire of New Zealanders to strike a blow for the mother-country took the practical shape of despatching to South Africa ten contingents of mounted men who behaved with credit.

The many experimental laws summarized above were passed in the last years of the long depression. In 1895 began a marked commercial revival, mainly due to the steady conversion of the colony's waste lands into pasture; the development of frozen meat and dairy exports; the continuous increase of the output of coal; the invention of gold-dredging; the revival and improvement of hemp manufacture; the exploiting of the deposits of kauri gum; the reduction in the rates of interest on mortgage money; a general rise in wages, obtained without strikes, and partially secured by law, which has increased the spending power of the working classes. Undoubtedly also commercial confidence was restored by the reconstruction in 1895 of the Bank of New Zealand, and activity was stimulated by large public loans, while more cautious banking and the systems of taxation and rating on land values, adopted in 1891 and 1896, did something to check land speculation at any rate until about 1908.

The Reform Party.—Since 1890 two political parties have had curiously long terms of power. The party headed by Ballance, Seddon and Ward held office without a break for 21 years, a result mainly due to the general support given to its agrarian and labour policy by the smaller farmers and the working classes. In 1912 it fell and the more conservative side, which had by then taken the title of Reform Party, at last returned to office, a good deal changed in complexion after its long exile. Though at the moment of success it could claim but a small majority in parliament and none outside it has since controlled affairs and in 1925 scored a sweeping victory at the elections. This striking reversal of fortune was mainly due to two causes which, working from inside, disintegrated the progressives and lost them the support of their main props, the farmers and labour. The farmers growing in numbers and prosperity with the progress of settlement, the subdivision of the soil and continuance of good prices found themselves able to control parliament. They were aided by the electoral law which counts 100 rural residents as 128 electors, a privilege not extended to urban or suburban voters. In the earlier years of this century they organized their class into a powerful union. Noting the rising prices of land they decided to destroy the liberal system of State tenancy substituting the freehold tenure with complete right of sale under the cheap and speedy land transfer law. The Reform Party was prepared to give them this and numbers of them joined it. At the same time labour began to break away. With its grievances redressed and its position made comfortable by the Arbitration and other labour laws it saw little more was to be had from the progressives. Under their régime, moreover, very few Labour leaders gained seats in parliament. The influence of labour on politics though great was more or less indirect. Australia set the example of separate and successful Labour Parties, and after 1910 New Zealand Labour set out on the same path. The more extreme Labour men even desired to destroy the Arbitration law as the main pacifying influence and barrier to a class war. They succeeded at times in stirring up strife among three or four unions, such as the coal miners, waterside workers and hands in freezing factories, but though serious strikes occurred in 1913, 1916, and 1921–22 New Zealand has remained on the whole industrially pacific. The number of working hours lost to industry through conflicts has been far less than in any other country where labour is well organized. Experience has taught the unions the value to them of the Arbitration law and in 1927 when it was attacked by the farmers they unanimously declared for it intact.

The World War Period.—The Reform Party began by granting the freehold according to promise, by passing a useful revision of the Education Act and also a law designed to put some check on strikes by unions not registered under the Arbitration Act. In 1914 came the World War and a coalition ministry of Reformers and Progressives was formed in which W. F. Massey the prime minister had the help of Sir Joseph Ward as finance minister, of Sir James Allen, an assiduous and resolute minister of defence, and of Sir Francis Bell, a leading barrister with a clear grasp of imperial affairs. New Zealand was not unprepared to be of service in war time. A law passed in 1909 paved the way for the compulsory training of the militia. Rifles had been procured from Canada, instructors and a general from England. Volunteers came forward with enthusiasm and their fine physique and complete submission to discipline were qualities which distinguished the New Zealand contingents through their long years of arduous service at Gallipoli, on the Western front and in Palestine. Respectable in numbers—84,000 of them took the field—the best witness to their valour and efficiency is found in the dry figures showing that, while they lost 17,000 by death and suffered more than 50,000 casualties, only 341 of them were captured by the enemy.

Heavy taxation and other severe war measures had to be endured in the dominion. Largely by forced loans from the banks and other direct taxpayers £55,000,000 were borrowed internally. No State currency notes were issued but bank notes were made—and still are—legal tender. The output of gold and the other chief products of food and raw material were commandeered at war prices for the imperial Government. There were protests—chiefly from labour—against conscription and some complaining from farmers who were left short-handed on their land. But on the whole the conduct of the people was patriotic and patient. Their war-debt, for their numbers enormous, finally exceeded £81,500,000; but the interest on it has been punctually paid. At the peace, New Zealand received a mandate to govern German Samoa, where her Administrator, Sir George Richardson, has by zealous and enlightened effort for the native race, arrested their decay and improved their material condition.

Social legislation was more or less at a standstill in war-time but an important change was made in the Liquor law. Local option was abandoned in favour of a triennial poll for and against national prohibition which may be voted by a bare majority. So far these polls have been in favour of the *status quo* though by somewhat small majorities. Thirteen districts which had "gone dry" under local option hold separate polls on the question; all but one of these adhere to "no licence." A practical reform closing all hotel bars at six P.M. appears to have reduced drunkenness.

After the War.—Peace was followed by three years of feverish prosperity and a wild speculation in rural land. Over £100 an acre was often paid for farms in the North island and when a very sudden fall of prices stopped the orgy in 1921 the reaction was extremely severe. Thousands had mortgaged themselves in buying freeholds without adequate capital and though nearly 1,000 farmers sought the bankruptcy court in the seven years 1921–27 and a larger number had to part with their holdings, the indebtedness of the rural population is still estimated at about £140,000,000. Owing to rural embarrassment a law of 1919 providing for a moratorium in the case of mortgages, other than trade mortgages, and of deposits, other than bank deposits, was continued until 1927.

After the war the Government had to deal with many thousands of demobilized soldiers without employment. It strove to do so by bestowing pensions on a liberal scale, by aiding men to find employment in the towns and by settling more than 9,000 soldiers on the land. This scheme of military settlements, excellent in intention, had to be carried out hastily and at a time when the price of land was highest. There was a good deal of miscalculation, disappointment and failure. The cost of the scheme so far (1928) has been about £30,000,000. After much rearrangement and writing down it seems likely that about three-fifths of the original

soldier-settlers will develop into well-to-do farmers.

In 1919 the progressive ministers withdrew from the Coalition in the belief that they could win the impending elections. While, however, labour held its own the progressives were decisively beaten and have since possessed little power in parliament. The Reformers continuing in office strove to meet industrial depression by economies in expenditure. The axe was applied to the departments. War bonuses were abolished and there have been some reductions of the land and income taxes. But borrowing by both Government and local bodies went on so that in 1927 the combined weight of taxes and rates was about £16 per head.

The general elections of 1922 left Massey with a bare majority in the House of Representatives. Labour captured 17 seats in a house of 84, but their hopeless division from the progressives enabled the Reformers just to hold their ground though comparatively little else could be done. Some of their more interesting post-war measures were the establishment of semi-official boards to regulate and control the export and sale of frozen meat, butter, cheese, fruit and kauri gum. Of these the meat board has, so far, been the most successful. The dairy control board in its first operations tried a fall with the middlemen of Tooley street and was badly beaten.

Massey, the veteran premier who had led the Reformers to victory in 1912, died in May 1925, after a long illness during which he had held on to his post indomitably. Sir Francis Bell took his place while the party settled the successorship. It was given to Gordon Coates, a comparatively young New Zealand-born minister who like Massey was an Auckland farmer. He had served with credit in the war and had shown himself an energetic administrator of railways and public works. Hopes centred on this new figure helped the Reformers in the elections. Moreover, the electors were weary of a parliamentary stalemate and irritated against labour in general by the wild strikes of British seamen in the seaports of Australia and New Zealand. The result was the most complete triumph ever gained by a conservative party in the dominion. Labour won but 12 seats; the progressives only 11. Labour—which has since won two by-elections—became indeed the official Opposition. Yet it is true to say that, isolated as it is, labour as a class has now less political influence than it had 35 years ago.

In 1926 and 1927 the country had to face further falls in prices. In the second year it contrived none too soon to make exports exceed imports and an improvement in the export market came at the end of 1927. Attempts to help farmers took the form of an act to enable the Bank of New Zealand to issue long-dated mortgages, and two others to encourage the raising of rural credit bonds and set up a scheme of chattel mortgage associations with public help. A family allowances arrangement (1926) grants a dole to the larger families of the poorest class. A petrol tax, estimated to yield nearly three-quarters of a million, is to be spent in keeping up the country roads. A revised customs tariff (1927) has substantially increased the preference granted to goods of British origin.

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NEXT FRIEND, in law, the phrase used for a person who represents in an action another person who is under the disability of infancy to maintain a suit on his own behalf. Every application to the court on behalf of an infant must be made through a next friend. Previous to the Married Women's Property Act 1882 it was also usual for a married woman to sue by a next friend, but that Act, allowing a married woman to sue in all respects as a *feme sole,* has rendered a next friend unnecessary in her case. In the case of an infant the father is prima facie the proper person to act as next friend; in the father's absence the testamentary guardian, if any; but any person not under disability may act as next friend so long as he has no interest in the action adverse to that of the infant. A married woman cannot, however, act as next friend, except in special cases. (*See* Rules of the Supreme Court, O. xvi. r. 16.) An infant defends a suit, not by a next friend, but by a guardian *ad litem.* A lunatic sues by his committee, but if he has no committee, or if the committee has some interest adverse to the lunatic, he sues by his next friend. A next friend has full power over the proceedings in the action as if he were an ordinary plaintiff, and he is therefore responsible for paying the costs, but he is not entitled to be heard in person. (*See* Lunacy.)

NEXT-OF-KIN: *see* Kin.

NEY, MICHEL (1769–1815), duke of Elchingen, prince of the Moskowa, marshal of France, was born at Saarlouis on Jan. 10, 1769. His father was a cooper, and he received only a rudimentary education. In 1788 he went to Metz and enlisted in a regiment of hussars; in 1792 he was elected lieutenant; and in 1794 he became captain and was placed by Kléber at the head of a special corps of light troops. He was soon promoted *chef de brigade,* and in 1796 general of brigade. He commanded the right wing of Hoche's army up to the peace of Campo Formio. On the resumption of hostilities he again took the field, and for his surprise of Mannheim in 1799 received the grade of general of division. He fought in the Swiss campaign of Masséna, and when Masséna turned against the Russians, who were approaching from Italy, Ney was left in command holding his ground successfully against the Austrians, although his opponent was the famous Archduke Charles. In 1800 he was present at Hohenlinden. In May 1802 he married Mâdemoiselle Auguié, whom Josephine had chosen for him at Bonaparte's request. This event marks a change in Ney's political opinions which can only be explained by Napoleon's power of captivating men. He was henceforward as ardent and sincere an admirer of Napoleon as hitherto he had been of revolutionary principles, and was one of the very few officers of the Army of the Rhine who became a trusted lieutenant of the emperor. He carried out an important mission in Switzerland, and in 1803 he was placed in command of the camp of Montreuil. While there he begged Napoleon to declare himself emperor, and on the establishment of the empire he was made marshal of France, and received the grand eagle of the Legion of Honour. In 1805 he commanded the VI. corps of the Grand Army, and his great victory at Elchingen (for which in 1808 he was made duke of Elchingen) practically secured the surrender of the Aus-

trians at Ulm. He was then ordered to the upper Adige, when he led the decisive attack at Friedland. After Friedland Napoleon gave him the title, "the bravest of the brave."

In 1808, after the first disaster to the French arms in Spain, Ney accompanied Napoleon there as commander of the VI. corps. He took part in the Peninsular War from 1808 to 1811. When acting under Masséna in the invasion of Portugal in 1810–11, he quarrelled bitterly with his former chief, and in spite of his distinguished service he was recalled to France by Napoleon and censured. He was re-employed with the *Grande Armée* in central Europe under Napoleon himself. In the 1812 expedition to Russia Ney commanded the centre at Borodino, and was created prince of the Moskowa on the evening of the victory. In the retreat he was a tower of strength, animating the rearguard with his own sublime courage, keeping the harassed and famished soldiers together under the colours and personally standing in the ranks with musket and bayonet. He was the last to recross the frontier, and threw the remaining muskets into the Niemen. In 1813 he commanded a corps in the German campaign, and in 1814 he shared in the campaign in France. At the fall of the Empire the fact that Ney acted in the negotiations in concert with Macdonald and Caulaincourt is sufficient proof of his desire to avert Napoleon's abdication. Less satisfactory was his loud protestation of devotion to the Bourbons, when the Restoration was a *fait accompli.* But he was mortified by the disdain of the returned *émigrés,* and retired to his country seat. While on his way to take up a command at Besançon, he heard of Napoleon's return. He hurried at once to assure Louis XVIII. of his fidelity. With the famous remark that the usurper ought to be brought to Paris in an iron cage, he proceeded to Lons-le-Saulnier to bar Napoleon's progress. But he deserted with his troops, and Napoleon's march became a triumphal progress. Ney's act was undeniably treason to his sovereign, but it was hardly the calculated treason that his *émigré* detractors saw fit to imagine. Napoleon received him kindly, but did not give him a command until just before the Waterloo campaign. The marshal took up the command of the left wing on the northern frontier on June 13. The next day the army moved into Belgium. Ney took part in the campaign successively in the rôles of strategist, tactician and soldier. (*See* WATERLOO CAMPAIGN.) Much controversy has raged over his actions of June 15 and 16. At Waterloo he was subordinated to the personal command of Napoleon, but his advice was often offered and sometimes accepted, and he personally led several charges of the French up to the British squares. But when all was lost, his courage was extinguished. He made no attempt to second Davout and Grouchy in the last days of Napoleon's reign, and in despair advocated the restoration of the Bourbons. Soon a fresh order was issued denouncing him by name, and he was arrested on Aug. 5. When Louis heard of Ney's arrest he exclaimed, "By letting himself be caught he has done us more harm than he did on the 13th of March!" But neither king nor ministers were in a position to resist the clamour of the ultra-royalists for blood. Every fresh delay in the process of Ney's trial raised a new outcry at the court, in the salons and in the Chamber of Deputies; and fiercest of all in demanding immediate execution was the king's niece, the unhappy duchess of Angoulême, who lived to confess that had she known the record of Ney's services to France she would never have consented to his death. Ney was placed on trial before a court martial composed chiefly of his former brothers-in-arms, whose participation in the tragedy was probably never forgiven them by their countrymen. Others of the marshal's old comrades refused to serve, and were disgraced in consequence, until public opinion forced their reinstatement. The court took advantage of the plea of Ney's counsel that he was entitled to be tried by his equals in the Chamber of Peers. In spite of the courageous and eloquent appeal of the young duc de Broglie, the result of the trial before the latter body was a foregone conclusion; de Broglie was alone in voting for his acquittal. In the early morning of Dec. 7, 1815, Ney was shot in the Luxembourg gardens, near the Observatory. He met his death quietly and with a perfect soldierly dignity.

Ney left materials for memoirs, but in an incomplete state. The *Mémoires du maréchal Ney,* published in 1833, were collected from these papers by his brother-in-law Gamot and by General Foy. They cover only the earlier part of his career, and end with the battle of Elchingen (October 1805). An edition in English was published the same year.

See Rouval, *Vie du maréchal Ney* (1833); Dumoulin, *Histoire du procès du maréchal Ney* (1815, Eng. trans. 1816); Nollet-Fabert, *Éloge du maréchal Ney* (Nancy, 1852); Welschinger, *Le Maréchal Ney, 1815* (1893); A. Delmas, *Mémoire sur la révision du procès du maréchal Ney* (1832); *Military Studies by Marshal Ney* (Eng. trans., 1833); G. A. B. E. H. Bonnal, *La Vie Militaire du maréchal Ney* (1910, etc.); R. Androix, *Ney* (1914).

NEZ PERCÉ, a tribe of Sahaptin lineage on Snake river in Idaho and Oregon, now on Lapwai reservation, Idaho. The estimated population was 6,000 in 1805, 1,400 in 1885, 1,500 in 1921. In 1877, under Chief Joseph, they fought the United States, winning some engagements and engaging in a notable but finally unsuccessful retreat almost to Canada. They were the largest and easternmost Sahaptin tribe and most affected by influences from the Plains Indians.

NGAMI, a shallow lake of variable size forming the centre of an inland drainage system in the Bechuanaland (*q.v.*) Protectorate, South Africa. The lake once extended to a length of 20 m. and a width of 10 m., but is now little more than an expanse of reeds growing in a soft soil, below which brackish water is found. It is cut by 20½° S. and 23° E. Ngami is the lowest point of a large depression in the great plateau of South Africa. The area which drains to it is bounded south by the basin of the Orange, east by the Matabele hills, north by the western affluents of the Zambezi. The greater part of the Ngami water-system lies, however, north-west of the lake in the Angola highlands. On the high plateau of Bihe, in the hinterland of Benguella, rise two large rivers, the Okavango and the Kwito, which uniting discharged their waters into Ngami. From the north-east end of Ngami issued the Botletle or Zuga, a stream which runs south-east and drains towards the Makarikari marsh, from which there is no outlet.

Although Ngami has contracted in size in modern times the Okavango and its tributary the Kwito remain large rivers. The Okavango is known in its upper course as the Kubango. Its most remote source lies in about 12½° S. and 16½° E. and its length is over 900 m. It flows first south then south-east and east. In about 18° S. and 20½° E. it is joined on the north bank by the Kwito, a large navigable stream rising almost as far north as the Okavango. Its general course is south-east, but between 15° and 17° S. it flows south and even south-west. Below the Kwito confluence the Okavango, which is also joined by various streams from the south-west, is a rapid stream, generally navigable as far as the Popa falls, in 21° 50′ E. In the dry season, the water-level is from 4 to 20 ft. below the banks, but these are overflowed during the rains. At this period, April–June, some of the surplus water finds its way (in about 19° S.) by the Magwekwana to the Kwando or Linyanti (Zambezi system), to which, it is thought, the whole body of water may have once flowed. Below the Magwekwana outlet the Okavango, now called the Taukhe or Tioghe, turns almost due south, enters a swampy reed-covered plain and is broken into several branches. In this region the effects of desiccation are marked. Through the swamps the river formerly entered Ngami. Through the swamp some of the waters of the Okavango find their way eastward through a channel called Tamalakane to the Zuga or Botletle, the river which formerly flowed out of Ngami. The Botletle, whose bed is about 100 m. in length, loses itself in a system of salt-pans—round or oval basins of varying size sunk to a depth of 30 to 45 ft. in the sandstone, and often bounded by steep banks. The outer pans are dry for a large part of the year, the whole system being filled only at the height of the flood-season in August. The Botletle, which receives in addition the scanty waters of the northern Kalahari, at this season reaches the Makarikari marsh. In 1849 Livingstone found a large shallow lake. In 1896 Lugard and Passarge both found none. (*See* S. Passarge, *Die Kalahari,* 1904.)

NIAGARA, FORT, an American fortification, on the east side and at the mouth of Niagara river, opposite the Canadian village of Niagara-on-the-Lake. Ft. Niagara has a reservation of 288 ac., with fairly modern equipments, and several historic

buildings of the time of French and of British possession, in one of which, the old magazine (1757), William Morgan was imprisoned in 1826. Fort Niagara was long, especially during the French occupation of Canada, one of the most important forts in North America, being the key to the Great Lakes, beyond Lake Ontario. La Salle wintered here in 1678–9, built his ship the "Griffon," and established a trading post and Fort Conti, destroyed not long afterwards. Fort Denonville, built in 1687 by Jacques René de Brésay, marquis de Denonville, governor-general of Canada, in his cruel campaign against the Iroquois, was abandoned in 1688, after the garrison, commanded by Pierre de Troyes (d. 1687), had been wiped out by an epidemic. The first Fort Niagara, to be so named, was built in 1725–1727 at the instance of Charles le Moyne, 1st baron of Longueil (1656–1729), and became a very important military and trading post; the fort was rebuilt by François Pouchot (1712–1769) in 1756, but in July 1759, after a siege of about sixteen days, it was surrendered to Sir William Johnson by Pouchot. On the 14th of September 1763 a British force marching from Fort Schlosser (about 2 m. above the Falls; built 1761) to Fort Niagara was ambushed by Indians, who threw most of their captives into Devil's Hole, along the Niagara river. In July 1764 a treaty with the Indians was signed here, which detached some of them from Pontiac's conspiracy. Joseph Brant, John Butler and, in general, the Indians of north-western New York favouring the British during the Revolutionary War, made Fort Niagara their headquarters, whence they ravaged the frontier, and many loyalists and Indians took refuge here at the time of Gen. Sullivan's expedition into western New York in 1779. The fort was not surrendered to the United States until Aug. 1796. In the War of 1812 it was bombarded by the guns of Ft. George immediately across the river, and on Dec. 19, 1813 was surprised and taken by assault—most of the garrison being killed or taken prisoners—by British troops under John Murray. After the close of the war, on March 27, 1815, Ft. Niagara was restored to the United States, and a garrison was kept there until 1826. The fort was regarrisoned about 1836, and has since remained a post of the regular army.

See F. H. Severance, *An Old Frontier of France* (1917); L. L. Babcock, *War of 1812 on the Niagara Frontier* (1927); *Publications of the Buffalo Historical Society;* F. Parkman, *Conspiracy of Pontiac* (1851) and *Montcalm and Wolfe* (1884).

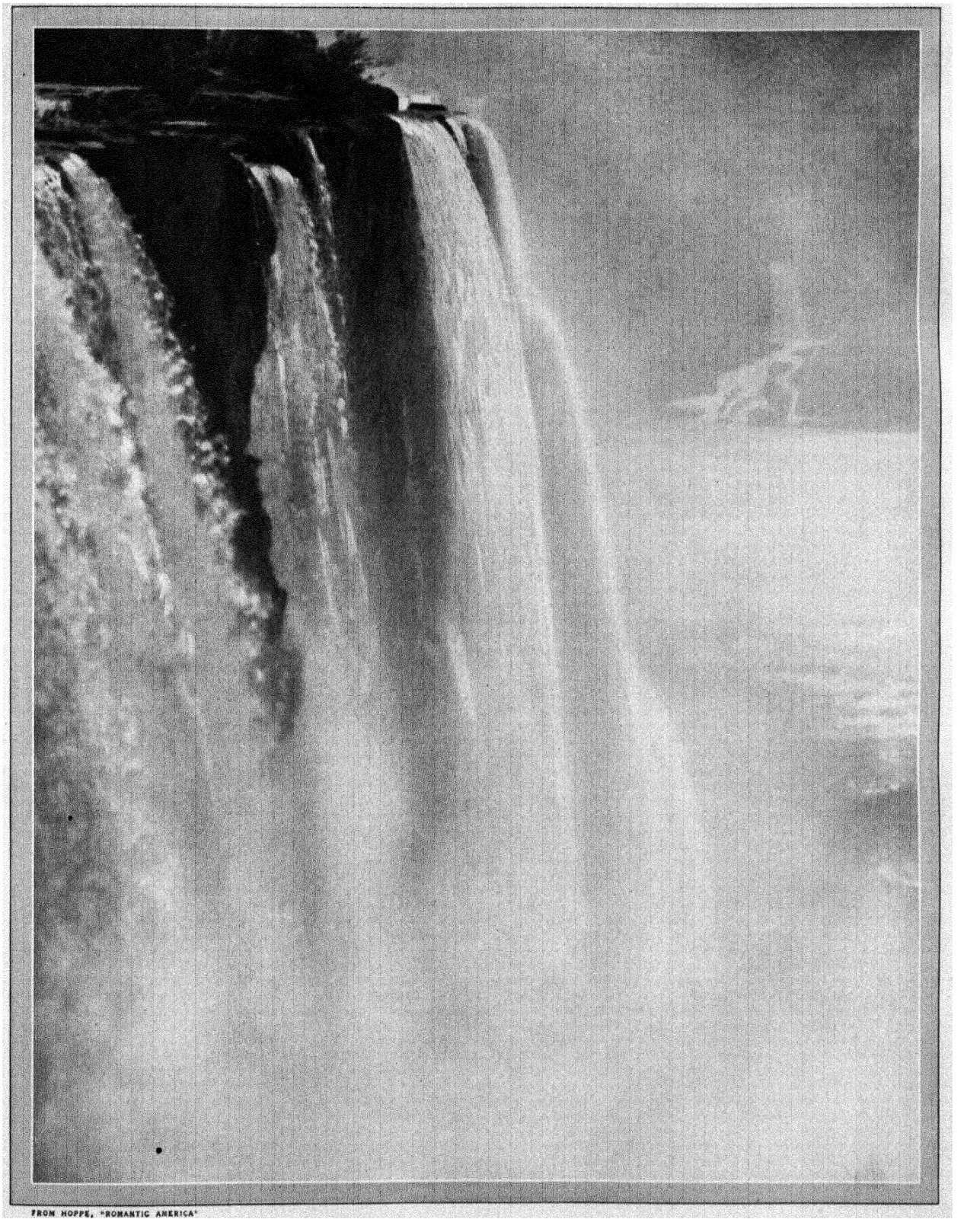
NIAGARA FALLS (formerly Clifton or Suspension Bridge), a city and port of entry of Welland county, Ontario, Canada, 40 m. S.S.E. of Toronto, on the west bank of the Niagara river and opposite the Falls. Pop. (1921) 14,764. It is a station on the Canadian National and Michigan Central and St. Catharines and Niagara Central railways, and has electric railway communication with the chief towns in the neighbourhood. Three large steel bridges connect it with the American town of Niagara Falls on the opposite bank. Its importance was chiefly due to the tourist traffic, but the unrivalled water power is being more and more employed. Factories have sprung up and large electric power plants, and power is transmitted to Toronto and other cities. A beautiful park, named after Queen Victoria, extends along the bank of the river for 2½ m. above the Falls.

NIAGARA FALLS, a city and a port of entry of Niagara county, New York, U.S.A., at the great falls of the Niagara river (*q.v.*) 22 m. N.N.W. of Buffalo. It is served by the Lehigh Valley, the Michigan Central, the New York Central, three electric railways and for freight also by the Erie and the Niagara Junction railways. Pop. (1920) 50,760 (35% foreign-born white); 1928 estimate 68,300. The city extends along the summit of the cliffs from above the falls (where the river makes a sharp curve) to 3 m. below them. Goat island separates the American fall (165 ft. high and 1,000 ft. wide) from the Horseshoe fall on the Canadian side (160 ft. high, with a crest of over 2,000 ft. in a deep curve), and between them is the delicate Bridal Veil. Below the falls the river rushes between perpendicular walls 300 ft. high, in a series of rapids to the whirlpool. Goat island, several smaller islands, and Prospect park (10 ac. on the brink of the gorge) have been a State reservation since 1885. Every evening (since 1925) the falls are illuminated with changing colours by 24 gigantic searchlamps developing a total of 1,440,000,000 candle-power, set in Queen Victoria park across the river. Niagara Falls probably attract more visitors than any other single natural phenomenon of America. To protect their aesthetic value, the amount of water which may be diverted from either the Canadian or the American fall is limited by an international treaty. Practically all the permitted American diversion is now utilized in a hydro-electric development with an installation of over 500,000 h.p., serving half the population of the State. The city is an important manufacturing centre, especially of the electro-chemical industries, which are largely concentrated here. Others of importance are the manufacture of abrasives, shredded wheat, caustic soda, paper, aluminium, ferro-alloys and a great variety of chemical compounds. The aggregate factory output in 1925 was valued at $108,479,229. Bank clearings in 1927 amounted to $60,800,000. The assessed valuation of property was $135,331,043. Since 1916 Niagara Falls has operated under a commission-manager form of government. It is the seat of Niagara university (Roman Catholic; 1856). Old Ft. Niagara (*q.v.*) 14 m. N., was in 1928 in process of restoration to its original condition.

A fort (Little Niagara) was built on the site of Niagara Falls in 1750, and after its destruction Ft. Schlosser was built in 1761. In 1806 Judge Porter founded the village of Manchester here, on the banks of the falls. It was burned by the British in 1813, and remained a straggling little settlement until the construction of the Hydraulic canal in 1852 and the subsequent development (especially after 1877) of power from the falls. The first bridge across the river was completed in 1835; the first railroad bridge (a suspension bridge by John A. Roebling) in 1855. In 1892 the villages of Manchester and Suspension Bridge were merged and chartered as the city of Niagara Falls, which in 1900 had a population of 19,457. Electric energy generated from the falls was first used for lighting Prospect park in 1879, and in 1881 power was sold for commercial use; but the great modern development dates from the World War, and the city's growth as a manufacturing centre has followed the development of the power resources. The falls have been the scene of many daring exploits, ever since Sam Patch in 1829 successfully leaped into the river twice, only to lose his life in a similar leap at the Genesee falls in Rochester. Several men and women have safely plunged over one or the other fall or through the whirlpool in barrels, and in 1859, and again in 1860 (on the occasion of the visit of Edward VII., then Prince of Wales) Blondin performed amazing feats on a tightrope stretched across the gorge.

NIAGARA RIVER flows in a northerly direction from Lake Erie to Lake Ontario, a distance of about 34 miles. It constitutes part of the boundary between the United States and Canada, separating the State of New York from the Province of Ontario. It is the principal drainage outlet of the four upper Great Lakes, whose aggregate basin area is about 248,500 sq. miles. Its discharges at standard low water and standard high water of Lake Erie (570 and 575·11 ft. above mean tide at New York) are about 153,000 and 267,000 second-feet, respectively. The river is navigable from its source to the upper rapids, 20 m., and from Lewiston to the mouth, 7 miles. The current is rapid for the upper navigable portion, where the average fall is about 0·5 ft. per mile. The total fall of the lower 7 m. is 0·5 foot. The intermediate section of the river, consisting of 7 m., includes a series of rapids and Niagara Falls, and has a total fall of 315 feet. The average width is about 3,500 feet.

Niagara Falls.—The falls of Niagara are justly celebrated for their grandeur and beauty, and are viewed every year by over 2,000,000 visitors. They are in two principal parts, separated by an island. The greater division, adjoining the left bank, is called the Horseshoe Fall; its height is 155 ft., and the length of its curving crest line is about 2,600 feet. The American Fall, adjoining the right bank, is 165 ft. high and about 1,400 ft. broad. The water is free from sediment, and its clearness contributes to the beauty of the cataract. In recognition of the importance of the waterfall as a great natural spectacle, the Province of Ontario and the State of New York have retained or acquired title to the adjacent lands and converted them into parks, which are main-



FROM HOPPE, "ROMANTIC AMERICA"

NIAGARA FALLS ON THE AMERICAN SIDE

The brink of the American Fall at Niagara, showing a point of Goat Island. The precipice on the American side is 167 feet in height

NIAGARA FALLS



PHOTOGRAPH, EWING GALLOWAY

AN AERIAL VIEW OF NIAGARA FALLS FROM ONTARIO, CANADA

The Horseshoe (Canadian) Fall at the right, 158 feet high, is about ten feet lower than the American Fall but over twice as long. The two falls are separated by Goat Island

tained at public expense for the convenience of visitors.

The scenic grandeur of Niagara Falls depends upon the volume of water flowing over the falls, but also on its distribution as it approaches the crest. The statement that the Horseshoe Fall is in danger of destroying itself as a spectacle by cutting a narrow "notch," destroying the symmetry of the horseshoe, possibly degenerating into a cascade and eventually draining the American Falls, has unfortunately been widely circulated. The mean annual rate of recession of the crest at the central part of the Horseshoe has been determined as being about 5 ft. since 1764, 3·7 ft. since 1842 and 2·3 ft. per year since 1906. The Horseshoe is now cutting back at a decreasing rate and the rate will continue to decrease. The recession of the American Falls is negligible. By proper action, supervision and control by the two Governments concerned, the scenic beauty of the Falls can be preserved, the tendency toward erosion in the Horseshoe can be checked, water can be distributed over the at present bared flanks of the Canadian Fall and a more dependable flow over the American Fall ensured.

Geologic Age.—The problem of the river's age is of much interest to geologists, because its solution would aid in establishing a relation between the periods and ages of geologic time and the centuries of human chronology. The great Canadian glacier, which in the glacial period alternately crowded forward over the Great Lakes region and melted back again, so modified the face of the land by erosion and by the deposit of drift that the waters afterwards had to find new courses. The Niagara river came into existence when the waning of the glacier laid bare the western part of the Ontario basin, and the making of the gorge was then begun. If it were supposable that the lengthening of the gorge proceeded at a uniform rate, the computation of the time would be easy, but there are various modifying conditions. A weighing of the evidence now available indicates 25,000 years as a lower limit for plausible estimates of the age of the river, but yields no suggestion of an upper limit.

Navigation.—Between Lake Erie and Lake Ontario, navigation passes through the Canadian Welland canal. The old canal has 25 lift locks, with a total lift of 326¾ feet. These locks are each 270 ft. long (usable length about 255 ft.) by 45 ft. wide, and were designed to have 14 ft. depth on the sills. The new Welland canal under construction by the Dominion of Canada in 1928, will admit the largest existing lake freighters. The southern portion of the new canal is chiefly an enlargement of the old canal. The northern portion follows a new location, entering Lake Ontario at Port Weller, about 3 m. east of the terminus of the old canal. The new canal will be 25 m. long, with a total lockage of 325½ feet. It will have 4 single locks, one flight of 3 double locks and 1 guard lock. The locks have a usable length of 820 ft., clear width 80 ft., and 30 ft. depth of water on the sill at lowest lake stages. All locks have a lift of about 46 feet. The gates are of the mitering type. The canal prism is 200 ft. wide at the bottom, 310 ft. wide at the water line, and from 25 to 26½ ft. deep at low water. All masonry structures are so designed as to allow an ultimate deepening to 30 ft. at low water. The estimated total cost of the canal is $115,600,000. The construction of this canal was commenced in 1913; it was largely suspended during the World War, but later resumed, and it is now estimated the canal will be opened to navigation about 1930.

Water Diversion for Hydro-electric Power.—By treaty stipulation the amount of water that may be diverted from the Niagara river for power purposes has been limited to 36,000 cu.ft. per second on the Canadian side and 20,000 cu.ft. per second on the United States side. Of the Canadian diversion all but about 10,000 cu.ft. per second is used by the Hydroelectric Power Commission of Ontario, in three plants, the largest of which, near Queenstown, has a gross head of over 300 ft. and develops about 450,000 h.p. from the nine turbo-generators installed. Of the American diversion practically all the water is utilized by one concern with an installation of 560,000 horsepower. Three of the units of the latter company are rated at 70,000 h.p. each and are the largest hydro-electric units in existence. At all the plants electricity is generated at 11,000 volts, 25 cycles. Much is used in nearby electro-chemical industries for the manufacture of aluminium, ferro-silicon, carborundum, artificial graphite, liquid chlorine, calcium carbide, cyanamide and other products. The remainder is transmitted to various cities for miscellaneous uses. The maximum distance to which this power is transmitted is somewhat in excess of 200 miles. (E. Ja.)

NIAM-NIAM: *see* Azande.

NIAS, largest of the chain of islands off the western coast of Sumatra, D.E. Indies. It is 80 m. long and nearly 30 wide, hilly, with coasts rocky or sandy, and landing is often dangerous: it is partly volcanic and earthquakes occur. There are three small rivers. Pop. 159,799. The islets Nako, Bunga, etc., near the north and west coasts are inhabited by a race which appears to be Indonesian in character and to have some affinity with the Bataks of Sumatra. Though intelligent, they have a reputation for treachery and thieving. They squander their means on feasting and ornaments, but are hospitable and have a high code of sexual morality, any infringement of which is severely punished. Marriage is exogamic and wives are bought. At death, wife and property pass to a man's brother. Land belongs to the settler and is inherited in the direct line. A council of notables assists hereditary chiefs in administration. Slave trade has been suppressed by the Dutch. Simple tattooing, teeth-filling and circumcision are practised. Weapons are carried and vendettas are common. Houses are built on piles, and sometimes are fortified with double walls. They have windows, a common room in the centre, and separate rooms for the various families which occupy one house, the entrance being through the floor, from underneath, in the house centre. Houses of chiefs are costly and have carved statues, or seats of wood, or stone, outside. The Niasese are pagans: human sacrifice on the death of a chief, also head-hunting, have been prohibited by the Dutch. Statues of the household gods are hung up in the houses, the phallic symbol is known, and in South Nias menhirs and large dissoliths exist. The funeral rites of an important person are celebrated by the sacrifice of pigs. There are good craftsmen in gold, silver, and wood, the coco-nut is cultivated and the oil traded with Malay and Achinese settlers, or taken to the Sumatran coast. Pigs are kept and form an important article of trade. Coal, of poor quality, iron, and copper have been found; gold is said to exist. Nias is administrated by the residency of Tapanuli, in Sumatra, with an assistant resident at Gunung Situli, the chief town. It has no telegraphic or steamer communication with the mainland.

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NIBELUNGENLIED, or Der Nibelunge Nôt, a mediaeval German heroic epic. The story on which it is based belongs to the general stock of Teutonic saga, and was very widespread under various forms, some of which are preserved. Thus it is touched upon in *Beowulf,* and fragments of it form the most important part of the northern *Eddas,* the poets of which evidently assumed that the tale as a whole was well known and that their hearers would be able to put each piece in its proper place. In the prose *Edda,* or *Volsungasaga,* which though largely primitive in spirit dates from the 13th century, it is set forth in full. The substance of this Norse version is as follows:—

"The three Anses—Odin, Loki and Hörnir—saw an otter devouring a salmon beside a waterfall. They killed and skinned the otter and, taking the skin with them, sought shelter for the night with Rodmar the giant. But Rodmar recognized the skin as that of his son, and demanded as *weregild* gold enough to cover it completely. Loki thereupon went back to the stream, where Andvari in the form of a pike was guarding a great treasure, caught him in a net, and forced him to surrender his hoard. But the piled-up gold left one hair exposed; in order to cover it Loki returned to Andvari and forced him to surrender a magic ring, which had the virtue of breeding gold. Thereupon Andvari, enraged, laid upon the hoard and all who should possess it a curse. This curse, the *Leitmotif* of the whole story, began to operate at once. Rodmar, for the sake of the treasure, was slain by his sons Fafnir and Regin; and Fafnir, seizing the whole, retired to a desolate heath and in the form of a snake or dragon brooded over the hoard. Regin, cheated of his share, plotted vengeance

and conquest of the treasure.

"To Regin, a notable smith, was sent Sigurd—son of the slain hero Sigmundr the Volsung and his wife Hiortis, now wife of the Danish king Alf—to be trained in his craft. To him Regin told of Fafnir and the hoard, and the young hero offered to go out against the dragon if Regin would weld him a sword. But every brand forged by the smith broke under Sigurd's stroke; till at last he fetched the fragments of the sword Gram, Odin's gift to his father, which Hiortis had carefully treasured. These Sigurd forged into a new sword, so hard that with it he could cleave the anvil, and so sharp that it would sever a flock of wool floating against it down stream; and, so armed, he sought and slew the dragon. But while roasting Fafnir's heart, which Regin had cut out, Sigurd burned his finger with the boiling fat and, placing it to his lips, found that he could understand the language of birds, and so learned from the chattering of the woodpeckers that Regin was planning treachery. Thereupon he slew the smith, and loading the treasure on the magic steed Grani, given to him by Odin, set out on his travels.

"On a fire-girt hill Sigurd found the Valkyrie Brunhild in an enchanted sleep, and ravished by her beauty awakened her; they plighted their troth to each other and, next morning, Sigurd left her to set out once more on his journey. Coming to the court of Giuki, a king in the Rhine country, Sigurd formed a friendship with his three sons, Gunnar, Hogni and Guthorm; and, in order to retain so valuable an ally, it was determined to arrange a match between him and their sister Gudrun. Queen Grimhild, skilled in magic, therefore gave him an enchanted drink, which caused him to forget Brunhild. Gunnar, on the other hand, wished to make Brunhild his wife, and asked Sigurd to ride with him on this quest, which he consented to do on condition of receiving Gudrun to wife. They set out; but Gunnar was unable to pass the circle of fire round Brunhild's abode, the achievement that was the condition of winning her hand. So Sigurd, assuming Gunnar's shape, rode through the flames on his magic horse, and in sign of troth exchanged rings with the Valkyrie, giving her the ring of Andvari. So Gunnar and Brunhild were wedded, and Sigurd, resuming his own form, rode back with them to Giuki's court, where the double marriage was celebrated. But Brunhild was moody and suspicious, remembering her troth with Sigurd and believing that he alone could have accomplished the quest.

"One day the two queens, while bathing in the river, fell to quarrelling as to which of their husbands was the greater. Brunhild taunted Gudrun with the fact that Sigurd was Gunnar's vassal, whereupon Gudrun retorted by telling her that it was not Gunnar but Sigurd who rode through the flames, and in proof of this held up Brunhild's ring which Sigurd had given to her. Brunhild, maddened by jealousy and wounded pride, now incited the three kings to murder Sigurd by exciting their jealousy of his power. The two elder, as bound to him by blood-brotherhood, refused; but the youngest, Guthorm, who had sworn no oaths, consented to do the deed. Twice he crept into Sigurd's chamber, but fled when he found the hero awake and gazing at him with flashing eyes. The third time, finding him asleep, he stabbed him; but Sigurd, before he died, had just strength enough to hurl his sword at the murderer, whom it cut in two. Brunhild, when she heard Gudrun wailing, laughed aloud. But her love for Sigurd was great as ever, and she determined not to survive him; distributing her wealth to her hand-maidens she mounted Sigurd's funeral pyre, slew herself with his sword, and was burnt with him.

"In course of time Gudrun married Atli (Attila), king of the Huns, Brunhild's brother. Atli, intent on getting hold of the hoard which Gudrun's brothers had seized, invited them to come to his court. In spite of their sister's warnings they came, after sinking the treasure in the Rhine. On their refusal to surrender the hoard or to say where it was concealed, a fierce fight broke out in which all the followers of Gunnar and Hogni fell. Atli then once more offered to spare Gunnar's life if he would reveal his secret; but Gunnar refused to do so until he should see the heart of Hogni. So Hogni's heart was cut out, the victim laughing the while; but when Gunnar saw it he cried out that now he alone knew where the hoard was and that he would never reveal the secret. His hands were then bound, and he was cast into a den of venomous serpents; but he played so sweetly on the harp with his toes that he charmed the reptiles, except one adder, by which he was stung to death. Gudrun, however, avenged the death of her brothers by slaying the sons she had borne to Atli and causing him unwittingly to drink their blood and eat their hearts. Finally, in the night, she killed Atli himself and burned his hall; then, leaping into the sea, she was carried by the waves to new scenes, where she had adventures not connected with those recorded in the *Nibelungenlied.*"

This story, in spite of the late date of the *Volsungasaga,* represents a very primitive version. The setting of the *Nibelungen* story, on the other hand, is mediaeval rather than primitive, though its extant versions are of much earlier date, and it contains primitive elements not found in the other. Everywhere the supernatural elements are eliminated or subordinated. The gods have vanished from the scene; there is nothing of Loki and his theft of Andvar's hoard, nothing of Odin and his gifts of the sword Gram, and the magic horse Grani; and not till the third *Aventiure,* when Siegfried comes to Worms, are we given even a hint that such things as the sword and treasure exist.

In the legend of Sigurd the Volsung, the plot had turned upon the love and vengeance of Brunhild, so in the song of the Nibelungs it is the love and vengeance of Kriemhild, the Gudrun of the northern saga, that forms the backbone of the story and gives it from first to last an artistic unity which the *Volsungasaga* lacks. The tragedy of the close of the story is emphasized by the pomp and circumstance that surround the ill-fated hero. The primitive setting of the northern version has vanished utterly. Sigmund is king of the Netherlands; the boy Siegfried is brought up by "wise men that are his tutors" (*Avent.* ii.); and when, attracted by the fame of Kriemhild's beauty, he rides to Worms to woo her, it is as the typical handsome, accomplished and chivalrous king's son of mediaeval romance.

It is at this point (*Avent.* iv.) that some primitive elements are suddenly and awkwardly introduced. As Siegfried approaches Worms, Kriemhild's brothers, the Burgundian kings Gunther, Giselhêr and Gêrnot watch his coming, and to them their faithful retainer, "the grim Hagen," explains who he is. This can be no other than the hero who slew the two kings of the Nibelungs, Schilbunc and Nibelunc, and seized their treasure, together with the sword Balmunc and the *tarnkappe,* or cape of darkness, which has the virtue of making him who wears it invisible. Another adventure, too, he can tell of him, namely, how he slew a dragon and how by bathing in its blood his skin became horny, so that no weapon could wound him save in one place, where a linden leaf had fallen upon him as he stooped, so that the blood did not touch this spot. In spite of Hagen's distrust and misgivings, Siegfried now fights as the ally of the Burgundians against the Saxons (*Avent.* iv.), and undertakes, on condition of receiving Kriemhild to wife, to help Gunther to woo Queen Brunhild, who can only be won by the man who can overcome her in three trials of strength (*Avent.* vi.). Siegfried and Gunther accordingly go together to Brunhild's castle of Isenstein in Iceland, and there the hero, invisible in his *tarnkappe,* stands beside Gunther, hurling the spear and putting the weight for him, and even leaping, with Gunther in his arms, far beyond the utmost limit that Brunhild can reach (*Avent.* vii.). Brunhild confesses herself beaten and returns with the others to Worms, where the double marriage is celebrated with great pomp (*Avent.* x.). But Brunhild is ill content; though she saw Siegfried do homage to Gunther at Isenstein she is not convinced, and believes that Siegfried should have been her husband; and on the bridal night she vents her ill humour on the hapless Gunther by tying him up in a knot and hanging him on the wall. "I have brought the evil devil to my house!" he complains to Siegfried next morning; and once more the hero has to intervene; invisible in his *tarnkappe* he wrestles with Brunhild and, after a desperate struggle, takes from her her girdle and ring before yielding place to Gunther. The girdle and ring he gives to his wife Kriemhild (*Avent.* x.).

One day, while Siegfried and his wife were on a visit to the Burgundian court, the two queens fell to quarrelling on the ques-

tion of precedence, not in a river but on the steps of the cathedral (*Avent.* xiv.). Kriemhild was taunted with being the wife of Gunther's vassal; whereupon, in wrath, she showed Brunhild the ring and the golden girdle taken by Siegfried, proof that Siegfried, not Gunther, had won Brunhild. So far the story is essentially the same as that in the *Volsungasaga;* but now the plot changes. Brunhild drops out, becoming a figure altogether subordinate and shadowy. The death of Siegfried is compassed, not by her, but by the "grim" Hagen, Gunther's faithful henchman, who thinks the glory of his master unduly overshadowed by that of his vassal. Hagen easily pursuades the weak Gunther that the supposed insult to his honour can only be wiped out in Siegfried's blood; he worms the secret of the hero's vulnerable spot out of Kriemhild on pretence of shielding him from harm (*Avent.* xv.) and then arranges a great hunt in the forest, so that he may slay him when off his guard. The 16th *Aventiure* describing this hunt and the murder of Siegfried is perhaps the most powerful scene in all mediaeval epic. When the hunters sat down to feast, it was found that the wine had been forgotten. Hagen thereupon proposed that they should race to a spring some way off in the forest. Siegfried readily agreed, and though handicapped by carrying shield, sword and spear, easily reached the goal first, but waited, with his customary courtesy, until the king had arrived and drunk before slaking his own thirst. Then, laying aside his arms, he stooped and drank. Hagen, seizing the spear, thrust it through the spot marked by Kriemhild on Siegfried's surcoat. The hero sprang up and, finding that his sword had been removed, attacked Hagen with his shield.

Then reproaching them for their cowardice and treachery, Siegfried fell dying "amid the flowers" while the knights gathered round lamenting. The whole spirit of this scene is primitive Teutonic rather than mediaeval. The same is true, indeed, of the whole of the rest of the poem. Siegfried, to be sure, is buried with Catholic rites; but Kriemhild, while praying for his soul like a good Christian, plots horrible vengeance like her pagan prototype. Mistress now of the Nibelungen hoard, she sought to win a following by lavish largesses; but this Hagen frustrated by seizing the treasure, with the consent of the kings, and sinking it in the Rhine, all taking an oath never to reveal its hiding-place (*Avent.* xix.). At last, however, after 13 years, Kriemhild's chance came, with a proposal of marriage from Etzel (Attila) king of the Huns, which she accepted on condition that he would help her to vengeance (*Avent.* xx.). Then more years passed; old feuds seemed to be forgotten; and the Burgundian kings, in spite of Hagen's warnings, accepted their sister's invitation to visit her court (*Avent.* xxiii.–xxiv.).

The journey of the Burgundians into Hunland is described by the poet at great length (*Avent.* xxv.–xxvii.). From this point onward the story is dominated by the figure of the grim Hagen, who, twitted with cowardice and his advice spurned, is determined that there shall be no turning back and that they shall go through with it to the bitter end. With his own hands he ferries the host over the Danube and then destroys the boat, so that there may be no return. At Attila's court (*Avent.* xxviii.) it is again Hagen who provokes the catastrophe by taunting Kriemhild when she asks him if he has brought with him the hoard of the Nibelungs:

> "The devil's what I bring you!" Hagen then replied,
> "What with this heavy harness and my shield beside,
> I had enough to carry; this helmet bright I brought;
> My sword is in my right hand, and that, be sure, I bring you not!"

The sword was Siegfried's. It is Hagen, too, who after the first onslaught of the Huns, strikes off the head of Ortlieb, the son of Etzel and Kriemhild, and who, amid the smoke and carnage of the burning hall, bids the Burgundians drink blood if they are thirsty.

But for all their prowess, after a prolonged struggle (*Avent.* xxix.–xxxvii.) the Burgundians were at last overwhelmed. Most of the chief figures of heroic saga had come up against them; Attila, Hildebrand, the Ostrogoth Theodoric (Dietrich von Bern). To the last named even Hagen armed with Siegfried's sword had to yield (*Avent.* xxxviii.). Kriemhild came to him as he lay in bonds and demanded the Nibelung treasure. He refused to reveal its hiding place so long as Gunther, also a prisoner, should live. Gunther was accordingly slain by the queen's orders and his head was brought to Hagen, who cried out when he saw it that all had been accomplished as he had foretold:

> "Now none knows where the hoard is save God and I alone:
> That to thee, devil-woman, shall nevermore be known!"

Whereupon Kriemhild slew him with Siegfried's sword. But Kriemhild was not destined, like Gudrun, to set out on further adventures. Hildebrand, horrified at her deed, sprang forward and cut her to pieces with his sword.

> In sorrow now was ended the king's high holiday,
> As ever joy in sorrow ends and must end alway.

To some mss. of the *Nibelungenlied* is added a supplementary poem called the *Klage* or *Lament,* a sequel of 2,160 short-line couplets, describing the lament of the survivors—notably Etzel—over the slain, the burying of the dead, and the carrying of the news to the countries of the Burgundians and others. At the end it is stated that the story was written down, at the command of Bishop Pilgrim of Passau, by a writer named Konrad (Kuonrât) in Latin and that it had since been sung (*getichtet*) often in the German tongue.

Sources of the Story.—The origin and nature of the various elements that go to make up the story of the *Nibelungenlied* have been, and continue to be, the subject of debate. The view at one time most generally accepted was that first propounded by Karl Lachmann in his "Kritik der Sage von den Nibelungen" (*Rheinisches Museum für Philologie,* num. 249, 250, 1829, republished in his *Zu den Nibelungen . . . Anmerkungen* in 1836), namely that the story was originally a myth of the northern gods modified into a heroic saga after the introduction of Christianity, and intermingled with historical elements. This view was also maintained by Richard von Muth in his *Einleitung in das Nibelungenlied* (Paderborn, 1877). On the other hand, so early as 1783 Johannes von Müller of Göttingen had called attention to the historical figures appearing in the Nibelungenlied, identifying Etzel as Attila, Dietrich of Bern as Theodoric of Verona, and the Burgundian kings Gunther, Giselhêr and Gêrnot as the Gundaharius, Gislaharius and Godomar of the *Lex Burgundiorum;* in 1820, Julius Liechtlen (*Neuaufgefundenes Bruchstück des Nibelungenliedes,* Freiburg-im-Breisgau) roundly declared that "the *Nibelungenlied* rests entirely on a historical foundation, and that any other attempt to explain it must fail." This view was, however, overborne by the great authority of Lachmann, whose theory, in complete harmony with the principles popularized by the brothers Grimm, was accepted by a long series of critics. In later years criticism tended to revert to the standpoint of Müller and Leichtlen and to recognize in the story of the Nibelungen a misty and confused tradition of real events and people. Mythical elements it certainly contains; and to those figures which—like Siegfried, Brunhild, or Hagen—cannot be traced to historical originals, a mythical origin is still provisionally ascribed, though Theodor Abeling (*Das Nibelungenlied,* 1907) made out a plausible case for identifying Siegfried with Segerio, son of the Burgundian king Sigimund and Brunhild with the historical Brunichildis.

The basis of the story is then, according to this view, historical, not mythical; a medley of Franco-Burgundian historical traditions, overlaid with mythical fancies. The historical nucleus is the overthrow of the Burgundian kingdom of Gundahar by the Huns in 436; and round this there gathered an accretion of other episodes, equally historical in their origin, however distorted, with a naïve disregard of chronological possibility. In the *Eddas* the identity of the original Franco-Burgundian sagas is fairly preserved. In the *Nibelungenlied,* on the other hand, the influence of other wholly unconnected stories is felt: thus Hildebrand appears during the final fight at Etzel's court, and Theodoric the Great (Dietrich von Bern; *see* THEODORIC).

Origin of the Poem.—The controversy as to the underlying elements of the Nibelung legend extends to the question of the authorship and construction of the poem itself. Was it from the first—whatever additions and interpolations may have followed—conceived as a single, coherent story, or is it based on a number

of separate stories, popular ballads akin to the *Eddas*, which the original author of the *Nibelungenlied* merely collected and strung together? The answer to these questions has been sought by a succession of scholars in a critical comparison of the mediaeval mss. of the poem still surviving. Of these 33 are now known, of which ten are complete, the rest being more or less fragmentary. The most important are those first discovered, viz., the mss. lettered Ċ (Hohenems 1755), B (Schloss Werdenberg, 1769), A (Hohenems 1779); and round these the others more or less group themselves. They exhibit many differences: put briefly C is the most perfectly finished in language and rhythm; A is rough, in places barbarous; B stands half-way between the two. Which is nearest to the original? Karl Lachmann (*Zu den Nibelungen und zur Klage, Anmerkungen*, 1836) decided in favour of A. He applied to the *Nibelungenlied* the method which Friedrich August Wolf had used to resolve the *Iliad* and *Odyssey* into their elements. The poem, according to Lachmann, was based on some 20 popular ballads, originally handed down orally, but written down about 1190 or 1200. This original is lost, and A—as its roughness of form shows—is nearest to it; all other mss. including B and C are expansions of A. Lachmann's view was first seriously assailed by Adolf Holtzmann (*Untersuchungen über das Nib.*, Stuttgart, 1854), who argued that the original could not have been strophic in form—the fourth lines of the strophes are certainly often of the nature of "padding"—that it was written by Konrad (Kuonrât of the *Klage*) writer to Bishop Pilgrim of Passau about 970–984, and that of existing mss. C is nearest to this original, B the copy of a ms. closely akin to C, and A an abbreviated corrupt copy of B. This view was adopted by Friedrich Zarncke, who made C the basis of his edition of the *Nibelungenlied* (Leipzig, 1856). A new hypothesis was developed by Karl Bartsch in his *Untersuchungen über das Nibelunglied* (Leipzig, 1865). According to this the original was an assonance poem of the 12th century, which was changed between 1190 and 1200 by two separate poets into two versions, in which pure rhymes were substituted for the earlier assonances; the originals of the *Nibelungenlied* and *Der Nibelunge Nôt* respectively. Bartsch's subsequent edition of the *Nibelunge Nôt* (1st ed., Leipzig, 1870) was founded on B, as the nearest to the original. To this view Zarncke was so far converted that in the 1887 edition of his *Nibelungenlied* he admitted that C shows signs of recension and that the B group is purer in certain details.

It is impossible here to follow the further developments of the question. Theodor Abeling's *Das Nibelungenlied und seine Literatur* gives a very full bibliography from 1756 to 1905. Other important contributions since are: Andreas Heusler, in the *Sitzungsberichte der Königl. Preuss. Akad. der Wissenschaften*, xlvii. (1914), in which he investigates anew the genesis of the saga; Hermann Fischer, *Über die Entstehung des Nibelungenliedes, in Sitzungsber der Königl. Bayer. Akad. der Wiss., Philos. und hist. Klasse*, 1914, who traces the various influences at work on the poem and concludes that it was written under that of Bishop Wolfger of Passau. With this Friedrich Wilhelm (in *Müncher Archiv*, part 7, 1916) is in agreement. There have also been during latter years advocates of a Latin original of the poem; *e.g.*, R. Pestalozzi, *Die Nibelungias* (*Neue Jahrbücher*, 39, 1916–17), but this idea is generally discredited.

There are English translations of the poem by A. G. Foster-Barham (1887) and Margaret Armour (prose, 1897); and Alice Horton (1898). (W. A. P.)

NICAEA or NICE (mod. *Isnik, i.e., εἰς Νικαίαν*), an ancient town of Asia Minor, in Bithynia, on the Lake Ascania. Antigonus built the city (316 B.C.?) on an old deserted site, and soon afterwards Lysimachus changed its name from Antigonia to Nicaea, calling it after his wife. Under the Roman empire Nicaea and Nicomedia disputed the title of metropolis of Bithynia. Strabo describes the ancient Nicaea as built regularly, in the form of a square, with a gate in the middle of each side. From a monument in the centre of the city all the four gates were visible at the extremities of great cross-streets. After Constantinople became the capital of the empire Nicaea grew in importance, and after the conquest of Constantinople by the Crusaders became the temporary seat of the Byzantine emperor; the double line of walls with the Roman gates is still well preserved. The possession of the city was long disputed between the Greeks and the Turks. It remained an important city for some time after its final incorporation in the Ottoman empire; but became subsequently an insignificant village.

NICAEA, COUNCIL OF. The Council of Nicaea (A.D. 325) is an event of the highest importance in the history of Christianity. Its convocation by Constantine and its course illustrate the radical revolution which the position of this religion, within the confines of the Roman empire, had undergone in consequence of the Edict of Milan. From his accession Constantine had shown himself the friend of the Christians; and, when his victory over Licinius (A.D. 323) gave him undisputed possession of the crown, he adhered to this religious policy, distinguishing and fortifying the Christian cause by gratuities and grants of privilege. This propitiatory attitude originated in the fact that he recognized Christianity—which had successfully braved so many persecutions—as the most vital and vigorous of religions, and as the power of the future. Consequently he directed his energies toward the establishment of a positive relationship between it and the Roman state. But the Church could only maintain its great value for the politician by remaining the same compact organism which it had proved itself to be under the stormy reign of Diocletian. Scarcely, however, did it find itself in the enjoyment of peaceful relations with the state, when violent feuds broke out in its midst, whose extent, and the virulence with which they were waged, threatened to dismember the whole religious body. Donatism in the West was followed by the Arian struggle in the East. The former movement had been successfully arrested, though it survived in North Africa till the 5th century. The conflict kindled by the Alexandrian presbyter Arius with regard to the relation of Christ to God assumed a more formidable character (*see* ARIUS). Constantine therefore had recourse to an institution previously evolved by the Christian Church—the convocation of a synod to pronounce on burning questions—enlarging it, however, to correspond with the altered circumstances. He convened a council, designed to represent the whole Church of the empire, at Nicaea in Bithynia, a town situated no great way from the imperial summer-residence of Nicomedia and within easy reach by sea of the Oriental bishops. In consequence of the vast distances, the West was not largely represented, but the able theologian Hosius, bishop of Cordova, was present. The three most important bishoprics of the East were represented (Alexandria, Antioch, and Jerusalem); a prominent part was also taken by Eusebius, bishop of Nicomedia, and his namesake of Caesarea (the historian), along with a very large number of others from the east. Among the attendant clergy, the still youthful deacon Athanasius, destined to succeed Alexander in the see of Alexandria, was prominent as the most powerful antagonist of Arianism (*see* ATHANASIUS). The synod sat from May 20 to July 25.

The deliberations on the Arian question passed through several distinct stages before the final condemnation of Arius and his doctrines was reached. A clearly defined standpoint with regard to this problem—the relationship of Christ to God—was held only by the comparatively small group of Arians and a not much larger group who adhered with unshaken conviction to the Alexandrian view. The bulk of the members occupied a position between these two extremes. They rejected the formulae of Arius, and declined to accept those of his opponents; that is to say, they were merely competent to establish negations, but lacked the capacity, as yet, to give their attitude of compromise a positive expression. That the majority of the council should have adopted this neutral tendency is easily intelligible when we consider the state of theology at that period. True, at Nicaea this majority eventually acquiesced in the ruling of the Alexandrians; yet this result was due, not to internal conviction, but partly to indifference, partly to the pressure of the imperial will—a fact which is mainly demonstrated by the subsequent history of the Arian conflicts. For if the Nicaean synod had arrived at its final decision by the conscientious agreement of all non-Arians, then the confession of faith there formulated might indeed have evoked the continued antagonism of the Arians, but must necessarily have

been championed by all else. This, however, was not the case; in fact, the creed was assailed by those very bodies which had composed the *laissez-faire* centre at Nicaea; and we are compelled to the conclusion that, in this point, the voting was no criterion of the inward convictions of the council.

In the synod, an Arian confession of faith was first brought forward and read; but it aroused such a storm of indignation that obviously, in the interests of a restoration of ecclesiastical peace, there could be no question of its acceptance. On this, Eusebius of Caesarea submitted the baptismal creed of his community. Since the creed dated from a period anterior to the outbreak of the Arian struggle, its reception would have been equivalent to a declaration on the part of the council that it declined to define its position with reference to the controversy of the hour. That the greater number of delegates were not disinclined to adopt this subterfuge, and to shelve the actual solution of the whole problems by recognition of this or some similar neutral formula, is extremely probable. But the emperor saw that, if the difficulties were eluded in any such way, it was inevitable from the very nature of the case, that they should rise again in an accentuated form, and that consequently no pacification could be expected from this policy.

Accordingly Constantine proposed that the Caesarean creed should be modified by the insertion of the Alexandrian passwords (including the decisive term ὁμοούσιος, "identical in nature"), as if for the purpose of more accurate definition, and by the deletion of certain portions. That he appreciated the import of these alterations, or realized that this revision was virtually the proclamation of a new doctrine, is scarcely probable. The creed thus evolved by an artificial unity was no ratification of peace: in fact, it paved the way for a struggle which convulsed the whole empire. For it was the proclamation of the Nicene Creed that first opened the eyes of many bishops to the significance of the problem there treated; and its explanation led the Church to force herself, by an arduous path of theological work, into compliance with those principles, enunciated at Nicaea, to which, in the year 325, she had pledged herself without genuine assent.

BIBLIOGRAPHY.—*See* the Histories of Dogma by Harnack, Loofs and Seeberg; articles in Hastings, *Encyclopaedia of Religion and Ethics* and Herzog-Hauck, *Realencyklopädie*, 3rd ed.; Bethune-Baker, *Introduction to the early History of Christian Doctrine;* Gore, *Dissertations on Subjects connected with the Incarnation;* and (from another point of view) Mellone, "Athanasius the Modernist" in *The Price of Progress* (1924). In addition to the Arian problem, the council dealt with the question of the "lapsed" in the recent persecution, the question of "heretical baptism" and other matters (*see* Hefele, *History of Councils*, vol. i.).

NICANDER (2nd cent. B.C.), Greek poet, physician and grammarian, was born at Claros, near Colophon, where his family held the hereditary priesthood of Apollo. He flourished under Attalus III. of Pergamum. He wrote a number of works both in prose and verse, of which two are preserved. The longest, *Theriaca*, is an hexameter poem (958 lines) on the nature of venomous animals and the wounds which they inflict. The other, *Alexipharmaca*, consists of 630 hexameters treating of poisons and their antidotes. In his facts Nicander followed the physician Apollodorus. Among his lost works may be mentioned: *Aetolica*, a prose history of Aetolia; *Heteroeumena*, a mythological epic, used by Ovid in the *Metamorphoses* and epitomized by Antoninus Liberalis; *Georgica* and *Melissourgica*, of which considerable fragments are preserved, said to have been imitated by Virgil (Quintilian x. 1. 56).

Editions by J. G. Schneider (1792, 1816); O. Schneider (1856) (with the Scholia); H. Klauser, "De Dicendi Genere . . . Nicandri" (*Dissertationes Philologicae Vindobonenses*, vi. 1898). The Scholia (from the Göttingen ms.) have been edited by G. Wentzel in *Abhandlungen der k. Gesellschaft der Wiss. zu Göttingen*, xxxviii. (1892). *See* also W. Vollgraff, *Nikander und Ovid* (Groningen, 1909 *seq.*).

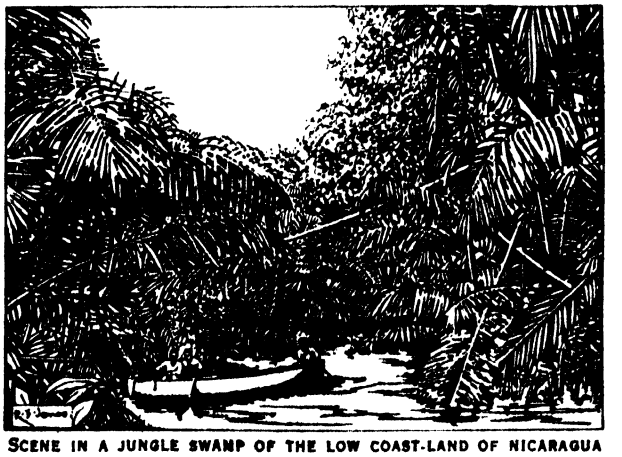
NICARAGUA, the largest country of Central America, lying between Honduras and Costa Rica, which form its north and south boundaries, respectively, and reaching from the Caribbean sea on the east to the Pacific ocean on the west. Its area, which is still undetermined owing to boundary disputes with Honduras and incomplete surveys, is generally put at from 49,200 to 51,660 sq.m., the former being the most generally accepted. Pop. (1920 census) 638,118, 13 to the square mile. The coast line is about 300 m. on the Caribbean and 200 m. on the Pacific. The Honduran boundary as generally accepted starts at Cape Gracias a Dios, follows the Segovia river inland and then at 86° W. takes an imaginary line to the upper waters of the Río Negro, which it follows to the Gulf of Fonseca. The Costa Rican boundary is now agreed upon, under treaties of 1858, confirmed in 1888 and settled in 1896, to be a line 2 m. S. of the San Juan river and Lake Nicaragua.

Physical Features.—Nicaragua is crossed by the two mountain chains that traverse the Western Hemisphere, and which provide some fine highland valleys. Its most striking natural features, however, are the two great lakes, Lake Nicaragua, about 100 m. long and 45 m. wide, and Lake Managua, to the north of it, and connected with it by the Tipitapa river. Lake Managua's length is 38 m. and its width varies from 10 to 16 miles.

The coasts of Nicaragua are strikingly different in configuration. The low, swampy and monotonous shore of the Caribbean, with its numerous lagoons and estuaries, and its fringe of reefs and islets, contains only three harbours: Gracias a Dios, Bluefields and Greytown (San Juan del Norte). The Pacific coast is bold, rocky and unbroken by any great indentation; here, however, are the best harbours of the republic—the southern arm of the Bay of Fonseca (*q.v.*), Corinto, Brito and San Juan del Sur.

The surface of the country is naturally divided into five clearly distinct zones: (1) the series of volcanic peaks which extend parallel to the Pacific at a little distance inland; (2) the plains and lakes of the great depression which lies to the east of these mountains and stretches from sea to sea, between the Bay of Fonseca and the mouths of the San Juan; (3) the main cordillera, which skirts the depression on the east, and trends north-west from Monkey Point or Punta Mico on the Caribbean sea, until it is merged in the ramifications of the Hondurian and Salvadorian highlands; (4) the plateaux which slope gradually away from the main cordillera towards the Caribbean; (5) the east or Mosquito coast (*q.v.*), with its low-lying hinterland. The chain of volcanic cones, which constitutes a watershed quite equal in importance to the cordillera itself, consists for the most part of isolated igneous peaks, sometimes connected by low intervening ridges.

The main Nicaraguan cordillera, which flanks the depression on the east, has often been called the Cordillera de los Andes, from



SCENE IN A JUNGLE SWAMP OF THE LOW COAST-LAND OF NICARAGUA

its supposed continuity with the mountain-chains of Panama and the west coast of South America. There is in fact no such continuity, for the San Juan valley completely separates the mountains of Panama from the main Nicaraguan system. The main cordillera bears different names in different parts of Nicaragua. Thus the important section which terminates at Monkey Point is commonly called the Cordillera de Yolaina. The summits of the main cordillera seem nowhere to exceed 7,000 ft. in altitude; the mean elevation is probably less than 2,000 ft.; the declivity is sheer towards the lakes, and gradual towards the Caribbean. On

the east, the cordillera abuts upon the region of plateaux and savannas, which occupies nearly half of the area of Nicaragua.

Climate.—The climate along the coasts, where most of the population lives, is hot and often sultry; in the highland sections there is the usual relatively cool and even climate of the tropical upland. There are two seasons, wet and dry, the former extending from May or June to November or December and dry in the remaining period, although on the east coast, the rainy season often extends well into the so-called dry period. Rainfall varies in different sections, as much as 297 in. a year having been recorded at Bluefields, on the Caribbean coast; the mean at Rivas, on the Pacific side, is 102 in. a year.

Inhabitants.—The census of 1882 placed the population of Nicaragua at 275,816; in 1890, it was 375,000; in 1900, 500,000; in 1905, 550,000; in 1920, as noted, the census reported 638,118. None of these tabulations is entirely accurate, as the difficulties of census-taking entail costs which the Nicaraguan Government has wisely deemed greater than the advantages. The population is increasing, however, and in approximately the rate shown by the various censuses recorded. The overwhelming proportion of the population is of mixed Indian and Spanish blood, the pure Indians being estimated at 30,000 and those of white descent, purely, at about the same number; foreigners and their descendants number about 2,000, according to local estimates.

Political Organization.—The present Constitution of Nicaragua was proclaimed in Dec. 1911, superseding those of 1905 and 1894. The legislative power is now vested in a congress composed of two chambers, senate and chamber of deputies (under the previous Constitution there was but one chamber). The country is divided into departments, to be fixed by law, representation in congress being from the departments, on the basis of one deputy for every 15,000 inhabitants, and one senator to each two deputies; deputies are elected for four and senators for six years, each having an alternate, elected at the same time, who succeeds him in case of disability. The executive power is vested in the president, elected by popular vote for a four-year term; he must be over 30 years of age and a native citizen of Nicaragua: a vice president is chosen at the same time, to succeed the president in case of death or disability. In case the vice president is eliminated, the senate elects a "designate," who assumes the office of president under the same circumstances as the vice president. The presidential cabinet consists of six ministers, appointed by the president, these being ministers of government and police, foreign relations, public instruction, treasury and public credit, war and marine, promotion (*fomento*), justice and public works. The judiciary is exercised by a supreme court of justice with five members, three courts of appeal and inferior courts. Congress elects justices of the supreme court for six years, and of the courts of appeals for four years.

Education and Religion.—Illiteracy in Nicaragua is estimated at 50%, but the Government, in co-operation with the Roman Catholic Church (which has been close to the conservative political group which ruled Nicaragua from 1912 to 1928), has made definite efforts to reduce this and make education more general. In 1927 there were 402 State elementary schools, with 788 teachers and 24,800 pupils; three State secondary schools, with 37 teachers and 260 pupils; five professional schools with 219 pupils; 3 normal schools with 35 teacners and 2,500 students. There are also 79 private schools with 5,557 pupils; this includes some but not all of the parochial schools. There are three universities—at Managua, León and Granada. The Roman Catholic Church is powerful in Nicaragua, with an archbishop at Managua and bishops at Granada, León and Matagalpa, but religious tolerance is provided under the Constitution.

Finances.—Nicaragua has been under foreign supervision in financial matters since 1912, and despite the costly and destructive revolution of 1926–27, its finances, internal and external, have continued excellent. The foreign debt, of 1909, originally £1,250,000, has been reduced to (March 31, 1928) £677,400, with all arrears of interest paid and the debt on a 5% basis, to which it was reduced by agreement with the British bondholders on the inauguration of the American-supervised collector-generalship of customs, in 1912. There is also outstanding 2,372,000 *córdobas* (the *córdoba* is equal in value to the American dollar and is designated C$) of the guaranteed customs bonds, issued in payment of war and revolutionary claims up to 1912. There were, at the end of 1928, some C$17,000,000 of claims for damages and other revolutionary debts, which have still to be settled, and there is likelihood of a new loan of approximately C$12,000,000, to refund the remainder of the 1909 issue, to pay damage claims (estimated as capable of settlement for C$2,000,000 in cash) and to furnish some funds for starting work on a railway or highway to join the east and west coasts of the country.

The financial history of Nicaragua is made up of the usual list of loans and defaults characteristic of Central American countries. In 1912 following difficulties with President José Santos Zelaya, the loan of 1909 went into default, and as a result of this and the concomitant political developments, the so-called Financial Plan of 1912 was put into effect. This plan provided for the installation of an American collector-general of customs, and a rearrangement of Nicaraguan finances generally under the supervision of American bankers. When the interest and sinking fund, with arrears, was satisfactorily arranged, the Council of Foreign Bondholders of London accepted a reduction in the rate of interest, from 6 to 5%. In 1917, another financial plan was adopted, bringing up to date the payments on the foreign debt, which had been suspended owing to financial difficulties incident to the war. In that year Nicaragua received from the United States $3,000,000 in payment for an option to the site and defences of any proposed Nicaraguan interoceanic canal; this money was applied to the settlement of old war claims and arrears of interest on the debt. Under the Financial Plan of 1917, a high commission, with one resident American member, was installed to handle the Guaranteed Customs Bonds issued to take care of the balance of war damage claims awarded by a mixed commission.

The National Bank of Nicaragua was founded under the Financial Plan of 1917, with the New York bankers in control, but the Nicaraguan Government holding 49% of the stock; the bank was operated by the Bank of Central and South America, New York, now dissolved. At the time (1925) that the interests of the Bank of Central and South America were transferred, so far as Latin American branches were concerned, to the Royal Bank of Canada, the Bank of Nicaragua was sold to the Nicaraguan Government; American management was retained, however, and the Government elected as directors, in New York, the men from the interested banks who had been in charge previously. This bank was given full power to issue currency in the form of bank notes, with the new unit of currency, the *córdoba*, equal to the American dollar.

Defence.—Nicaragua has been virtually without an army since 1912, when American marines were first landed, to remain 13 years, and furnished ample defence to the Government from enemies within and without. A small guard was maintained at the capital, largely for parade purposes. When the marines were withdrawn on Aug. 3, 1925, a National Guard had been designed, but was organized only with difficulty by former American army officers employed by the Nicaraguan Government. Following the return of the American marines in 1927, the guard was organized on a new basis, with active American army officers and non-commissioned officers detailed to the work. The Guardia Nacional numbered (1929) between 2,000 and 2,500 men and is used as both police and military; the American marine guard continues in the country.

Economics and Trade.—Nicaragua is prosperous when the coffee crop is good and the world prices high; other factors in its economic life are dependent almost alone on the political and financial situation. The coffee crop in 1927, owing to revolutionary disturbances and somewhat lowered world prices, was the lowest since 1923, a year of low prices throughout the world. Coffee, even in 1927, amounted to about 45% of the total exports. The figures of imports and exports for the five years 1923–27 are

as follows:—

Year	Imports	Exports
1923	C$7,268,432	C$11,028,309
1924	8,806,896	12,990,026
1925	10,376,291	12,359,585
1926	10,254,512	13,028,726
1927	10,208,242	9,025,677

Coffee exports in 1927 were 10,255,112 kilo., valued at C$4,081,605. In 1926 they were 17,671,644 kilo., valued at C$8,100,397. Lumber, the second item of export, was valued at C$1,725,749 in 1927, and at C$1,342,238 in 1926. Bananas were exported in 1927 to a total of 2,386,191 bunches, worth C$1,442,383, and in 1926 2,162,745 bunches, worth C$1,225,661.

In the import trade of Nicaragua, the United States is the chief source, sending C$6,777,574 in 1927; Great Britain second with C$1,169,632 and Germany third with C$687,812. The United States also receives the bulk of the exports. In 1927 France was second, Germany third and Great Britain fourth. Nicaragua exports a considerable number of cattle, including draught animals, to the other Central American countries. It is also a producer of gold and silver, the gold mines in the interior on the Caribbean side of the country having been the scene of the depredations of the *insurrecto* Sandino in 1927–28.

Communications.—Nicaragua has one excellent port, Corinto (*q.v.*), on the Pacific coast; and San Juan del Sur is also used for the southern part of the country. On the Caribbean coast, Bluefields (*q.v.*) and San Juan del Norte or Greytown (*q.v.*) are the chief ports, although San Juan is now virtually isolated by sand bars. Within the country communications are limited. The only railway is the Pacific railway, extending from Corinto to Granada, a distance of 118 m., but reaching en route Chinandega, León, Managua and Masaya, among the principal towns of the country. Highways are not greatly developed.

History.—The history of Nicaragua in connection with the other Central American countries and down to the dissolution of the Union is discussed in the article on CENTRAL AMERICA. The first white man to see Nicaragua was Gil González de Avila, who landed on the coast of Chirique in 1522. The leading Indian tribe of the country was then led by a great chief called Nicarao, from whom the country doubtless derived its name. Nicarao was baptized, and his tribe converted to the Roman Catholic faith, and moved with the Spaniards to the conquest of the other tribes. Hernán de Córdoba, who succeeded Gil González in command of the province for Spain, founded Granada in 1524, the city then being situated between the two great lakes. Nicaragua was incorporated, for administrative purposes, in the captain-generalcy of Guatemala. Nicaragua, with independent existence dating from the dissolution of the Central American Union in 1838, early developed into a battle between the two rival cities of León and Granada, the former the capital of the Liberals, the latter of the Conservatives. In 1856 the American filibusterer, William Walker (*q.v.*), arrived with his 66 followers, espousing the cause of León and waging a bitter war against the Granadinos which ended in his execution in 1860.

Nicaragua was in difficulties with various European powers from time to time during the ensuing period. In 1875, Germany blockaded Nicaraguan ports, and obtained an indemnity for alleged insults to a German consul. In 1895 the British blockaded Corinto to obtain redress for the arrest and expulsion of British Vice Consul Hatch at Bluefields. In 1909, two Americans, Cannon and Groce, were executed, after torture, and this led to an American naval demonstration and demands, and was one of the direct elements leading to American intervention. A period of comparative quiet existed in Nicaragua under a series of Conservative presidents until 1893, when José Santos Zelaya, a Liberal, seized the power as a result of a revolution and ruled Nicaragua until 1909. There were various attempts at revolution, but none succeeded until that of 1909, which broke out, as most insurrections in Nicaragua do, on the Caribbean seaboard. The United States broke off diplomatic relations with Zelaya as a result of the Cannon-Groce executions, describing the Zelaya régime as a "blot on the history" of Nicaragua. The U.S. cruiser "Des Moines" prevented fighting at Bluefields on Dec. 18, 1909, thus making defeat of the Conservative revolutionists impossible, and inaugurating what is now known as the "intervention" of the United States against Zelaya and the Liberals who backed him. On Dec. 23, the Conservatives defeated the Zelaya troops at Rama, capturing most of the army, and on the following day Zelaya took refuge aboard a Mexican gunboat at Corinto and left the country. Dr. José Madriz, a Liberal, took the reins of Government, but the United States refused recognition; he was succeeded by Juan M. Estrada, an artisan, who had some Conservative and some Liberal backing and was regarded as a neutral. The United States accorded his Government recognition, but it was short-lived. Adolfo Díaz was elected provisional president in 1910. He was elected a second time in 1913, retiring in 1916; he was again chosen provisional president by vote of the senate in 1927. Under President Díaz, in 1912, the American marines were invited into Nicaragua on the plea of their need to protect foreign lives and property during the so-called Mena revolution, and the legation guard which succeeded the 1912 expeditionary force remained until 1925, and unquestionably preserved peace and gave Nicaragua the period of rest and recuperation which was marked by its prosperity. *See* CENTRAL AMERICA.

President Díaz was succeeded by Emiliano Chamorro in 1916, and he in turn by his nephew, Diego M. Chamorro (1920–23), who died in office and was succeeded by Dr. Bartolo Martínez, vice president. The election of 1924, under laws framed by an American expert but without the American supervision that had been planned, resulted in the election of a coalition ticket, President Solorzano being an anti-Chamorro Conservative, and Dr. Juan B. Sacasa, vice president, being the leader of the Liberals. Gen. Emiliano Chamorro, who stood again for the presidency as a Conservative, was defeated, and on Oct. 24, 1925, he led a *coup d'état* which captured the Loma, the fortified hill overlooking Managua, and forced the resignation and departure first of Vice President Sacasa and next of President Solorzano. Gen. Chamorro was named "designate" for the presidency by the senate, which had been changed in political complexion through the support of the Chamorro charges of fraud in the previous election (although previously these claims had been disallowed). Dr. Sacasa was declared to have given up his rights by his departure from the country and Gen. Chamorro assumed the presidency. The United States refused recognition, as did other Central American and European Governments. Dr. Sacasa, meanwhile, had pressed Washington for his own recognition as the legitimate president, but this was refused on the ground that he was not in his country nor in possession of the power. He left Washington and went to Mexico, where he had been recognized and where President Calles furnished him with arms, ammunition and men. The appearance of the Mexican element in the situation greatly disturbed Washington, and while before the attitude had been one of neutrality, the United States immediately moved to outwit the Mexican smuggling of arms, to isolate the fighting (the Sacasa forces had formed their bases on both the Caribbean and Pacific coasts) and to bring the revolution to an end with the elimination of Dr. Sacasa.

The American policy of isolating the fighting and landing marines and bluejackets to protect foreign interests and important cities resulted in the weakening of the Liberal offensive, and also in the resignation and flight of Gen. Chamorro. The Nicaraguan senate, reorganized with alternates or with the original members in their seats, elected Adolfo Díaz "designate" and thus automatically president. An outcry arose throughout Latin America that this appointment had been forced by the United States. Col. Henry L. Stimson, ex-secretary of War of the United States, went to Nicaragua as a personal representative of President Coolidge to find a way of stopping the revolution and settling difficulties. He succeeded in a remarkably short time in obtaining the consent of the Liberal leaders and the Conservative Government to an armistice, followed by the surrender of rifles, at C$10 each, by the soldiers, and the agreement to an election at the end of 1928, supervised by American marines and officers.

The Liberals laid down their arms, with the exception of a single band of *insurrectos* led by Sandino, who were practically eliminated before the election. The new Guardia Nacional was organized, and American officers brought in to superintend the registration and election. The vote was taken on Sunday, Nov. 4, 1928, and resulted in an overwhelming victory for Gen. José M. Moncada, who was the leader of the Liberal army at the time of the signing of the Stimson armistice, as president, and Dr. Enoc Aguado, a Liberal jurist of Managua, as vice president.

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(W. THO.)

NICASTRO, a town and episcopal see of Calabria, Italy, in the province of Catanzaro, 17 m. W.N.W. of it by rail, and 5½ m. E. of S. Eufemia, a station on the line along the west coast from Naples to Reggio di Calabria. Pop. (1921) 19,339 (town), 21,629 (commune). It is on the isthmus between the gulfs of S. Eufemia and of Squillace, the narrowest part of Calabria, 970 ft. above sea-level, and commands a fine view. Frederick II.'s son Henry was imprisoned in the castle. The place suffered greatly from the earthquake of 1638, which also destroyed the Benedictine abbey of S. Eufemia, founded by Robert Guiscard.

NICCOLI, NICCOLO DE' (1363–1437), Italian humanist, was born and died at Florence. He was one of the chief figures in the company of learned men which gathered round Cosimo de' Medici. Niccoli's chief services to classical literature consisted in his work as a copyist and collator of ancient mss. Many of the most valuable mss. in the Laurentian library are by his hand, amongst them those of Lucretius and of 12 comedies of Plautus. Niccoli's private library was the largest and best in Florence; he also possessed a small but valuable collection of ancient works of art, coins and medals. He regarded himself as an infallible critic, and could not bear the slightest contradiction.

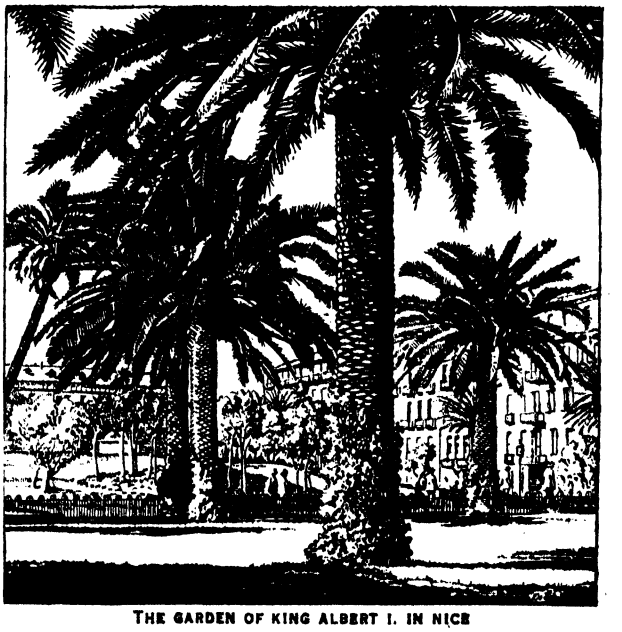
See the *Life* in *Traversarii Epistolae* (ed. L. Mehus, 1759); G. Voigt, *Die Wiederbelebung des klassischen Altertums* (1893); G. Zippel, *Nicolò Niccoli* (Florence, 1890).

NICCOLITE, a mineral consisting of nickel arsenide, NiAs, containing 43·9% nickel. Crystals are hexagonal, but are rare and indistinct. It usually occurs as compact masses of a pale copper-red colour, with metallic lustre on the uneven fractured surfaces. It is opaque and brittle, and the streak is brownish-black. The specific gravity is 7·5 and the hardness 5½. Niccolite occurs with ores of cobalt, silver and copper at Annaberg and Schneeberg in Saxony, at Sangerhausen and Mansfeld in Prussian Saxony and other localities.

NICE, a city of France, the chief town of the department of the Alpes Maritimes, and previous to 1860 the capital of the county of Nice (Nizza) in the kingdom of Sardinia, 739 m. by rail from Paris. Pop. (1926) 144,360. The population fluctuates with the seasons, owing to the influx of winter visitors.

The town is situated at the mouth of the Paillon (Paglione), at the northern end of the Baie des Anges. The historical nucleus of the town is an isolated limestone hill, running back for some distance from the shore and formerly crowned by a castle. Towards its south-west corner stands a tower (Tour Bellanda or Clérissy) dating, it is said, from the 5th century. The old town stretches along the western base of the hill; the "town of the 18th century" on ground farther west slopes gently towards the Paillon; and to the north-east and north and west beyond the stream lies the modern city. To the east of the hill the commercial quarter surrounds the port. The whole frontage of Nice is composed of fine embankments, notably the Promenade des Anglais begun 1822–24 at the cost of the English colony, and the course of the Paillon also is embanked on both sides. Besides a Roman Catholic cathedral—Ste. Réparate, dating from 1650—Nice possesses two Russian churches, two synagogues and an Anglican chapel. Architecturally the most remarkable church is Notre Dame du Voeu, a modern Gothic building. The lycée was founded by the Jesuits in the 17th century and at some distance from the town there is an astronomical and meteorological observatory on Mont Gros (1,220 ft.).

Industry and Trade.—The industrial establishments are perfumery factories, distilleries, oil-works, furniture and woodwork factories, confectionery works, soap-works, factories for silk goods, straw hats, rubber goods, pianolas, metal goods and a national tobacco factory. Besides the vine, the trees principally cultivated in the neighbourhood are the olive, the orange, the mulberry and the carob; and the staple exports are oil, agricultural produce, fruits and flowers. Nice now joins on the north-east the ancient episcopal town of Cimiez, where are the most luxurious hotels. Reckoning from east to west the town is surrounded by a girdle of beautiful towns—Carabacel, St. Etienne, St. Philippe and Les Beaumettes. On the east of the port lie Montboron, Riquier and St. Roch, the last partly occupied by barracks. The entrances to the port of Nice and the outer pier have been improved; that of the outer port is 300 ft. wide, and that of the inner 220 ft. The area of the harbour is about 8 acres; vessels drawing more than 23 ft. cannot enter; its trade is mostly coastal, principally in French and Italian vessels. Nice is an episcopal see (first mentioned at the end of the 4th century) under the archbishop of Aix. It belongs to the XV. military division (Marseilles). It is the seat of a prefect, of tribunals of first instance and of commerce, and of a board of trade arbitrators. The coastal railway is the main line of communication; an extension of the branch line up the Paillon valley to l'Ecarène joining the Ventimiglio-Coni (Cuneo) line at Breil was opened on Oct. 30, 1928.



THE GARDEN OF KING ALBERT I. IN NICE

Climate.—Protected towards the north by hills which rise stage behind stage to the main ridge of the Alps, Nice is celebrated for the mildness of its climate. The mean temperature is 60°, that of winter being 49°, of spring 56°, of summer 72° and of autumn 63°. For a few nights in winter there is frost, but snow is practically unknown. The highest reading of the thermometer is rarely above 90°. There are sixty-seven days with rain in the course of the year; but it usually falls in heavy showers which soon leave the sky clear again; the whole annual amount exceeds

32 in. Fine days and rainy days are almost equally distributed throughout the different seasons. The winds are very variable, sometimes changing several times a day, but the most frequent is the east wind. April and May are the most windy months. The south-west wind (called *Libeccio*, or wind of Lybia) is moist and warm; the north-east (or *Gregaou*, Greek), which is happily rare, brings storms of hail and even snow in winter. The mistral (from the north-west) and the tramontane (from the north) are generally stopped by the mountains. For two thousand years the climate of Nice has been considered favourable in chest complaints; it also benefits cases of gout, asthma, catarrhs, rachitic affections, scrofula, stone; but the reverse is the case when heart disease, nervous disorders or ophthalmia are concerned. Autumn is the best season; in spring the sudden changes of temperature demand great care. The city is famous for its carnival festivities, especially the "battle of flowers."

History.—Nice (*Nicaea*) was founded about two thousand years ago by the Phocaeans of Marseilles, and was named in honour of a victory (νίκη) over the neighbouring Ligurians. It soon became a busy trading station, but had a rival in the town of Cemenelum, in existence till the time of the Lombard invasions, which has left its ruins at Cimiez. In the 7th century Nice joined the Genoese league formed by the towns of Liguria. In 729 it repulsed the Saracens; but in 859 and 880 they pillaged and burned it, and for the most of the 10th century remained masters of the surrounding country. As an ally of Pisa Nice was the enemy of Genoa, and both the king of France and the emperor endeavoured to subjugate it; but it maintained its liberties. In the course of the 13th and 14th centuries it fell more than once into the hands of the counts of Provence; and at length in 1388 it placed itself under the protection of the counts of Savoy. The maritime strength of Nice now rapidly increased till it was able to cope with the Barbary pirates; the fortifications were largely extended and the roads to the city improved. During the struggle between Francis I. and Charles V. great damage was caused by the passage of the armies invading Provence; pestilence and famine raged in the city for several years. In 1543 Nice was attacked by the united forces of Francis I. and Barbarossa; and the inhabitants were ultimately compelled to surrender, and Barbarossa was allowed to pillage the city and to carry off 2,500 captives. Pestilence appeared again in 1550 and 1580. In 1600 Nice was taken by the duke of Guise.

By opening the ports of the countship to all nations, and proclaiming full freedom of trade, Charles Emmanuel in 1626 gave a great stimulus to the city. Captured by Catinat in 1691, Nice was restored to Savoy in 1696, but it was again besieged by the French in 1705, and in the following year its citadel and ramparts were demolished. The treaty of Utrecht in 1713 once more gave the city back to Savoy; and in the peaceful years which followed the "new town" was built. From 1744 till the peace of Aix-la-Chapelle (1748) the French and Spaniards were again in possession. In 1775 the king of Sardinia destroyed all that remained of the ancient liberties of the commune. Conquered in 1792 by the armies of the French Republic, the county of Nice continued to be part of France till 1814; but after that date it reverted to Sardinia. By a treaty concluded in 1860 between the Sardinian king and Napoleon III. it was again transferred to France.

NICEPHORUS, the name of three emperors of the East.

NICEPHORUS I., emperor 802–811, was a native of Seleucia in Pisidia, who was raised by the empress Irene to the office of *logothetes*. With the help of the patricians and eunuchs he contrived to dethrone Irene, and to be elected emperor. His sovereignty was endangered by the revolt of his general Bardanes. But Nicephorus achieved the submission of Bardanes, who was relegated to a monastery. A conspiracy headed by the patrician Arsaber had a similar issue. Nicephorus set himself with great energy to increase the empire's revenue. By his rigorous imposts he alienated the favour of his subjects, and especially of the clergy. In 803 and 810 he made a treaty with Charlemagne, by which the limits of the two empires were amicably fixed. Venice, Istria, the Dalmatian coast and South Italy were assigned to the East, while Rome, Ravenna and the Pentapolis were included in the Western realm. By withholding the tribute which Irene had agreed to pay to Harun al-Rashid, Nicephorus committed himself to a war with the Saracens. Compelled by Bardanes's disloyalty to take the field himself, he sustained a severe defeat at Crasus in Phrygia (805), and only obtained peace on condition of paying a yearly contribution of 30,000 gold pieces. By the death of Harun in 809, Nicephorus was left free to deal with the Bulgarian king, Krum, who was harassing his northern frontiers. In 811 Nicephorus invaded Bulgaria and drove Krum to ask for terms, but in a night attack he allowed himself to be surprised and was slain along with a large portion of his army.

See Gibbon, ed. Bury (1911) vol. v., p. 204–205, Bury's *Eastern Roman Empire*.

NICEPHORUS II. (Phocas), emperor 963–969, belonged to a Cappadocian family which had produced several distinguished generals. He was born about 912, joined the army at an early age, and, under Constantine VII., became commander on the eastern frontier. In the war with the Saracens he began with a severe defeat (956), which he retrieved in the years following by victories in Syria. In 960 he led an expedition to Crete, and wrested the whole island from the Saracens. He then returned to the east with a large and well-equipped army. In the campaigns of 962–963 he forced his way through Cilicia to Syria and captured Aleppo, but made no permanent conquests. Upon the death of Romanus II., Nicephorus was proclaimed emperor by the eastern troops, and was eventually acknowledged at Constantinople as colleague of the infant sons of Romanus. In 964–966 he definitely conquered Cilicia and again overran Mesopotamia and Syria, while the patrician Nicetas recovered Cyprus. In 968 he reduced most of the fortresses in Syria, and after the fall of Antioch and Aleppo (969), which were recaptured by his lieutenants, secured his conquests by a peace. On his northern frontier he began a war against the Bulgarians, to whom the Byzantines had of late been paying tribute (967), and by instigating an attack from the Russians distracted their attention effectively. Nicephorus was less successful in his western wars. After renouncing his tribute to the Fatimite caliphs, he sent an expedition to Sicily under Nicetas (964–965), but was forced by defeats on land and sea to evacuate that island completely. In 967 he made peace with the Saracens of Kairawan and turned to defend himself against their common enemy, Otto I. of Germany, who had attacked the Byzantine possessions in Italy; but after some initial successes his generals were defeated and driven back upon the southern coast. Owing to the care which he lavished upon the proper maintenance of the army, Nicephorus was compelled to exercise rigid economy in other departments. By his heavy imposts and the debasement of the coinage he forfeited his popularity with the rest of the community, and gave rise to riots. He was finally assassinated in his sleeping apartment by his nephew and successor John Zimisces. Nicephorus was the author of an extant treatise on military tactics.

NICEPHORUS III. (Botaniates), emperor 1078–1081, rose to be commander of the troops in Asia. He revolted in 1078 from Michael VII., and with the connivance of the Turks assumed the purple. In face of another rebellious general, Nicephorus Bryennius, his election was ratified by the aristocracy and clergy. With the help of Alexius Comnenus he drove out of the field Bryennius and other rivals, but failed to clear the invading Turks out of Asia Minor. Nicephorus ultimately quarrelled with Alexius, and was banished to a monastery.

See Gibbon, *Decline and Fall* (ed. Bury, 1911); Finlay, *Hist. of Greece;* G. Schlumberger, *Nicéphore Phocas* (Paris, 1890); K. Leonardt, *Kaiser Nicephorus II.* (Halle, 1887).

NICEPHORUS PATRIARCHA (*c.* 758–829), Byzantine historian and patriarch of Constantinople (806–815). He was, like his father Theodorus, a zealous opponent of Iconoclasm. He was secretary to the imperial commissaries at the council of Nicaea in 787, which witnessed the triumph of his opinions; but, feeling dissatisfied with court life, he retired into a convent. In 806 he suddenly succeeded Tarasius as patriarch of Constantinople, but was deposed by the Iconoclast Leo V. in 815 and died in exile 827. After his death he was included among the saints of the Orthodox Church.

Nicephorus is the author of two important works on the iconoclastic questions: the *Apologeticus Maior* (817) and the *Apologeticus Minor;* his historical works are two: the *Chronologia Compendiaria,* a table of dates from Adam to the year of his own death; the *Breviarium Historicum,* a history of the years 602–799—a very poor composition, only valuable owing to the paucity of other materials. Editions: Complete, J. P. Migne, *Patrologia Graeca,* vol. c. Theological: A Mai, *Nova Patrum Bibliotheca* i., ii. and iii. Historical: de Boor Teubner, 1880. *See* also Krumbacher, *Geschichte der byzantinischen Litteratur* (1897) and A. Burckhardt in *Byzantinische Zeitschrift* 5. p. 465.

NICHOLAS, ST., bishop of Myra, in Lycia, a saint honoured by the Greeks and the Latins on the 6th of December. His cult is as celebrated as his history is obscure. He was bishop of Myra in the time of the emperor Diocletian, was persecuted, tortured for the faith, and kept in prison until the more tolerant reign of Constantine, and is said to have been present at the council of Nicaea, though Athanasius, who knew all the notable bishops of the period, never mentions Nicholas, bishop of Myra. The oldest known monument of the cult of St. Nicholas seems to be the church of SS. Priscus and Nicholas built at Constantinople by the emperor Justinian. (*See* Procopius, *De aedif.* i. 6.) In the West, the name of St. Nicholas appears in the 9th century martyrologies, and churches dedicated to him are to be found at the beginning of the 11th century. It is more especially, however, from the time of the removal of his body to Bari, in Apulia, that his cult became popular. The inhabitants of Bari organized an expedition, seized his remains by means of a ruse, and transported them to Bari, where they were received in triumph on May 9, 1087, and where the foundations were laid of a new basilica in his honour. This was the origin of a famous and still popular pilgrimage. There are nearly 400 churches in England dedicated to St. Nicholas. He is the patron saint of Russia; the special protector of children, scholars, merchants and sailors; and is invoked by travellers against robbers. In art St. Nicholas is represented with various attributes, being most commonly depicted with three children standing in a tub by his side.

A legend of his surreptitious bestowal of dowries upon the three daughters of an impoverished citizen, who, unable to procure fit marriages for them, was on the point of giving them up to a life of shame, is said to have originated the old custom of giving presents in secret on the Eve of St. Nicholas, subsequently transferred to Christmas Day. Hence the association of Christmas with "Santa Claus," an American corruption of the Dutch form "San Nicolaas," the custom being brought to America by the early Dutch colonists. (For the ceremony of the boy-bishop elected on St. Nicholas's Day *see* BOY-BISHOP.)

See N. C. Falconius, *Sancti Nicolai acta primigenia* (Naples, 1751); *Bibliotheca hagiographica Graeca* (Brussels, 1895), p. 96; *Bibl. hagiogr. Latina* (Brussels, 1899), n. 6104–6221; F. Nitti di Vito, *Le Pergamene di S. Nicola di Bari* (Bari, 1901); Charles Cahier, *Caractéristiques des saints* (Paris, 1867), p. 354; Frances Arnold-Forster, *Studies in Church Dedications* (London, 1899), i. 495–501 and iii. 21; L'abbé Marin, *Saint Nicholas, évêque de Myre* (1917).

NICHOLAS I., sometimes called The Great, and certainly the most commanding figure in the series of popes between Gregory I. and Gregory VII., succeeded Benedict III. in April 858. According to the annalist Prudentius of Troyes, "he owed his election less to the choice of the clergy than to the presence and favour of the emperor Louis II. and his nobles"—who can hardly have foreseen with what ability and persistency the rights of the Holy See as supreme arbiter of Christendom were to be asserted even against themselves by the man of their choice. Of the previous history of Nicholas nothing is recorded. His pontificate of nine years and a half was marked by at least three memorable contests which have left their mark in history. The first was that in which he supported the claims of the unjustly degraded patriarch of Constantinople, Ignatius (*q.v.*); but two of its incidents, the excommunication of Photius (*q.v.*), the rival of Ignatius, by the pope in 863, and the counter-deposition of Nicholas by Photius in 867, were steps of serious moment towards the permanent separation between the Eastern and the Western Church.

The second great struggle was that with Lothair (*q.v.*) the king of Lorraine (second son of the emperor Lothair I., and brother of the emperor Louis II.), about the divorce of his wife Theutberga or Thietberga. The pope not only quashed the whole proceedings against Theutberga, but excommunicated and deposed bishops Gunther and Thietgaud, who had been audacious enough to bring to Rome in person the "libellus" of the synod which had given judgment. The archbishops appealed to Louis II., then at Benevento, to obtain the withdrawal of their sentence by force; but, although he actually occupied the Leonine city (864), he was unsuccessful in obtaining any concession, and had to withdraw to Ravenna.

The third great ecclesiastical cause which marks this pontificate was that in which the right of bishops to appeal to Rome against their metropolitans was maintained in the case of Rothad of Soissons, deposed by Hincmar of Reims. In the course of the controversy with the great and powerful Neustrian archbishop papal recognition was first given (in 865) to the False Decretals, which had probably been brought by Rothad to Rome in the preceding year. (*See* DECRETALS.) Nicholas was the pope to whom Boris, the newly converted king of Bulgaria, addressed himself for practical advice in some of the difficult moral and social problems arising out of the transition from heathenism to Christianity. The pope's letter in reply to the hundred and six questions and petitions of the barbarian king is perhaps the most interesting literary relic of Nicholas I. now extant. He died on Nov. 13, 867, and was succeeded by Adrian II.

The *epistolae* of Nicholas I. are printed in Migne, *Patrologia Lat.* vol. 119, p. 769 *seq. See* F. Gregorovius, *Rome in the Middle Ages,* vol. iii. (Eng. trans., London, 1900–1902); H. Lämmer, *Nikolaus I. und die byzantinische Staatskirche seiner Zeit* (Berlin, 1857); J. Roy, *Saint-Nicolas I.* (Paris, 1900); J. Richterich, *Papst Nikolaus I.* (Bern, 1903); A. Greinacher, *Die Anschauungen des Papstes Nikolaus I. über das Verhältnis von Staat und Kirche* (1909).

NICHOLAS II., pope from December 1058 to July 1061, was a Burgundian named Gerard, who at the time of his election was bishop of Florence. He was set up by Hildebrand, with the support of the empress-regent Agnes and of the powerful Duke Godfrey of Lorraine, against Benedict X., the nominee of the Roman nobles, and was crowned at Rome, after the expulsion of Benedict, on Jan. 24, 1059. He continued the policy of ecclesiastical reform associated with the name of Hildebrand (afterwards Gregory VII.). He entered into relation with the Normans, now firmly established in southern Italy, and the new alliance was cemented at Melfi, where Nicholas II., invested (1059) Robert Guiscard with the duchies of Apulia, Calabria and Sicily, and Richard of Aversa with the principality of Capua, in return for fealty and the promise of assistance. The first fruits of this arrangement, based on no firmer foundation than the forged "Donation of Constantine" (*q.v.*), but destined to make the papacy more independent in both the Eastern and Western Empires, was the reduction in the autumn, with Norman aid, of Galera, where the anti-pope had taken refuge, and the end of the subordination of the papacy to the Roman nobles.

Meanwhile Nicholas had sent legates to Milan to adjust the difference between the Patarenes and the archbishop and clergy. Archbishop Wido, in face of the ruinous conflict in the Church of Milan, was forced to submit to the terms proposed by the legates, involving the subordination of Milan to Rome; the new relation was advertised by the unwilling attendance of Wido and the other Milanese bishops at the council summoned to the Lateran palace in April 1059. This council continued the Hildebrandine reforms by sharpening the discipline of the clergy, and regulated future elections to the Holy See. (*See* LATERAN COUNCILS, and CONCLAVE.) The emperor's traditional rights in the matter of papal elections were completely ignored. Stephen, cardinal-priest of S. Chrysogonus, was sent to the German court to attempt to allay the consequent ill-feeling, but was not received. Pope Nicholas, moreover, had offended the German bishops by what they regarded as arbitrary interference with their rights; they retaliated, in a synod held early in 1061, by declaring the new electoral law annulled, and the pope himself deposed. But party strife in Germany enabled the pope to ignore these proceedings. Nicholas II. died at Florence in July 1061.

His *Diplomata, epistolae, decreta* are in Migne, *Patrolog.* Lat. 143, pp. 1301–1366. *See* the article "Nikolaus II." by C. Mirbt in Herzog-

Hauck, *Realencyklopädie* (3rd ed., Leipzig, 1904), with bibliography. Other lists of authorities are in Potthast, *Biblioth. Hist. Med. Aev.* (2nd ed., Berlin, 1896), p. 854; and Ulysse Chevalier, *Répertoire des sources hist. biobibliogr.* (Paris, 1905), vol. 3347, *s.v.* "Nicolas II."

NICHOLAS III. (Giovanni Gaetano Orsini), pope from Nov. 25, 1277 to the 22nd of August 1280, was a Roman nobleman who had served under eight popes. He succeeded John XXI., largely through family influence, after a six-months' vacancy in the Holy See. A born politician, he concluded a concordat with Rudolph of Habsburg in May 1278, by which the Romagna and the exarchate of Ravenna were guaranteed to the pope; and in July he issued an epoch-making constitution for the government of Rome, which forbade foreigners taking civil office. Nicholas issued the bull *Exiit* on Aug. 14, 1279, to settle the strife within the Franciscan order between the parties of strict and loose observance. He repaired the Lateran and the Vatican at enormous cost. Nicholas brought just reproach on himself by his nepotism. *See* also the *Catholic Encyclopaedia* (*s.v.*).

See "Les Registres de Nicolas III.," published by Jules Gay in *Bibliothèque des écoles françaises d'Athènes et de Rome* (Paris, 1898–1916); A. Potthast, *Regesta pontif. Roman.* vol. 2 (Berlin, 1875); A. Demski, "Papst Nikolaus III.," in *Kirchengeschichtliche Studien* (Münster, 1903); F. Gregorovius, *Rome in the Middle Ages*, vol. 5, trans. by Mrs. G. W. Hamilton (London, 1900–1902); Fr. Wertsch. *Die Beziehungen Rudolfs von Habsburg zur röm. Kurie bis zum Tode Nikolaus III.* (Bochum, 1880); G. Palmieri, *Introiti ed esiti di Papa Niccolò III.* (Rome, 1889).

NICHOLAS IV. (Girolamo Masci), pope from Feb. 22, 1288, to April 4, 1292, a native of Ascoli and a Franciscan monk, succeeded St. Bonaventura as general of his order in 1274, was made cardinal-priest of Sta. Prassede and Latin patriarch of Constantinople by Nicholas III., cardinal-bishop of Palestrina by Martin IV., and succeeded Honorius IV. after a ten-months' vacancy in the papacy. He was a pious, peace-loving monk with no ambition save for the church, the crusades and the extirpation of heresy. He steered a middle course between the factions at Rome, and sought a settlement of the Sicilian question. In May 1289 he crowned Charles II. king of Naples and Sicily after the latter had expressly recognized papal suzerainty, and in February 1291 concluded a treaty with Alphonso III. of Aragon and Philip IV. of France looking toward the expulsion of James of Aragon from Sicily. The loss of Ptolemais in 1291 stirred the pope to renewed enthusiasm for a crusade. He sent the celebrated Franciscan missionary, John of Monte Corvino (*q.v.*), with some companions to labour among the Tatars and Chinese. He issued an important constitution on July 18, 1289, which granted to the cardinals one-half of all income accruing to the Roman see and a share in the financial management, and thereby paved the way for that independence of the college of cardinals which, in the following century, was to be of detriment to the papacy. Nicholas was succeeded by Celestine V.

See "Les Registres de Nicolas IV.," ed. by Ernest Langlois in *Bibliothèque des écoles françaises d'Athènes et de Rome* (Paris, 1886–1893); A. Potthast, *Regesta pontif. Roman.* vol. 2 (Berlin, 1875); F. Gregorovius, *Rome in the Middle Ages*, vol. 5, trans. by Mrs. G. W. Hamilton (London, 1900–1902); O. Schiff, "Studien zur Geschichte Papst Nikolaus IV." in *Historische Studien* (1897); W. Norden, *Das Papsttum u. Byzanz* (Berlin, 1903); R. Röhricht, *Geschichte des Königreichs Jerusalem* (Innsbruck, 1898); J. B. Sägmüller, *Die Thätigkeit u. Stellung der Kardinäle bis Papst Bonifaz VIII.* (Freiburg-i.-B., 1896); J. P. Kirsch, "Die Finanzverwaltung des Kardinalkollegiums im 13. u. 14. Jahrhunderte" in *Kirchengeschichtliche Studien* (1895). *See* also the *Catholic Encyclopaedia* (*s.v.*).

NICHOLAS V. (Tomaso Parentucelli or Tomaso da Sarzana), pope from March 6, 1447, to March 24, 1455, was born at Sarzana, where his father was a physician, in 1398. In 1444 he was made bishop of Bologna by Pope Eugenius IV., who sent him to Frankfort to negotiate an understanding between the Holy See and the empire with regard to the reforming decrees of the council of Basel. On his return to Rome, he was made cardinal priest of Sta. Susanna (December 1446). He was elected pope in succession to Eugenius IV. on March 6, 1447.

With the German king, Frederick III., he made the Concordat of Vienna, or Aschaffenburg (Feb. 17, 1448), by which the decrees of the council of Basel against papal annates and reservations were abrogated so far as Germany was concerned; and in the following year he secured a still greater triumph when the resignation of the anti-pope Felix V. (April 7), and his own recognition by the rump of the council of Basel, assembled at Lausanne, put an end to the papal schism. The next year, 1450, Nicholas held a jubilee at Rome. In March 1452 he crowned Frederick III. as emperor in St. Peter's, the last occasion of the coronation of an emperor at Rome. Under the generous patronage of Nicholas humanism made rapid strides. He employed hundreds of copyists and scholars, giving as much as ten thousand *gulden* for a metrical translation of Homer, and founded a library of nine thousand volumes. He restored the walls and numerous churches of Rome and began the rebuilding of the Vatican and St. Peter's.

In 1452 a formidable conspiracy for the overthrow of the papal government, under the leadership of Stefano Porcaro, was discovered and crushed. This revelation of disaffection, together with the fall of Constantinople, darkened the last years of Nicholas; "As Thomas of Sarzana," he said, "I had more happiness in a day than now in a whole year." He died on March 24, 1455.

See Herzog-Hauck, *Realencyklopädie für protestantische Theologie und Kirche*, vol. xiv. (1904), with full references; *Cambridge Modern History*, i. 76–78; and M. Creighton, *History of the Papacy* (London, 1882), vol. ii.

NICHOLAS V. (Pietro Rainalducci), antipope in Italy from 1328 to 1330 during the pontificate of John XXII. at Avignon, a native of Corbara in the Abruzzi, joined the Franciscan order in 1310. He was elected through the influence of the excommunicated emperor, Louis the Bavarian, by an assembly of priests and laymen, and consecrated at St. Peter's on May 12, 1328, by the bishop of Venice. After spending four months in Rome, he withdrew with Louis to Viterbo and thence to Pisa, where he was guarded by the imperial vicar. He was excommunicated by John XXII. in April 1329, and sought refuge with Count Boniface of Donoratico near Piombino. Having obtained assurance of pardon, he presented a confession of his sins first to the archbishop of Pisa, and then (Aug. 25, 1330) to the pope at Avignon. He remained in honourable imprisonment in the papal palace until his death in October 1333.

See F. Gregorovius, *Rome in the Middle Ages*, vol. 6, trans. by Mrs. G. W. Hamilton (London, 1900–1902); Baluzius, *Vitae paparum Avenionensium*, vol. 1 (Paris, 1693); J. B. Christophe, *Histoire de la papauté pendant le XIVième siècle*, vol. 1 (Paris, 1853); E. Marcour, *Anteil der Minoriten am Kampfe zwischen König Ludwig IV. von Bayern und Papst Johann XXII.* (Emmerich, 1874); Eubel, "Der Gegenpapst Nicolaus V. u. seine Hierarchie," in *Hist. Jahrbuch*, vol. 12 (1891).

NICHOLAS I. [NIKOLAI PAVLOVICH], emperor of Russia (1796–1855), eighth child of the emperor Paul I. and his wife Maria Feodorovna, was born at Tsarskoe-Selo on June 25 (July 6, N.S.), 1796. He was only five years old when his father's murder brought his brother Alexander I. to the throne (1801). His education was supervised by M. von Lambsdorff, director of the 1st cadet corps and ex-governor of Courland. But Nicholas and his brother Constantine had little taste for learning. They were interested mainly in military matters.

The grand-duke Nicholas joined the Russian headquarters in France in 1814, but not to take part in any fighting. In 1815 he was with the Allies in Paris, and in the following year set out on the *grand tour*, visiting Moscow and the western provinces of Russia, Berlin (where he was betrothed to Princess Charlotte Louise, daughter of Frederick William III.), and England. His marriage marked the beginning of intimate relations between the courts of Berlin and St. Petersburg. On the 17/29th of April 1818 their first child, the future emperor Alexander II., was born. In the autumn Nicholas was placed in command of the 2nd brigade of the 1st division of the Guard.

Alexander I. died at Taganrog on Dec. 1, 1825. Constantine was at Warsaw; Nicholas was too conscious of his unpopularity in the army—the fruit of his drastic discipline—to dare to assume the crown without a public abdication on the part of the legitimate heir. The result (*see* CONSTANTINE PAVLOVICH) was a three weeks' interregnum, of which the discontented spirits in the army took advantage to bring to a head a plot that had long been

hatching in favour of constitutional reform. When on Dec. 14 the troops who had already taken the oath to Constantine were ordered to take another to Nicholas, it was easy to persuade them that this was a treasonable plot against the true emperor. The Moscow regiment refused to take the oath, and part of it marched, shouting for Constantine and "Constitution," to the square before the Senate House, where they were joined by a company of the Guard and the sailors from the warships. In this crisis Nicholas showed high personal courage, if little decision and initiative. For hours he stood, or sat on horseback, amid the surging crowd, facing the mutinous soldiers—who had loaded their muskets and formed square—while effort after effort was made to bring them to reason, sometimes at the cost of life—as in the case of Count Miloradovich, military governor of St. Petersburg, who was mortally wounded by a pistol shot while arguing with the mutineers. When at last the emperor consented to use force, a few rounds of grape-shot sufficed to quell the mutiny. The chief conspirators—Prince Shchepin-Rostovski, Suthoff, Ryleyev, Prince Sergius Trubetskoi, Prince Obolenski and others—were arrested the same night and interrogated by the emperor in person. A special commission, consisting entirely of officers, was then set up; and before this, for five months, the prisoners were subjected to a rigorous inquisition. The prisoners were kept in solitary confinement in the casemates of the inner fortress of St. Peter and St. Paul. They were brought blindfolded before the commission, and then suddenly confronted with their interrogators. Many went mad under the ordeal, one died, and one starved himself to death (Schiemann, ii. 73). It was soon clear that the Dekabrist (December) rising was but one manifestation of a vast conspiracy permeating the whole army. A military rising on a large scale in the south was only averted by the news of the failure of the mutiny at St. Petersburg; and at Moscow there were many arrests, including that of Colonel Paul Pestel, the chief of the revolutionary southern league. The 121 prisoners were finally brought to trial before a supreme criminal court, established by imperial *ukaz* (June 1–12, 1826). Some were condemned to death, others to solitary confinement in fortresses, others to the Siberian mines and colonies. Of the latter many were accompanied by their wives, though the Russian law allows divorce in the case of such sentences; the emperor unwillingly allowed the devoted women to go, but decreed that any children born to them in Siberia would be illegitimate.

In spite of his reverence for his brother's memory, Nicholas made a clean sweep of "the angel's" Bible Society; as for Alexander's projects of reform, the pitiful legacy of a life of unfulfilled purposes, these were reported upon by committees, and shelved. Nicholas too saw the need for reform; the Dekabrist conspiracy had burnt that into his soul; but he had his own views as to the reform needed. The state was corrupt, disorganized; what was wanted was not more liberty but more discipline. So he put civil servants, professors and students into uniform, and for little offences had them marched to the guard-house; thought was disciplined by the censorship, the army by an unceasing round of parades and inspections. The one great gift of Nicholas I. to Russia, a gift which he really believed would be welcome because it would bring every subject into immediate contact with the throne, was—the secret police, the dreaded Third Section of the Private Chancery of the emperor.

The crowning fault of Nicholas was, however, that he would not delegate his authority; whom could he trust but himself? In this he resembled his contemporary the emperor Francis I. But Francis would "sleep upon" a difficult problem; Nicholas never slept. His constitution was of iron, his capacity for work prodigious; reviews and parades, receptions of deputations, visits to public institutions, then eight or nine hours in his cabinet reading and deciding on reports and despatches—such was his ordinary day's work. Under the "Iron Tsar" the outward semblance of authority was perfectly maintained; but behind this imposing façade the whole structure of the Russian administrative system continued to rot and crumble.

Revelations of the rottenness of the under-structure had, indeed, begun before the outbreak of the war with Turkey in 1828. The newly organized squadron which in 1827 set out on the cruise which ended at Navarino only reached Plymouth with difficulty, and there had to be completely refitted. The disastrous Balkan campaign of 1828 was an even more astounding revelation of corruption, disorganization and folly in high places. The weary and starving soldiers were forced to turn out amid the marshes of the Dobrudscha before the emperor as spick and span as on the parade grounds of St. Petersburg; but he could do nothing to set order in the confusion of the commissariat, which caused the troops to die like flies of dysentery and scurvy; or to remedy the scandals of the hospitals. His presence hampered the initiative of Prince Wittgenstein, the nominal commander-in-chief; for Nicholas was incapable of leaving him a free hand.

These then were the leading principles which underlay Nicholas's domestic and foreign policy from first to last: to discipline Russia, and by means of a disciplined Russia to discipline the world. The mission of Russia in the West was, in accordance with the principles of the Holy Alliance as Nicholas interpreted them, to uphold the cause of legitimacy and autocracy against the Revolution; her mission in the East was, with or without the co-operation of "Europe," to advance the cause of Orthodox Christianity, of which she was the natural protector, at the expense of the decaying Ottoman empire. The sympathy of Europe with the insurgent Greeks gave the tsar his opportunity. The duke of Wellington was sent to St. Petersburg in 1826 to congratulate the new tsar on his accession and arrange a concert in the Eastern Question. The upshot proved the diplomatic value of Nicholas's apparent sincerity of purpose and charm of manner; the "Iron Duke" was to the "Iron Tsar" as soft iron to steel; Great Britain, without efficient guarantees for the future, stood committed to the policy which ended in the destruction of the Ottoman sea-power at Navarino and the march of the Russians on Constantinople. By the treaty of Adrianople in 1829 Turkey seemed to become little better than a vassal state of the tsar, a relation intensified, after the first revolt of Mehemet Ali, by the treaty of Unkiar-Skelessi in 1833. In the West, Nicholas himself proposed an armed intervention of the Alliance "to restore order" in Belgium and France; and when his allies held back even proposed to intervene alone, a project rendered impossible by the outbreak of the great insurrection in Poland, which tied the hands of all three powers.

Then, the insurrection in Poland once crushed, and Poland itself scarce surviving even as a geographical expression, he drew the three eastern autocratic powers together in a new "Holy Alliance" by the secret convention of Berlin (Oct. 3, 1833) reaffirming the right and duty of intervention at the request of a legitimate sovereign. The cordial understanding with Austria, cemented at Münchengrätz and Berlin, was renewed, after the accession of the emperor Ferdinand, at Prague and Töplitz (1835); on the latter occasion it was decided "without difficulty" to suppress the republic of Cracow, as a centre of revolutionary agitation. He allowed himself to be persuaded by Metternich to support the cause of Don Carlos in Spain, and so early as May 1837, in view of the agitation in Hungary, he announced that "in every case" Austria might count on Russia.

These cordial ties were loosened, however, by the fresh crisis in the Eastern Question after 1838. Metternich was anxious to summon a European conference to Vienna, with a view to placing Turkey under a collective guarantee. Nicholas refused to be a party to it. Moreover, as Austria showed an inclination to approach the maritime powers, he determined to come to an agreement with Great Britain, in order to settle the Eastern Question according to his own views; this is the explanation of those concessions in the Eastern Question which ended in the Quadruple Alliance of 1840 and the humiliation of Louis Philippe's government. The new Anglo-Russian *entente* led in 1844 to a visit of the tsar to the English court. (*See* EASTERN QUESTION.)

When the storm of revolution burst over Europe in 1848, Nicholas remained entrenched behind the barriers of his own disciplined empire. But in 1849 he intervened in Hungary, at the entreaty of Francis Joseph, crushed the insurgent Hungarians and handed back their country as a free gift to the Habsburg king. Scarcely less valuable to Austria was the tsar's intervention in the quarrel between Austria and Prussia arising out of the Hesse inci-

dent and the general question of the hegemony of Germany. In October 1850 he had a meeting with Francis Joseph at Warsaw, at which Count Brandenburg and Prince Schwarzenberg were present. Prussia, he declared, must in the German question return to the basis of the treaties of 1815 and renew her *entente* with Austria; this was the only way of preserving the old friendship of Prussia and Russia. In face of the threat conveyed in this, the Prussian government decided to maintain peace (Nov. 2), Radowitz resigning as a protest. Thus Nicholas, who refused to believe in the perfidy ascribed by Frederick William to Austria, was the immediate cause of Prussia's humiliation at Olmütz.

Nicholas was soon to have personal experience of the perfidy of Austria in the troubles that led up to the Crimean War. Gratitude, in the tsar's opinon, should have made her neutral if not friendly. When the dispute arose with Napoleon III. over the guardianship of the Holy Places Nicholas could not believe that Christian powers would resent his claim to protect the Christian subjects of the sultan; he believed he could count on the friendship of Austria and Prussia; as for Great Britain, he would try to come to a frank understanding with her. The disillusionment that followed was profound. In October 1853 Nicholas met his brother monarchs of the triple alliance at Warsaw for the last time. In December, at the conference of Vienna, Austria had already passed over to the enemy. Prussia was wavering, neutral indeed, but joining the other powers in a guarantee of the integrity of Turkey (April 9, 1854), urging the tsar to accept the decisions of the Vienna conference, and on his refusal signing a defensive alliance with Austria (April 20, 1854), which included among the *casus belli* the incorporation in Russia of the banks of the Danube and a Russian march on Constantinople. Thus Nicholas, the pillar of the European alliance, found himself isolated and at war, or potentially at war, with all Europe. The invasion of the Crimea followed, and with it a fresh revelation of the corruption and demoralization of the Russian system. At the outset Nicholas had grimly remarked that "Generals January and February" would prove his best allies. These acted, however, impartially; and if thousands of British and French soldiers perished of cold and disease in the trenches before Sevastopol, the tracks leading from the centre of Russia into the Crimea were marked by the bones of Russian dead. The revelation of his failure broke the spirit of the Iron Tsar, and on March 2, 1855, he threw away the life which a little ordinary care would have saved.

BIBLIOGRAPHY.—All other works on Nicholas I. were more or less superseded by Professor Theodor Schiemann's *Geschichte Russlands unter Kaiser Nikolaus I.*, of which the 1st vol., *Kaiser Alexander I. und die Ergebnisse seiner Lebensarbeit*, was published at Berlin in 1904; the 2nd, carrying the history of Nicholas's reign down to the revolutions of 1830, in 1908. It is based on a large mass of unpublished material, and considerably modifies, *e.g.*, the account of the accession of Nicholas and of the Dekabrist conspiracy given in chapter xiii. of vol. x. of the *Cambridge Modern History*, and tells for the first time the secret history of the Russo-Turkish War of 1828–29. The great *Recueil des traités conclus par la Russie* of T. T. de Martens (St. Petersburg, 1874–1909) contains admirable introductory essays, based on the unpublished Russian archives, and giving much material for the study of Nicholas's character and policy. Many documents are published for the first time in Schiemann's work; some, from the archives of Count Nesselrode, are published in the *Lettres et papiers du Chancelier Comte de Nesselrode*, t. vi. *seq.* For other works *see* bibliographies attached to the chapters on Russia in vol. x. and xi. of the *Cambridge Modern History*. (W. A. P.; X.)

NICHOLAS II. (1868–1918), tsar of Russia, eldest son of Alexander III., was born at St. Petersburg (Leningrad), on May 18, 1868. An English tutor, Mr. Charles Heath, taught him excellent English, and inspired a love of sports and healthy exercise, while a Russian general, Danilovich, supervised his military training, but there was no attempt to provide him with the comprehensive knowledge requifed from one whom fate had destined to rule an immense empire. The only occasion which was offered to the young tsarevich to acquaint himself with the problems of the world was his journey to the Far East, so abruptly cut short in Kyoto by the sabre cut of a Japanese fanatic.

He wedded Princess Alix of Hesse at the deathbed of his father; at the festival of his coronation more than 3,000 people were crushed to death through the negligence of the officials who had to arrange a distribution of bounties; and during the coronation itself the imperial chain on his breast fell to the ground. Such impressions contributed strongly to inspire him with a mystic resignation, especially unsuitable for a monarch who had to lead the nation through times of great crisis at home and in foreign affairs. Nicholas II. followed in the footsteps of his father, seeking to preserve peace in foreign relations, and continuing in home affairs, though in a much milder form, the policy of centralization and Russification which had characterized the previous reign. His pacific tendencies were shown by his systematic opposition to all bellicose excitement, by his maintaining M. de Giers in the post of minister of foreign affairs, by his offering the post, on the death of that statesman, to M. de Staal, by his restraining France from dangerous adventures, and by initiating the Peace Conference at The Hague. To these ought perhaps to be added the transformation of the Franco-Russian *entente cordiale* into a formal alliance, since the alliance in question might be regarded as favourable to the preservation of the *status quo* in Europe. In the internal administration during the first years of his reign he introduced by his personal influence, and without any great change in the laws, a more humane spirit towards those of his subjects who did not belong by language and tradition to the dominant nationality, and who were not members of the Eastern Orthodox Church; but he disappointed the men of liberal views by giving it to be clearly understood soon after his accession that he had no intention of circumscribing and weakening the autocratic power by constitutional guarantees or parliamentary institutions. In spite, however, of his desire for peace he let his country drift into the disastrous war with Japan; and notwithstanding his sincere attachment to the principles of bureaucratic autocracy, it was he who granted the constitutional reforms which altered the whole political outlook in Russia. (*See* RUSSIA.)

Nicholas II.'s political outlook was dominated by a kind of theocratic or hieratic spirit; he was looking back for inspirations to the ideas and customs of the Muscovite period; he was induced to impersonate the figure of Alexis Mikhallovich, the father of the western reformer Peter the Great; in 1913 the tercentenary of Michail Feodorovich's accession to the throne after the "Great Troubles" was celebrated with much splendour and emphasis. Pilgrimages were performed with great devotion and circumstance.

The courtiers and bureaucrats in the immediate surroundings of the tsar, men like Sipiaguin, Nicolas Maklakov and Sabler, took advantage of these prepossessions in order to keep up a constant hostility against progressive reformers and western adaptations. But the most dangerous representative of mystic reaction was the tsar's consort, the Empress Alexandra Feodorovna. Of German descent on her father's side and of English descent on the side of her mother (Princess Alice, the daughter of Queen Victoria), she had received her education in England, but, on coming to Russia, she surrendered completely to the most extreme form of theocratic exaltation.

While her sister, the widow of the Grand Duke Sergius, killed by a terrorist, had devoted herself to a simple life at the head of a community of hospital nurses, Alexandra Feodorovna, highly strung and hysterical, sought providential guidance in the midst of unbalanced women and false prophets like the French medium Philippe and the famous Rasputin. The latter obtained a hold on her through the hypnotising influence he exercised over her son, the tsarevich Alexis, a boy affected by the rare disease of hereditary haemophilia. But the crafty peasant had contrived to obtain gradually a psychical domination over the empress and her friends which made it possible for him to distribute political favours and to have his say in the most important affairs of state. The empress considered him as the God-sent representative of the Russian nation, of that mass of peasants which, as she was convinced, was the firm mainstay of autocracy in Russia. And in the later years of Nicholas II.'s reign, the years of great trial and danger, Alexandra Feodorovna stepped in more and more often to direct the tsar's choice of his ministers and to prevent him from making concessions to the spirit of the time. For the circumstances which brought Russia into the World War *see* RUSSIA: *History*.

The suspicion that Alexandra Feodorovna was secretly favour-

ing the cause of Germany and revealing military secrets to the Kaiser—a suspicion often expressed abroad and popularly accepted in Russia—is, according to most competent witnesses, devoid of any basis in fact. The empress was intensely patriotic in her own way, opposed to the aggressive policy of the Hohenzollerns, and never advocated a treacherous compromise with the Central Powers. A former lady-in-waiting, Princess Vassiltchikov, who towards the close of 1916 brought the project of such a compromise from Germany, was promptly ordered out of St. Petersburg (Leningrad). Nevertheless, Alexandra Feodorovna proved to be the evil genius of the Russian dynasty, by her blind and obstinate support of reactionary tendencies and of worthless adventurers, at a time when a wise and firm policy of reform was more needed than ever. All the better representatives of the dynasty—the Dowager Empress, the Grand Duke Nicholas Mikhailovich, the Grand Duchess Victoria—warned her of the imminent danger of that régime of fleeting ministerial shadows which set in after the catastrophe of the War Office in 1915.

The emperor remained passive as commander-in-chief at headquarters while the Empress Alexandra spurned all advice with contempt and continued to pull the strings by dismissing men like Sazonov and Palivanov, and appointing timeservers like Sturmer, Protopopov or Galitzin. The assassination of Rasputin did not frighten but enraged her; she erected a kind of shrine over the body of the prophet and sent the Grand Duke Dmitry Pavlovich, who had taken part in the murder, into exile. Her power was broken only by the revolution.

The thread of the Romanov dynasty was cut without much resistance. When in March 1917 the emperor received at headquarters a telegram from the president of the Duma informing him of the events of St. Petersburg and demanding his abdication, and Gutchkov and Shulgin arrived with the act of abdication itself, he submitted with fatalistic composure. He refused to give up his crown to his son with Grand Duke Michael as regent, because he did not wish to trust the boy to the danger of a political storm; and his abdication was made in favour of the Grand Duke Michael, who in his turn refused to accept the crown unless it was tendered to him by the will of the people. The last chance of a régime of constitutional monarchy was cut short. Proposals were made on behalf of the British Government to allow Nicholas II. and his family to take up their abode in England; but the Provisional Government in St. Petersburg did not accede to that plan. Kerensky and Milyukov declared that the imperial family were in safety in Russia. Later on the emperor submitted meekly to be transferred from Pskov to Tsarskoe Selo and thence to Tobolsk, where he was interned with his family—his wife, his son and his four daughters—for months.

The end came in connection with Kolchak's advance on the Ural in 1918. The Soviet of Commissaries in Moscow enjoined the greatest vigilance to the Ekaterinburg commissar, Yourkovsky, and the commander of the guard, Medvediev, without indicating any means for removing the prisoners from the threatened zone. The communists of Ekaterinburg held a secret meeting in which they decided to put the tsar and his family to death, and sent an order in this sense to Yourkovsky. The latter demanded that it should be duly signed, and 16 signatures were affixed to it. On the night of July 16 Yourkovsky roused the prisoners and conducted them into a cellar of the house. Medvediev, with the Lettish guards, entered the room while some Russian soldiers were looking in from the staircase. Yourkovsky placed the seven doomed persons at one end of the room and read the sentence hurriedly by torchlight. The tsar stepped forward and said something indistinctly, when Yourkovsky drew his revolver and shot him in the head. A general fusillade followed. During the next few days the corpses were removed to an isolated spot in the neighbourhood of Ekaterinburg and destroyed by fire, after having been soaked with petroleum. A few objects of apparel were later picked up on the spot. (*See* RUSSIA.)

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NICHOLAS I. (1841–1921), king of Montenegro, was born at Njeguš, the ancient home of the Njeguš-Petrović dynasty, on Sept. 1, 1841. His father, Mirko Petrović, was brother of the Vladika Danilo II. who had declined episcopal office, married and declared the succession hereditary in the direct male line. As, however, Danilo II. left no male issue, and Mirko declined the succession, Nicholas became heir to the throne of Montenegro. He was educated in Trieste and at the Academy of Louis le Grand in Paris, returning to Montenegro on the assassination of his uncle (Aug. 13, 1860). He took part in the campaign against Turkey of 1862, which, after Austria's intervention, was followed by a prolonged peace. In 1868 he travelled to St. Petersburg (Leningrad) to meet the tsar Alexander II., who received him with favour, and afterwards regularly supplied him with subventions of arms and money, referring to him on a memorable occasion as his "only friend." During the Near Eastern crisis of 1876 (*see* EASTERN QUESTION), Nicholas declared war on the Porte, and winning brilliant successes in this and the following wars at Vučidd, Podgorica and Nikćić, captured Antivari and Dulcigno. The Congress of Berlin (*q.v.*) brought Montenegro formal recognition as a sovereign State and doubled her area, besides giving her an outlet on the sea at Antivari. Nicholas now entered on a long period of peace largely filled with intrigues with and against his son-in-law, Peter, later King Peter I. of Serbia (*q.v.*) regarding a possible later Yugoslav state to comprise both Serbia and Montenegro. On Dec. 19, 1900, Nicholas assumed the title of Royal Highness.

In 1905 he was forced by public opinion, which was revolting against his despotic methods, to grant a constitution. He was at once involved in quarrels with his political opponents, culminating in the scandalous but obscure "Cetinje bomb plot" of 1905. On Aug. 28, 1910, encouraged by Austria, who helped to estrange him further from Serbia, Nicholas assumed the title of king. In the Balkan Wars (*q.v.*) he was the first to declare war on Turkey, but although these wars gave Montenegro an accession of territory, the dynasty lost prestige, its unpopularity and with it the movement for the union of Serbia with Montenegro, increased. In the World War Montenegro threw in her lot with Serbia; Nicholas, however, maintained touch with Austria, from whom he begged a separate peace (Jan. 13, 1916). On Jan. 19, Nicholas fled to Italy and France. The breach widened between him and his people, and the "Great National Assembly" on Nov. 26, 1918, proclaimed his deposition and that of his dynasty. The old ex-king passed the remainder of his days in Italy. He died at Antibes on March 1, 1921.

A rude but often benevolent despot of the fighting type, Nicholas was also a poet of talent. His works include *Balkanska Tsaritsa* and *Knyaz Arvaniti* (dramas); *Haïdana, Potini Abenserage* and *Pesnik i Vila* (poems), *Skuplijene Pesme* and *Nova Kola* (songs). In Nov. 1860, Nicholas married Milena (1847–1923) daughter of the *voivode* Petar Vukotić. On the death of Nicholas, his eldest son Danilo was proclaimed by the small monarchist party king of Montenegro (Mar. 1, 1921), but abdicated on Mar. 7, 1921, in favour of his nephew Michael, eldest son of Prince Mirko (b. Sept. 1, 1908).

NICHOLAS (1856–1929), Russian Grand Duke and soldier. Nikolai Nikolaievich was born on Nov. 6, 1856, the grandson of the emperor Nicholas I. and first cousin of the emperor Alexander III. Educated at the school of military engineers, he received his commission in 1872, and in the following year, at the early age of 16, entered the military academy. In the war of 1877–78, as a general staff officer for special service, he joined the staff of his father, the very popular Grand Duke Nikolai Nikolaievich (Senr.), who had been appointed commander-in-chief of the Russian forces. He distinguished himself at the crossing of the Danube at Zimnicea on April 15, 1877, and in the attack on the Shipka.

After the war the Grand Duke joined the Guard Hussar Regiment, in which the emperor Nicholas afterwards served, and passed through every stage as officer till appointed commander in 1884—a position he occupied for 6½ years. He then commanded in succession a brigade and a division, and in 1895 was appointed

inspector-general of cavalry. He held this post for ten years, a period which is regarded as a bright epoch in the history of the Russian cavalry, for he carried through fundamental reforms in training and in the organization of the cavalry schools, of the cavalry reserves and of the remount service.

In 1905 Nicholas was appointed commander-in-chief of the St. Petersburg military district, a post he held till the outbreak of the World War in Aug. 1914. Here, as elsewhere, he gave proof of his zeal for efficiency. Setting himself the task of instilling the lessons of the Japanese war, he encouraged musketry and work in extended order, but at the same time allowed no slackness in ceremonial. To help him in his work he called from the Far East men like Generals Ivanov, Lesh and Lechitski, who were of comparatively humble origin but had made their reputation in the field. The appointment of such men to high command in the Imperial Guard was characterized in his diary at the time by another grand duke as "revolutionary," but the men selected justified their choice in the World War.

In the same year (1905) as he was appointed commander-in-chief of the St. Petersburg military district, Nikolai Nikolaievich became the first president of the newly created council of national defence, and he held this position till 1908, when the council was abolished. During this time the emperor seems to have hesitated between the final adoption of a military system analogous to that of Germany, under which the chief of the general staff, as well as the minister of war, should have the right of access and of direct report to the sovereign, and of the system in vogue in countries with a constitutional Government, under which that right was confined to the minister of war. On the council the Grand Duke worked in close co-operation with General Palitsin, who, in 1908, on the emperor's decision in favour of the latter system, gave way to General Sukhomlinov as chief of the general staff, the latter, in the following year, replacing General Rediger as minister of war.

From 1908 to 1914 Nicholas took no part in the strategical preparation for the war, the work being delegated by the emperor to General Sukhomlinov and his nominees on the general staff. At the outbreak of war the emperor first intended to take command himself, and actually appointed the grand duke Commander-in-chief of the VI. (Reserve) Army at St. Petersburg (Leningrad). It was only on the evening of Aug. 1, the day of Germany's declaration of war, that he yielded to the entreaties of his ministers and decided to hand over the supreme command to the grand duke.

Services During the War.—The commander-in-chief was responsible for carrying out a plan which he had no hand in drawing up, a plan which was dependent on promises previously made, without his cognisance, to the French general staff. He had to work in accordance with the "Regulations for the Direction of the Army in the Field," a new edition of which had been issued on the very eve of the war, handing over much power to the two group commanders.

The plan of the Russian general staff consisted of the invasion of East Prussia by a right group (I. and II. Armies), while a left group (IV., V., III. and VIII. Armies) operated against the Austrians in Galicia, and a centre group (IX. and X. Armies) assembled at Warsaw to advance on Posen. It was owing to the decision of the grand duke that this centre group was broken up, the X. Army being sent north to fill the gap left by the failure in East Prussia, and the IX. Army sent south to overwhelm the Austrians in southern Poland.

When the Germans came to the rescue of their discomfited ally by advancing in Oct. 1914 to the outskirts of Warsaw, the transfer of the Russian armies from left to right in rear of the Vistula, and the concentration of superior forces on the enemy's left or northern flank which compelled his retreat, were masterly movements. If the next German advance, culminating in the operation of Łódz owing to mistakes by Russian army commanders, definitely removed all possibility of an invasion of Posen, the Russians held on through the winter of 1914–15 to the line of the Narev-Vistula-San-Carpathians, and were only compelled by lack of munitions in the spring and summer of 1915 to retreat to a line that they held substantially through 1916–17.

There was no demand from the fighting men at the front for the change at G.H.Q. which occurred on Aug. 21, 1915, when the emperor announced that he would assume the supreme command. It is said that Rasputin had prophesied that the Russian armies would continue to be defeated till the emperor placed himself at their head. Certainly the impostor had no reason to love the Grand Duke Nicholas. A story repeated among the soldiers relates that he had applied to the commander-in-chief for permission to come to the front "to bless the troops," and the latter had telegraphed in reply two Russian words which being translated run—"Come, I shall hang you."

The grand duke was appointed viceroy and commander-in-chief in the Caucasus. Up to that time the brunt of the fighting against Turkey had been borne by the British in Gallipoli, the Sinai Peninsula and Mesopotamia. The advent of the new commander put new life into the Russian forces. He pushed forward an expeditionary force under General Baratov through Enzeli and Hamadan to screen Persia from further German penetration, and to establish touch with the British troops in Mesopotamia. He collected guns and stores, and raised and trained efficient troops, and, in spite of immense difficulties in supply, ably assisted by Generals Yudenich and Prjvalski, occupied in three successful offensives all Armenia, including the fortress of Erzerum, the port of Trebizond and the town of Erzinjan.

The revolution of March 12, 1917, found the grand duke still in the Caucasus. The emperor's last official act was to nominate him to be once more supreme commander-in-chief. His journey from the Caucasian headquarters at Tiflis to the headquarters at Mogilev was in the nature of a triumphal procession, patriotic demonstrations and crowds of people greeting him at every station on the way. Twenty-four hours after his arrival at Mogilev he received a telegram from Prince Lvov, the chief of the provisional Government, cancelling his appointment. The next two years the grand duke spent in the Crimea, taking no part in politics. At last, in March 1919, he left Russian soil on the British cruiser "Marlborough," and lived quietly near Paris. He died in Jan. 1929. (A. W. F. K.)

NICHOLAS, SIR EDWARD (1593–1669), English statesman, was born on April 4, 1593, of a Wiltshire family. He was educated at Salisbury grammar school, Winchester college and Queen's college, Oxford. After studying law at the Middle Temple, Nicholas became secretary to Lord Zouch, warden and admiral of the Cinque ports, in 1618, and continued in a similar employment under the duke of Buckingham. In 1625 he became secretary to the Admiralty; then extra clerk of the privy council with duties relating to Admiralty business, and from 1635 to 1641 he was one of the clerks in ordinary to the council. In this situation Nicholas was concerned with the levy of ship-money. He had Charles's confidence, became a privy councillor and a secretary of State, and attended the king at Oxford, and carried out the business of the treaty of Uxbridge. Nicholas arranged the details of the king's surrender to the Scots, though he does not appear to have approved of the step; and he arranged the capitulation of Oxford. He went to France, and after the king's death he remained on the Continent concerting measures on behalf of the exiled royal family, but he never had any real influence with Charles II. After the Restoration he lived in retirement.

See *The Nicholas Papers*, ed. by G. F. Warner (Camden Society, 1886–97), containing Nicholas's correspondence and some autobiographical memoranda. Private correspondence between Nicholas and Charles I. will be found in the *Memoirs of John Evelyn*, ed. by W. Bray (1827); *The Egerton Mss.* and the *Ormonde Papers* contain many references to Nicholas.

NICHOLAS, NORTHERN or **LENIN LAND** lies in the Arctic sea, about 30 m. N. of Cape Chelyuskin, extending in a north-easterly direction from 77° 50′ N., 99° E. to beyond 81° N. The small Alexis (Little Taimir) and Starokadomski islands lie at the eastern end of Alexis strait, which separates Nicholas Land from the mainland. This land was discovered in 1913 by the Russian hydrographical expedition in the "Taimir" and "Vaigach" under B. A. Vilkitski. He took possession for Russia and charted the eastern side. In the following year he returned and

charted the southern coast. The northern and western sides are unknown. The east coast is much indented and a deep gulf or strait occurs in about 79° N. In the south there is a low plain covered with tundra, but on the east the land is lofty (1,500 ft.) and flat-topped with large valley glaciers. Both sedimentary and volcanic rocks occur, but details are lacking. Water of over 100 fathoms depth lies close to the eastern side.

See papers in *Petermann's Mitteilungen*, 60 (1914); *Geographical Journal* (Dec. 1919), and *Geographical Review* (July 1925).

(R. N. R. B.)

NICHOLS, JOHN (1745–1826), English printer and author, was born at Islington on Feb. 2, 1745. He edited the *Gentleman's Magazine* from 1778 till his death, and in that periodical, and in his numerous volumes of *Anecdotes and Illustrations*, he made invaluable contributions to the personal history of English men of letters in the 18th century. He was apprenticed in 1757 to "the learned printer," William Bowyer, who took him into partnership in 1766. On the death of his friend and master in 1777 Nichols published a brief memoir, which afterwards grew into the *Anecdotes of William Bowyer and his Literary Friends* (1782). *The Literary Anecdotes of the 18th Century* (1812–1815), into which the original work was expanded, forms only a small part of Nichols's production. It was followed by the *Illustrations of the Literary History of the 18th Century, consisting of Authentic Memoirs and Original Letters of Eminent Persons*, which was begun in 1817 and completed by his son John Bowyer Nichols (1779–1863) in 1858. He died on Nov. 26, 1826.

Nichols's other works include: A *Collection of Royal and Noble Wills* (1780); *Select Collection of Miscellaneous Poems* (1782), with subsequent additions, in which he was helped by Joseph Warton and by Bishops Percy and Lowth; *Bibliotheca Topographica Britannica* (1780–1790); with Richard Gough, *The Progresses and Public Processions of Queen Elizabeth* (1788); and the *History and Antiquities of the Town and County of Leicester* (8 vols., 1795–1815).

A full memoir of John Nichols by Alexander Chalmers is contained in the *Illustrations*, and a bibliography in the *Anecdotes* (vol. vi.) is supplemented in the later work. *See* also R. C. Nichols, *Memoirs of J. G. Nichols* (1874).

NICHOLS, ROBERT MALISE BOWYER (1893–), English poet and writer, the son of J. B. B. Nichols, also a poet, was born on Sept. 6, 1893, and educated at Winchester and at Trinity college, Oxford. In 1914 he obtained a commission in the Royal Field Artillery, and served in France until 1916. From 1918 to 1919 he was engaged on propaganda work in the United States for the Ministry of Information. From 1921 to 1924 he was professor of English literature at the Imperial college, Tokyo. His first volume of poetry, *Invocation*, appeared in 1916. In addition to his poetry, he has written *The Smile of the Sphinx* (1920) and contributed to *The London Mercury* and other periodicals.

His published work includes *Ardours and Endurances* (1917); *The Budded Branch* (1918); *Aurelia* (1920); *Guilty Souls* (*drama*) (1922); *Fantastica* (1923).

NICHOLSON, JOHN (1822–1857), Anglo-Indian soldier and administrator, son of Alexander Nicholson, a north of Ireland physician, was born on Dec. 11, 1822, and educated at Dungannon College. He was presented with a cadetship in the Bengal infantry in 1839 by his uncle Sir James Hogg, and served in the first Afghan War of 1839–42; he distinguished himself in the defence of Ghazni, and was one of the prisoners who were carried to Bamian and escaped by bribing the guard upon General Pollock's successful advance. In Afghanistan Nicholson first met Sir Henry Lawrence, who got him the appointment of political officer in Kashmir and subsequently on the Punjab frontier. In 1847 he was given charge of the Sind Sagar district, and did much to pacify the country after the first Sikh War. On the seizure of Multan by Mulraj, he rendered great service in securing the country from Attock, and was wounded in an attack upon a tower in the Margalla Pass, where a monument was subsequently erected to his memory. On the outbreak of the second Sikh War he was appointed political officer to Lord Gough's force, when he rendered great service in the collection of intelligence and in furnishing supplies and boats.

On the annexation of the Punjab he was appointed deputy commissioner of Bannu. There he became a kind of legendary hero, and many tales are told of his stern justice, his tireless activity and his commanding personality. In the course of five years he reduced the most turbulent district on the frontier to such a state of quietude that no crime was committed or even attempted during his last year of office, a condition of things never known before or since. He would go personally to the scene of a crime or a legal dispute and decide the question on the spot. Every man in his district, whether mountain tribesman or policeman, felt that he was controlled by a master hand, and the natives said of him that "the tramp of his war-horse could be heard from Attock to the Khyber." It is little wonder that the natives worshipped him as a god under the title of Nikalsain.

When the Mutiny broke out in May 1857 Nicholson did more than any other single man to keep the Punjab loyal and to bring about the fall of Delhi. When the news of the rising at Meerut arrived, Nicholson was with Edwardes at Peshawar, and they took immediate steps to disarm the doubtful regiments in that cantonment. Together they opposed John Lawrence's proposal to abandon Peshawar, in order to concentrate all their strength on the siege of Delhi. In June Nicholson was appointed to the command of a movable column, with which he again disarmed two doubtful regiments at Phillaur. In July he made a forced march of 41 m. in a single day in the terrific heat of the Punjab summer, in order to intercept the mutineers from Sialkot, who were marching upon Delhi. He caught them on the banks of the Ravi near Gurdaspur, and utterly destroyed them, thus successfully achieving what hardly any other man would have attempted. In August he had pacified the Punjab and was free to reinforce General Wilson on the Ridge before Delhi.

Before Nicholson's arrival the counsels of the commanders before Delhi, like those at Meerut, suffered from irresolution and timidity. As General Wilson's health declined, his caution became excessive, and Nicholson was specially sent by Sir John Lawrence to put more spirit into the attack. His first exploit after his arrival was the victory of Najafgarh, which he won over the rebels who were attempting to intercept the British siege train from Ferozepore. After marching through a flooded country scarcely practicable for his guns, Nicholson, with a force of 2,500 troops, defeated 6,000 disciplined sepoys after an hour's fighting, and thenceforth put an end to all attempts of the enemy to get in the rear of the British position on the Ridge. Nicholson grew fiercely impatient of General Wilson's procrastination, and at one time was thinking of appealing to the army to set Wilson aside and elect a successor; but at last, on Sept. 13, he forced Wilson to make up his mind to the assault, and he himself was chosen to lead the attacking column. On the morning of the 14th, he led his column, 1,000 strong, in the attack on the Kashmir gate, and successfully entered the streets of Delhi. But in trying to clear the ramparts as far as the Lahore Gate, he undertook a task beyond the powers of his wearied troops. In encouraging them as they hesitated, he turned his back on the enemy and was shot in the back. The wound was mortal; he died on Sept. 23.

His best epitaph is found in the words of Sir John Lawrence's Mutiny Report:—

> Brigadier-General John Nicholson is now beyond human praise and human reward. But so long as British rule shall endure in India, his fame can never perish. He seems especially to have been raised up for this juncture. He crowned a bright, though brief, career by dying of the wound he received in the moment of victory at Delhi. The Chief Commissioner does not hesitate to affirm that without John Nicholson Delhi could not have fallen.

See J. L. Trotter, *Life of John Nicholson* (1904); Sir John Kaye, *Lives of Indian Officers* (1889); Bosworth Smith, *Life of Lord Lawrence* (1883); Lady Edwardes, *Memorials of Sir Herbert Edwardes* (1886); and S. S. Thorburn, *Bannu* (1876).

NICHOLSON, JOSEPH SHIELD (1850–1927), British economist, son of an Independent minister, was born on Nov. 9, 1850 at Wrawby in Lincolnshire, and educated at Edinburgh university and Trinity college, Cambridge, where he won the Cobden Prize in 1877 (the first award), and again in 1880. After studying at Heidelberg and at London university, he became a private tutor at Cambridge.

In 1880 he went to Edinburgh university as professor of political economy. He wrote more than twenty volumes on economics, of which the chief are: *The Silver Question* (1886); *Money and Monetary Problems* (1888); *Bankers' Money* (1903); *The Tariff Question* (1903); *The History of the English Corn Laws* (1903); *Project of Empire* (1909); and *Principles of Political Economy* (3 vols., 1893, 1897, 1901). In all his economic writings he advocated the principles of Adam Smith, of whom he was a fervent disciple. He resigned his chair in 1925, and died in Edinburgh on May 12, 1927.

NICHOLSON, MEREDITH (1866–), American writer, was born at Crawfordsville (Ind.), Dec. 9, 1866, and educated in the public schools of Indianapolis. He was a reporter and later editor on the Indianapolis *News*, and has been the recipient of various honorary degrees.

He has published the following novels: *The Main Chance* (1903), *The House of a Thousand Candles* (1905), *The Port of Missing Men* (1907), *The Little Brown Jug at Kildare* (1908), *The Lords of High Decision* (1909), *A Hoosier Chronicle* (1912), *The Poet* (1914), *And They Lived Happily Ever After* (1925); also *Poems* (1906); and several volumes of historical and critical essays, among them *The Hoosiers* (1900) and *The Valley of Democracy* (1918).

NICHOLSON, WILLIAM (1753–1815), English writer on natural philosophy, was born in London in 1753. Nicholson occupied himself with writing and lecturing on natural philosophy, including chemistry, and with the construction of various machines and the first voltaic pile in England. In 1797 the *Journal of Natural Philosophy, Chemistry and the Arts*, generally known as *Nicholson's Journal*, the earliest work of the kind in Great Britain, was begun; it was carried on till 1814. He died in London on May 21, 1815.

Besides contributions to the *Philosophical Transactions*, Nicholson wrote translations of Fourcroy's *Chemistry* (1787) and Chaptal's *Chemistry* (1788), *First Principles of Chemistry* (1788) and a *Chemical Dictionary* (1795); he also edited the *British Encyclopaedia, or Dictionary of Arts and Sciences* (6 vols., 8vo, London, 1809).

NICHOLSON, WILLIAM (1872–), English painter, engraver and illustrator, was born at Newark-on-Trent in 1872. He first became known to the wider public by his illustrative work in *An Alphabet, An Almanack of Sports* (with Rudyard Kipling), and *London Types* (with W. E. Henley) in 1898; by the "Portrait of Queen Victoria," a delightful coloured wood engraving, the *Velveteen Rabbit* with its clever end-papers, and by the whole series of quaint and witty books and posters which he produced in collaboration with his brother-in-law, James Pryde (as "the Beggarstaff Brothers"). His more serious work is found in his painting, whether dealing with a portrait, a landscape, or still-life. Among his paintings in oil are "The Black Pansy," "The Landlord" (Manchester City Art gallery), "The Girl with the Tattered Gloves," "Fish," and the portraits of "Marie Tempest," "Ursula Lutyens" and "The Master of Jesus." Other works are the "Square Book of Animals" and the "Buildings of Oxford."

See monograph in *Contemporary British Artists*, by S. K. North (1923).

NICHOLSON'S NEK: *see* SOUTH AFRICAN WAR.

NICIAS (d. 414 B.C.), a soldier and statesman in ancient Athens, inherited from his father Niceratus a considerable fortune invested mainly in the silver mines of Laurium. Evidence of his wealth is found in the fact that he had no less than 1,000 slaves whom he hired out. He was several times colleague with Pericles in the strategia, and on Pericles' death became the leading advocate of the Periclean policy of pinpricks (ἐπιτοιχισμοί) and concentration on the Thraceward region against the offensive policy of the democrats under Cleon. At the amphibious tactics of the ἐπιτοιχισμός he was unsurpassed. Having been largely responsible for the "Peace of Nicias" (421) he appears in the rather obscure history of the following years as the leader of the peace party, in opposition to Alcibiades. In 415 much against his will, he was appointed leader of the Sicilian expedition with Alcibiades and Lamachus, and the recall of Alcibiades, followed by the death of Lamachus, left him in sole command. Demosthenes came out with reinforcements early in 413, and took charge for a brief space, but at the end the main responsibility for the delay, and so perhaps for the disaster, rests with Nicias. He was put to death during that year by the Syracusans.

Besides Thucydides *see* Plutarch's *Nicias* and Diod, xii. 83; also GREECE, and PELOPONNESIAN WAR.

NICKEL (symbol Ni, atomic number 28, atomic weight 58·69, isotopes 58 and 60), a greyish-white metallic element of considerable malleability and ductility. It has been known from the earliest times, being employed by the Chinese in the form of an alloy called pakfong. It was first isolated in an impure condition in 1751 by A. F. Cronstedt from nicolite, and his results were afterwards confirmed by T. O. Bergman in 1775 (*De niccolo, opusc.* 2, p. 231; 3, p. 459; 4, p. 374). It occurs in the uncombined condition and alloyed with iron in meteorites; as sulphide in millerite and nickel blende, as arsenide in kupfernickel, and frequently in combination with arsenic and antimony in the form of complex sulphides. It is found in considerable quantities in New Caledonia in the form of a hydrated silicate of nickel and magnesia approximating to the constitution $(NiO, MgO)SiO_2.nH_2O$, and in Canada in the form of nickeliferous pyrrhotines, which consist of sulphides of iron associated with sulphides of nickel and copper, embedded in a matrix of gneiss; these form the chief sources of nickel. When the former is used it is roasted with calcium sulphate or alkali waste to form a matte which is then blown in a Bessemer converter or heated in a reverberatory furnace with a siliceous flux with the object of forming a rich nickel sulphide. This sulphide is then by further heating converted into the oxide and finally reduced to the state of mental by ignition with carbon in clay crucibles. The process adopted for the Canadian ores, which are poor in copper and nickel, consists in a preliminary roasting in heaps and smelting in a blast furnace in order to obtain a matte, which is then further smelted with a siliceous flux for a rich matte. This matte is then mixed with coke and salt-cake and melted down in an open hearth furnace, or in a Bessemer converter with a silicate lining.

In the Mond process, this refined matte, which contains copper, nickel and iron sulphides, is roasted to remove the sulphur, and extracted by sulphuric acid, whereby the iron and copper contents are diminished and the nickel content is relatively increased. Reduction by "water-gas" at 300° C. then leaves nickel and copper as metals and iron oxide unaffected; at the same time, the water-gas is largely deprived of its hydrogen and becomes relatively richer in carbon monoxide, the content of which is raised to 80% by passage through a retort of hot coke. This enriched gas is then passed over the metallic mixture at about 80° C., whereby the nickel is "volatilised" as the carbonyl $Ni(CO)_4$; the product is passed through towers at 180–200° C., where it decomposes and is deposited (often on pellets of pure nickel), the resulting carbon monoxide being used again. The nickel so obtained is of a high degree of purity.

The following tables show the output of nickel from Canada and the shipments of nickel ore from New Caledonia in recent years as metric tons:—

	Canada	New Caledonia
1913	22,539	164,406
1918	41,960	90,650
1923	28,329	3,520
1925		4,447
1926	29,817	

The metal may also be obtained on the small scale by the reduction of the oxide by hydrogen or by carbon, by ignition of the oxalate or of nickel ammonium oxalate by reduction of the chloride in a current of hydrogen (E. Péligot), by electrolysis of nickel ammonium sulphate, as in the process of nickel plating.

Its specific gravity varies according to the method employed for its preparation, being about 8·8. It melts at 1,452° C. Its specific heat increases with rise of temperature, the mean value from 15° to 100° C. being 0·1084. It is magnetic, but loses its magnetism when heated, the loss being complete at about 340–350° C. Nickel occludes hydrogen readily, is attacked by the halogen elements, and oxidizes easily when heated in air. In the massive state it is unacted upon by dry air, but if moistened with acidified water, oxidation takes place slowly. When obtained by reduction

processes at as low a temperature as possible the finely divided metal so formed is pyrophoric, *i.e.*, it may ignite spontaneously in the air. It decomposes water at a red heat. Sheet nickel is passive to fairly concentrated nitric acid, and the metal remains passive even when heated to redness in a current of hydrogen. Nickel is largely used as a catalyst for the reduction of organic compounds by hydrogen—a process first used by P. Sabatier and J. B. Senderens (*see* HYDROGEN and HYDROGENATION).

It rapidly oxidizes when fused with caustic soda, but is scarcely acted upon by caustic potash. Hydrochloric and sulphuric acids are almost without action on the metal, but it dissolves readily in dilute nitric acid. Nickel salts are antiseptic; they arrest fermentation and stop the growth of plants. Nickel carbonyl, however, is extremely poisonous. On the toxic properties of nickel salts *see* A. Riche and Laborde, *Jour. Pharm. Chem.*, 1888 (5), 17, pp. 1, 59, 97.

Nickel is used for the manufacture of domestic utensils, for crucibles, coinage, plating and for the preparation of various alloys, such as German silver, nickel steels such as invar (nickel, 35·7%; steel, 64·3%), which has a negligible coefficient of thermal expansion, and constantan (nickel, 45%; copper, 55%), which has a negligible thermal coefficient of electrical resistance.

COMPOUNDS

Nickel Oxides.—Several oxides of nickel are known. The *monoxide*, NiO, occurs naturally as bunsenite, and is obtained artificially when nickel hydroxide, carbonate, nitrate or sulphate is heated. It may also be prepared by the action of nickel on water, by the reduction of the oxide Ni_2O_3 with hydrogen at about 200° C., or by heating nickel chloride with sodium carbonate and extracting the fused mass with water. It is a green powder which becomes yellow when heated. It dissociates at a red heat, and is readily reduced to the metal when heated with carbon or in a current of hydrogen. It is readily soluble in acids, forming salts. The *hydroxide*, $Ni(OH)_2$, is obtained in the form of a greenish amorphous powder when nickel salts are precipitated by the caustic alkalis. It is readily soluble in acids and in an aqueous solution of ammonia. Nickel sesquioxide, Ni_2O_3, is formed when the nitrate is decomposed by heat at the lowest possible temperature. It is a black powder, the composition of which is never quite definite, but approximates to the formula given above. When heated with oxy-acids it dissolves, with evolution of oxygen, and with hydrochloric acid it evolves chlorine. Numerous hydrated forms of the oxide have been described. A *peroxide*, NiO_2, has been obtained as a salt of barium, $BaO{\cdot}2NiO_2$, by heating the monoxide with anhydrous baryta in the electric furnace. G. Pellini and D. Meneghini obtained a greyish green powder by adding an alcoholic solution of potassium hydrate to nickel chloride and hydrogenperoxide at −50°. It has all the reactions of hydrogenperoxide and S. Tanatar regards it as $NiO{\cdot}H_2O_2$. An oxide, Ni_3O_4, has been obtained by heating nickel chloride in a current of moist oxygen at about 400° C., or by heating the sesquioxide in hydrogen at 190° C. The former method yields greyish, metallic-looking, microscopic crystals, the latter a grey amorphous powder. A hydrated form, $Ni_3O_4{\cdot}2H_2O$, is obtained when the monoxide is fused with sodium peroxide at a red heat, and the fused mass extracted with water.

Nickel Salts.—Only one series of salts is known, namely those corresponding to the monoxide. In the anhydrous state they are usually of a yellow colour, whilst in the hydrated condition they are green. They may be recognized by the brownish violet colour they impart to a borax bead when heated in an oxidizing flame. The caustic alkalis added to solutions of nickel salts give a pale green precipitate of the hydroxide, insoluble in excess of the precipitant. This latter reaction is hindered by the presence of many organic acids (tartaric acid, citric acid, etc.). Potassium cyanide gives a greenish yellow precipitate of nickel cyanide, $Ni(CN)_2$, soluble in excess of potassium cyanide, forming a double salt, $Ni(CN)_2{\cdot}KCN$, which remains unaltered when boiled with excess of potassium cyanide in presence of air (*cf.* COBALT). Ammonium sulphide precipitates black nickel sulphide, which is somewhat soluble in excess of the precipitate (especially if yellow ammonium sulphide be used), forming a dark-coloured solution. Ammonium hydroxide gives a green precipitate of the hydroxide, soluble in excess of ammonia, forming a blue solution. Numerous methods have been devised for the separation of nickel and cobalt, the more important of which are:—the cobaltinitrite method in which the cobalt is precipitated in the presence of acetic acid by means of potassium nitrite (the alkaline earth metals must not be present); the cyanide method, in which the two metals are precipitated by excess of potassium cyanide in alkaline solution, bromine being afterwards added and the solution warmed, when the nickel is precipitated; the dimethyl glyoxime method, whereby nickel is precipitated as $Ni(C_4H_7O_2N_2)_2$, a scarlet flocculent compound stable at 120° C. Similar separations are based on the insoluble cobalt compound of nitroso-β-naphthol, $C_{10}H_6(NO){\cdot}OH$, and on the insoluble compound $Ni(C_2H_5ON_4)_2{\cdot}2H_2O$, formed by nickel with dicyanodi-amidine.

Nickel Fluoride, NiF_2, obtained by the action of hydrofluoric acid on nickel chloride, crystallizes in yellowish green prisms which volatilise above 1,000° C. It is difficultly soluble in water, and combines with the alkaline fluorides to form double salts. *Nickel chloride*, $NiCl_2$, is obtained in the anhydrous condition by heating the hydrated salt to 140° C., or by gently heating the finely divided metal in a current of chlorine. It readily sublimes when heated in a current of chlorine, forming golden yellow scales. It is easily reduced when heated in hydrogen. It forms crystalline compounds with ammonia and the organic bases. It is soluble in alcohol and in water. Three hydrated forms are known, viz., a mono-, di- and hexa-hydrate, the last being the form usually obtained by the solution of the oxide or carbonate in hydrochloric acid. *Nickel chloride ammonia*, $NiCl_2{\cdot}6NH_3$, is obtained as a white powder when anhydrous nickel chloride is exposed to the action of ammonia gas, or in the form of blue octahedra by evaporating a solution of nickel chloride in aqueous ammonia. When heated to 100° C. it loses four molecules of ammonia (*see* AMMINES). Numerous double chlorides of nickel and other metals are known. The *bromide* and *iodide* of nickel resemble the chloride and are prepared in a similar fashion.

Several sulphides of the element have been obtained. The monosulphide, NiS, is obtained by heating nickel with sulphur, by heating the monoxide with sulphuretted hydrogen to a red heat, and by heating potassium sulphide with nickel chloride to 160–180° C. When prepared by dry methods it is an exceedingly stable, yellowish, somewhat crystalline mass. When prepared by the precipitation of nickel salts with alkaline sulphide in neutral solution it is a greyish black amorphous compound which readily oxidizes in moist air, forming a basic nickel sulphate. The freshly precipitated sulphide is somewhat soluble in hydrochloric acid and yellow ammonium sulphide. Nickel sulphate, $NiSO_4$, is obtained anhydrous as a yellow powder when any of its hydrates are heated. When heated with carbon it is reduced to the metal. It forms hydrates containing one, two, five, six and seven molecules of water. The heptahydrate is obtained by dissolving the metal or its oxide, hydroxide or carbonate in dilute sulphuric acid (preferably in the presence of a small quantity of nitric acid), and allowing the solution to crystallize between 15° and 20° C. It crystallizes in emerald green rhombic prisms and is moderately soluble in water. It effloresces gradually on exposure to air and passes into the hexahydrate. It loses four molecules of water of crystallization when heated to 100° C. and becomes anhydrous at about 300° C. Nickel sulphate combines with many metallic sulphates to form double salts, and also forms additional compounds with ammonia, aniline and hydroxylamine. The *nitrate*, $Ni(NO_3)_2{\cdot}6H_2O$, is obtained by dissolving the metal in dilute nitric acid and concentrating the solution between 40° and 50° C. It crystallizes in green prisms which deliquesce rapidly on exposure to moist air.

Nickel Carbonyl, $Ni(CO)_4$, is obtained as a colourless mobile liquid by passing a carbon monoxide over reduced nickel, at a temperature of about 80° C. (*see* above). It boils at 43° C. (751 mm.), and sets at −25° C. to a mass of crystalline needles. It is readily soluble in hydrocarbon solvents, in chloroform and in alcohol. Its critical pressure is 30 atmospheres and its critical temperature is in the neighbourhood of 195° C. It decomposes

with explosive violence when heated rapidly, and is decomposed by the halogens (dissolved in carbon tetrachloride) with liberation of carbon monoxide and formation of a nickel halide. With aromatic hydrocarbons in the presence of anhydrous aluminium chloride, in the cold, there is a large evolution of hydrochloric acid gas, and an aldehyde is formed; at 100° C., on the other hand, anthracene derivatives are produced. Thus by using benzene, benzaldehyde and anthracene are obtained. *Nickel carbonate*, $NiCO_3$, is obtained in the anhydrous state by heating nickel chloride with calcium carbonate in a sealed tube to 150° C. It crystallizes in microscopic rhombohedra insoluble in cold acids. By precipitation of nickel salts with solutions of the alkaline carbonates, basic carbonates of variable composition are obtained. (X.)

PRODUCTION

The world's chief source of nickel is Canada: in 1913 she contributed 69% of the world's production. The heavy World War demand caused the Canadian output to increase, and by 1918 it had risen from 20,000 tons in 1914 to 41,000 tons in 1918, which latter figure represented 87% of the world's production for that year. The highest percentage was reached in 1920, when Canada produced 88% of the world's supply. As a result of the market being congested with large stocks and accumulated scraps at the end of the war, Canadian production declined, reaching its lowest ebb in 1922, when less than 8,000 tons of Canadian nickel were mined. When the congested supplies had been absorbed, the industry quickly revived; demand soon exceeded production, and a steadily increasing output has since been maintained. The world's output in 1923 was estimated at about 30,000 tons, of which approximately 27,000 tons were produced from the nickel mines in Canada, including a relatively small quantity of nickel recovered as a by-product from the cobalt-silver ores in that Dominion.

With regard to foreign producers of nickel, the most important is the island of New Caledonia, a French possession about 1,250 m. north-east of Australia. This island's output, in spite of the increased demand for the metal between 1914 and 1918, has since then gradually fallen, being in 1921 only about 14% of the world's output. Norway, which in the earliest days of the industry held a monopoly of the world's supply, closed down her mines in 1921 for economic reasons. In the United States the nickel deposits are nowhere being worked for the metal, though a small quantity is incidentally recovered there each year in the process of electrolytic refining of blister copper. Under the exigencies of war Germany produced from her own low-grade mines a small tonnage of nickel ore, but since the close of hostilities she has reverted to the practice of importing refined metal. Besides the above, there have been obtained from time to time small supplies of ore from Greece, Tasmania, Sweden, etc.

Practically the whole of the Canadian output is obtained from the Sudbury district in the Province of Ontario, relatively small quantities being obtained from the deposits 150 m. due north of Sudbury in the Temiscaming district, and from the cobalt-silver area in the same province. Other occurrences are known in the townships of MaCart, Munro, Strathy and near Lake Shebendowan in the district of Thunder Bay, Ontario, and nickeliferous pyrrhotite associated with copper occurs in the Gabbro copper mines, Vancouver Island, British Columbia.

World's Production of Nickel Ore

Long Tons

	1913	1918	1923‡	1925
Canada	22,177	41,298	27,881	32,972***
Germany	267	1,841	3**	..
Greece	943	658	..	..
Norway	492	238	61	..
Sweden	..	24	..	..
New Caledonia*	8,098	2,666	2,624	3,320
United States†	214	394	89	243

*Exports.
†Produced as by-product in electrolytic refining of copper.
**Ore, nickel content not stated.
‡Italy produced 44 tons in this year and 6 tons in 1925.
***This figure is not comparable with the preceding columns owing to the adoption of a new method of computing the metal content of ores.

For nickel plating *see* ELECTRO-PLATING.

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NICKEL-CHROMIUM STEEL, an alloy of iron, nickel, chromium and carbon. Nickel strengthens the alloy and increases its toughness. Chromium unites first with the carbon to form complex carbides, and forms a material that, after quenching even at a slow rate, is hard both at the surface and inside. The two elements in one steel seem to intensify these respective effects, and after proper heat treatment produce unexampled alloys, strong, hard, tough, with great resistance to shock, penetration and repeated stresses. Nickel-chromium steel for armour plate is made as follows: a steel ingot containing 0·40% carbon, 3·75 to 4·0 nickel and 1·5 to 2·0 chromium after forging into a thick slab is placed in a carbonizing furnace, covered with a pile of charcoal and heated for several days until the steel at the surface has absorbed an additional 1% carbon, gradually tapering off to the original content at a depth of about 1¼ inches. It is later given a complex heat treatment designed to produce maximum toughness at the back and maximum hardness at the carbonized surface. Even more intricate and skilful heat treatment is required for armour-piercing shells, with their glass hard piercing point (often protected by a soft wrought iron cap) and a tough body which will retain its shape and contents of high explosive even after passing through a 12 in. plate. Such alloy steels must be very carefully made of clean raw materials—acid open-hearth and electric furnaces are preferred (although American armour is usually basic steel). Since chromium is oxidized readily, and its oxides are quite detrimental to the steel, the ferro-chromium is added near the end of the heat after the bath has been thoroughly deoxidized. Ingots are cast of cool metal, stripped and placed in soaking pits as soon as possible. Air-hardening steels such as these are "tender" in the ingot; surface cracks are frequent and must be carefully chipped out of the billet. Reheating of large masses must be very deliberate to avoid interior cracks.

Nickel-chromium steels now hold first place in use in the United States for important parts which are to be case-hardened, or for highly stressed forgings. About 2½ times as much nickel as chromium seems to withstand best the normal variations in commercial heat treatments. Some 15 analyses current in the United States fall within the following ranges:—

	Society of Automotive Engineers' Code No.	Chemical analysis		
		Carbon	Nickel	Chromium
	series			
Low alloy	3,100	0·10 to 0·45	1·0 to 1·5	0·45 to 0·75
Medium alloy	3,200	0·10 to 0·55	1·5 to 2·0	0·90 to 1·25
High alloy	3,300	0·07 to 0·45	3·25 to 3·75	0·25 to 1·75

During carburization of a nickel-chromium steel the carbon penetrates deeper than into a plain carbon steel or into simpler alloys. The gradation in carbon content from surface to interior is gradual, and thus avoids cracked or spalled surfaces during heat treatment or use. It is important that all nickel-chromium steels be cooled quickly after the drawing heats; air or furnace cooling is liable to cause them to lose their toughness.

Series 3100 with carbon about 0·35% is used for high quality

forgings, because it can be water quenched from a fairly wide temperature range and is somewhat cheaper than the 3½% nickel steel (*q.v.*). After a deliberate drawing operation such forgings machine easily and uniformly. Principal uses are for automobile steering knuckles, connecting rods, crank and drive shafts, axes, chisels and locomotive and car axles. Physical properties of medium size forgings after the respective draws are:

	Drawn at 600° F	Drawn at 900° F	Drawn at 1,200° F
Ultimate strength, lb. per sq.in.	230,000	165,000	115,000
Elastic limit, lb. per sq.in.	200,000	145,000	95,000
Elongation, per cent	10	15	22
Reduction in area per cent	32	50	61
Brinell hardness	430	320	230

The excellence of these steels is more than is indicated in the above table, for they have great toughness against repeated shock.

Heat-treated castings have given satisfaction when made of about 0·45% carbon, 2·6 nickel and 0·75 chromium. They can compete with cast manganese steel for street railroad crossings and special track-work because they are about as durable under traffic, cheaper and can be machined in the usual way. Joints can be welded satisfactorily with thermit and the battered points rebuilt by fusion welding. An important European use of such material in hardened and tempered condition is for railroad car couplings.

Since 1925 a considerable demand has arisen from the chemical industry for metals which will withstand corrosive action at high heat and pressure when used in the synthesis of nitrates or solvents, and for gasolene "cracking." Among other materials used for such service are the following austenitic nickel-chromium steels:

Chemical composition			Izod impact strength ft.-lb.
Carbon	Nickel	Chromium	
0·15	10·9	14·8	110
0·14	7·9	18·1	110
0·25	5·8	21·0	84

Such materials are noted for great toughness and easy workability; they are permanently soft, and do not air harden after any local heating during fabrication or use. They resist scaling at high temperature well, but if they must bear heavy loads at high heats, tungsten is added to their composition. (*See* ALLOYS; IRON AND STEEL.) (E. E. T.)

NICKEL SILVER. An alloy of nickel, copper and zinc, also known as German silver or argentan. The proportions of the three metals used in the alloy vary greatly in different grades, a good quality, as specified by a British government department, having 19% nickel, 59% copper and 22% zinc. Nickel silver is used as the base of the best silver-plated ware, and is also used unplated for cheap table-ware and ornaments.

NICKEL STEEL, an alloy of iron, carbon and nickel; nickel primarily conferring toughness. Research and experience gained with ordnance steels resulted in the present large use of alloy steels for making case hardened parts, for high strength castings, boiler plate, bridge steel, forgings and for special electrical alloys. High grade nickel steel is made in the acid open-hearth furnace. Nickel oxide is not stable at any stage of the process, consequently nickel in the scrap steel charged is completely recovered and the shot nickel needed for correct analysis may also be added at any time. In the World War many firms had difficulty in making this steel in basic open-hearth furnaces, probably due to inclusions of oxide particles. Surface conditions of a nickel steel ingot, slab and forging are especially important. Smooth ingot moulds with fluted walls, scrupulously clean, filled without splashing of the metal, and with hot tops are necessary to avoid later trouble. Ingots are stripped as soon as solidified and placed immediately in a hot soaking pit. The billet or slab must be cleaned during rolling of an unusually adherent scale by water sprays, salt or water-soaked burlap caught between the rolls and the hot metal. Billets are cooled, any surface defects chipped out, then reheated slowly in a smoky flame and rolled to final dimensions. Boiler plate or structural steel to be used without heat treatment must be finished slightly above the transformation range, and slowly cooled in a pile protected from drafts. Steel forgings with 3½% nickel should be sand-blasted, pickled or machined all over before final heat treatment if uniform hardness at the surface is a requisite.

Nickel (*a*) forms a solid solution with either gamma or alpha iron; (*b*) strengthens and toughens this solid solution; (*c*) slows down the speed of the carbon reactions, and reduces the temperature at which they occur; (*d*) refines the grain in quenched and tempered steel; (*e*) prevents grain growth at elevated temperature. These effects are a desirable combination in the use of nickel steels for case-hardening purposes. The following represent the wide range of these steels used in the United States:—

	Low nickel		Medium nickel	High nickel
	A	B	C	D
	%	%	%	%
Carbon	0·10–0·20	0·15	0·10–0·20	Max 0·17
Manganese	0·30–0·60	0·30–0·60	0·30–0·60	0·30–0·60
Nickel	0·40–0·60	1·25–1·75	3·25–3·75	4·50–5·25
Molybdenum	..	0·25	..	..

Steel A is used for parts requiring moderate quality; oil quenching from the carbonizing pot will give a tough core and a file-hard case. Steel B is given a complex heat treatment and used for roller bearing races. Steel C is used for important and highly stressed parts, such as clash gears and cam shafts, and is heat-treated in a variety of ways depending upon the required combination of surface hardness, toughness of core and constancy of dimension. Steel D is hard to work, either hot or cold, but after proper case hardening gives gears and like parts having extreme hardness and resistance to shock.

Probably a greater tonnage of steel containing 3 to 3·5% nickel and 0·20 to 0·55% carbon is made than any other class of alloy; it goes into heat-treated forgings, heat-treated castings and high strength structural and boiler steels. A 0·45% carbon, 3·5% nickel steel forging of moderate size oil quenched from 1,450° F will have the following properties after the respective draws:—

	Drawn at 600° F	Drawn at 900° F	Drawn at 1,200° F
Ultimate strength	230,000	160,000	118,000
Elastic limit	210,000	150,000	100,000
Elongation in 2 inches	13	18	25
Reduction of area	43	57	63
Birnell hardness	450	320	240

Annealed eye-bar tension members (carbon 0·37%, nickel 3·3%) were first used in 1902 on a cantilever bridge across the East river, New York. The physical properties of this material in 16 by 2½ in. bars were:—

	Specified minimum	Average
Ultimate strength	85,000	95,000
Elastic limit	45,000	55,000
Elongation in 8 inches	..	23
Elongation in 18 feet	9	..

Design stresses on this bridge were 30,000 lb. per square inch; 50% more than customary for regular carbon steel eye-bars. Structural shapes with slightly lower carbon have been used in many long bridges since then.

High-pressure locomotive boilers of nickel steel are used on Canadian and American railroads. Properties in comparison with plain carbon steel boiler plate follow:—

Physical properties	Nickel steel	Carbon steel
Ultimate strength, lb. per sq.in.	77,880	59,200
Yield point, lb. per sq.in.	47,550	36,200
Elongation in 8 in. per cent	26·3	28·6
Izod impact, ft.-lb.	63·4	..

Some high nickel alloys with iron have interesting properties. "Platinite" (46% nickel) has the same coefficient of expansion as glass, and is used for lead-in wires in electric light globes and radio tubes. "Nickeloy" (50% nickel) has high magnetic permeability, and is used for radio transformer cores. Permalloy (78% nickel) is discussed under TELEPHONE; and ALLOYS. Invar (35% nickel) is treated under INVAR. (*See* MANGANESE STEEL; ALLOYS; IRON AND STEEL.) (E. E. T.)

NICOBAR ISLANDS, a British group of twelve inhabited and seven uninhabited islands in the Bay of Bengal, between Sumatra and the Andaman Islands, to which latter they are administratively appended. They have an aggregate area of about 2,508 sq.m., Great Nicobar (*Loöng*), the largest and southernmost of any size, covering 333 sq.m. A careful census of the natives, taken by R. F. Lowis in 1911, gave a total population of 8,818. Car Nicobar (*Pu*), the most northerly island, with an area of 49 sq.m., was by far the most densely populated. The marine surveys of these islands are still meagre and unsatisfactory, but the whole of the Nicobars and outlying islands were surveyed topographically by the Indian Survey Department in 1886–1887. Some of the islands have mere flat, coral-covered surfaces; others, again, are hilly, the Great Nicobar rising to 2,105 ft. On that island there are considerable and beautiful streams, but the others generally are badly off for fresh surface water. There is one good harbour, a magnificent land-locked shelter called Nankauri Harbour.

Geology.—The Nicobars form part of a great submarine chain, of which the Andamans are a continuation. Elaborate geological reports were issued by a Danish scientific expedition in 1846 and an Austrian expedition in 1858. Dr. Rink of the former considered that the islands belong to the Tertiary age. Von Hochstetter of the Austrian expedition classified the most important formations thus: eruptive, serpentine and gabbro; marine deposits, probably late Tertiary, consisting of sandstones, slates, clay, marls, and plastic clay; recent corals. He considered the whole group connected geologically with the great islands of the Malay Archipelago farther south. Earthquakes of great violence were recorded in 1847 and 1881 (with tidal wave), and mild shocks were experienced in December 1899.

The climate is unhealthy for Europeans. The islands are exposed to both monsoons, and smooth weather is only experienced from February to April, and in October. Rain falls throughout the year, generally in sharp, heavy showers. The rainfall varies from 90 to 135 in., and the shade temperature from 64° to 92° F.

Flora and Fauna.—The vegetation of the Nicobars has not been subjected to a systematic examination by the Indian Forest Department like that of the Andamans, and indeed the forests are quite inferior in economic value to those of the more northerly group; besides fruit trees—such as the coco-nut (*Cocos nucifera*), the betel-nut (*Areca catechu*), and the mellori (*Pandanus leeram*)—a thatching palm (*Nipa fruticans*) and various timber trees have some commercial value, but only one timber tree (*Myristica irya*) would be considered first-class in the Andamans. The palms of the Nicobars are, however, exceedingly graceful. The mammals are not numerous. In the southernmost islands are a small monkey, rats and mice, tree-shrews (*Cladobates nic.*), bats, and flying-foxes, but it is doubtful if the "wild" pig is indigenous; cattle, when introduced and left, have speedily become "wild." There are many kinds of birds, notably the megapod (*Megapodius nic.*), the edible-nest-building swift (*Collocalia nidifica*), the hackled and pied pigeons (*Calaenas nic.* and *Carpophaga bicolor*), a paroquet (*Palaeornis caniceps*) and an oriole (*Oriolus macrourus*). Fowls, snipe and teal thrive after importation or migration. Reptiles—snakes, lizards and chameleons, crocodiles, turtles and an enormous variant of the edible Indian crab—are numerous; butterflies and insects, the latter very troublesome, have not yet been systematically collected. The fresh-water fish are reported to be of the types found in Sumatra.

Natives.—The Nicobarese may be best described as a Far Eastern race, having generally the characteristics of the less civilized tribes of the Malay Peninsula and the south-eastern portion of the Asiatic continent, and speaking varieties of the Mon-Annam group of languages, though the several dialects that prevail are mutually unintelligible. Though short according to the standard of whites (average height, man, 5 ft. 3¾ in.; woman, 5 ft.), the Nicobarese are a fine, well-developed race, and live to seventy or eighty years of age. Their mental capacity is considerable, though there is a great difference between the sluggish inhabitant of Great Nicobar and the keen trader of Car Nicobar. The religion is an undisguised animism, and all their frequent and elaborate ceremonies and festivals are aimed at exorcising and scaring spirits. On the whole the Nicobarese are a quiet, inoffensive people, friendly to each other, and not quarrelsome, and by inclination friendly and not dangerous to foreigners. Such government as there is, is by the village. The clothing, when not a caricature of European dress, is of the scantiest, and the waggling tags in which the loin-cloths are tied behind gave rise to fanciful stories that the inhabitants were naked and tailed. The houses are good, and often of considerable size. The natives are skilful with their lands, and though they never cultivate cereals, exercise some care and knowledge over the coco-nut and tobacco, and have had much success with the foreign fruits and vegetables introduced by the missionaries. The staple article of trade has always been the ubiquitous coco-nut, of which it is computed that 15 million are produced annually. There is an old-established internal trade, chiefly between the older islands and Chowra, for pots (which are only made there) and racing and other canoes.

History.—The situation of the Nicobars along the line of a very ancient trade route has caused them to be reported by traders and seafarers through all historical times. In the 17th century the islands began to attract the attention of missionaries. At various times France, Denmark, Austria and Great Britain all had more or less shadowy rights to the islands, the Danes being the most persistent in their efforts to occupy the group, until in 1869 they relinquished their claims in favour of the British, who at once began to put down the piracies of the islanders, and established a penal settlement, which was withdrawn in 1888. There are native agencies at Nankauri and on Car Nicobar, both of which places are gazetted ports. At the latter is a Church of England mission station under an Indian catechist.

Ethnology.—The Nicobarese inhabitants are probably of mixed Malay and Indonesian origin, with hair generally straight, sometimes wavy. The Shom Pen tribe of Great Nicobar differs from or perhaps is merely purer blooded than the coastal tribes. The use of cloth waist-belts with the end pulled between the legs under the belt, behind which it hangs down at the back has given rise to stories of tailed men. There are six tribes said, like the sexes, to be distinguishable by their smell, the natives of Chowra being malodorous on account of eating dog flesh. The marriage tie is loose, the *couvade* (*otô*) is practised, the head is flattened in infancy, the teeth blackened and the ears distended. Betel is chewed, pandanus fruit used as food, and the people dislike milk. Pigs and fowls are fed on coco-nut. Houses are built on piles; a benign Creator is believed in; disease is ascribed to sorcerers and treated by expulsion of devils or by pretended extraction of foreign matter palmed by the sorcerer. Villages are protected by scare-devils. The cross-bow is used.

See E. H. Man, *The Nicobar Islanders* (Journal of the Royal Anthrop. Inst., 1889); Kloss, *In the Andaman and Nicobar* (1903); Whitehead, *In the Nicobar Islands* (1924).

NICOLAI, CHRISTOPH FRIEDRICH (1733–1811), German author and bookseller, was born on March 18, 1733 at Berlin, son of the well-known bookseller, Christoph Gottlieb Nicolai (d. 1752). Nicolai's *Briefe über den jetzigen Zustand der schönen Wissenschaften in Deutschland*, published anonymously in 1755 and reprinted by G. Ellinger in 1894, were directed against both Gottsched and Gottsched's Swiss opponents, Johann Jakob Bodmer and Johann Jakob Breitinger; his enthusiasm for English literature won for him the friendship of Lessing and Moses Mendelssohn. In association with Mendelssohn he established in 1757 the *Bibliothek der schönen Wissenschaften;* and with Lessing and Mendelssohn *Briefe, die neueste Literatur betreffend* (1759); from 1765 to 1792 he edited the *Allgemeine deutsche Bibliothek.* The *Bibliothek* served as the organ of the so-called

"popular philosophers," who warred against authority in religion and against what they conceived to be extravagance in literature, and Nicolai showed a complete incomprehension of the new movement of ideas represented by Herder, Goethe, Schiller, Kant and Fichte. He died in Berlin on Jan. 11, 1811.

See his *Bildniss und Selbstbiographie* ed. M. S. Löwe in the *Bildnisse jetzt lebender Berliner Gelehrter*, in 1806. *See* also L. F. G. von Göckingk, *F. Nicolai's Leben und literarischer Nachlass* (1820); J. Minor, *Lessings Jugendfreunde*, in J. Kürschner's *Deutsche Nationallitteratur*, vol. lxxii. (1883); M. Sommerfeld, *F. Nicolai und der Sturm und Drang* (Halle, 1921).

NICOLAÏ, OTTO (1810–1849), German composer, was born on the 9th of June in Königsberg. He studied music in Berlin and in 1833 became organist to the German embassy in Rome. There his operas *Enrico II.* (1839) and *Il Templario* (1840) were produced, besides some church music, a series of songs, and a number of compositions for the pianoforte. He was Kapellmeister of the court opera in Vienna from 1841 to 1847, when he was appointed Hof Kapellmeister at the Berlin Opera House. There, only two days before he died (on the 11th of March, 1849), was performed his famous opera, *The Merry Wives of Windsor*.

NICOLAS, SIR NICHOLAS HARRIS, G.C.M.G., 1840 (1799–1848), English antiquary, fourth son of John Harris Nicolas (d. 1844), was born at Dartmouth on the 10th of March 1799. Having served in the navy from 1812 to 1816, he studied law and was called to the bar at the Inner Temple in 1825. His work as a barrister, however, was confined principally to peerage cases before the House of Lords, and his time was mainly devoted to genealogical and historical studies. He died near Boulogne on Aug. 3, 1848.

The most important of the works of Nicolas is his *History of the Orders of Knighthood of the British Empire; of the Order of the Guelphs; and of Medals, Clasps, etc., for Naval and Military Services* (1841–42).

See E. S. P. Haynes, *Personalia* (1918).

NICOLAUS DAMASCENUS, Greek historian and philosopher of Damascus, flourished in the time of Augustus and Herod the Great, with both of whom he was on terms of friendship. He instructed Herod in rhetoric and philosophy, and had attracted the notice of Augustus when he accompanied his patron on a visit to Rome. Later, when Herod's conduct aroused the suspicions of Augustus, Nicolaus was sent on a mission to bring about a reconciliation. He survived Herod, and it was through his influence that the succession was secured for Archelaus; but the date of his death, like that of his birth, is unknown. Fragments of his universal history (Ἱστορία καθολική), from the time of the Assyrian empire to his own days, his autobiography, and his life of Augustus (Βίος Καίσαρος) have been preserved, chiefly in the extracts of Constantine Porphyrogenitus.

Fragments in C. Müller, *Fragmenta historicorum Graecorum*, iii.; *see* also F. Navet, *Nikolaus von Damascus* (1853), containing an account of his life and writings, and translation of the fragments.

NICOLAUS OF LYRA (*c.* 1265–1349), French commentator, was born in Lire, now Vieille-Lyre (Eure). He entered the Franciscan order at Verneuil about 1300, and studied at Paris, where, becoming a doctor some time before 1309, he taught for many years. From 1319 he was provincial of his order in France, and was present in that capacity at the general chapter at Pérouse (1321). In 1325 he was provincial of Burgundy, and as executor of the estate of Jeanne of Burgundy, widow of King Philip VI., he founded the college of Burgundy at Paris, where he died in the autumn of 1349, being buried in the chapter hall of the convent of the Cordeliers.

Among the authentic works of Nicolaus of Lyra are: (1) two commentaries on the whole Bible, one (*Postilla litteralis*, 1322–31) following the literal sense, the other (*Postilla mystica seu moralis*, 1339) following the mystic sense. There are numerous editions (Rome, 1471–72; Douai, 1617; Antwerp, 1634). (2) *Tractatus de differentia nostrae translationis* (*i.e.*, Vulgate) *ab Hebraica veritate*, 1333. (3) Two treatises against the Jews. (4) A theological treatise on the Beatific Vision, directed against pope John XXII. (1334), unpublished. (5) *Contemplatis de vita S. Francisci*, a book of devotions.

In addition to the notices in Wadding, du Moustier, Sbaraglia and Fabricius, *see* C. Siegfried, in *Archiv. f. wissenschaftliche Erforschung des A.T.*, vols. i., ii.; A. Merx, *Die Prophetie des Joel und ihre Ausleger* (1879, pp. 305–366); M. Fischer in *Jahrbücher f. protestantische Theologie*, xv.; F. Maschkowski, in *Zeitschrift f. alttestamentliche Wissenschaft*, xv.; Neumann in *Revue des études juives*, vols. 26 and 27; H. Labrosse in *Positions des thèses de l'École des Chartes* (1906).

NICOLE, PIERRE (1625–1695), one of the most distinguished of the French Jansenists, was the son of a provincial barrister, and was born at Chartres. Sent to Paris in 1642 to study theology, he soon entered into relations with the Jansenist community at Port Royal (*q.v.*) through his aunt, Marie des Anges Suireau, who was for a short time abbess of the convent. For some years he was a master in the "little school" for boys established at Port Royal, and taught Greek to young Jean Racine, the future poet. With Antoine Arnauld, he acted as general editor of the controversial literature put forth by the Jansenists. He had a large share in collecting the materials for Pascal's *Provincial Letters* (1656); in 1658 he translated the *Letters* into Latin, under the pseudonym of Nicholas Wendrock. In 1664 he himself began a series of letters, *Les Imaginaires*, intended to show that the heretical opinions commonly ascribed to the Jansenists really existed only in the imagination of the Jesuits. His letters being violently attacked by Desmaretz de Saint-Sorlin, an erratic minor poet who professed great devotion to the Jesuits, Nicole replied to him in another series of letters, *Les Visionnaires* (1666). In the course of these he observed that poets and dramatists were no better than "public poisoners."

About the same time Nicole became involved in a controversy about transubstantiation with the Huguenot Claude; out of this grew a massive work *La Perpétuité de la foi de l'église catholique touchant l'eucharistе* (1669), the joint effort of Nicole and Antoine Arnauld. But Nicole's most popular production was his *Essais de morale* (14 vols., 1671 *seq.*), a series of short discussions on practical Christianity. In 1679, on the renewal of the persecution of the Jansenists, Nicole was forced to fly to Belgium in company with Arnauld. But the two soon parted. Nicole was elderly and in poor health; the life of a fugitive was not to his taste, and he complained that he wanted rest. "Rest," answered Arnauld, "when you have eternity to rest in!" In 1683 Nicole made a rather ambiguous peace with the authorities. and was allowed to come back to Paris. There he continued his literary labours; he was writing a refutation of the new heresy of the Quietists when death overtook him on Nov. 16, 1695. (*See* PORT ROYAL.)

Several abridgments of the *Essais* exist, notably a *Choix des essais de morale de Nicole*, ed. Silvestre de Saci (1857).

Nicole's life is told at length in the 4th volume of Sainte Beuve's *Port-Royal*.

NICOLL, ROBERT (1814–1837), Scottish poet, was born on Jan. 7, 1814, at the farm of Little Tullybeltane, in the parish of Auchtergaven, Perthshire. At sixteen the boy was apprenticed to a grocer and wine-merchant at Perth. In 1833 he began to contribute to *Johnstone's Magazine* (afterwards *Tait's Magazine*), and in the next year his apprenticeship was cancelled. In 1836 he became editor of the *Leeds Times*. He died at the house of his friend William Tait, at Trinity, near Edinburgh, on Dec. 7, 1837, in his twenty-fourth year. He had published a volume of *Poems* in 1835; and in 1844 appeared a further volume, *Poems and Lyrics*, with an anonymous memoir of the author by Mrs. C. I. Johnstone. The best of his lyrics are those written in the Scottish dialect.

See P. R. Drummond, *Life of Robert Nicoll, Poet* (1884).

NICOLL, SIR WILLIAM ROBERTSON (1851–1923), Scottish Nonconformist divine and man of letters, was born at Auchindoir, Aberdeenshire, on Oct. 10, 1851, the son of a Free Church minister. He graduated M.A. at Aberdeen in 1870, and studied for the ministry at the Free Church college there until 1874, when he was ordained minister of the Free church at Dufftown. Three years later he moved to Kelso, and in 1884 became editor of the *Expositor*. In 1886 he founded the *British Weekly*, a Nonconformist organ which obtained great influence over opinion in the free churches. Robertson Nicoll helped to make the fortunes of the paper by the papers which he contributed over the signature of "Claudius Clear." He also founded and edited the *Bookman* (1891, etc.), and acted as chief literary adviser to the publishing firm of Hodder and Stoughton. He edited *The*

Expositor's Greek Testament (1897, etc.), and a series of *Contemporary Writers* (1894, etc.), and *Literary Lives* (1904, etc.). He was knighted in 1909, and died on May 4, 1923.

NICOLLS, RICHARD (1624–1672), American colonial governor, was born probably at Ampthill, Beds., England, in 1624. He commanded a royalist troop of horse during the Civil War, and on the defeat of the king went into exile. Soon after the Restoration he entered the service of the duke of York, through whose influence he was appointed in 1664 on a commission to conquer New Netherland from the Dutch and to regulate the affairs of the New England colonies and settle disputes among them. The expedition set sail from Portsmouth on May 25, 1664, and New Amsterdam was surrendered to Nicolls on Sept. 8. Under authority of a commission from the duke of York, Nicolls assumed the position of deputy governor of New Netherland (New York). His policy was vigorous but tactful, and the transition to the new regime was made smoothly and with due regard to the interests of the conquered people. The English system of law and administration was at once introduced into Long Island, Staten Island and Westchester, where the English element already predominated, but the change was made much more slowly in the Dutch sections. A code of laws, known as the "duke's laws," drafted by the governor with the help of his secretary, Matthias Nicolls (*c.* 1630–1687), was proclaimed in 1665 and continued in force until 1683. Nicolls returned to England in the summer of 1668 and continued in the service of the duke of York. He was killed in the naval battle of Southwold bay May 28, 1672.

See J. R. Brodhead, *History of the State of New York* (rev. ed., 1872); and Woodrow Wilson, *A History of the American People*, vol. i. (1902). For the "Duke's Laws" see *Laws of Colonial New York*, i. 6–100.

NICOMACHUS, a Neo-Pythagorean philosopher and mathematician, born at Gerasa in Arabia Petraea, flourished about 100 A.D. Two treatises by him are extant: (1) The *Introductio arithmetica* sets out the elementary theory and properties of numbers. Numbers are no longer denoted by lines as in Euclid, but are written in the ordinary notation; hence general principles can only be stated with reference to particular numbers taken as illustrations. Nicomachus states a rule about cubes which enables us to sum any number of forms of the series of natural cubes beginning from 1; otherwise the book is mathematically unimportant. It had, however, great vogue ("you count like Nicomachus" says a character in Lucian). A Latin translation by Apuleius of Madaura (born about 125 A.D.) is lost; but we have Boëtius's version. The commentators include Iamblichus, Heronas, Asclepius of Tralles, Joannes Philoponus, Proclus. The Greek text has been edited by R. Hoche (Teubner, 1866) and the commentaries of Iamblichus and Philoponus by Pistelli (Teubner, 1894) and Hoche (Leipzig, 1864, and Berlin, 1867) respectively. There is an elaborate English edition by F. E. Robbins and L. C. Karpinski (New York, 1926). (2) The *Enchiridion Harmonices* (edited by Jan in *Musici Scriptores Graeci*, 1895) is on the Pythagorean theory of music. Nicomachus is also said to have written *Theologumena arithmetices* (in two books) on the properties of numbers, of which the *Theologumena arithmeticae* edited by Ast (1817) contains no more than fragments, at most.

(T. L. H.)

NICOMACHUS, of Thebes, Greek painter, active *c.* 390–340 B.C., was a contemporary of the greatest painters of Greece; Vitruvius observes that if his fame was less than theirs, it was the fault of fortune rather than of demerit. Pliny (xxxv. 108) gives a list of his works; among them a "Rape of Persephone," "Victory in a Quadriga," a group of Apollo and Artemis, and the "Mother of the Gods seated on a Lion." Pliny tells us that he was a very rapid worker and used but four colours.

NICOMEDIA (mod. *Ismid*), an ancient town at the head of the Gulf of Astacus, which opens on the Propontis, was built in 264 B.C. by Nicomedes I. of Bithynia, and has ever since been one of the chief towns in this part of Asia Minor. It was the metropolis of Bithynia under the Roman empire (*see* NICAEA), and Diocletian made it the chief city of the East. Owing to its position at the convergence of the Asiatic roads to the new capital, Nicomedia retained its importance even after the foundation of Constantinople and its own capture by the Turks (1338).

NICOPOLIS ("Victory-City"), **ACTIA,** an ancient city of Epirus, founded 31 B.C. by Octavian (Augustus) in memory of his victory over Antony and Cleopatra at Actium. The colony, composed of settlers from many neighbouring towns, succeeded and became the capital of southern Epirus and Acarnania, with the right of sending five representatives to the Amphictyonic council. On the spot where Octavian's tent had stood he built a sanctuary to Neptune adorned with beaks of captured galleys, and instituted the Actian games in honour of Apollo. The city was restored by the emperor Julian, and again (after the Gothic invasion) by Justinian; but in the middle ages it was supplanted by Prevesa. The ruins, now known as Palaeoprevesa (Old Prevesa), lie about 3 m. north, on a small bay at the narrowest part of the peninsula which separates the Gulf of Arta (Sinus Ambracius) from the Ionian Sea. The most conspicuous objects are the acropolis, two theatres and an aqueduct.

NICOSIA, the capital of Cyprus, situated in the north central part of the island. Pop. (1911) 18,461. Its earliest name was Ledra, but Leucos, son of Ptolemy Soter (280 B.C.), is said to have changed its name to Leucotheon, corrupted into mediaeval Greek *Leucosia* and Frankish *Nicosia*. A mile south-west of the town lies the very large Bronze age necropolis known as Hagia Paraskevi. The principal monuments of the Lusignan period are the fine Gothic cathedral of St. Sophia, the church of St. Catherine, of the 14th century (both these are now mosques); and the church of St. Nicolas of the English (now a grain store), built for the Knights of St. Thomas of Acre; and the gateway of the Venetian palace of the 15th century. The circuit of the city was reduced in 1567, under the direction of the Venetian engineer, G. Savorgnano, from 9 m. to 3 m.; 80 churches and a number of fine houses were sacrificed. The new walls were given a circular shape, with 11 bastions and three gates. In 1571 Nicosia was besieged and taken by the Turks, but remains the principal centre of business and administration. Water is supplied by two aqueducts. The residence of the governor, the Government offices, museum, hospital, prison and English church are without the walls. The fosse has been planted, and part of it used as an experimental garden. The chief industries are tanning and hand weaving.

NICOSIA, city and episcopal see (since 1816), Sicily, province of Catania, 21 m. by road north of the railway station of Leonforte (which is 49 m. west of Catania), 2,840 ft. above sea-level. Pop. (1921) 14,586. The town retains a thoroughly mediaeval appearance, with a fine Norman cathedral and some other interesting churches, among them S. Maria Maggiore, with a reredos by Antonio Gagini. A Lombard dialect is still spoken here.

NICOTERA, GIOVANNI (1828–1894), Italian patriot and politician, was born at San Biagio on Sept. 9, 1828. Joining the party of Young Italy he was among the combatants at Naples in May 1848, and was at San Pancrazio with Garibaldi during the defence of Rome. After the fall of Rome he fled to Piedmont, where he organized the expedition to Sapri in 1857, but shortly after his arrival there he was defeated and severely wounded by the Bourbon troops. Condemned to death, but reprieved through the intervention of the British minister, he remained a prisoner at Naples and at Favignana until 1860, when he joined Garibaldi at Palermo. Sent by Garibaldi to Tuscany, he attempted to invade the Papal States with a volunteer brigade, but his followers were disarmed and disbanded by Ricasoli and Cavour. In 1862 he was with Garibaldi at Aspromonte; in 1866 he commanded a volunteer brigade against Austria; in 1867 he invaded the Papal States from the south, but the defeat of Garibaldi at Mentana put an end to his enterprise. His parliamentary career dates from 1860. During the first ten years he engaged in violent opposition, but from 1870 onwards he joined in supporting the military reforms of Ricotti. Upon the advent of the Left in 1876, Nicotera became minister of the interior, and governed with remarkable firmness. He was obliged to resign in December 1877, when he joined Crispi, Cairoli, Zanardelli and Baccarini in forming the "pentarchy" in opposition to Depretis, but he only returned to power thirteen years later as minister of the interior in the Rudini cabinet of

1891. On this occasion he restored the system of uninominal constituencies and resisted the socialist agitation. He fell with the Rudini cabinet in May 1892, and died at Vico Equense, near Naples, on June 13, 1894.

See V. Giordano, *La Vita ed i discorsi di Giovanni Nicotera* (Salermo, 1878); Mauro, *Biografia di Giovanni Nicotera* (Rome, 1886; German trans., Leipzig, 1886); and Mario, *In memoria di Giovanni Nicotera* (Florence, 1894).

NICOTIANA, a genus of plants of the nightshade family (Solanaceae), comprising about 45 species of herbs and shrubs, native chiefly to tropical America. They are strongly-scented, annuals or perennials, possessing narcotic-poisonous properties. They have alternate, simple, usually entire but sometimes wavy-margined, large leaves, and white, yellow, greenish or purple, fragrant flowers, with a long, tubular, five-lobed corolla, usually opening at night. Besides *N. Tabacum,* important as the source of commercial tobacco (*q.v.*), several other species are cultivated as ornamental plants. Some 10 species are found in the southern and western parts of the United States, *N. glauca* (tree tobacco) a slender evergreen shrub native to Brazil, has become widely naturalized on the Pacific coast. *N. rustica* (wild tobacco), still cultivated by the Indians of the eastern States, is of uncertain origin.

NICOTINE, a volatile liquid, is the principal alkaloid (*see* ALKALOIDS) of tobacco, in which it occurs to the extent of 4 to 5% along with minute amounts of closely related alkaloids. Nicotine is still used in medicine to a small extent, but the principal demand for it is as a horticultural insecticide. It is prepared by adding lime or caustic soda to a filtered, concentrated, aqueous extract of tobacco (stalk and other tobacco refuse is generally used) and recovering the alkaloid so set free, by extraction with a suitable solvent or by steam-distillation. This crude alkaloid is freed from water by a chemical drying agent, such as solid potash, and then fractionally distilled. Pure nicotine, $C_{10}H_{14}N_2$, is a highly poisonous colourless liquid, with an unpleasant odour; it boils at 246–274° C, $[\alpha]$, −168·5°, and is soluble in most solvents including water. The picrate crystallizes in short, yellow prisms, melts at 218° C and is characteristic of the alkaloid. Nicotine was synthesized in the year 1904 by Pictet, Crepieux and Rotschy.

NICTHEROY, a city of Brazil and capital of the State of Rio de Janeiro, on the E. shore of the Bay of Rio de Janeiro, opposite the city of that name. Pop. (including its municipal district), 1920, 86,238. A railway connects the city with the interior, with Macahé, on the coast, and with the lines of Minas Geraes. Nictheroy is practically a residential suburb of Rio de Janeiro. It occupies, in great part, the low alluvial plain that skirts the shores of the bay and fills the valleys between numerous low wooded hills. The site is shut off from the sea-coast by a range of high rugged mountains. The shore line of the bay is broken by large, deeply indented bays (that of Jurujuba being nearly surrounded by wooded hills), shallow curves and sharp promontories.

The city consists of a number of these partially separated districts—Praia Grande, São Domingos, Icarahy, Jurujuba, Santa Rosa, São Lourenço, Ponta d'Areia and Barreto—all together covering 8 or 9 m. of the shore. An electric street railway connects all the outlying districts with the ferry stations of Praia Grande and São Domingos. The city is characteristically Portuguese in the construction and style of its buildings—low, heavy walls of broken stone and mortar, plastered and coloured outside, with an occasional facing of glazed Lisbon tiles, and covered with red tiles. Among the public buildings are several churches and hospitals (including the Jurujuba yellow-fever hospital and the Barreto isolation hospital), the Government palace, a municipal theatre and a large Salesian college situated in the suburbs of Santa Rosa on an eminence overlooking the lower bay. Several large islands fill the upper bay near the eastern shore; some are used as coal deposits for the great steamship companies, and one (Flores) is used as an immigrants' depôt. Manufactures include cotton and woollen fabrics, tobacco, spirits, soap and tiles.

The first settlement on the east side of the Bay of Rio de Janeiro dates from 1671, when a chapel was erected at Praia Grande, in the vicinity of an Indian village. The settlement did not become a village until 1819, when it was named Villa Real da Praia Grande. In 1834 the city and municipal district of Rio de Janeiro were separated from the province, and Praia Grande became the capital of the latter in the following year. In 1836 it was raised to the dignity of a city and received the appropriate name of Nictheroy, from the Indian name *Nyterõi,* "hidden water." In the naval revolt of 1893–94 the older districts of the city suffered much damage from desultory bombardments, but the insurgents were too few to take possession. Soon afterwards the seat of government was removed to Petropolis, where it remained until 1903, when Nictheroy again became the capital of the State.

NIEBUHR, BARTHOLD GEORG (1776–1831), German statesman and historian, son of Karsten Niebuhr (*q.v.*), was born at Copenhagen on Aug. 27, 1776. After studying at the university of Kiel, he became private secretary to Count Schimmelmann, Danish minister of finance, but in 1799 entered the state service. He was chief director of the National Bank from 1804 to 1806 when he took a similar appointment in Prussia. He accompanied the Prussian government to Königsberg, where he rendered considerable service in the commissariat, and was afterwards still more useful as commissioner of the national debt and by his opposition to ill-considered schemes of taxation. In 1810 he was made royal historiographer and professor at Berlin university, and two years later published two volumes of his *Römische Geschichte* (Eng. trans., 1847–51). In 1816, while on his way to Rome to take up the post of ambassador, he discovered in the cathedral of Verona the long-lost *Institutes* of Gaius, afterwards edited by Savigny, to whom he communicated the discovery under the impression that he had found a portion of Ulpian. During his residence in Rome Niebuhr discovered and published fragments of Cicero and Livy, aided Cardinal Mai in his edition of Cicero *De Republica,* and shared in planning the great work on the topography of ancient Rome by von Bunsen and Platner (1773–1855), to which he contributed several chapters. In 1823 he resigned the embassy and established himself at Bonn, where he died on Jan. 2, 1831.

Niebuhr's *Roman History,* to which he added a 3rd vol. (1832), counts among epoch-making histories both as marking an era in the study of its special subject and for its momentous influence on the general conception of history. "The main results," says Leonhard Schmitz, "arrived at by the inquiries of Niebuhr, such as his views of the ancient population of Rome, the origin of the plebs, the relation between the patricians and plebeians, the real nature of the ager publicus, and many other points of interest, have been acknowledged by all his successors." He was the first to deal with the ancient history of Rome in a scientific spirit and introduced new principles into historical research. He suggested the theory of the myth; he brought in inference to supply the place of discredited tradition and showed the possibility of writing history in the absence of original records; he drew attention to the importance of ethnological distinctions, and laid stress on institutions, and social traits to the neglect of individuals.

See Niebuhr's *Politische Schriften* edited by G. Küntzel in 1923 and his *Briefe* by D. Gerhard (1926 foll.); D. Hensler, *Lebensnachrichten über B. G. Niebuhr, aus Briefen desselben und aus Erinnerungen einiger seiner nächsten Freunde* (3 vols., 1838–39, Eng. trs. 1852); J. Classen, *B. G. Niebuhr, eine Gedächtnisschrift* (1876), G. Eyssenhardt, *B. G. Niebuhr* (1886); J. E. Sandys, *History of Classical Scholarship* (1908), iii.; C. Seitz, *L'historien Niebuhr* (1909).

NIEBUHR, KARSTEN (1733–1815), German traveller, was born at Lüdingworth, Lauenburg, Holstein, on March 17, 1733, the son of a farmer. He worked as a peasant in his early years, but managed to learn surveying. In 1760 he was invited to join the expedition which was being sent out by Frederick V. of Denmark for the scientific exploration of Egypt, Arabia and Syria. He studied mathematics and Arabic for a year and a half before the expedition set out. The expedition sailed in January 1761, and, landing at Alexandria, ascended the Nile. Proceeding to Suez, Niebuhr visited Mount Sinai, and in October 1762 the expedition sailed from Suez to Jeddah, journeying thence overland to Mocha. Here in May 1763 the philologist of the expedition, van Haven, and the naturalist Forskål, died. Sana, the capital

of Yemen, was visited, but the remaining members of the expedition were obliged to return to Mocha. Niebuhr saved his life and restored his health by adopting native dress and food. From Mocha the ship sailed to Bombay; the artist of the expedition and the surgeon died. Niebuhr was now the only surviving member of the expedition. He stayed fourteen months at Bombay, and then returned home by Muscat, Bushire, Shiraz and Persepolis, visited the ruins of Babylon, and thence went to Baghdad, Mosul and Aleppo. After a visit to Cyprus he toured Palestine, crossing Mount Taurus to Brussa, reaching Constantinople in February 1767 and Copenhagen in the following November. He married in 1773, and held a post in the Danish military service and lived at Copenhagen. In 1778 he accepted a position in the civil service of Holstein, and went to reside at Meldorf, where he died on April 26, 1815.

He published *Beschreibung von Arabien* (1772); *Reisebeschreibung von Arabien und anderen umliegenden Ländern* (2 vols., 1774–78) besides papers in *Deutsches Museum*. He also edited Forskål's *Descriptiones animalium, Flora Aegyptiaco-Arabica*, and *Icones rerum naturalium* (1775–76).

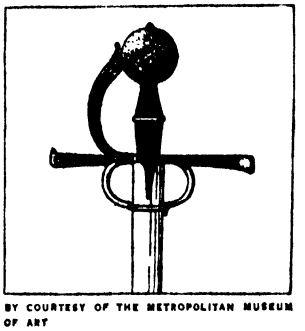
French and Dutch translations of his narratives were published during his lifetime, and a condensed English translation, by Robert Heron, of the first three volumes in Edinburgh (1792). His son Barthold (*see* above) published a short *Life* at Kiel in 1817; an English version was issued in 1838 in the *Lives of Eminent Men*, published by the Society for the Diffusion of Useful Knowledge. *See* D. G. Hogarth, *The Penetration of Arabia* ("Story of Exploration" series) (1904).

NIEDERWALD, a broad hill in Germany, in the province of Hesse-Nassau, opposite Bingen, forming the south-western apex of the Taunus range (*q.v.*). Its summit is clothed with dense forests of oak and beech, while its southern and western sides, which descend sharply to the Rhine, are covered with vineyards. On the hill above Rüdesheim, stands the national monument of the war of 1870–71. Cog railways run up the hill.

NIEHAUS, CHARLES HENRY (1855–), American sculptor, was born at Cincinnati, O., on Jan. 24, 1855. He was a pupil of the McMichen school of design, Cincinnati, and also studied at the Royal Academy, Munich, returning to America in 1881. In 1885, after several years in Rome, he established his studio in New York city. In 1906 he became a National Academician. His principal works are a statue of President Garfield, for Cincinnati; the Hahnemann memorial, in Washington; "Moses" and "Gibbons," for the congressional library, and "James A. Garfield," "John J. Ingalls," "William Allen" and "Oliver P. Morton," for Statuary hall, the Capitol, Washington; "Hooker" and "Davenport," State House, Hartford, Conn.; the Astor memorial doors, Trinity church, New York; "General Forrest," Memphis, Tenn.; Generals Sherman and Lee, and William the Silent; "The Scraper, or Greek Athlete using a Strigil"; statues of Lincoln, Farragut and McKinley, at Muskegon, Mich.; a statue of McKinley and a lunette for McKinley's tomb, at Canton, O.; "The Driller," at Titusville, Pa., in memory of Col. E. L. Drake, who, in 1859, originated the petroleum industry of America; "Francis Scott Key," at Baltimore; and the war memorials at Newark and Hackensack, N.J.

NIEL, ADOLPHE (1802–1869), marshal of France, was born at Muret on Oct. 4, 1802, and entered the École Polytechnique in 1821, whence he passed to the engineer school at Metz, becoming lieutenant in the Engineers in 1827 and captain in 1833. He served with distinction in Algeria and in the Crimean War. Niel commanded the IV. corps in the war against the Austrians. (*See* ITALIAN WARS.) On the field of battle of Solferino he was made a marshal of France. After service in a home command, he became minister of war (1867). He drafted and began to carry out a far-reaching scheme of army reform, based on universal service and the automatic creation of large reserves. He also rearmed the whole of the army with the chassepôt rifle. He died on Aug. 13, 1869, in Paris.

NIELLO (the Italian form of Lat. *nigellum*, diminutive of *niger*, "black"), a method of producing delicate and minute decoration on a polished metal surface by incised lines filled in with a black metallic amalgam. In some cases it is very difficult to distinguish niello from black enamel; but the black substance differs from true enamel in being metallic, not vitreous. Our knowledge of the process and materials employed in niello-work is derived mainly from four writers, Eraclius the Roman (a writer probably of the 11th century), Theophilus the monk, who wrote in the 12th or 13th century, and, in the 16th century, Benvenuto Cellini and Giorgio Vasari. The design was cut with a sharp graving tool on the smooth surface of the metal, which was usually silver, but occasionally gold or even bronze. An alloy was formed of two parts silver, one-third copper and one-sixth lead; to this mixture, while fluid in the crucible, powdered sulphur in excess was added; and the brittle amalgam, when cold, was finely pounded, and sealed up in large quills for future use. A solution of borax to act as a flux was brushed over the metal plate and thoroughly worked into its incised lines. The powdered amalgam was then shaken out of the quills on to the plate, so as to cover completely all the engraved pattern. The plate was now carefully heated over a charcoal fire, fresh amalgam being added, as the powder fused, upon any defective places. When the powder had become thoroughly liquid, so as to fill all the lines, the plate was allowed to cool, and the whole surface was scraped, so as to remove the superfluous niello, leaving only what had sunk into and filled up the engraved pattern. Last of all the nielloed plate was very highly polished, till it presented the appearance of a smooth metal surface enriched with a delicate design in fine grey-black lines. This process was chiefly used for silver work on account of the vivid contrast between the whiteness of the silver and the darkness of the niello. As the slightest scratch upon the metal received the niello, and became a distinct black line, ornament of the most minute and refined description could easily be produced.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

VENETIAN SWORD HILT OF THE EARLY 16TH CENTURY

The earliest specimens of niello belong to the Roman period. Two fine examples are in the British Museum. One is a bronze statuette of a Roman general, nearly 2 ft. high, found at Barking hall in Suffolk. The dress and armour have patterns partly inlaid in silver and partly in niello. The dark tint of the bronze rather prevents the niello from showing out distinctly. This statuette is apparently a work of the 1st century. The other example is not earlier than the 4th century. It is a silver casket or lady's toilet box, in which were found an ampulla and other small objects, enriched with niello-work.

From Roman times till the end of the 16th century the art of working in niello seems to have been constantly practised in some part at least of Europe, while in Russia and India it has survived to the present day. From the 6th to the 12th century a large number of massive and splendid works in the precious metals were produced at Byzantium or under Byzantine influence, many of which were largely decorated with niello; the silver dome of the baldacchino over the high altar of S. Sophia was probably one of the most important of these. Niello is frequently mentioned in the inventories of the treasures belonging to the great basilicas of Rome and Byzantium. The Scala d'Oro in S. Mark's, Venice, 10th century, owes much of its refined beauty to niello patterns in the borders. This art was also practised by Bernward, artist-bishop of Hildesheim (11th century). In France, too, judging both from existing specimens of ecclesiastical plate and many records preserved in church inventories, this mode of decoration must have been frequently applied all through the middle ages: especially fine examples once existed at Notre Dame, Paris, and at Cluny, where the columns of the sanctuary were covered with plates of silver in the 11th century, each plate being richly ornamented with designs in niello. Among the early Teutonic and Celtic races, especially from the 8th to the 11th centuries, both in Britain and other countries, niello was frequently used to decorate the very beautiful personal ornaments of which so many specimens enrich the museums of Europe. The British Museum

possesses a fine fibula of silver decorated with a simple pattern in niello and thin plates of repoussé gold. This, though very similar in design to many fibulae from Scandinavia and Britain, was found in a tomb at Kerch (Panticapaeum). Several interesting gold rings of Saxon workmanship have been found at different times, on which the owner's name and ornamental patterns are formed in gold with a background of niello. One with the name of Ethelwulf, king of Wessex (836–858), is now in the British Museum. Another in the Victoria and Albert Museum has the name of Alhstan, who was bishop of Sherborne from 823 to 867. The metal-workers of Ireland, whose skill was quite unrivalled, practised largely the art of niello from the 10th to the 12th century, and possibly even earlier. Fine croziers, shrines, fibulae and other objects of Irish workmanship, most skilfully enriched with elaborate niello-work, exist in considerable numbers. From the 13th to the 16th century but little niello-work appears to have been produced in England. It is, however, in Italy that the art of niello-work was brought to greatest perfection. During the whole mediaeval period it was much used to decorate church plate, silver altar-frontals and the like. The magnificent frontals of Pistoia cathedral and the Florence baptistery are notable instances of this. During the 15th century, especially at Florence, the art of niello-work was practised by almost all the great artist-goldsmiths of that period. The British Museum possesses the finest existing example of 15th-century German niello. It is a silver beaker, covered with graceful scroll-work, forming medallions, in which are figures of cupids employed in various occupations.

BIBLIOGRAPHY.—*The Archaeological Journal* of 1862 (vol. xix., p. 323) has an excellent monograph on the subject, *see* also vol. xii., p. 79 and vol. iv., p. 247; Labarte, *Arts of the Middle Ages* (1855); Texier, *Dictionnaire de l'orfèvrerie*, p. 1822 (Paris, 1857); Lessing, *Collectaneen zur Literatur* (vol. xii., art. "Niellum"); C. Davenport in *Journal of Soc. of Arts*, vol. xlviii. (1901).

NIEM [NYEM, or NIEHEIM], **DIETRICH OF** (*c.* 1345–1418), mediaeval historian, was born at Nieheim, a small town subject to the see of Paderborn. He became a notary of the papal court of the rota at Avignon, and in 1376 went with the Curia to Rome. Urban VI. made him an abbreviator to the papal chancery. His chief importance lies in the part he took in the controversies arising out of the Great Schism. He accompanied Gregory XII. to Lucca in May 1408, and, having in vain tried to make the pope listen to counsels of moderation, he joined the Roman and Avignonese cardinals at Pisa. He adhered to the pope elected by the council of Pisa (Alexander V.) and to his successor John XXIII., resuming his place at the Curia. In view of the increasing confusion in the Church, however, he became one of the most ardent advocates of the appeal to a general council. He was present at the council of Constance as adviser to the German "nation." He died at Maastricht on March 22, 1418.

Niem's most important works are the *Nemus unionis*, a valuable collection of papal documents; and the *De schismate*, giving the history of events from 1376 to 1410, when he completed the work. It was continued in the *Historia de vita Johannis XXIII.*

For bibliography *see* Potthast, *Bibl. hist. medii aevi* (2nd ed., Berlin, 1896), p. 1,051, *s.v.* "Theodoricus de Niem"; and generally *see* the article on Niem by Theodor Lindner in *Allgemeine deutsche Biographie* (Leipzig, 1886); and Erler, *Dietrich von Nieheim* (Leipzig, 1887).

NIEMCEWICZ (nyĕm-tsā'vĭch), **JULIAN URSIN** (1757–1841), Polish scholar, poet and statesman, was born in 1757. In the earlier part of his life he acted as adjutant to Kosciusko, was taken prisoner with him at the fatal battle of Maciejowice (1794), and shared his captivity at St. Petersburg. On his release he travelled for some time in America, where he married. After the Congress of Vienna he was secretary of state and president of the constitutional committee in Poland, but in 1830–31 he was again driven into exile. He died in Paris on the 21st of April 1841. Niemcewicz wrote comedies, novels and historical works, but he is best remembered by his *Historical Songs of the Poles* (Warsaw, 1816), a series of lyrical compositions.

His collected works were published in 12 vols. at Leipzig (1838–40).

NIEMEN or **MEMEL RIVER:** *see* NEMUNAS.

NIEPCE, JOSEPH NICEPHORE (1765–1833), French physicist, and one of the inventors of photography, was born at Châlon-sur-Saône on March 7, 1765. He served in the army and was *administrateur* of the district of Nice from 1795 to 1801. Returning in that year to his birthplace, he devoted himself along with his elder brother Claude (1763–1828) to mechanical and chemical researches. In 1813 the idea of obtaining photographs first suggested itself to him, and in 1827 he succeeded in producing a photograph on a metal plate. Niepce learned that L. J. M. Daguerre was working in the same direction, and in 1829 the two united their forces "pour coopérer au perfectionnement de la découverte inventée par M. Niepce et perfectionnée par M. Daguerre" (*see* also PHOTOGRAPHY). Niepce died at Gras, his property near Châlon, on July 3, 1833.

NIERSTEIN, a village of Germany, in the republic of Hesse, on the left bank of the Rhine, 8 m. S. from Mainz by the railway to Worms. Pop. (1925) 4,591. Nierstein was originally a Roman settlement, and was a royal residence under the Carolingian rulers. Later it passed from the emperor to the elector palatine of the Rhine. It contains an old Roman bath—Sironabad—and sulphur springs. It is famous for its wines.

NIETZSCHE, FRIEDRICH WILHELM (1844–1900), German philosopher, born Oct. 15, 1844 at Röcken near Lützen, in the Prussian province of Saxony, came of a family of clergymen. Both his father and his grandfather were Protestant pastors, while his paternal grandmother and his mother, née Oehler, were also pastors' daughters. They were honourable, pious people, cheerful and happy, with a social life embellished by poetry and music; while their official standing secured them from the petty cares of existence. Nietzsche's forbears also enjoyed singular bodily vigour, which they retained in all its freshness to old age. Nietzsche's father, who died prematurely from a fall down a flight of steps, was an exception. In his joy over the birth of a son, this father inserted in the Church register of Röcken at Friedrich's christening the question from Luke i., 66, "what manner of child shall this be?"

Wagner and Schopenhauer.—The boy was educated at Naumburg and at the famous old Fürstenschule of Pforta, which he left with an excellent leaving certificate (with only one "unsatisfactory," in mathematics). In the autumn (1864) he was entered at the University of Bonn, as a student of theology and classical philology. As, however, he found at Bonn an exceptionally gifted teacher of classical philology in Ritschl, he soon, to the great grief of his family, abandoned theology and devoted himself exclusively to philological studies. In fact, the undergraduate Nietzsche severed himself not only from theology but from Christianity; the determining influence in this change was his reading of Schopenhauer, whose great work, *The World as Will and Idea*, had fallen into his hands by accident.

His enthusiasm for Schopenhauer and for music—an art which Nietzsche loved and practised throughout his life—brought him into touch with Richard Wagner, who was then living at Triebschen on the Lake of Lucerne. Nietzsche, as a young student of 25, had, on Ritschl's recommendation, been appointed professor at Basel; and close personal intercourse with Wagner followed. The two men agreed in their judgment of their own time, and in their appreciation of antiquity; Nietzsche combined Wagner's views and his own researches on Greek artistic achievement in *Die Geburt der Tragödie* (1870–71). But the book was severely condemned by the official German school, under the leadership of Ulrich v. Wilamowitz, and Nietzsche as a classical scholar was outlawed.

He clung all the more closely to Wagner, at whose side he waged war against German lack of culture. The four *Unzeitgemässen Betrachtungen*, devoted to this struggle, were intended to restore Germany, whose development Nietzsche felt had been jeopardized by the victories of 1864, '66 and '70, to intellectual pursuits. These four polemical works (1873–76) are entitled *David Strauss, der Bekenner und Schriftsteller; Vom Nutzen und Nachteil der Historie für das Leben; Schopenhauer als Erzieher;* and *Richard Wagner in Bayreuth.*

In working on the last of these, Nietzsche began to be conscious of reservations both on the cultural value of Wagner's creations, and on his personality; during the Bayreuth Festival, these reser-

vations led to estrangement and ultimately to passionate renunciation. (See *Der Fall Wagner, Nietzsche contra Wagner,* 1888.) Nietzsche held that Wagner's art was nothing more than the dope required by a decadent generation, and the whitewashing of Schopenhauer's pessimism. In both his models, Schopenhauer and Wagner, he began to discern tendencies towards Christian and Buddhistic negation, and therefore, though with much pain, broke loose from them. The first expression of this emancipation is found in *Menschliches all-zu Menschliches* (2 vols. 1878), in which Nietzsche enters on his essentially negative critical period. In 1879, probably owing to the pain caused by his violent separation from his friends and masters, Nietzsche's health became so bad that he had to resign his professorship at Basle. Thenceforward, he lived chiefly in northern Italy, the Engadine, or the French Riviera, on the small pension granted him by the university of Basle.

Maturity.—From this time onwards, he devoted himself wholly to philosophy, and with the gradual improvement in his health, entered the third and mature period of his creative life, during which his best works were given to the world. In *Morgenröte* (1880–81) and *Die fröhliche Wissenschaft* (1881–82), he fought romanticism in all its manifestations, and revealed art, religion and philosophy as illusions invented by man as weapons in his struggle for development, for prevailing over himself and his fellows.

In the years 1883–85, he produced work which he himself regarded as his highest achievement. Written in the style of an Old Testament prophet, this work which was his own New Testament, the gospel of the superman and the eternal recurrence, was entitled *Also Sprach Zarathustra. Ein Buch für Alle und Keinen.* Nietzsche provided a valuable interpretation of this work, parts of which even to-day are difficult to understand, in the two volumes of *Jenseits von Gut und Böse* (1885–86) and *Genealogie der Moral* (1887). He then planned a greater work, *Der Wille zur Macht: Versuch zur Umwertung aller Werte.* It was never finished, but contains no less than 1,052 valuable aphorisms: its two volumes (Vols. xiv. and xv. in the English works) are divided into the following sections:—(1) European Nihilism, (2) A Criticism of the Highest Values that have prevailed hitherto, (3) The Principles of a New Valuation, (4) Discipline and Breeding. The three fine and stimulating books, *Götzendämmerung, oder wie man mit dem Hammer philosophiert, Der Antichrist,* and the autobiography *Ecce Homo,* date from his last and exceptionally productive period, the year 1888.

At the turn of the year (1888–89) Nietzsche broke down, probably from overwork; for, outwardly calm as his life had been, the philosopher had suffered most violent moral upheavals, and had moreover recorded his innermost experience in a brief space of time in a number of carefully thought out works. Another cause of his breakdown was probably his extreme loneliness; only in the last year of his conscious life was he "discovered" by the Danish-European critic and author, Georg Brandes; he himself had neither followers nor disciples. We may take him at his word when, on July 8, 1886, he writes to his sister:—"My health is really quite normal—only my soul is so sensitive and so full of longing for good friends of my own kind. Get me a small circle of men who will listen to me and understand me—and I shall be cured." Nietzsche lived on for another 12 years, first with his mother at Naumburg and, after the latter's death, with his widowed sister, Elizabeth Förster-Nietzsche at Weimar, where he died on Aug. 25, 1900. He was buried in the churchyard of Röcken.

The Message.—In order to understand Nietzsche's philosophy, which departs conspicuously from the orthodox and academic, it is necessary once more to make a profound study of his development. Nietzsche, it must be remembered, did not spin his view of life out of his inner consciousness, but lived and suffered it—a fact which explains both his language, free from learned jargon, and his half pathetic, half ironical style, which is yet always so full of poetry and metaphor.

Nietzsche, as we have seen, started his philosophical career with Schopenhauer—the philosopher who took such a gloomy and despondent view of life that, at last, in wrath over his own aversions, he denied the will to life altogether. In the end Nietzsche came to regard Schopenhauer's principal work as the outpourings of a melancholy young man. Its author never fought his way through to cheerful maturity, but remained fettered to the doctrines he had laid down early in life. Nietzsche, whose motto was, "Only he who altereth remains unalterably mine," condemned this lack of capacity for development.

The changes in Nietzsche's own nature took place under the influence of Pre-Socratic antiquity; by this standard he weighed both Schopenhauer's and every other philosophy which either denied or was hostile to life. He saw that pagan antiquity had said "yea" to life; but that there had been, and now existed, other and different judgments and valuations of existence and "things." The attitude of civilization towards existence and "things," depended upon that civilization's values; and values may be either life-promoting or life-arresting.

The Good, The True and The Beautiful.—What are the ruling values of our civilization? Nietzsche replies, the ruling values of our civilization are those of the good, the true and the beautiful; which have ruled for thousands of years. All thinkers, including Plato, have acknowledged them as the highest. Nietzsche condemns these values as life-arresting; they are moreover quite illusory, for there is no instinct for goodness, truth and beauty. What does exist is another instinct—the will to power, the will to a stronger and higher existence. This will to power designates as good, true and beautiful, whatever is useful to the individual, whatever serves his advancement and enables him to establish his type by victory over others and using those others for his ends. Not goodness, truth or beauty *per se* determines what is good, true and beautiful, but something which lies behind goodness, truth and beauty, something which is higher, deeper, more important and more mighty than any of them, and uses "good," "true" and "beautiful," merely as means, as weapons to affirm and promote its own life and the lives of those that are like it—to wit, the will to power.

Good, true and beautiful are therefore not fixed values; they are relative, and there always stands behind them some human type, which by means of them is furthering its own ends. How came they to prevail as absolute values? How came they to prevail to such an extent that ultimately they were imposed upon all? "*Cui bono* were these values proclaimed?" Nietzsche asks. And he replies, "Even these, our present values, are the expression of a will to power—but of the will of the impotent, the humble, the feeble, the subjected, the peaceloving, who by means of these values wished to predominate and—have succeeded."

Our values "good," "true" and "beautiful," which led to Schopenhauer's philosophy and to the gloomy and disintegrated state of the world, came, according to Nietzsche, from the Jews. Among the Jews, the slave people of antiquity, arose the values which, with the help of religion and its moral content, still rule our present-day world. It is true that the Jews themselves once maintained a yea-saying attitude to the world. In the days of their prosperity, when they were still a triumphant and warlike people, ruled by capable kings, they too called "good" everything that was "bold," "vigorous," "joyful," "cruel" and "self-reliant." But ultimately these Jews fell under the heel of various foreign invaders, and their faith in the old natural values declined —but not their will to live, which now they fostered under a table of values and judgments the reverse of those they had formerly held.

Thenceforward they gradually and systematically demonetized "good." They called good all that was "cautious," "clever," "humble," "pacific," "mendacious" and "adaptable"; while their "evil" became everything that was "strong," "hard," "upright," "energetic," "exuberant" and "self-respecting." Thus, in the end, the Jews transvalued all values; thus they corrupted the master morality into the slave morality. "The Jews," says Nietzsche, "performed the miracle of the inversion of valuations; they led the slave-insurrection in morals. Jesus of Nazareth, this 'Redeemer,' bringing salvation and victory to the poor, the sick, the sinful—was he not really temptation in its most irresistible form, tempta-

tion to seize hold of those very Jewish values and new ideals? *'Sub hoc signo'* Israel, with its slave morality, triumphed over the noble ideals of master morality. Under Israel's flag the people have triumphed, or the slaves, or the populace, or the herd, or whatever name you care to give them. The 'masters' have been done away with; the morality of the common man has triumphed."

Levelling.—The Jews thus bequeathed the values of their decadence to Christianity, and the latter, for its part, accentuated them, and spread them all over the world through many centuries of preaching and propaganda. Since the Crucifixion of Christ the noble have only been able to assert themselves for brief periods in Europe; *i.e.*, at the Renaissance, under Louis XIV., and under Napoleon I. They were immediately suppressed by the Reformation, the French Revolution and the so-called Wars of Liberation against the "Corsican invader." All this occurred gradually, without mankind becoming aware of what had happened, so that the world never obtained a clear conception of how thoroughly it had been Semitized.

The 19th, Nietzsche's own century, which he assailed most wrathfully, had, according to him, finally let loose all these Christian instincts. These instincts, in their political disguise, dominate all modern movements—the labour, pacifist and feminist movements. "All distinctions must be removed," is the order of the day, even the natural distinction between man and woman. Yet, according to Nietzsche, the emancipation of woman can lead only to her enfeeblement and the destruction of her charm; and, therefore, only to defective offspring. If healthy children are to be produced, the differences between the sexes should be maintained, even deepened. But modern democracy will have nothing to do with differences, and in this demand is it not the legatee of Christianity? Christianity claims the equality of men before God, democracy, the equality of all men before the law. And as democracy derives from Christianity, so does socialism, which is little more than the Gospel in modern dress. For the Gospel was originally "the announcement that the road to happiness lies open to the poor and lowly—that all that is necessary is emancipation from institutions, tradition, and the tutelage of the ruling classes.

"This Christianity is no more than the typical teaching of the Socialists. Property, acquisition, fatherland, rank and position, courts of law, the police, State, Church, education, art, militarism: all these are so many obstacles in the way of happiness, so many mistakes, snares, and devil's artifices, on which the Gospel passes sentence—all this is typical of socialistic doctrine." (*Der Wille zur Macht*, Aphorism 209.)

The Will to Power.—Is there then no escape from this topsy-turvy world? Is there no hope that other than Semitic values will once again prevail, and that other than "herd" men will be born? Are the "meek and the poor in spirit" always to be allowed to "have their say," and thus continue to "torture" the ears of him who "remembers with a shudder that mankind's fate depends upon the success of its highest types?"

To the anxious enquirer who puts this question, Nietzsche replies:—"Yes, there is a way, but new Gods, or resuscitated old Gods can no longer be of any avail. Our only hope lies in new men." And, according to him, these new men are already in process of formation. "The aspect of the European of to-day," says our philosopher, "makes me very hopeful. A daring and ruler race is building itself up, upon the foundation of an extremely intelligent gregarious mass. . . . The same conditions which go to develop the gregarious animal also force the development of the leaders." (*Der Wille zur Macht*, Aph. 955–56.) "While, therefore, the democratization of Europe will tend to the production of a type prepared for slavery in the most subtle sense of the term, the strong man will necessarily, in individual and exceptional cases become stronger and richer than he has perhaps ever been before. . . . The democratization of Europe is at the same time an involuntary preparation for the rearing of tyrants—taking the word in all its meanings, even in its most spiritual sense.". . .

For Nietzsche saw great dangers threatening both the 20th century and its successor. With them would come the classical era of great wars and revolutions, says this poet-philosopher, who, incidentally, was also a true prophet. In these wars and revolutions (which by-the-bye he only foresaw and did not bring about as Allied War propaganda alleged), he welcomed a means for the masculinization of the world, the rearing of a higher type of man, and the creation of a new ruler caste.

For these, and these alone, he demanded emancipation from the Judaeo-Christian morality. Only to these higher and stronger men, from whom ultimately Superman was to spring, did he grant and recommend his famous formula of the transvaluation of all values:—"The aim should be to prepare a transvaluation of values for a particularly strong kind of man, most highly gifted in intellect and will, and, to this end, slowly and cautiously to liberate in him a whole host of slandered instincts, hitherto held in check: whoever meditates about this problem belongs to us, the free spirits—though not to that kind of 'free spirit' which has existed hitherto: for these desired practically the reverse." (*Der Wille zur Macht*, Aph. 957.) And in the very next aphorism he adds: "I am writing for a race of men which does not yet exist: for the lords of the earth.". . . "Live dangerously!"—this motto, which he himself lived up to, Nietzsche addresses to these future lords of the earth, while gladly conceding to others the right to strive for happiness and safety, and to cultivate domestic virtues. For, in all his writings, the philosopher emphasized that he had set up no moral code for the generality of men, and that he had no wish to lead lesser men away from their virtues and their duties. "I am a law only for mine own; I am not a law for all. He, however, who belongs to me must be strong of bone and light of foot,"—(*Also Sprach Zarathustra*).

The Rejection of Nietzsche.—An aristocratic doctrine like this, addressed to a self-confident democracy, inevitably met in the first place with misunderstanding, or, rather, with silence, then contempt, and finally with rejection. It was rejected all the more firmly, when, despite Nietzsche's warning, many uninvited guests pressed into his garden, and indulged their chaotic and rebellious instincts "beyond good and evil." Nietzsche himself had forseen these unwanted disciples, and had warned the world as follows:—"The first followers of a Creed prove nothing against it." To these false followers, Nietzsche preferred his adversaries, among whom the true believers were by no means the worst.

But those he esteemed least were his former colleagues; for the ears of scholars and university professors were least attuned to his message. To these men, as has been well said, the new teaching was a "bolt from the blue": although even this was not entirely true; for, like every other thinker, Nietzsche of course had his predecessors, whom he expressly mentioned by name—Heraclitus, Empedocles, Spinoza and Goethe.

His doctrine fared just as badly with the politicians whom he offended, without exception, the conservatives by his revolutionary views, and the socialists by his conservatism. He arraigned no less all the religious sects and classes. Jew and gentile, man and woman, patriot and pacifist, were all criticized; for the roller of equality had levelled everything and everybody, and property constituted the only distinction—not, however, in Nietzsche's eyes; for he saw and asked: "Mob above, mob below! what to-day means poor or rich?" Thus, for the first 50 years after it was expounded, the teaching, despite the recognition of individuals, fell, as it were, between all stools; while its messenger by his countless opponents in every country, including Germany, was branded as misanthropist, madman, promotor of wars, infidel, dysangelist and corruptor of morals.

Nietzsche's Contribution.—A further and more dispassionate study of his philosophy must, however, lead to a different conclusion, particularly on the charge of irreligion, although it must be admitted that the firm rejection of Nietzsche's teaching by those who clung to the old beliefs is quite comprehensible. Nietzsche was a destructive genius of the first order, and his revolutionary movement could not but arouse suspicion and misunderstanding at the time. Men felt, if only unconsciously, the unprecedented acuteness and the novelty of his attack; for Nietzsche's vigilant eye descried all his opponents' weak points, and his psychological ruthlessness tore veil after veil from ideals cherished for centuries. Where his predecessors had seen vices, he saw virtues, or the possibility of virtues; and where they had

seen virtues, he saw vices, or the possibility of vices. His attack on Christianity was much more thorough than that of Voltaire, whose *"écrasez l'infâme!"* had really done no more than assail the out-works of the Christian stronghold, its dogmas and ceremonies, without however aiming at the inner core of the Faith, the Christian ideal itself. Thus Nietzsche's rejection of all the values which had been held most sacred for centuries, inevitably made him the great solitary that he was. Such daring and scornful condemnation, such glacial negation, could not be understood at once, or greeted with applause, especially as at first his very motives remained obscure. Nobody understood in the early days that his teaching against pity sprang from his love of healthy life, against morality, from his love of a higher ethic, and against patriotism from his desire for a united Europe.

Late and slowly the world began, or is beginning to change its mind about "the anti-antichrist," and to perceive that he was not merely "anti"; but that the destroyer of the old tables of values was also a creator of new values. For in Nietzsche, destruction was accompanied by creation, wrath by blessing, and his vehement nay by an equally emphatic yea. His nay was directed at sickness, weakness and decadence, while his yea was for all those healthy instincts slandered and suppressed by the religion and morality up to his day. Nietzsche became the redeemer of these honest and virile instincts, and endeavoured to make their corresponding lordly virtues contribute to a great vision which he had had of the future. This vision, conceived in ecstasy, he depicted with the versatile talent of a scholar, a musician and a poet, and left to posterity a series of works which bear witness to his profound morality, and are to be regarded in the highest sense of the word, as religious.

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(O. L.)

NIEUPORT (Flem. Nieuwpoort), a town of Belgium in the province of West Flanders. Pop. (1920) 3,016. It was the port of Ypres, and is situated on the Yser about 10 m. S. of Ostend. At one time Lombartzyde was the port of the Yser, but in the course of the 12th century mud was silted up, and ships went further south to Sandeshove, where it was more navigable. This place became the "Novus portus": Nieuport. It was strongly fortified in the middle ages and its siege by the French in 1488–89 is an episode of its heroic period. Under its walls in 1600 Maurice of Nassau defeated the archduke Albert and the Spaniards. It contains an ancient cloth market, a fine town-hall and an old church, and outside is a lighthouse dating from 1289. More than once in the course of its history, the town has been completely rebuilt, hence its draughtsboard plan, preserved even after the wholesale destruction of 1914–18.

Nieuport has one of the main artificial drainage outlets of the low country, the locks of Palingbrug. Since the World War they have been rebuilt in the form of six locks debouching on the canal of the Yser. They played an important part in the war, being the instrument of the famous flooding of the front on the Yser on Oct. 29, 1914; all that was necessary to submerge a large part of the district, under the enemy's fire, was to reverse the normal process, *i.e.*, to close the locks to the lower and open them to the higher water, so as to allow the tide to flow inland.

Nieuport Bains, 2 m. from the town, is a fashionable seaside resort dating only from 1869.

NIÈVRE, a department of France, formed from the old province of Nivernais with a small part of the Orléanais. It is bounded north-west by Loiret, north by Yonne, east by Côte d'Or, east and south-east by Saône-et-Loire, south by Allier and west by Cher. Pop. (1926) 260,502. Area 2,658 sq. miles. Nièvre falls into three regions. In the east are the granitic mountains of the Morvan, one of the most picturesque parts of France, containing Mont Prénelay (2,789 ft.) and several lesser heights. The north and centre are occupied by plateaux of Jurassic limestone with a maximum elevation of 1,400 feet. The west and south-western part of the department is a district of plains, composed mainly of Tertiary formations with alluvial deposits, and comprising the valleys of the Loire and the Allier. The lowest level of the department is 446 ft., at the exit of the Loire. Eastern Nièvre belongs to the upper basin of the Yonne, a tributary of the Seine, followed by the southern part of the Nivernais canal; western Nièvre drains towards the Loire, which crosses its south-western corner and then forms its western boundary.

The principal cereals are oats and wheat; potatoes and various kinds of forage are also largely grown. On the extensive pastures much cattle is fattened. The Nivernais and Charolais are the chief breeds. The rearing of sheep and draught-horses is also important. Vines are grown in the Loire valley and near Clamecy. The white wines of Pouilly are widely known. Nièvre abounds in forests, the chief trees being the oak, beech, hornbeam, elm and chestnut. Coal is mined at Decize, and gypsum, building stone, and kaolin are quarried. The best-known mineral springs are those of Pougues and St. Honoré. Nièvre is famous for iron-works, the most important being those of Fourchambault. At Imphy there are large steel-works. The government works of La Chaussade at Guérigny make chain-cables, anchors, armour-plates, etc. There are also manufactories of agricultural implements and hardware, potteries, manufactories of porcelain and faïence (at Nevers) and glass works, tile-works, chemical works, paper-mills and saw-mills, as well as tanneries, boot and shoe factories, cask manufactories and oil works (colza, poppy and hemp). In the Morvan district the timber industry is important.

Much of the traffic is by water: the canal along the Loire runs through the department for 38 m., and the Nivernais canal for 78 miles. The chief railway is that of the P.L.M. Company, whose main line to Nîmes follows the valley of the Loire and Allier. Nièvre is divided into 3 arrondissements (Nevers, Château-Chinon and Clamecy being their capitals), 25 cantons, 313 communes. It forms the diocese of Nevers under the archbishop of Sens and part of the académie (educational district) of Dijon and of the region of the VIII. army corps. The chief towns are Nevers, the capital, Clamecy, Fourchambault, Cosne, La Charité and Decize. The appeal court is at Bourges.

NIFO, AGOSTINO [AUGUSTINUS NIPHUS] (1473?–1538 or 1545), Italian philosopher and commentator, was born at Japoli, Calabria. He lectured at Padua, Naples, Rome and Pisa, and was deputed by Leo X. to defend the Catholic doctrine of Immortality against the attack of Pomponazzi and the Alexandrists. In return for this he was made Count Palatine, with the right to call himself by the name Medici. He edited (1495) the works of Averroes; with a commentary compatible with his lately acquired orthodoxy. In the great controversy with the Alexandrists he opposed Pomponazzi's theory that the death of the body means the death of the soul. He insisted that the individual soul, as part of absolute intellect, is indestructible, and on the death of the body is merged in the eternal unity.

His principal philosophical works are *De immortalitate animi* (1518 and 1524); *De intellectu et daemonibus; De infinitate primi motoris quaestio* and *Opuscula moralia et politica*. His numerous commentaries on Aristotle were frequently reprinted, the best-known edition being printed at Paris in 1654 in 14 vols.

NIGDEH (Arab. *Nakidah*), the chief town of a vilayet in Asia Minor, situated on the Kaisarieh-Cilician Gates road. It is remarkable for the beauty of its buildings, dating from almost all ages of the Seljuk period. After the fall of the sultanate of Rum (of which it had been one of the principal cities), Nigdeh became independent, and, according to Ibu Batuta, ruinous, and did not pass into Ottoman hands till the time of Mohammed II. It represents no classical town, but, with Bor, has inherited the importance of Tyana, whose site lies about 10 m. S.W. A Hittite-inscribed monument, brought perhaps from Tyana, has been found at Nigdeh. The population (1927) is 59,289.

NIGEL (d. 1169), bishop of Ely, head of the exchequer in the reigns of Henry I. and Henry II., was brought into the exchequer in early life (1130). Soon after his uncle Roger of Salisbury secured him the bishopric of Ely, much to the disgust of the monks. Nigel incurred the suspicion of leaning towards the Angevin interest, when Roger of Salisbury and Alexander of Lincoln were arrested by Stephen (Jan. 1139). He attempted to maintain himself in his see by force of arms, but he was forced to fly to the empress at Gloucester. He was reconciled to Stephen in 1142 and restored to his see; but he now quarrelled with Henry of Winchester and was forced to go to Rome. Fortunately, he secured the strong and uniform support of the Roman Curia. At the accession of Henry II. (1154) Nigel was summoned to reorganize the exchequer. He was the only surviving minister of Henry I., and his knowledge of the exchequer business was unrivalled. This was the great work of his life. To the work of his son Richard, the *Dialogus de Scaccario*, we owe our knowledge of exchequer procedure as it was left by Nigel. The bishop took little part in politics, except as an administrator. In 1166 his health was broken by a paralytic seizure.

See F. Liebermann, *Einleitung in den Dialogus de Scaccario* (1875); J. H. Round, *Geoffrey de Mandeville* (1892).

NIGER, a great river of West Africa, inferior only to the Congo and Nile among the rivers of the continent. Rising within 150 m. of the sea in the mountainous zone which marks the north-east frontiers of Sierra Leone and French Guinea, it traverses the interior plateaux in a vast curve, flowing north-east, east and south-east, until it finally enters the Gulf of Guinea through an immense delta. Its total length is about 2,600 miles. About 250 m. from its mouth it is joined by the Benue, coming from the east from the mountainous region of Adamawa. From its mouth to the limit of navigability from the sea the Niger is in British territory; above that point it flows through French territory. The area of the Niger basin is calculated at 580,000 sq.m. at least.

The source of the Niger lies in 9° 5′ N. and 10° 47′ W.; the most northerly point of the great bend is about 17° N. and the mouth is in 4° 30′ N. 6° E. The river is known locally under various names, the most common being Joliba (a Mandigo word meaning great river) and Kworra or Quorra. By the last name the Niger was known in its lower reaches before its identity with the upper river was established. The Tembi, the stream considered the chief source of the Niger, issues from a deep ravine 2,800 ft. above sea-level where, from a moss-covered rock a spring issues and has made a pool below. The overflow forms the Tembi, which within a short distance is joined by two other rivulets, the Tamincono and Falico, which have their origin in the same mountainous district. After flowing north for about 100 m., the river turns eastward and at its confluence with the Tankisso (a northern tributary), 210 m. from its source, has attained dimensions sufficient to earn for itself the title Joliba. Taking at this point a decided trend northward, the Niger, 100 m. lower down, at Bamako has a depth of 6 ft. with a breadth of 1,300 feet. Seven or eight miles below Bamako the Sotuba rocks mark the end of what may be considered the upper river. Thirty miles below Sotuba are the rapids of Tulimandio; a little lower down is Kulikoro, from which point the bed of the stream for over 1,000 m. is fairly free from impediments.

Middle Niger and Lake Region.—The Niger here turns more directly to the east and increases in volume and depth. Below Sansandig the banks of the river become low and the Niger is split up into a number of channels. Mopti is at the junction of the main stream with a large right-hand backwater or tributary, the Bani or Mahel Balevel, on which is situated the important town of Jenné. Below Mopti is a swampy and treeless region and the first of a series of lakes (Debo) is reached. These lakes are chiefly on the left of the main stream, with which they are connected by channels conveying the water in one direction or the other according to the season. At high water most of these are united into one general inundation. The largest lake, Faguibini, is nearly 70 m. long by 12 m. broad, has high shores and reaches a depth exceeding, in parts, 160 feet. It is not until Kabara, the port of Timbuktu, is reached, a distance of 450 m. from Sansandig, that the labyrinth of lakes, creeks and backwaters ceases. Below Kabara the river reaches its most northerly point. Here, and for some 500 m. down stream the river is bordered on the north by the Sahara; in places it is desert on both sides, with long lines of sand dunes. At Bamba it is shut in by steep banks, and narrows from 600 to 700 yd., again spreading out some distance down. At Tosaye (about 250 m. from Timbuktu) the stream turns distinctly south-east and preserves that direction throughout the remainder of its course. Here, just before the bend becomes pronounced, the Baror and Chabar rocks reduce the width of the river to less than 500 ft., and at low water the strength of the current is a serious danger to navigation.

At Ansongo, 430 m. below Timbuktu, the navigable reach of the middle Niger, in all 1,057 m., ends. Four huge flint rocks bar the river at Ansongo and effectually prevent further navigation except in very shallow draught vessels. From Ansongo to Say, some 250 m., the river presents a labyrinth of rocks, islands, reefs and rapids. From Say, where the stream is about 700 yd. in breadth, to Bussa, there is another navigable stretch extending 300 miles. After the desert region is past the Niger receives the waters of the river Sokoto, a considerable stream flowing from the north-east. Some distance below this confluence are the Bussa rapids. These rapids are of a more dangerous character than any encountered between Ansongo and Say. "In one pass, some 54 yd. wide, shut in between two large reefs, a good half of the waters of the Niger flings itself over with a tremendous roar" (Hourst). The rapids extend for 50 m. or more; in a less obstructive form they continue to Rabba.

Lower River and Delta.—A little above Rabba the river makes a loop south-west, at the head of the loop being (right bank) Jebba. Here there is an island in midstream, taken advantage of in the bridging of the river by the railway from Lagos. Sixty miles lower down is the mouth of the (left hand) tributary the Kaduna, a river of some magnitude whose head waters are not far from Kano. In 7° 50′ N. 6° 45′ E. the Niger is joined by its great tributary the Benue. At their confluence the Niger is about ¾ m. broad and the Benue rather more than a mile. The united stream forms a lake-like expansion about 2 m. in width, dotted with islands and sandbanks; the peninsula at the junction is low, swampy and intersected by numerous channels. The stream, as far south as Iddah (Ida), a town on the east bank, rushes through a valley cut between the hills, the sandstone cliffs at some places rising 150 ft. high. Between Iddah and Onitsha, 80 m., the banks are lower and the country flatter, and to the south of Onitsha the whole land is laid under water during the annual floods. Here may be said to begin the great delta of the Niger, which, extending along the coast for about 120 m., and 140 or 150 m. inland, forms one of the most remarkable of all the swampy regions of Africa. The river breaks up into an intricate network of channels, dividing and subdividing, and intercrossing not only with each other but with the branches of other streams, so that it is exceedingly difficult to say where the Niger delta ends and another river system begins. The Rio Nun is a direct continuation of the line of the undivided river, and is thus the main mouth of the Niger. From the sea the only indication of a river mouth is a break in the dark green mangroves which here universally fringe the coast. The crossing of the bar—where the depth of water is but 12 or 13 ft.—requires considerable care, and as other branches of the Niger afford better access the Nun mouth is now little used. East of the

Nun the estuaries known as the Brass, Sombrero, New Calabar, Bonny, Opobo (or Imo), etc. (with the exception, perhaps, of the first-named), seem to derive most of their water from independent streams. West of the Nun all the estuaries up to the Forcados seem to be true mouths of the great river. The Forcados has supplanted the Nun river as the chief channel of communication by water with the interior. The mouth of the Forcados is 2 m. wide, the bar, formerly but ¾ m. across, had by 1927 grown to 2¼ m. across, but the depth of water allowed vessels of 18 ft. draught to enter the river; within the bar is a deep water natural harbour of 3 to 4 square miles. Five miles up stream is the port of Burutu. From the mouth of the Forcados to the main stream is 105 m., with a minimum depth in the dry season of seven feet. The other western mouths of the Niger have as a rule shallow and difficult bars. The delta is the largest in Africa and covers 14,000 square miles, a larger area than the more famous Nile delta.

The Benue.—The Benue is by far the most important of the affluents of the Niger. The name signifies in the Batta tongue "Mother of Waters." The river rises in Adamawa in about 7° 40′ N. and 13° 15′ E., at a height of over 3,000 ft., being separated by a narrow water parting from one of the head-streams of the Logone, whose waters flow to Lake Chad. In its upper course the Benue is a mountain torrent falling over 2,000 ft. in some 150 miles. With the Chad system it is connected by the Kebbi or Mayo Kebbi, a river which issues from the south-west end of the Tuburi marshes, and eventually joins the Benue. The Tuburi marshes occupy an extensive depression in the plateau east of the Mandara hills, and are cut by 10° N., 15° E. The central part of the marshes forms a deep lake, whence there is a channel going northward to the Logone.

Below the Kebbi confluence the Benue, now a considerable river, turns from a northerly to a westerly direction and is navigable all the year round by boats drawing not more than 2½ feet. At Yola, a town some 850 m. by river from the sea and at an altitude of 600 ft., the width of the stream at flood time reaches to 1,000 or 1,500 yd., and though it narrows at the somewhat dangerous rapids of Runde Gilla to 150 or 180 yd., it soon expands again. About 50 m. above Yola the Benue is joined by the Faro, a river rising in the Adamawa hills, and some 50 m. below Yola the Benue receives, on the right bank, the Gongola, which rises in the Bauchi highlands and after a great curve north-east turns southward. It is over 300 m. long, and at flood time is navigable for about half of its course. In its lower course the Benue is joined by several other streams; its valley is bordered by ranges of hills.

As the Niger and the Benue have different gathering grounds, they are not in flood at the same time. The upper Niger rises in June and decreases in December. The middle Niger, however, reaches its maximum near Timbuktu only in January and April–July is the low water season. The Benue reaches its greatest height in August or September, begins to fall in October, falls rapidly in November and slowly in the next three months, and reaches its lowest in March and April. The flood rises with great rapidity, and reaches 50, 60 or even 75 ft. above the low-water mark.

Below the Benue confluence the Niger is at its lowest in April and May; in June it is subject to great fluctuations; about the middle of August it usually begins to rise; and its maximum is reached in September. In October it sinks, often rapidly. A slight rise in January, known as the *yangbe*, is occasioned by water from the upper Niger. Between high and low-water mark the difference is as much as 35 ft.

History and Exploration.—Vague ideas of the existence of the river were possessed by the ancients. The great river flowing eastward reached by the Nasamonians as reported by Herodotus can be no other than the Niger. Pliny mentions a river Nigris, of the same nature with the Nile, separating Africa and Ethiopia, and forming the boundary of Gaetulia; and it is not improbable that this is the modern Niger. In Ptolemy, too, appears along with Gir (possibly the Shari) a certain Nigir (Νίγειρ) as one of the largest rivers of the interior; but so vague is his description that it is impossible definitely to identify it with the Niger. Arabian geographers, such as Ibn Batuta, who were acquainted with the middle course of the river, called it the Nile of the Negroes. At the same time contradictory opinions were held as to the course of the stream. It was supposed by some geographers to run west, an opinion probably first stated by Idrisi in the 12th century. Idrisi gave the Nile of Egypt and the Nile of the Negroes a common source in the Mountain of the Moon. Fountains from the mountain formed two lakes, whence issued streams which united in a very large lake. From this third lake issued two rivers—the Nile of Egypt flowing north, and that of the Negroes flowing west (*see* R. Dozy and M. J. de Goeje's *Edrisi*, Leiden, 1866: Premier Climat, 1st four sections). From Idrisi's description it would appear that he regarded the Shari, Lake Chad, the Benue, Niger and Senegal as one great river which emptied into the Atlantic. From 1405 to 1413 a Frenchman, Anselme d'Isalguier, lived at Gao, a city on the Niger 400 m. below Timbuktu; the account of his travels was never printed and is lost. Knowledge of his adventures, never widely known, was completely forgotten until brought to light by Ch. de la Roncière (*see* his *Découverte de l'Afrique au Moyen Âge*, vol. iii., Cairo, 1927). Leo Africanus visited the Niger regions in 1513–15 without settling the question as to the direction of the river. The belief that a western branch of the Nile emptied itself into the Atlantic was held by Prince Henry of Portugal, who instructed the navigators he despatched to Guinea to look for the mouth of the river, and when in 1445 they entered the estuary of the Senegal, the Portuguese were convinced that they had discovered the Nile of the Negroes (*see* Azurara's *Discovery and Conquest of Guinea*, Beazley and Prestage's translation, vol. ii., London, 1899, chap. lx. and lxi., and introduction and notes). The Senegal being proved an independent river and the eastward flow of the Niger assumed, the theory that it ran into the Nile was revived.

That the vast network of rivers on the Guinea coast, of which the Nun was the chief, known as the Oil rivers, formed the delta of the Niger does not appear to have been suspected before the beginning of the 19th century. Consequently it was from the direction of its source that the river was first explored in modern times. In 1795 Mungo Park (*q.v.*), sent out by the African Association, landed at the Gambia, and struck the Niger near Segu on July 20, 1796, where he beheld it "glittering in the morning sun as broad as the Thames at Westminster and flowing slowly to the eastward" (*Travels*, 1st ed., p. 194). He descended the river some distance, and on his return journey went up stream as far as Bamako. In 1805 Park returned to Africa for the purpose of descending the Niger to its mouth. From Bamako he sailed down the river for over 2,000 miles and on the eve of the successful accomplishment of his undertaking lost his life during an attack on his boat by the natives at Bussa (Nov. or Dec. 1805). Park held to the opinion that the Niger and Congo were one river, though in 1802 C. G. Reichard, a German geographer, had suggested that the Rio Nun was the mouth of the Niger. Owing to Park's death the results of his second journey were lost, and the work had to be begun afresh. In 1822 Maj. A. G. Laing (who had reached Timbuktu by way of Tripoli) obtained some accurate information concerning the sources of the river, and in 1828 the French explorer René Caillié went by boat from Jenné to the port of Timbuktu. In 1826 Bussa was reached from Benin by Hugh Clapperton, and his servant Richard Lander. On Clapperton's death Richard Lander and his brother John led in 1830 an expedition which went overland from Badagry to the Niger. Canoeing down the river from Yauri—60 m. above Bussa—to the mouth of the Rio Nun they finally settled the doubt as to the lower course of the stream.

Heinrich Barth (1851–54) made known to Europe the course of the river from Timbuktu to Say. Later, the extension of French influence throughout the western Sudan led to an accurate knowledge of the river above Timbuktu. From 1880 onwards Col. (afterward General) Gallieni took a leading part in the operations on the upper river, where in 1883 a small gunboat, the "Niger," was launched for the protection of the newly

established French posts. In 1885 a voyage was made by Capt. Delanneau past the ruins of Sansandig, as far as Diafarabe. In 1887 the "Niger" made a more extended voyage, reaching the port of Timbuktu. A more important expedition was that of Lieut. Hourst, who, starting from Timbuktu in Jan. 1896, navigated the Niger from that point to its mouth, executing a careful survey of the river and the various obstructions to navigation.

In addition to the main stream, the Niger basin was made known during the last quarter of the 19th century and the early years of the 20th. The journeys of the German traveller G. A. Krause (north from the Gold Coast, 1886–87) and the French Capt. Binger (Senegal to Ivory Coast, 1887–89) first defined its southern limits by revealing the unexpected northward extension of the basins of the Guinea coast streams, especially the Volta and Komoe, a fact which explained the absence of important tributaries within the Niger bend. The exploration of the Benue dates from the middle of the 19th century. In 1851 Barth crossed the Benue at its junction with the Faro, but the region of its sources was first explored by the German E. R. Flegel (1882–84), who traversed the whole southern basin of the river and reached Ngaundere. The Benue itself had been ascended 400 m. by the "Pleiad" expedition in 1854 and in 1889 the river was traced to 13½° E., and Kebbi to Bifara by Maj. (afterwards Sir Claude) Macdonald, further progress towards the Tuburi marsh being prevented by the shallowness of the water. In 1903, a French officer, Capt. E. Lenfant (who had in 1901 succeeded in navigating the Bussa rapids on the Niger) ascended the Kebbi and discovered the Lata fall, continuing up the river to its point of issue from Tuburi. Crossing the marshes he found and navigated the narrow river leading to the Logone. Save for the portage round the Lata fall the whole journey from the mouth of the Niger to Lake Chad was made by water.

From Kulikoro (which is connected by railway with the port of Dakar) downward, the French have undertaken works on the Niger with a view to deepening the channel, and they maintain a regular steamer service to the port of Timbuktu. In 1910 the British began dredging with the object of obtaining in the lower river a minimum depth of 6 ft. of water; however, while there is still a large river traffic the building of railways in Nigeria has deprived the lower Niger and the Benue of their importance as highways of commerce to the far interior.

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NIGERIA, a British colony and protectorate in West Africa, occupying the basin of the lower Niger and adjacent regions. Area 335,700 sq.m.; pop. (1928) about 19,000,000. Administratively attached to Nigeria is that part of the Cameroons under British mandate, which has an area of some 32,300 sq.m. and a population of about 370,000. Nigeria is bounded south by the Gulf of Guinea; west by Dahomey, north by the French Niger Colony; and east by the French sphere of the Cameroons. It includes the former British colony and protectorate of Lagos (*q.v.*), and is nearly seven times the size of England. The following particulars do not include the British sphere of the Cameroons (*q.v.*).

Physical Features.—Nigeria is divisible, broadly, into zones parallel with the coast: (1) the delta, (2) forest region, (3) a zone of comparatively open country giving place to (4) the plateau region. The coast-line, some 500 m. in length, extends along the Gulf of Guinea from 2° 46′ 55″ E. to 8° 45′ E., ending at the Rio del Rey, where the great bend eastwards of the continent ceases and the land turns south. The Niger (*q.v.*), which enters the country at its north-west corner and flows thence south-east to the Atlantic, receives, 250 m. from the sea, the Benue, which, rising in the mountains of Adamawa south of Lake Chad, flows west across the plateau. Into the huge delta of the Niger several other rivers (the "Oil Rivers") empty themselves; the chief being, on the west, the Benin (*q.v.*), and, on the east, the Brass. East of the Niger delta is that formed by the Imo or Opobo, Bonny and other streams, and still farther east is the Calabar estuary, mainly formed by the Cross river (*q.v.*).

The delta region is swampy, and forms, for a distance of from 20 to 60 m. inland, a network of interlacing creeks and broad sluggish channels fringed with monotonous mangrove forests. Beyond the delta firm ground takes the place of mud and the mangroves disappear. The land rises gradually at first, becoming, however, in many districts very hilly, with heights of 3,000 ft., and is covered with dense evergreen or rain forests which give place to deciduous forest as the rainfall decreases. The evergreen and deciduous forests form part of the great West African forest belt; the trees are straight, tall and cylindrical and there is little undergrowth, though often bound together by creepers. The forest belt extends 50 to 100 m. and is succeeded by park-like land, the savannah and orchard forests much more extensive than the dense forest, with strips of deciduous forest going through it along the river banks.

North of the Niger-Benue confluence, which is but 250 ft. above sea-level, are hills forming the walls of the plateau which extends over the major part of the country and is part of the great plateau of North Africa. This plateau, broken only by the valleys of the rivers, does not attain an elevation approaching that of the plateaux of South Africa, the culminating point (apart from particular mountain districts), situated in about 10° N., reaching a height of 3,000 ft. only. The valleys of the Niger and Benue, especially the latter, are much lower, the town of Yola on the Benue, some 400 m. inland, lying at an altitude of little over 600 feet. The surface is generally undulating, with isolated "table mountains" of granite and sandstone often rising abruptly from the plain. It is clothed largely with thin forest, but becomes more open to the north until, towards the French frontier, the arid steppes bordering the Sahara are reached. Much of the country north of Zaria (11° N.) is covered with heavy, loose sand. The most mountainous districts are northern Bauchi (a little N. of 10°), where there are heights of 6,000 ft. or more; parts of Muri, along the north bank of the Benue; and the southern border of the Benue basin, where the hills consist of ironstone, quartz and granite. On the east the plateau sinks to the plains of Bornu (*q.v.*), which extend to Lake Chad. Tributaries of the Niger traverse the western portion of the country, the most noteworthy being the Gublin Kebbi, or Sokoto, river and the Kaduna, which flows through a valley not more than 500 ft. above the sea. The north-eastern part of the country drains to Lake Chad by the Waube or Yo, an intermittent stream, which in its lower course forms the Anglo-French boundary. The western portions of Lake Chad (*q.v.*) belong to the protectorate, which contains no other large lake. The water parting between the Chad and Niger systems runs north-west and south-east from about Katsina in 13° N. to the Bauchi hills.

Geology.—Except in the coast belt, which is composed of superficial deposits, crystalline rocks are the fundamental formation. From the edge of the coast belt to near the Niger-Benue confluence, these rocks are overlain by unfossiliferous sandstones, lying undisturbed, and possibly of the age of the sandstone of the

Congo basin. Much of the plateau—with its flat-topped hills and red earths—consists of what is called the fluvio-volcanic series. The alluvial deposits here are often unconnected with the present drainage lines. On the Bauchi plateau are large deposits of cassiterite (tin) mostly found in the detrital deposits resulting from the great denudation over the plateau. Limestones, with fossils indicating a Tertiary age, have been found near Sokoto. Recent alluvium and a thick deposit of black earth border the upper reaches of the Benue and cover wide areas around Lake Chad. Coal measures are found in the Enugu district east of the Niger and south of the Benue, and in the Bende district near the Cross river; there are large deposits of lignite in the younger Tertiary group in the Niger valley and in the neighbourhood of the Benue, where they are interstratified with white clays; rock phosphates are found north of Lagos and there is a belt of auriferous country north of Minna (towards the Kaduna river).

Climate.—Though Nigeria lies wholly within the tropics, there is a distinct difference in the climate of the northern and southern regions. In the south the climate is typical of the tropics; in northern Nigeria it resembles that of Egypt and may be described as sub-tropical. In the south the temperature varies comparatively little, from 70° to 100° F, and averages over 80° F. The air is both hot and humid; the rainy season is sometimes prolonged to ten months or more, the rainfall in the delta being from 100 to 140 or more inches a year. (At Bonny in 1923 the fall was 150·59 in., rain occurring on 151 days.) The prevailing wet season wind is from the south-west. From November to March the *harmattan*, a dry, dust-laden north-east wind, coming from the Sahara, blows intermittently, and this is the dry season, when at Lagos humidity has been known to fall to 26% against a mean of 90%. At Lagos the usual rainfall is 77 in. a year. Tornados occur at the beginning and end of the *harmattan*. Malaria is still a scourge in these southern districts and the country is unhealthy for Europeans. In the north the temperature is still high, but for nine months of the year the air is dry, "the dry air of the desert, the intense parching dryness of which is almost inconceivable by anyone who has not experienced it" (O. T. Faulkner, director of agriculture, Nigeria). July–September are the rainy months in the north, the fall being usually 25 to 30 in. a year, though in places it is as much as 60 inches. The *harmattan* begins in the north in October and lasts till April. In this season variations in temperature are great. At Hadeija, in 1922, a minimum of 35° F and a maximum of 115° F were recorded. In some parts of the plateau Europeans can live in comparative comfort, the climate resembling that of an unusually fine English summer, often with cool nights. Between the southern and northern regions there is an intermediate zone with a normal rainfall of from 40 to 50 in. a year and still considerable humidity.

Fauna and Flora.—There are many large and small mammals. They include the elephant, lion, leopard, giraffe, West-African buffalo, many kinds of antelope and gazelle and smaller game. The chimpanzee, the drill ape, the baboon and many kinds of monkeys are found in the forests and snakes are common. There are many varieties of squirrel, some finely coloured. The camel is found in the northern regions. In the rivers are rhinoceros, hippopotamus and crocodile. The manatus is also found. The birds include the ostrich, marabout, vultures, kites, hawks, ground hornbill, great bustard, guinea fowl, partridge, lesser bustard, quail, snipe, duck widgeon, teal, geese of various kinds, paraquets, doves, blue, bronze and green pigeons and many others. Domestic animals include the horse and donkey in the plateaux, but baggage animals are rare in the coast-lands, where the tsetse fly is found. Mosquitoes are abundant throughout the delta. There are the remarkable hammer-headed fruit-bat and other varieties of bats and a curious kind of dormouse. Many species of butterfly and spiders are recorded.

The mangrove is the characteristic tree of the swamps. North of the swamps the oil palm (*Elaeis guineensis*) flourishes abundantly. It is common as far as about 7° N. The evergreen and deciduous forests contain a great wealth of timber. Among the trees are mahogany, cedars and scented cedars, walnut, rosewood, satinwood, ebony, African teak and other valuable species. There are also African maple, shingle-wood, cork-wood, cotton-wood and other general utility woods, including the *abura* whose timber is acid resisting. Rubber vines are also found in these forests. Other trees found, chiefly on the plateaux, are the baobab, the shea-butter tree, the locust tree, gambier, palms, including the date and dum palm (Hyphaene), the tamarind, and, in the arid regions, the acacia and mimosa.

Inhabitants.—The vast majority of the inhabitants are typical negroes. In the south-west the Yorubas (*q.v.*) are the chief race. They occupy the country behind the coast-lands, from Dahomey to Benin, and have a considerable degree of civilization. In the delta district and the forest zone, besides the people of Benin, are the Jekri, living on the lower part of the Benin river and akin to the Yorubas, the Ijos, living in the delta east of the main mouth of the Niger, and the Ibos, occupying a wide tract of country just above the delta and extending east from the Niger to the Cross river. South of the Ibos live the Aros, a tribe of relatively great intelligence, who dominated many of the surrounding tribes and possessed an oracle or *ju-ju* of reputed great power. On the middle Cross river live the Akuna-kunas, an agricultural race, and in the Calabar region are the Efiks, Ibibios and Kwas. All these tribes are fetish worshippers, though Christian and Muslim missionaries have made numerous converts. The Efiks, a coast tribe which early came into contact with white men, have adopted several European customs, and educated Efiks are employed in Government service. The great secret society called Egbo (*q.v.*) is an Efik institution.

In the northern parts of Nigeria the inhabitants are of more mixed blood, owing to the invasion of Fula, Berber and Arab or Arabized people. But the bulk of the people are negroes. The most important of these negro peoples are the Hausa (*q.v.*), among whom the superior classes adopted Mohammedanism in the 13th and 14th centuries. The Hausa are keen traders and make excellent soldiers. The Fula tribe, besides providing the ruling families in many of the Hausa States, form a separate caste of cattle-rearers. Arab merchants live in some of the larger Hausa towns.

In general, the people living in the river valleys have been little or not at all affected by Muslim propaganda, either in blood or religion. Thus along the banks of the Niger, Benue and other streams, the inhabitants are negro and pagans, and generally of a primitive though often rather fine type. Of these the Munshi, who inhabit the district nearest the junction of the Benue with the Niger, were long noted for their intractability and hostility to strangers, whom they attacked with poisoned arrows. The Yorag-



FROM E. D. MOREL, "NIGERIA"

A GROUP OF HAUSAS CARRYING THE SHORT-HANDLED HOES IN THE ANCIENT HOE DANCE

hums, their neighbours, were cannibals. Nearer Yola live the Battas, who also had a bad reputation. In the central hilly region of Kachia are other pagan tribes. When first met by Europeans they wore no clothes, and their bodies are covered with hair. South of the Benue, near the Niger confluence, dwell the Okpotos, Bassas and other tribes, which had a reputation for savagery and war-lust. In the districts of Illorin and Borgu, west of the Niger, the inhabitants are also negroes and pagan, but of a more advanced type than the tribes of the river valleys. According to some native traditions, the people of Borgu claim to have a Coptic

origin. In Bornu (*q.v.*) the population consists of (1) Berberi or Kanuri, the ruling race, containing a mixture of Berber and negro blood, with many lesser indigenous tribes; (2) so-called Arabs, and (3) Fula.

A complete list of the tribes in Nigeria would run into many scores, and each has its separate language. In the old province of Bauchi alone as many as 60 different languages are spoken. The most widely diffused languages are Hausa and Yoruba. Arabic is the court and official language in the Fula emirates. In the ports many natives speak English.

The European inhabitants number (1929) some 5,000. They are chiefly officials, traders and missionaries. On the tin-fields are some 700 whites including over 100 women.

Chief Towns.—A large proportion of the people are town-dwellers. The ports, with the exception of Lagos, are all on the rivers. From west to east the ports reached by ocean steamers are Lagos (*q.v.*), the capital of Nigeria; Forcados, at the mouth of the Forcados branch of the Niger and the main port of entry for the river, having 18 ft. of water over the bar; Burutu, 5 m. above Forcados and the port of the Niger Co.; Warri 30 m. above Forcados; Koko and Sapele, on the Benin river, but reached by way of Forcados. All these ports are west of the Nun mouth of the Niger, where on the west bank is Akassa (14 ft. of water). West of the Nun mouth are Brass town (on the Brass river) and Bonny, at the mouth of the Bonny river. The three last-named ports, once flourishing, are now little used. Some 40 m. up the Bonny river is Port Harcourt (*q.v.*), second in importance of the ports of Nigeria. Farther east are Opobo (13 ft. of water), on the Imo river, richest of the oil-rivers of Nigeria, Degema (18 ft.), and Calabar (*q.v.*). On the river Niger, at the head of the delta, are Asaba (west bank) and Onitsha (east bank); farther north is Idah (east bank) in the palm-oil zone; Lokoja (*q.v.*) is at the Niger-Benue confluence; Baro, 70 m. above Lokoja, is on the railway system; and still farther north, on the river, are Egga, Jebba and Bassa (*q.v.*).

The largest cities are found in Yorubaland. Of these Ibadan (pop. about 240,000), the largest native city in Africa, Ilorin and Abeokuta are separately noticed. Other Yoruba cities are Ogbomosho (pop. 85,000), Oshogbo (pop. 51,000), Iwo (53,000), Ede (48,000) and Ogo (40,000). Other towns in the south are Benin (*q.v.*), west of the Niger and Bende, and Enugu, east of the river. Enugu (pop. 40,000) is the centre of the Udi coalfield.

In northern Nigeria, where the larger towns have generally a population of from 40,000 to 50,000, the chief city is Kano (*q.v.*), the commercial capital, situated in 12° N., 8° 32′ E. Sokoto, the religious and political centre of the Fula, is some 220 m. W.N.W. of Kano. Katsina (*q.v.*), near the frontier and 84 m. N.W. of Kano, has a reputation as an educational centre; other chief Hausa towns are Zaria (*q.v.*), Bauchi (or Yakoba); Beda; and Yola (*q.v.*). The chief towns of Bornu are Kukawa or Kuka (*q.v.*), near Lake Chad, Maidugari and Dikwa (Dikoa). The administrative capital of northern Nigeria is Kaduna; Jos, a modern town with European amenities, is the centre for the Bauchi tin-fields.

Communications.—Railways are now the chief means of transport, the shallowness of the Niger and Benue for a large part of the year rendering them an uncertain means of communication. There is still, however, a considerable river traffic, and in the delta the rivers remain the great highways. There is a regular steamer service between Forcados and Lagos, and between Lagos and Dahomey by the lagoons. From Forcados two steamers ascend the main Niger to Jebba, a distance of 530 miles. On the Benue there is steamer traffic as far as Yola. But between May and October navigation is only possible to vessels drawing not more than 3 ft. of water. There are navigable stretches of several other rivers—the Cross river can be ascended for 240 miles. For the main part the river services are (except in the delta) auxiliary to the railways.

Railway building began in 1896, with a line from Lagos to Ibadan, a distance by rail of 123 miles. This line was finished in 1900. In 1906 a forward policy was adopted, and since then progress has been rapid. The railways have been built and are owned and worked by the Nigerian Government and are of the standard African 3 ft. 6 in. gauge, unless otherwise stated. In 1929 some 1,900 m. of railway were open, the system consisting of:—(1) A western line running from Lagos to Kano (705 m.), via Abeokuta, Ibadan, Ilorin, Kaduna and Zaria. The Niger is crossed at Jebba—where there is an island—by two bridges, together 1,795 ft. long. The bridges, the last part of the line to be built, were completed in 1914. A branch line (111 m.) runs from Minna to Baro, on the Niger. Another branch line runs from Zaria, by Guasu to Kaura Namoda (142 m.), and in 1928–29 the main line was extended from Kano to Hadejia (102 miles). (2) An eastern line (built 1913–26) from Port Harcourt to Enegu, for the Udi coalfields, and Kaduna (569 m.), where it joins the western railway. The Benue is crossed at Makurdi, pending the completion of a bridge, by train ferry. A short branch line running to Jos, for the tin-fields, was opened in April 1927, and since then all the tin is sent to Port Harcourt. Jos was formerly served by a light line (2 ft. 6 in. gauge) from Zaria, on the western railway. This light line now carries cotton. In 1928 the building of a trunk railway to Lake Chad, at an estimated cost of some £5,000,000, was sanctioned. The capital cost of the railways, up to March 1928, had been £18,104,000 of which sum £15,245,000 had been raised by loan on the London market, at an average rate of interest under 5%. The railways are worked as a business concern, but the ultimate profits go to the colonial treasury. Motor traffic has to a large extent superseded other methods of road travel. Some 3,000 m. of all-the-year-round motor roads were being maintained in 1928 by the Public Works Department alone. There are, additionally, many miles of dry-season motor roads in the north.

There is regular steamship communication by several lines between Europe and Lagos and other Nigerian ports; direct cable communication with Europe and South Africa, an extensive system of inland telegraphs, and a wireless station at Lagos. The principal passenger and mail service is by the Elder Dempster line from Liverpool to Lagos, the voyage taking 15 days. A regular service between British ports and Nigeria has been maintained since 1852.

Administration.—The country is divided into three parts; the colony of Nigeria (the old Lagos colony) with an area of 1,400 sq.m. only; and the northern and southern provinces (78,600 sq.m. and 255,700 sq.m. respectively) which form the Protectorate of Nigeria. At the head of the administration is a governor; there is a lieut.-governor for the northern and for the southern provinces, and, since Oct. 1927, a separate administrator for the colony. Certain important services, *e.g.*, the railways, function throughout Nigeria. The governor, whose headquarters are in Lagos, is aided by an executive council of officials, and for the colony and the southern provinces there is a legislative council on which, since 1923, elected members have sat to represent the towns of Lagos and Calabar. (The franchise is conferred on adult males with an income of £100 a year or more.) On the council are also members nominated by various commercial bodies and others nominated to represent African interests. The legislative council is given control of expenditure in the northern provinces derived from the revenues of the central Government. The number of provinces has varied from time to time. As far as possible the system of indirect rule is observed; that is, the native governments existing before the British occupation are retained, each with its own treasury and judiciary, the rulers being guided by the advice of a British resident, under whom are district officers. This indirect rule prevails in almost all the northern provinces and also in Yorubaland. In these native states direct taxation and a fixed income for the emirs and other paramount chiefs has led to the abolition of many abuses. Fifty to 70% of the direct tax goes to the native treasuries.

Education and health are departments of primary value. There are Government elementary and technical schools, and King's college, Lagos, founded 1909, provides secondary education. At Katsina is a training college for native teachers, opened 1922, and there are training colleges in southern Nigeria, including two for women teachers. Education remained, however, chiefly in the hands of Christian missions; the Hope Waddell institute at Calabar, a Scottish missionary enterprise, has a high reputation for

industrial training. Both the missions and State schools now pay special attention to practical agricultural training. Some of the native administrations have their own schools. The Yoruba have for long shown an eagerness for education; after the World War the demand for education among the natives generally greatly increased. The health department has done a great and successful work in fighting malaria, dysentery, yellow fever and plague, and in insisting upon better housing and better food for Europeans. As one result the death rates of whites fell between 1903 and 1926 from over 20 per 1,000 to under 9 per 1,000.

Before amalgamation the administration of northern Nigeria required grants-in-aid to meet expenses, which were partly furnished by her richer neighbour, southern Nigeria. Since amalgamation, Nigeria has been self-supporting, though revenue in some years falls short of expenditure. In 1914 revenue was £3,048,000 and expenditure £2,967,000; in 1923–24 revenue had risen to £6,260,000 and expenditure to £5,501,000. The figures for 1926–27 were, revenue £7,734,000, expenditure £7,584,000. Revenue is derived from customs duties on imports fixed at 15% *ad valorem* in 1922; on the chief exports (this duty was first imposed in 1916); by direct taxation; and, in the colony only, and since 1927, income tax. It may be noted that a special West African currency is in circulation and that for purposes of trade between natives it has been necessary to mint a coin valued at one-tenth of a penny. The Bank of British West Africa and the Colonial Bank have agencies in the chief towns. British weights and measures are in use.

Economic Conditions.—There is a very large internal trade, as to which no statistics are available, but it is believed to exceed in value the external trade. The great majority of the people are agriculturists, including, in the north, cattle-rearing. Native manufactures are of minor importance—they include in the Hausa States the making of "Morocco" leather; mining (tin and coal) owes its development to the British. Fishing is largely followed in the delta. In a broad generalization the products of southern Nigeria are sylvan, palm oil and palm kernels taking the leading place. Cocoa and cotton are other products. From the middle belt come benniseed and shea-butter—both adding to the oil output. From northern Nigeria come groundnuts (a basis for margarine), hides and skins, cattle, and, in increasing quantities, cotton. (Cotton and maize are the only crops common to the northern and southern provinces.) Add to the products named coal and tin and timber, and the leading exports have been stated.

The coast peoples, since the 15th century, had traded directly with the European merchants who came to their ports, but the dense forest belt cut off intercourse with the interior—though the Niger and Benue might have afforded means of penetration. But up to the middle of the 19th century the trade of Hausaland and Bornu (that is northern Nigeria) was either with the Mediterranean by caravan across the Sahara, or east and west to other parts of the Sudan. Direct, but, at first, very limited, trade with the interior followed the efforts of the British government and merchants to open up the country by sending expeditions up the Niger and Benue. Modern developments date from the founding of the Royal Niger company by Sir George Goldie and the conquest of the Fula emirates by Sir F. D. (Lord) Lugard. (*See* p. 442, *History*.) The trade of Lagos and the oil rivers, the last the eastern part of southern Nigeria, partly through having been long established, was, up to 1928 at least, more valuable than that of northern Nigeria, which contains large areas sparsely peopled and little cultivated, and was not fully opened to trade with the south until the beginning of the 20th century. (This trade via the Gulf of Guinea, together with minor causes, almost killed the trade via the Sahara.) In 1901 when the total external trade of the southern regions was valued at over £4,000,000 that of northern Nigeria was probably (statistics are lacking) not £250,000. With the completion of the railway to Kano in 1911, there was a great increase in trade in the north. Since the amalgamation of southern Nigeria (including Lagos) with northern Nigeria in 1914 statistics are given for the country as a unit. In that year the imports were valued at £6,276,000 and the exports at £6,420,000. In 1924, when normal conditions following the World War were considered to be restored, the figures were:—imports £10,948,000; exports £14,460,000. In 1927 the external trade was nearly £30,000,000—imports being £14,146,000 and exports £15,654,000. These figures exclude specie.

Almost all sylvan and agricultural work in Nigeria is done by native owners, peasant farmers with small holdings, usually about 3 acres. The main concern of the farmer is to produce food crops—guinea corn and millet, yams and bananas, and maize—for himself and his family; he works for sale only in his spare time and to get luxuries. The great occupation in the delta is the production of palm oil and palm kernels. The yearly export is about 100,000 tons of oil and double that weight of kernels. Native methods of treating the fruit waste about half of the oil; up to 1928 only one factory had been started to deal with the fruit. Cocoa plantations were started in south Nigeria about 1905; the production of cocoa grew by 1928 to 40,000 tons in the year. Cotton growing for export dates from the early years of the 20th century; in 1912 an American variety of cotton was introduced and found suitable. In the centre and south a native cotton is also grown for export. By 1925 the export had reached 35,000 bales; two or three poor seasons followed; the 1925 output was nearly reached again in 1928, and the acreage under cotton increased. Many ginneries have been set up. The cultivation of groundnuts in northern Nigeria—climate and soil are well suited to the crop—grew rapidly with increased transport facilities. In the year 1927–28 (April and March inclusive) the railways carried 96,000 tons of nuts as against 4,800 tons of cotton. Generally, farming in Nigeria is not on a high level, partly because fertilizers are not used. The exhaustion of much land within easy reach of transport caused grave concern to the Government which from 1926 onward took measures to instruct the farmers in the use of manures and other fertilizers. There are, however, good stock farms in the north with large herds of cattle and flocks of sheep and goats.

The chief industries which are owned by Europeans are the tin and coal mines. The ascertainment of the richness of the tin-fields in Bauchi in 1902 led to a speedy development of the mines (which employ 30,000 to 35,000 natives), and the output of coal from Ude, which began in 1915, is of much importance. The coal mines are worked by the railway department for the Government; they supply the fuel for the tin mines, for their own railway and for the Gold Coast railways, and still have a surplus for the Government marine and the shipping companies. The output for the year ended March 31, 1928, was 345,000 tons. The tin-fields (*see* BAUCHI) are worked by private enterprises, mostly for companies registered in London. The timber-cutting concessions are also in the hands of Europeans. There are 200,000 sq.m. of forest in Nigeria; the timber exported is mainly mahogany, cedar and walnut, the mahogany chiefly from the Benin forests. Gum arabic is obtained from Bornu and other northern provinces. "Wild" rubber is still tapped, and plantation rubber is exported. The relative value of the chief exports is shown in the following figures for 1927:—Palm oil, £3,617,000; palm kernels, £4,574,000; groundnuts £1,633,000 (£2,342,000 in 1926); cocoa, £1,968,000; cotton lint, £611,000 (£1,182,000 in 1926); tin, £2,403,000.

The imports are of a most miscellaneous character; they may be classed under the main heads of cigarettes, cotton goods (both from the United Kingdom), provisions, hardware, salt, kola nuts (from the Gold Coast), petrol, and alcoholic liquors (mostly gin from Holland). (Though the import of "trade spirits" has been prohibited since 1919, and no alcoholic liquors, save for Europeans, are allowed into northern Nigeria, the growing wealth of the natives of southern Nigeria led to an increased demand for ordinary spirits and beer.) With regard to the direction of trade the figures for 1927 showed that 53·5% was done with the United Kingdom—which supplied 62% of the imports and took 45·6% of the exports. In that year Germany had 15% and the United States 10% of the total trade. Of the exports the palm kernels—largely used as cattle food—go to Germany and England, and the groundnuts to Germany, 60%, and France. The United States supplies kerosene, petrol and unmanufactured tobacco, and takes about 25% of the palm oil, and 30% of the cocoa.

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Defence.—With a population approaching 19,000,000, order is maintained in Nigeria, and defence provided for the colony, by the Nigeria regiment of the West African frontier force (*see* GREAT BRITAIN: *Colonial Forces*). This force, which was raised in 1901, consists of officers and non-commissioned officers of the British Army and other ranks recruited locally for 6 years with the colours and 3 in the reserve, with facilities for re-engagement. Training is on the lines of the British army. Regimental transport is by native carriers; transport animals are not used. The Nigeria regiment includes 1 battery of artillery (3·7 inch howitzers), 4 battalions of infantry, 1 light mortar unit, a signal school, and a depot. The establishment is 3,590, with a reserve of 682. There are also armed police with an establishment of 1,260 in the northern provinces, 2,105 in the southern. These police are liable for military service, and distributed in 7 territorial divisions, each under a senior commissioner.

See also League of Nations *Armaments Year-Book* (Geneva, 1928). (G. G. A.)

HISTORY

Of the early history of the races inhabiting the coast lands little is known. The Beni appear to have been the most powerful race at the time of the discovery of the coast by the Portuguese in the 15th century, and the kings of Benin in the 17th century ruled a large part of the south-western portion of the existing British protectorate (*see* BENIN). The Benin influence does not seem to have reached east of the Forcados mouth of the Niger. In the greater part of the delta region each town owned a different chief and there was no one dominant tribe. Among these people, who occupied a low position even among the degenerate coast negroes and who were constantly raided by the more virile tribes of the interior, trading stations were established by the Portuguese, and later on by other Europeans, British traders appearing as early as the 17th century. There was no assertion of political rights by the white men, who were largely at the mercy of the natives and who rarely ventured far from their ships or the "factories" established on the various rivers.

By the end of the 18th century British enterprise had almost entirely displaced that of other nations on the Niger coast. But the principal trade of all Europeans was still in slaves. After the abolition of the slave-trade in the 19th century palm oil formed the staple article of commerce, and the various streams which drain the Niger coast near the mouth of the great river became known as the "Oil rivers." The opening up of the interior was in the meantime promoted, chiefly by the efforts of British travellers and merchants. Mungo Park traced the Niger from Segu to Bussa, where he lost his life in 1805. From Bussa to the sea the course of the river was first made known in 1830 by the brothers Richard and John Lander. Maj. Dixon Denham and Capt. Hugh Clapperton entered the country now known as Northern Nigeria from the north in 1823, crossing the desert from Tripoli. Clapperton in 1826–27 made a second journey, approaching the same territory from the Guinea coast. Dr. Barth, travelling under the auspices of the British Government, entered the country from the north and between 1852 and 1855 made the journeys whose record still remains the principal standard work for the interior. Macgregor Laird first organized in 1832 the navigation of the River Niger from its mouth to a point above the Benue confluence. During the next 25 years expeditions were despatched into the interior and a British consul was posted at Lokoja. Possession was also taken, in 1861, of Lagos island, with the object of checking the slave traffic still being carried on in that region. But the deadly climate discouraged the first efforts of the British Government, and, after the parliamentary committee of 1865 had recommended a policy which would render possible the ultimate withdrawal of British official influence from the coast, the consulate of Lokoja was abandoned, but re-established a few years later to meet the still steadily growing requirements of British trade upon the river.

The Royal Niger Company.—In 1880 the international "scramble for Africa" led to the establishment under the recognized protection of the French Government of two French firms which opened upwards of 30 trading stations on the Lower Niger. The establishment of these firms was admittedly a political move which coincided with the extension of French influence from Senegal into the interior. Nearly at the same time a young Englishman, George Goldie-Taubman, afterwards better known as Sir George Goldie (*q.v.*), having some private interests on the Niger, conceived the idea of amalgamating all local British interests and creating a British province on the Niger. To effect this end the United African Company was formed in 1879 and trade was pushed upon the river with an energy which convinced the French firms of the futility of their less united efforts. They yielded the field and allowed themselves to be bought out by the United African Company in 1884. At the Berlin Conference held in 1884–85 the British representative was able to state that Great Britain alone possessed trading interests on the Lower Niger, and in June 1885 a British protectorate was notified over the coast lands known as the Oil rivers. Germany had in the meantime established itself in Cameroons, and the new British protectorate extended along the Gulf of Guinea from the British colony of Lagos on the west to the new German colony on the east, where the Rio del Rey marked the frontier. In the following year, 1886, the United African Company received a royal charter under the title of the Royal Niger Company. The territories which were placed by the charter under the control of the company were those immediately bordering the Lower Niger in its course from the confluence at Lokoja to the sea. On the coast they extended from the Forcados to the Nun mouth of the river. Beyond the confluence European trade had not at that time penetrated to the interior.

The interior was held by powerful Mohammedan rulers who had imposed a military domination upon the indigenous races and were not prepared to open their territories to European intercourse. To secure British political influence, and to preserve a possible field for future development, the Niger Company had negotiated treaties with some of the most important of these rulers, and the nominal extension of the company's territories was carried over the whole sphere of influence thus secured. The movements of Germany from the south-east, and of France from the west and north, were thus held in check, and by securing international agreements the mutual limits of the three European Powers concerned were definitely fixed. The principal treaties relating to the German frontiers were negotiated in 1886 and 1893; the Anglo-French treaties were more numerous; those of 1890 and 1898, which laid down the main lines of division between French and British possessions on the northern and western frontiers of Nigeria, having been supplemented by many lesser rectifications of frontier. It was not until 1909 that the whole of the frontier between Nigeria and the French and German possessions had been definitely demarcated. Thus, mainly by the action of the Royal Niger Company, and with the employment of a force of 500 Hausa trained under European officers, a territory of vast extent, into which the chartered company itself was not able to carry either administrative or trading operations, was secured for Great Britain.

The Protectorate.—Owing to pressure of foreign nations on the company's frontiers, a situation had arisen which the resources of a private company were inadequate to meet. In 1897 relations with France on the western border became so strained that Mr. Chamberlain, who was then secretary of state for the colonies, thought it necessary to raise a local force, afterwards known as the West African Frontier Force, for the special defence of the frontiers of the West African dependencies. In these circumstances it was arranged that in consideration of compensation for private rights the company should surrender its charter and transfer all political rights in the territories to the Crown. The transfer took place on Jan. 1, 1900, from which date the company, which dropped the name of "royal," became a purely trading corporation. The southern portion of the territories was amalgamated with the Niger Coast protectorate, the whole district taking the name of the Protectorate of Southern Nigeria,

while the northern portion, extending from a line drawn slightly above 7° N. to the frontier of the French possessions on the north and including the confluence of the Niger and the Benue at Lokoja, was proclaimed a protectorate under the name of Northern Nigeria.

The company, during its tenure of administrative power under the charter, had organized its territories south of the confluence into trading districts, over each of which there was placed a European agent. The executive powers in Africa were entrusted to an agent-general with 3 provincial and 12 district superintendents. There was a small judicial staff directed by a chief justice, and there was a native constabulary of about 1,000 men, trained and drilled by white officers. The company kept also upon the river a fleet of about 30 steamers. The entire direction of the proceedings of the company was, however, in the hands of the council in London, and the administrative control of the territories was practically from first to last vested in the person of Sir George Goldie. The local work of the representatives of the company was mainly commercial.

Southern Nigeria, 1885–1906.—While the development of the Royal Niger Company's territories was proceeding in the manner described, the regions under direct British control were also being opened up and law and order introduced. In 1893, when the title Oil Rivers Protectorate was changed to that of Niger Coast Protectorate, a regular administration was established (subject to the Foreign Office in London) under Sir Claude Macdonald, who was succeeded as commissioner and consul-general in 1896 by Sir Ralph Moor (1896–1904). Under these officials peace was gradually established between various tribes, trade routes opened, and progress made in civilization. The work was one of extreme difficulty, largely because there was no central native authority with which to deal. Small military expeditions had constantly to be employed to break up slave-raiding gangs or reduce to order tribes which blocked trade routes or made war on other tribes living peaceably under British protection. The most serious military operations were against the Beni, a peaceful mission to the king of Benin having been massacred in the bush in Jan. 1897. The operations were completely successful and the Benin country was added to the protectorate (*see* BENIN). The administration improved the condition of the natives without undue interference with customary law. The submission of the Aros to the Government in 1902 brought to an end the system of tribal warfare for the purpose of making slaves, while a proclamation of 1901 prohibited the buying, pawning, or selling of slaves. Trade steadily developed, and owing to the large sums paid as duty on imported spirits the revenue of the protectorate was sufficient to cover the expenditure.

Northern Nigeria.—In Northern Nigeria at the time of the transfer (1900) British authority had still to be established. The man selected for the post of first high commissioner was Colonel (Lord) Lugard, who had conducted one of the Royal Niger company's most successful expeditions into the western portion of the interior and had already been employed by the British Government to raise and organize the West African Frontier Force.

On Jan. 1, 1900, the Union Jack was hoisted at Lokoja, and the formation of a local administration was entered upon. The headquarters of the West African Frontier Force had been at Jebba, not far from the point at which Mungo Park had lost his life upon the river. Neither Jebba nor Lokoja was considered suitable for the permanent capital of the protectorate and survey parties were sent out to find a more suitable site, with strict orders to avoid conflict with the nominally friendly natives. This was selected on a branch of the Kaduna river in the south-western corner of the province of Zaria, at a place of which the native name of Zungeru was retained. The ruler of Zaria, while professing friendliness, was, however, unable or unwilling to restrain the rulers of Kontagora and Nupe from aggression. These two potentates raided for slaves to the borders of the rivers and openly threatened the British position on the Niger. The Ashanti War of 1900 claimed the despatch of a strong detachment of the West African Frontier Force, and it was not until the return of the troops in Feb. 1901 that Nupe and Kontagora could be effectively dealt with. In that year both provinces were subdued, their emirs deposed, and letters of appointment given to new emirs, who undertook to rule in accordance with the requirements of humanity, to abolish slave-raiding and slave dealing, and to acknowledge the sovereignty of Great Britain. Illorin and Borgu with a portion of Kabba were already under British rule. The rulers of other neighbouring provinces offered their allegiance, and by the end of the year 1901 nine provinces, Illorin, Kabba, Middle Niger, Lower Benue, Upper Benue, Nupe, Kontagora, Borgu and Zaria had accepted the British occupation. An initial system of administration was organized and British residents were appointed to each province. Seventeen legislative proclamations were enacted in the first year dealing with the immediate necessities of the position and providing for the establishment of a supreme and provincial court of justice, for the legalization of native courts of justice, and for regulating questions of slavery, importation of liquor and firearms, land titles, etc. In the autumn of 1901 the emir of Yola (the extreme eastern district in the territories bordering upon the Benue) was, in consequence of the aggressions upon a trading station established by the Niger Company, dealt with in the same manner as the emirs of Nupe and Kontagora, and a new emir was appointed. In 1902 Bauchi and Bornu were brought under British rule. Military stations were established in each and both were included in the system of British administration. Later in the same year an act of treachery culminating in the murder of a British resident, Captain Moloney, in the province of Nassarawa, led to the military subjugation of that province. By the end of the year 1902 British administration had been extended to the whole of the provinces in the south, east, and west of the protectorate. The important Mohammedan states of Sokoto, Gando, Kano, and Katsena remained independent. These states were regarded as the stronghold of Fula supremacy. The emir of Sokoto held the position of religious as well as political head of all the lesser states of Northern Nigeria, and in response to friendly overtures on the part of the British administration had declared that between Sokoto and Great Britain there could be nothing but war. Katsena was the centre of local learning, while Kano was at once the commercial and the military centre of power. By the end of 1902 it had become evident that a trial of strength between the Mohammedan powers and the new British administration was inevitable. The Mohammedan rulers were themselves of comparatively recent date. In fighting them there was no question of fighting the whole country. On the contrary it was presumed with justice that their overthrow would be hailed with satisfaction by many of the subject peoples. Every attempt was made to settle the question at issue by conciliatory methods, but, these having failed, a campaign against Kano and Sokoto was entered upon in Jan. 1903. It was entirely successful. The capital of Kano, a walled and fortified town of great extent and formidable strength, fell to a British assault in Feb. 1903. Sokoto submitted after a battle which took place on May 17. The sultan fled, and on May 21 a new sultan, chosen by the council of elders, was installed by the British high commissioner, after he had publicly accepted the conditions imposed by the British Government, namely, that all rights of conquest acquired by the Fulani throughout Northern Nigeria passed to Great Britain, that for the future every sultan and emir and principal officer of state should be appointed by Great Britain, that the emirs and chiefs so appointed should obey the laws of the British Government, that they should no longer buy and sell slaves, nor enslave people, that they should import no firearms, except flintlocks, that they should enforce no sentences in their courts of law which were contrary to humanity, and that the British Government should in future hold rights in land and taxation. When these conditions were accepted by the Fulani chiefs the supremacy of Great Britain was established over the entire country. Katsena and Gando followed the example set for them by Kano and Sokoto. After the conquest of the Hausa states in 1902–3 the King's writ ran—with the exception of a few districts inhabited by primitive savages—through the whole area known as Northern Nigeria.

THE AMALGAMATION OF NIGERIA

Union of Lagos and Southern Nigeria.—In 1904 it was decided to unite the two Nigerias and Lagos under one government, and as a first step in that direction Sir Walter (then Mr.) Egerton was appointed both governor of Lagos and high commissioner of Southern Nigeria. This was followed in Feb. 1906 by the amalgamation of these two administrations under the style of "the Colony and Protectorate of Southern Nigeria," with headquarters at Lagos town. The former colony and protectorate of Lagos (*q.v.*) became the western or Lagos province of the new administration. In the year of amalgamation the revenue reached a record figure, the amount collected being £1,088,000, to which Lagos province contributed £424,000. Over 80% of the revenue was derived from customs. In the same year the expenditure from revenue was £1,056,000.

Northern Nigeria Railway.—Northern Nigeria continued to be a separate protectorate, and in 1907 Sir Frederick Lugard was succeeded as high commissioner by Sir Percy Girouard. In August of that year the British Government, on administrative, strategic, and commercial grounds decided on a railway to give the cities of Zaria and Kano direct communication with the perennially navigable waters of the Lower Niger. In view of the approaching unification of Southern and Northern Nigeria, the money needed, about £1,250,000, was raised as a loan by Southern Nigeria. The route chosen for the line was that advocated by Sir Frederick Lugard. This important work, essential for the welfare of the northern territories, was begun under the superintendence of Sir Percy, the builder of the Wadi Halfa-Khartoum railway. At the same time the Lagos railway was extended to join the Kano line near Zungeru, the Niger being bridged at Jebba.

Land Tenure.—Sir Percy Girouard gave much attention to the land tenure, probably the most important of administrative questions in West Africa. He adopted the land policy of Sir Frederick Lugard and recommended "a declaration in favour of the nationalization of the lands of the protectorate." This was in accord with native laws—that the land is the property of the people, held in trust for them by their chiefs, who have not the power of alienation. In 1909 he was succeeded as Governor (the title High Commissioner having been changed) by Sir H. H. J. Bell; and meanwhile the secretary for the colonies had appointed a strong committee, which, after hearing much evidence, issued a report in April 1910 in substantial agreement with his recommendations. This policy was adopted by the Colonial Office and the natives of Nigeria were secured in the possession of their land—the Government imposing land taxes, which are the equivalent of rent. The exclusion of the European land speculator and denial of the right to buy and sell land and of freehold tenure was held by all the authorities to be essential for the moral and material welfare of the inhabitants of a land where the duty of the white man is mainly that of administration and his material advantages lie in trade.

Amalgamation of Northern Nigeria.—The constitution of Southern Nigeria (1906) left the protectorate still divided into two very different, and, for political purposes, distinct dependencies of the Crown. Southern Nigeria, with an area of about 76,000 sq.m., stretched inland from the Guinea coast through a tropical belt of generally dense forest land to a line irregularly corresponding with the latitude of 7′10″ N. Northern Nigeria, with an area of 255,700 sq.m., composed largely of open prairie, hill country, and dry desert plains, extended from the latitude of 7′10″ to the frontiers of the French and Zinder territory on the north, to French Dahomey on the west, and to the German Cameroons on the east. The population of Southern Nigeria was about 8,000,000 and the population of Northern Nigeria, with more than three times the area, was about 9,000,000. In both divisions primitive and very backward races had been overrun and influenced by civilizations of a higher type. In the south the new civilization had been European and Christian; in the north, Arab and Mohammedan.

The interdependence of these two regions was obvious and their amalgamation had long been urged upon the Imperial Government. It was not, however, until 1911 that the secretary for the colonies, Mr. L. V. Harcourt, determined to adopt the policy. Sir F. (Lord) Lugard, who had been the first high commissioner for Northern Nigeria, was asked to initiate and carry out a scheme of amalgamation, being in 1912 appointed governor at the same time of both Southern and Northern Nigeria. The preliminary work was completed in about 18 months, and on Jan. 1, 1914, the governments of Southern and Northern Nigeria were formally amalgamated, Sir Frederick Lugard receiving the personal title of governor-general. The geographical divisions of north and south were maintained. Two lieutenant-governors were appointed, one for the northern and one for the southern province. An administrator was appointed to the colony, the executive council of which became the executive council of the protectorate, while the jurisdiction of the legislative council was confined to the narrow limits of the colony's 1,400 sq.m.

At the time of amalgamation Northern Nigeria was divided into 12 provinces, the native communities being for the most part each under its native ruler, the five principal native states being known as first-class emirates, while each independent chieftainship, however small, retained its treasured liberty, and this system of government was maintained. The southern provinces at that period consisted of three divisions under provincial commissioners. They were the territories east of the Niger, west of the Niger, and the hinterland of Lagos. The native races in the hinterland of Lagos and to the east of the Niger were in a much less advanced state of tribal organization than were the tribes in the north and scarcely fitted for any form of enlightened self-rule. Fetish worship, cannibalism, and barbarous practices were rife. On the west of the Niger, however, three native states, Yoruba, Egbe, and Benin, were strongly organized. They were induced to renounce the exceptional position they enjoyed, under treaties made with Great Britain, and to accept conditions similar to those of the first-class emirates of the north. The introduction of the new system was accompanied by some difficulty, and in 1918 an easily suppressed rising in Egbeland gave momentary uneasiness. Indirect rule has now been fully accepted in both Egbeland and Yorubaland and the report of 1924 stated that it was working admirably in Benin. The way for the extension of such indirect rule as might be found possible was prepared by the division of Southern Nigeria into nine provinces (later increased), each under a British resident, as in the north.

The World War.—The outbreak of the World War within seven months of amalgamation postponed the consolidation of the new system. Patriotic sentiment in the protectorate ran high. Every department was depleted by volunteers for active service, and it was with difficulty that the administrative machine was held together with the remnant of overworked staff retained. For four years, the first thought of every Englishman in Nigeria was given to the war. And not of the Englishmen only. The War served at once to test and to exemplify the solid results of British rule. Throughout the War period the great native chiefs of the north were constant and unflagging in their loyalty.

The native troops of the West African Frontier Force did gallant service, both in the arduous campaign carried out under the leadership of Generals Dobell and Cunliffe in the Cameroons, and in what was to them foreign service in East Africa. The Cameroons campaign which opened in August and September 1914, with reverses all along the British line, at Mora (Aug. 25) and Garua (Aug. 29) in the north, and at Nsanakang (Sept. 6) in the south, lasted until Feb. 1916. It was a severe test for the troops engaged. The fighting was heavy, but they stood it well. Early in 1915 the campaign, in which French troops took an active part, was reorganized. British forces in the north were placed under the command of General Cunliffe, and the final taking of Garua and the storming of Banyo Hill under his leadership on Nov. 6, 1915, in face of a hail of dynamite bombs, was a feat of which any regiment might be proud. The conquered territory was divided between France and Great Britain, to be administered under mandate according to the provisions of the Treaty of Versailles. The portion taken by Great Britain was 31,000 sq.m., with an estimated population of 600,000 (*see* CAMEROONS).

Reforms.—While the War by arresting material development also delayed the application of schemes for the moral welfare of the native population, some progress was made. The judicial and legal systems of the two protectorates were, on amalgamation, combined. One chief justice for the whole of Nigeria and four puisne judges were appointed, and each lieutenant-governor was provided with a legal adviser. The reorganization of the two systems and the revision of the laws of the two protectorates, was a long and heavy job. The first reforms were initiated in 1914. Notwithstanding the difficulties of the moment, an education ordinance was promulgated in 1916 having for its object the reform and co-ordination of the systems of the north and south. It set a definite standard, of which the principal aim was to substitute self-discipline and the formation of character for set examinations in literary subjects, and generally to fit local education to local needs. A forestry ordinance of the same year (1916) dealt with the rapid destruction of the forests, which constitute the principal wealth of the southern provinces.

Not the least achievement of the War period was the elimination of the traffic in foreign "trade spirits," on which the revenue of the southern provinces had largely depended. It was the declared policy of the amalgamated Government to kill this trade by gradually raising the duty. Conditions of war hastened the process. Before the War the revenue from this traffic formed 34·26% of the revenue of Southern Nigeria. By the end of the War it had fallen to a proportion of 1·23. It was held that this result established two important conclusions. First, that the Government of Nigeria could dispense with revenue derived from spirits; secondly, that the produce trade could be conducted successfully without them. As from Feb. 1, 1919, the importation of trade spirits was formally prohibited in all the West African colonies and protectorates.

Constitutional Changes.—Sir F. (later Lord) Lugard retired at the end of the War, and Sir Hugh Clifford succeeded him as governor of Nigeria in July 1919. It was an era of prosperity, and at the end of Clifford's term of governorship great economic progress had been made. Sir Hugh's tenure of office was also notable for two modifications in the system of administration. The first was the extension and reorganization of the central secretariat, a step which in practice tended to curtail the responsibility and initiative of the lieutenant-governors and residents of provinces. The second was the abolition of an advisory Nigerian council established under the amalgamation scheme, and the restoration of the jurisdiction of the legislative council for the colony over the whole of the southern provinces. In the new and enlarged council the elective principle was introduced. The introduction of this elective principle, of which experience in the West Indies has not been altogether encouraging, was new to West Africa, though it has since been applied to Sierra Leone and the Gold Coast. The new council retains an official majority, but includes three elected unofficial members representing the municipal area of Lagos, and one elected unofficial member representing the municipal area of Calabar. The unofficial element also includes members chosen by the three Chambers of Commerce (Lagos, Port Harcourt, and Kano) and the Chamber of Mines, two members representing respectively the banking and shipping interests, and eight the otherwise unrepresented African population of the colony and the southern provinces. The first elections for this council were held in Sept. 1923, and the council was inaugurated by the governor on Oct. 1, 1923. The governor retains the power to legislate for the northern provinces, but the council may discuss affairs of interest to any part of Nigeria. In Sept. 1925 Sir Hugh Clifford was succeeded as governor by Sir Graeme Thomson.

Improvement of Communications.—During his first year of office Sir Graeme made extensive tours, in one of which he traversed the protectorate from Lagos to Lake Chad, the whole distance being covered for the first time by motor; and in Feb. and March, 1926, Mr. W. G. A. Ormsby-Gore, the under-secretary of state, visited Nigeria. Later in the year proposals for the improvement of communications were submitted by the governor and approved in general by the secretary of state. In his address to the legislative council on Feb. 1, 1927, Sir Graeme outlined a large programme of accelerated road and railway construction. In the next five years the Nigerian Government proposed to increase the 2,970m. of then existing roads by 200m. per annum, and to add to the 1,597m. of railways then open, new branch lines (to feed the main trunk lines) at the rate of 150m. a year.

The necessity for a big improvement in the transport facilities was emphasized by the condition of the cotton industry. In the years 1906–1926 the value of the external trade of Nigeria rose from 5 to 34 millions sterling. More than half of the exports (of the total value of £16,888,361 in 1926) are palm oil and kernels, but among other industries cotton growing, introduced by the British Cotton Growing Association in 1902, is notable, as affording a prospect of mutual benefit to the Africans of the protectorate and to Britain. It is only in recent years, however, that the production of lint for export has been replaced largely by the growing of the long staple American cotton. In the season 1924–25 the amount of American cotton exported was 28,100 bales, and in 1925–26 it rose to 38,350 bales. When in this hopeful stage of development the industry was threatened with disaster by the fall of the world-price of raw cotton in 1926.

To meet the danger the Government carried cotton on the railways at nominal rates, and, in response to Sir Graeme's appeal, the British Cotton Growing Association reduced the ginning charges and Messrs. Elder Dempster their sea-freights. Six months later he was able to announce the success of these measures to a Manchester audience. "A practicably established but growing industry," he said on Sept. 3, had been saved "from a very serious set-back." At the same time, in view of the relative failure of the American cotton when grown in mixture with other crops (as is customary among the African farmers), the Agricultural Department of Nigeria is trying to produce a strain of native cotton with the long fibre required by the Lancashire cotton spinners. If such strains can be produced in sufficient quantities, it is believed that the area under cotton will be largely extended in the near future.

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(F. L. L.; W. B. W.)

NIGHTHAWK, an insect-hunting bird closely related to the goatsuckers of the Old World, and less closely to the swifts and humming birds. The nighthawk (*Chordeiles virginianus*) belongs to the family *Caprimulgidae*, goatsuckers, so called from the fancy that they sucked the milk of goats. The wide skull, soft plumage, noiseless flight and nocturnal vision connect these birds with the owls. The nighthawk wanders in migration from the Arctic ocean to southern South America and breeds in eastern North America from Florida to Labrador. The eggs are laid on the ground or on the flat roof of a building. The Texan nighthawk (*Ch. acutipennis texensis*) has rusty-brown spots on the flight feathers.

NIGHTINGALE, FLORENCE (1820–1910), hospital reformer, younger daughter of William Edward Nightingale, of Embley Park, Hampshire, and Lea Hurst, Derbyshire, was born at Florence on May 12, 1820, and named after that city, but her childhood was spent in England, mainly in the country at one of her father's houses, but with periodical visits to London. Sidney Herbert was a neighbour of the Nightingales in Hampshire, and both he and his wife were Florence's friends. She received

a good classical and mathematical education at home under her father's guidance. She began to visit the hospitals in 1844, as she was not content merely to lead the ordinary social life of a girl of her class. In the winter of 1849–50 she made a tour in Egypt with friends, travelling by way of Paris. On the journey she met two sisters of St. Vincent de Paul, who gave her introductions to their order in Alexandria, where she visited their schools and hospital. From the sisters she learned the importance of formal discipline in hospital nursing. She then visited the Institute of Protestant Deaconesses at Kaiserswerth, returning the next year, when she remained for four months to study the organization, and to undergo a regular course of training as a nurse. She then studied the London and Edinburgh hospitals, and in 1853 was in Paris, studying nursing organization there. On her return to England she became (Aug. 1853) superintendent of the Hospital for Invalid Gentlewomen in Chandos street, London, which she moved to Harley street.

In the year 1854 England was stirred profoundly by the report of the sufferings of the sick and wounded in the Crimea. There was an utter absence of the commonest preparations to carry out the first and simplest demands in a place set apart to receive the sick and wounded of a large army. The condition of the large barrack-hospital at Scutari was abominable. A royal commission of enquiry was appointed, a patriotic fund opened, and money flowed in fast. To Florence Nightingale this proved the opportunity for which she had systematically prepared herself. She wrote to her friend Sidney Herbert, secretary at war, and offered her services. Her letter crossed with one from him inviting her to proceed to the Crimea. "My question simply is," he wrote, "would you listen to the request to go out and supervise the whole thing? You would, of course, have plenary authority over all the nurses, and I think I could secure for you the fullest assistance and co-operation from the medical staff, and you would also have an unlimited power of drawing on the Government for whatever you think requisite for the success of your mission."

She set out on Oct. 21 with a staff of 38 nurses. They reached Scutari on Nov. 4 in time to receive the Balaklava wounded. A day or two later these were joined by 600 from Inkerman. The story of Florence Nightingale's labours in the huge insanitary barrack-hospital at Scutari became a legend in her lifetime, a legend diffused over the English-speaking world by Longfellow's verses on "Filomena." She gave herself, body and soul, to the work. She would stand for 20 hours at a stretch to see the wounded accommodated. She regularly took her place in the operation-room, to hearten the sufferers by her presence and sympathy, and at night she would make her solitary round of the wards, lamp in hand, stopping here and there to speak a kindly word to some patient. Soon she had 10,000 men under her charge, and the general superintendence of all the hospitals on the Bosporus. But the actual superintendence of the hospitals and of the nursing was only part, perhaps only the smaller part, of the work. She wrestled daily and successfully with the military authorities, especially with the commissariat, who naturally regarded her as a dangerous innovator, and indeed thwarted her efforts to break through the mazes of the red-tape methods of administration. In the end her firmness, and, at need, her anger won. The death-rate in the hospitals was 42% in Feb. 1855; in June it was 2%. She had secured by superhuman effort and the force of a dominating personality a measure of sanitation and decent conditions. Even her energy would hardly have triumphed but for the backing she received from Sidney Herbert. Things were going well enough in the summer to allow her to leave Scutari to visit the hospitals at Balaklava. There she caught Crimean fever and herself lay dangerously ill in hospital for 12 days. She refused to leave her post, and remained alternately at Balaklava and Scutari till Turkey was evacuated by the British in July 1856. A man-of-war was ordered to bring her home and London prepared to give her a triumphant reception; but she returned quietly in a French ship, crossed to England, and escaped to her country home before the news of her return could leak out. She visited Queen Victoria at Balmoral in September, and laid before the queen and her husband a plan of the urgent reforms needed in the military hospitals. The queen's comment on the visitor was: "Such a head! I wish we had her at the War Office."

The experiences of the terrible months in the Crimea permanently affected Florence Nightingale's health, but the quiet life she afterwards led was a busy one. Blue Books and statistics were her daily food; she was always ready to confute the War Office from their own records. With the £50,000 raised in recognition of her services she founded the Nightingale Home for training nurses at St. Thomas's hospital. She watched over the growth of the new institution and each year addressed the nurses. The example of St. Thomas's was followed by others. Florence Nightingale was, indeed, the effective founder of the nursing system in England. She also turned her attention to the question of army sanitary reform and army hospitals, and to the work of the Army Medical College at Chatham. She wrote a candid official report on the working of the army medical department in the Crimea, and in 1858 printed her *Notes on Matters affecting the Health, Efficiency and Hospital Administration of the British Army*. The 800 pages of these notes formed the basis of the Royal Commission to enquire into the health of the army, and are a classic in the literature on army medicine.

If Florence Nightingale lived a life of the strictest retirement she was consulted constantly by the authorities, and expressed her views with great clearness and vigour. The foundation of the hospital schools of nursing in London was followed, at her suggestion, by the formation of a school at Liverpool infirmary (1862). She helped to establish various institutions for nursing, from the East London Nursing society in 1868 to the Queen's Jubilee Nursing institute in 1890. She would have liked to have gone out to India during the Mutiny. She was not invited to go, but she took the deepest interest in the progress of sanitation and of health measures in India, and was constantly in correspondence with the secretary of State for India, and with high officials in India up to 1872.

In her later years, from 1872, when, as she says, she "went out of office," she made a close study of Plato, under the direction of her friend Benjamin Jowett, and of the Christian mystics. She still maintained an enormous correspondence with the heads of the nursing profession and with members of the rank and file. She sought to promote rural hygiene, and was indefatigable in demanding health missionaries for Indian villages. Generally she was a prisoner in her room, where she received favoured visitors from time to time, but she never went out except occasionally for a drive in the park in the early morning. She was 87 when the Order of Merit was brought to her in 1907. Three years later she died in her house at South street on Aug. 13, 1910, and was buried at East Wellow, Hampshire, on Aug. 20.

See Sir E. Cook, *Life of Florence Nightingale* (2 vols., 1913); M. A. Nutting and L. L. Dock, *History of Nursing* (New York, 1907), which contains a bibliography of Miss Nightingale's writings; and a sketch by Lytton Strachey in *Eminent Victorians* (1918).

NIGHTINGALE, the bird celebrated beyond all others by European writers for the vocal powers which, contrary to usual belief, it exercises at all hours of the day and night during some weeks after its return from its winter-quarters in the south. The song itself is indescribable, though several attempts have been made to express in syllables the sound of its many notes. The cock alone sings (*see* SONG). In great contrast to the nightingale's voice is the inconspicuous colouration of its plumage, which is alike in both sexes, and is of a reddish-brown above and dull greyish-white beneath, the breast being rather darker and the rufous tail showing the only bright tint.

The range of the European nightingale, *Luscinia megarhyncha*, is peculiar. In Great Britain it is abundant in suitable localities to the south-east of a line stretching from the valley of the Exe, in Devonshire, to York, but it does not visit Ireland, Wales or Scotland. On the continent of Europe it does not occur north of a line stretching irregularly from Copenhagen to the northern Urals, and it is absent in Brittany; over south Europe otherwise it is abundant. It reaches Persia, and is a winter visitor to Arabia, Nubia, Abyssinia, Algeria and as far south as the Gold Coast. The larger eastern *L. philomelà*, is russet-brown in both

sexes, and is a native of eastern Europe. *L. hafizi* of Persia, is probably the Perso-Arabic bulbul of poets.

The nightingale reaches its English home about the middle of April, the males (as is usual among migratory birds) arriving some days before the females. The nest is of a rather uncommon kind being placed on or near the ground, the outworks consisting chiefly of a great number of dead leaves ingeniously applied together so that the plane of each is vertical. In the midst of the mass is a deep cup-like hollow, neatly lined with fibrous roots, but the whole is so loosely constructed, and depends for lateral support so much on the stems of the plants, among which it is built, that a slight touch disturbs its arrangement. Herein from four to six eggs of a deep olive colour are laid, and the young hatched. The nestling plumage of the nightingale differs from that of the adult, the feathers above being tipped with a buff spot, just as in the young of the redbreast, hedge-sparrow and redstart. Towards the end of summer the nightingale disappears to its African winter haunts.

The name nightingale has been applied to several other birds. The so-called "Virginian nightingale" is a species of grosbeak (*q.v.*); the "Pekin nightingale" or "Japanese nightingale" is a small babbler (*Liothrix luteus*) of the Himalayas and China.

NIGHTJAR or **GOATSUCKER** (*Caprimulgus europaeus*, Linn.), a bird erroneously believed since very ancient days to have the habit implied by its second name. It is characterized by its flat head, wide mouth fringed with bristles, large eyes, soft plumage and consequently noiseless flight. It arrives in Europe from Africa late in the spring, returning in the early autumn. Its food consists of insects, chiefly moths and cockchafers, which it catches on the wing at night. When resting on a bough the nightjar sits along its length. In this position the cock bird utters his curious burring note. The eggs are laid on the ground and number two; the young are clad in dark-spotted



FROM KOEHLER, "MEDIZINAL PFLANZEN"

DEADLY NIGHTSHADE OR DWALE (ATROPA BELLADONNA), SHOWING BRANCH WITH FLOWERS AND FRUIT

down, rendering them, like their parents, exceedingly difficult to see when crouching on the ground.

A second species, *C. ruficollis*, occurs in Spain and Portugal and others are found throughout the Old World. In America their place is taken by the allied genus, *Antrostomus*, one member of which, *A. vociferus*, is the whip-poor-will (*q.v.*). The nighthawk (*q.v.*) is another common American species, with a voice quite different from that of the whip-poor-will.

The family *Caprimulgidae* is almost cosmopolitan, but is not represented in New Zealand and Polynesia.

NIGHTSHADE, a general term for plants of the botanical genus *Solanum* (family Solanaceae). The species to which the name of nightshade is commonly given in England and North America is *Solanum Dulcamara* which is called also bittersweet or woody nightshade. It is a common plant in damp hedgebanks and thickets, scrambling over underwood and hedges. It has slender slightly woody stems, with alternate lanceolate leaves



WOODY NIGHTSHADE OR BITTERSWEET (SOLANUM DULCAMARA)

more or less heart-shaped and auriculate at the base. The flowers are arranged in drooping clusters and resemble those of the potato in shape, although much smaller. The flower clusters spring from the stems at the side of, or opposite to, the insertion of a leaf. The corolla is rotate, of a lilac-blue colour with a green spot at the base of each segment, or sometimes white, and bears the yellow sessile anthers united at their margins so as to form a cone in the centre of the flower. The flowers are succeeded by ovate scarlet berries, ½ in. long, which in large doses appear to be poisonous or, to say the least, dangerous to children, cases of poisoning by them having occurred. The plant derives its names of "bittersweet" and *Dulcamara* from the fact that its taste is at first bitter and then sweet. It is a native of Europe, North Africa and temperate Asia, and is widely naturalized.

The black nightshade, *S. nigrum*, differs from *S. Dulcamara* in having white flowers in small umbels and globose black berries. It is a common and well nigh cosmopolitan weed in gardens and waste places, growing about 12 or 18 in. high, and has ovate, entire or sinuate or toothed leaves. The berries have been known to produce poisonous effects when eaten by children, and owe their properties to the presence of solanine. In Réunion and Mauritius the leaves are eaten like spinach. (*See* SOLANUM.)

Deadly nightshade, dwale or belladonna (*Atropa belladonna*) is a tall bushy herb of the same plant family. It grows to a height of 4 or 5 ft., having leaves of a dull green colour, with a black, shining, berry fruit, about the size of a cherry, and a large tapering root. The plant is a native of central and south Europe,

extending into Asia, and is found locally in England, chiefly on chalk and limestone, from Westmorland and southwards. The entire plant is highly poisonous, and accidents not infrequently occur through children and unwary persons eating the attractive-looking fruit. Its leaves and roots are largely used in medicine, on which account the plant is cultivated, chiefly in south Germany, Switzerland and France. (*See* BELLADONNA.)

The name nightshade is applied to plants of different genera in other countries.

NIGRA, COSTANTINO, COUNT (1828–1907), Italian diplomatist, was born at Villa Castelnuovo, in the province of Turin, on June 11, 1828. During the war of 1848 he interrupted his studies to serve as a volunteer against Austria, and was wounded at the battle of Rivoli. On the conclusion of peace he entered the Piedmontese foreign office; he accompanied Victor Emmanuel and Cavour to Paris and London in 1855, and in the following year he took part in the conference of Paris by which the Crimean War was brought to an end. After the meeting at Plombières between Cavour and Napoleon III. Nigra was sent to Paris as an agent of Cavour. After the breach with Napoleon he was secretary of state to the prince of Carignano, viceroy of the Neapolitan provinces. When Napoleon recognized the kingdom of Italy in 1861, Nigra returned to France as minister-resident, and for many years played a most important part in political affairs. In 1876 he was transferred to St. Petersburg with the rank of ambassador, in 1882 to London, and in 1885 to Vienna. In 1899 he represented Italy at the first Hague Peace Conference. In 1904 he retired, and he died at Rapallo on July 1, 1907. He was created count in 1882 and senator in 1890.

NIHILISM, the name commonly given to the earliest Russian form of revolutionary anarchism. It originated in the early years of the reign of Alexander II. The term was first used by Turgeniev in his celebrated novel, *Fathers and Children,* published in 1862. (*See* RUSSIA: *History,* and ANARCHISM.)

NIIGATA, the chief town of the province of Echigo, Japan. Pop. (1925), 108,941. It occupies an area of rather more than 1 sq.m., and consists of five long parallel streets intersected by cross-streets, which in most cases have canals running down the middle and communicating with the river, so that the internal traffic of the city is mainly carried on by water. Niigata was originally chosen as one of the five open ports—Nagasaki, Kobe, Yokohama, Niigata and Hakodate—but it failed, chiefly owing to a bar which prevents the entry of vessels of any size. The town has been brought within the railway circuit, and the production of petroleum has been developed in the district. There is a large manufacture of lacquer-ware in the town.

NIJAR, a town of south-eastern Spain, in the province of Almeria; on the southern slope of the Sierra Alhamilla, and on the small river Artal, which flows into the Mediterranean sea 6 m. S.W. Pop. (1920) 10,809. Lead, iron and manganese are mined in nearby mountains; the fertile plain watered by the Artal yields an abundance of wheat, fruit, olives and esparto grass; fine porcelain and woollen and cotton goods are manufactured there.

NIJMWEGEN, NIMEGUEN, NYMEGEN or NIMWEGEN, a residential town in the province of Gelderland, Holland, on the left bank of the Waal, 24½ m. E. by S. of Tiel by rail. Pop. (1927), 76,069. It has regular steamboat communication with Rotterdam, Cologne and Arnhem, and is very prettily situated on the slopes of five low hills rising from the river-side. It stands up with a boldness quite unusual in a Dutch town, and steps are even necessary to lead to the higher portions of the town. In 1877–1884 the old town walls were demolished, a promenade and gardens taking their place, and since then a new quarter has grown up on the south side with a fine open place called the Emperor Charles's plain. On the east of the town is the beautiful park called the Valkhof, which marks the site of the old palace of the Carolingian emperors. The palace was ruined by the French bombardment of 1794, and only two portions of it remain. These are a part of the choir of the 12th century palace-church, and a sixteen-sided baptistry originally consecrated by Pope Leo III. in 799 and rebuilt in the 12th or 13th century. Close by is the lofty tower of the Belvedere, dating from 1646. The *Groote Kerk* of St. Stephen forms with its tall square tower one of the most striking features of the town. Originally built about 1272, it dates in its present condition mainly from the 15th and 16th centuries. The interesting Renaissance town-hall was built in 1554 (restored in 1879). There is also an interesting museum of antiquities. Other buildings of note include the old weigh-house and Flesher's hall, probably built in 1612 and restored in 1885. Nijmwegen is the seat of a Roman Catholic university. Beer, Prussian blue, leather, tin, pottery, cigars and gold and silver work are the chief industrial products.

NIJNI-NOVGOROD (NIZHNI-NOVGOROD), chief town of province Nijni-Novgorod, R.S.F.S.R., at the confluence of the Oka and Volga rivers in 56° 24′ N., 44° E. Pop. (1926) 180,926. The city owes its importance to its position at the junction of the navigable rivers between which, to the west of it, was the flourishing Moscow region, though the development of its trade, at first mainly in furs, was much hampered by Tatar raids, which did not cease until the second half of the 16th century. After the last raid in 1536 it became a dépôt for goods brought from the south-east, and the conquest of Kazan in 1552 and of Astrakhan in 1556 opened free navigation on the Volga. The thick forests of the district provided material for shipbuilding and a yearly "caravan" of boats under military protection began to carry the products of Moscow and the north to the Caspian and to return laden with the products of the south and east.

The Fair.—From remote antiquity Russian merchants were wont to meet in summer with those from the east at different places on the Volga between the mouths of the eastward flowing Oka and the westward flowing Kama, the fair changing its site with the increasing or decreasing power of the nationalities which struggled for the possession of the Middle Volga. Bolgari, Nijni-Novgorod, Kazan and Vasilsursk have been successively the site of the fair since the 10th century. From 1641 its seat was at a monastery 55 m. below Nijni and close to Makaryev; this situation later proved inconvenient, and after the destruction of the shops by fire, the fair was transferred to Nijni in 1817 and has remained there ever since.

The long distances in Russia, the poor network of communications, the seasonal nature of production and river transport, the dependence of the peasant on handicrafts as a supplement to agriculture, the close link between Russia and the Orient, are some of the factors which have tended to preserve the importance of fairs as a medium of exchange and barter. In the more industrialized regions of the south and west, with their better railway facilities and higher level of literacy, fairs are gradually dying out, but in other regions they are still of the greatest importance for home trade. The state grants special customs exemptions to goods destined for the Nijni fair and gives cheaper transport facilities and special credits to traders. Products of the peasant home industries from every region in which they are at all developed are increasingly taking an important place in the fair.

Until the '80s Russian manufacturers depended largely on barter trade in tea from Kiakhta and its price at the fair regulated output. Later the price of raw cotton and madder from Asia at the fair influenced the output of the growing textile industry of the central productive region. The owners of the iron works in the Ural district sent "caravans" of boats laden with iron goods to Nijni, where the purchases of iron made for Asia and Middle Russia determined the amount of credit on which they could depend for the next year's work. Similarly the corn and salt trade of the south and the general trade of Siberia and Turkistan depended on the prices obtaining at the fair.

The fair reached its highest development between 1880 and 1884, when the turnover was 21·5 million pounds. In 1910 the turnover was 15·9 million pounds. During the 1914–1922 war and civil war, the trade of Nijni was interrupted, and when the fair re-opened in 1923, conditions had altogether changed. Private trade, though not entirely suppressed, had been markedly reduced and the various State Trading Departments and local goods exchanges had taken over much of the regulation between supply and demand, formerly largely dependent on the fair. Only 647 firms took part in the 1923 fair and the turnover was small, but

trade has gradually adapted itself to the changed conditions and in 1927 the turnover was 20·3 million pounds, and the number of firms taking part was 2,549.

Sales to Eastern countries at the 1927 fair amounted to 2·3 million pounds and purchases from them to 1·5 million pounds. Trade with the Ural metal region via the Kama, with Siberia and with the corn, salt, wine and naphtha regions of the Caspian has revived. The duration of the fair is fixed for Aug. 1 to Sept. 15. A horse fair is held in June, and one in January on the ice of the river Oka for wooden goods made by the peasants, the river being frozen from November to April.

In addition to its trading activities the town has shipbuilding and repair yards and manufactures machinery, telephones, chemicals, sewn goods, matches, bricks, flour, confectionery and alcoholic drinks. These industries are now supplied with electricity from the Balakhna peat fuel plant opened in 1925–26. A recently established industry is the making of radio sets, in connection with which there is an experimental station. The town has railway links through Vyatka with Perm and Sverdlovsk, and also with Kotlas, which will probably be linked with Murmansk via Soroka at no distant date, with Moscow, and, by a branch line to Arzamas, with the trans-Siberian railway. There is also a short branch to Pavlov. Steam navigation on the Volga began in 1821, and has developed rapidly since 1845. A bi-weekly air service between Moscow and Nijni-Novgorod has been established, with daily services during the period of the fair.

The Town consists of three parts. The upper city is built on three hills on the right bank of the rivers (490 ft.). On one of them is the ancient citadel or Kremlin, first erected as a palisaded fort in the second half of the 14th century, and rebuilt in the early 16th century, with a wall 2,300 yards long, 65 to 95 ft. high and having eleven towers. Within it are the law courts, the former governor's residence, the arsenal, barracks, etc., a museum and the Preobrazhensky and Archangel cathedrals, dating from 1225 and 1222 respectively, but much spoilt by later restorations. Kozma Minin Sukhorukov, a cattle-dealer of the town, who organized the army that saved Moscow from Polish dominion in 1612, is buried in the Preobrazhensky cathedral and a square in the Kremlin contains a monument to Minin and Pozharsky erected in 1826. The view from the Kremlin of the broad Volga with its low-lying and far-spreading left bank is very striking. Near the Kremlin are two monasteries, the Pechersky, built in the first half of the 16th century to replace one founded in 1330 and destroyed by a landslip in 1596, and the Blagovyeshchensk (1370, rebuilt 1647). Five descents lead to the lower town, the Nijni bazaar, built on the alluvial terrace 30 to 35 ft. above the banks of the Oka and Volga.

The fair is held on the flat sandy tongue of land between the rivers, connected with the town by a bridge of boats, 1,500 yards long, which is taken to pieces in winter. The shops of the fair, 4,000 in number, built of stone in regular rows, are surrounded by a canal and cover half a square mile, and there are more than 4,000 other shops outside this inner fair. There are salt, grain and timber wharves and rough goods are landed on an island in the Volga. Tea boxes and temporary shelters for the tea tasters accumulate in the Siberian harbour during fair time. The point of the peninsula is occupied by the storehouses of the steamboat companies, while metal wares and corn are discharged on a long island in the Oka, at the iron harbour, and in the Grebnovskaya harbour. The railway from Moscow has its terminus close to the fair buildings, to the south of which is the Kunavino pleasure suburb. On the fair side are the Alexander Nevsky cathedral (1881) and the "Fair" cathedral (1822). The climate is harsh and continental, average January temperature 10·6° F, July 64° F, extreme readings −40° F and +104° F.

History.—The confluence of the Oka and the Volga, inhabited in the 10th century by Mordvinian tribes, began to be coveted by the Russians as soon as they had occupied the upper Volga, and as early as the 11th century they established a fort, Gorodets, 20 m. above the mouth of the Oka. In 1221, the people of Suzdal, under Yuri Vsevolodovich, prince of Vladimir, erected a fort on the hill now occupied by the Kremlin. Until the beginning of the 14th century Nijni-Novgorod, which grew rapidly as the Russians colonized the banks of the Oka, remained subject to Suzdal; it enjoyed, however, almost complete independence, being ruled by its popular assembly. Until 1390, it elected its own princes. Ill-protected by its palisaded walls, it was plundered in 1377 and 1378 by the Tatars, supported by the Mordvinians.

In 1390 Prince Vasili of Moscow, in alliance with Toktamish, khan of the Golden Horde of the Mongols, took Nijni and established his own governors there; in 1417 it was definitely annexed to Moscow, becoming a stronghold for the further advance of that principality towards the east. It was fortified in 1508–1511, and was able to repel the Tatars in 1513, 1520 and 1536. In 1606–1611 the trading classes took an active part in the expeditions against the revolted serfs. A Nijni cattle-dealer, Sukhorukov, helped to deliver Moscow from the Poles in 1612. In 1667 the city withstood an attack by Stenka Razin. During the 17th century the country became the seat of a vigorous religious agitation, and in its forests the Raskolniks established hundreds of their monasteries and communities, those of the Kerzhenets playing an important part in the history of Russian Nonconformity.

Nijni-Novgorod had at one time two academies, Greek and Slav, and took some part in the literary movement of the end of the 18th century; its theatre also was of some importance in the history of the Russian stage. It has a growing university and a Workers' Scientific institute opened since the 1917 revolution.

NIKĖ, the goddess of victory (Gr. *νίκη*, Lat. *Victoria*). She does not appear personified in Homer. In Hesiod (*Theog.* 384) she is the daughter of the giant Pallas and Styx, and is sent to fight on the side of Zeus against the Titans. Nikē does not appear to have been the object of a separate cult at Athens. She was at first inseparably connected and confounded with Pallas Athena, the dispenser of victory, but gradually separated from her. As an attribute of both Athena and Zeus she is represented as a small figure carried by those divinities in their hand. Athena Nikē was always wingless, Nikē alone winged.

At Rome Victoria was said to have been worshipped ever since Evander's days, being identified with the obscure Vica Pota and other goddesses. Special games were held in her honour in the circus, and generals erected statues of her after a successful campaign. She came to be regarded as the protecting goddess of the senate, and her statue (originally brought from Tarentum and set up by Augustus in memory of the battle of Actium) in the Curia Julia (Dio Cassius li. 22; Suetonius, *Aug.* 100) was the cause of the final combat between Christianity and paganism towards the end of the 4th century. Victoria had altars in camp, a special set of worshippers and colleges, a festival on Nov. 1, temples at Rome and throughout the empire. Representations of Nikē-Victoria in art are very numerous. *cf.* GREEK ART (fig. 3).

See L. R. Farnell, *Cults of the Greek States*, i. (1896); G. Wissowa, *Religion und Kultus* (2nd ed. 1912) (bibl.); Roscher's *Lexikon*, arts. Nikē, Victoria.

NIKISCH, ARTHUR (1855–1922), Hungarian conductor, was a precocious child, making a public appearance as a pianist at eight years old. He studied at the Vienna Conservatoire from 1866 to 1873, and while there he composed a symphony and other works. In 1877 he began as assistant conductor at the Leipzig opera and two years later became chief conductor. His brilliant success in Leipzig gave him a world-wide reputation. Nikisch was conductor of the symphony orchestra at Boston, U.S.A., from 1889 to 1893; and subsequently, after having been director at the Budapest opera, at the Leipzig Gewandhaus. He died in Leipzig on Jan. 23, 1922.

See F. Pfohl, *Arthur Nikisch* (Hamburg, 1925).

NIKKO, one of the chief religious centres of Japan. The name belongs properly to the district, but is as commonly applied to the principal village, Hachi-ishi, which is 91 m. N. of Tokyo by rail. The chief mountain range is known as Nikko-Zan (Mountains of the Sun's Brightness). A Shinto temple seems to have existed at Nikko from time immemorial, and in 767 its first Buddhist temple was founded by Shodo Sho-nin (the subject of many strange legendary adventures); but the main celebrity of the place is due to the sepulchres and sanctuaries of Iyeyasu and

Iyemitsu, the first and third shoguns of the Tokugawa dynasty. Iyeyasu was buried with amazing pomp in 1617, and Iyemitsu, his grandson, was slain in 1650 while visiting his tomb. From 1644 to 1868 the "abbots" of Nikko were always princes of the imperial blood; thirteen of them are buried within the sacred grounds. The tomb of Iyeyasu lies apart about two hundred steps higher up the hills, in the shadow of tall cryptomerias—a single light-coloured bronze urn or casket standing on a circular base of three steps with a stone table in front on which rest a censer, a lotus-cluster and a stork with a candlestick in its mouth, the whole enclosed by a high stone wall. Somewhat similar are the tomb of Iyemitsu and its surroundings. Hotoké Iwa, the hill on which the tomb stands, is completely covered with trees and there are numerous temples and shrines of minor interest.

NIKOLAYEV, a seaport of the Ukrainian S.S.R., situated a little above the confluence of the Ingul and Bug rivers, at the head of the Bug estuary in 46° 58′ N., 31° 58′ E. Pop. (1926) 101,182. Vessels have to pass the bar of the Dnieper to reach the Ochakov channel, and dredging has been carried out to a depth of 25 ft., so that vessels of 24 ft. draught can pass without lightening their loads. Two icebreakers are now working so as to keep the estuary of the Dnieper and the channel of the Bug open for navigation from the Black sea to Nikolayev all the year round. There is a government commercial quay and a harbour for coasting vessels. The Varvarovka jetty was damaged during the civil war and is not at present open. A new quay, three quarters of a mile long is under construction (1928). There are floating elevators and a railway grain elevator. The chief imports are cement, iron, steel, machinery and general merchandise, and the exports are grains, oilseeds, sugar, wool, iron-ore, manganese and timber.

In common with other Black sea ports, Nikolayev has suffered from the effects of the civil war and the war of intervention and from the decrease in Black sea trade due partly to change of frontiers and partly to war damage and loss of ships and the cessation of repairs and construction until 1923. The town has ship yards where steamers for the admiralty and for the commercial fleet are built, the construction of armoured ships and torpedo boats dating back to 1870, and being carried out mainly along the bank of the Ingul river. Ochakov and Kimburn are potential forts to protect the double estuary in case of attack. The industrial enterprises of Nikolayev include the manufacture of machinery, ploughs, nails, glass, footwear, macaroni, tobacco and alcoholic drinks. The town is linked by rail with the general railway net to the north, and also has a branch to Kherson.

The remains of the Greek colony *Olbia* have been discovered close to the confluence of the Ingul with the Bug, 10 m. S. of Nikolayev. After the fall of Ochakov, Prince Potemkin established (1789) a wharf on the Ingul which received the name of Nikolayev.

NIKOLAYEVSK: *see* PUGACHEV.

NIKON [NIKITA MININ] (1605–1681), 6th patriarch of Moscow, Russian reformer and statesman, son of a peasant farmer named Mina, was born on May 7, 1605, in the village of Valmanovo, 90 versts from Nijni-Novgorod. Misery pursued the child from his cradle, and prematurely hardened a character not naturally soft; he ran away from home to save his life from an inhuman stepmother. He took orders, and became a popular preacher in Moscow, then, seeing in the loss of his three little children a providential warning to seek the higher life, he first persuaded his wife to take the veil, and then withdrew himself first to a desolate hermitage on the isle of Anzersky on the White Sea, and finally to the Kozhuzersky monastery, in the diocese of Novgorod, of which he became abbot in 1643. On becoming a monk he took the name of Nikon. In his official capacity he had frequently to visit Moscow, and in 1646 made the acquaintance of the pious and impressionable Tsar Alexius, who fell entirely under his influence. Alexius appointed Nikon archimandrite, or prior, of the wealthy Novospassky monastery at Moscow, and in 1648 metropolitan of Great Novgorod. Finally (Aug. 1, 1652) he was elected patriarch of Moscow. It was only with the utmost difficulty that Nikon could be persuaded to become the archpastor of the Russian Church, and he only yielded after imposing upon the whole assembly a solemn oath of obedience to him in everything concerning the dogmas, canons and observances of the Orthodox Church.

Ecclesiastical reform was already in the air. A number of ecclesiastical dignitaries, known as the party of the protopopes (deans), had accepted the responsibility for the revision of the church service-books inaugurated by the late Patriarch Joasaf, and a few other very trivial rectifications of certain ancient observances. Nikon was bolder and more liberal. He consulted the most learned of the Greek prelates abroad; invited them to a consultation at Moscow; and finally the scholars of Constantinople and Kiev opened the eyes of Nikon to the fact that the Muscovite service-books were heterodox, and that the ikons actually in use had very widely departed from the ancient Constantinopolitan models, being for the most part imitations of later Polish and Frankish (West European) models. He at once (1654) summoned a properly qualified synod of experts to re-examine the service-books revised by the Patriarch Joasaf, and the majority of the synod decided that "the Greeks should be followed rather than our own ancients." A second council, held at Moscow in 1656, sanctioned the revision of the service-books as suggested by the first council, and anathematized the dissentient minority, which included the party of the protopopes and Paul, bishop of Kolomna. Heavily weighted with the fullest oecumenical authority, Nikon's patriarchal staff descended with crushing force upon the heterodox. His scheme of reform included not only service-books and ceremonies but the use of the "newfangled" ikons, for which he ordered a house-to-house search to be made. His soldiers and servants were charged first to gouge out the eyes of these "heretical counterfeits" and then carry them through the town in derision. He also issued a *ukaz* threatening with the severest penalties all who dared to make or use such ikons in future. This ruthlessness goes far to explain the unappeasable hatred with which the "Old Ritualists" and the "Old Believers," as they now began to be called, ever afterwards regarded Nikon and all his works.

From 1652 to 1658, Nikon was not so much the minister as the colleague of the tsar. Both in public documents and in private letters he was permitted to use the sovereign title. Such a free use did he make of his vast power, that some Russian historians have suspected him of the design of establishing "a particular national papacy"; and he himself certainly maintained that the spiritual was superior to the temporal power. He enriched the numerous and splendid monasteries which he built with valuable libraries. His emissaries scoured Muscovy and the Orient for precious Greek and Slavonic mss., both sacred and profane. But his severity raised up a whole host of enemies against him, and by the summer of 1658 they had convinced Alexius that the sovereign patriarch was eclipsing the sovereign tsar. Alexius suddenly grew cold towards his "own familiar friend." Nikon thereupon publicly divested himself of the patriarchal vestments and shut himself up in the Voskresensky monastery (19th of July 1658). In February 1660 a synod was held at Moscow to terminate "the widowhood" of the Muscovite Church, which had now been without a pastor for nearly two years. The synod decided not only that a new patriarch should be appointed, but that Nikon had forfeited both his archiepiscopal rank and his priest's orders. Against the second part of this decision, however, the great ecclesiastical expert Epifany Slavenitsky protested energetically, and ultimately the whole inquiry collapsed, the scrupulous tsar shrinking from the enforcement of the decrees of the synod for fear of committing mortal sin.

For six years longer the Church of Muscovy remained without a patriarch. Every year the question of Nikon's deposition became more complicated and confusing. At last the matter was submitted to an oecumenical council, which opened its sessions on Nov. 18, 1666, in the presence of the tsar. On Dec. 12 the council pronounced Nikon guilty of reviling the tsar and the whole Muscovite Church, of deposing Paul, bishop of Kolomna, contrary to the canons, and of beating and torturing his dependants. His sentence was deprivation of all his sacerdotal functions;

henceforth he was to be known simply as the monk Nikon. The same day he was sent as a prisoner to the Therapontov Byelozersky monastery. Yet the very council which had deposed him confirmed all his reforms and anathematized all who should refuse to accept them. Nikon survived the tsar (with whom something of the old intimacy was resumed in 1671) five years, expiring on Aug. 17, 1681.

See R. Nisbet Bain, *The First Romanovs* (1905); S. M. Soloviev, *History of Russia* (Rus.), vol. x. (1895, etc.); A. K. Borozdin, *The Protopope Avvakum* (Rus.) (1898); V. S. Ikonnikov, *New Materials concerning the Patriarch Nikon* (Rus.) (Kiev, 1888); William Palmer, *The Patriarch and the Tsar* (1871–76). (R. N. B.)

NIKOPOLI or **NICOPOLIS** (Bulgarian *Nikopol*), the chief town of a sub-prefecture in the district of Plevna (Pleven), Bulgaria. Pop. (1926) 4,936. Nikopoli is picturesquely situated on the south bank of the Danube, where it receives the Osem. The chief industries are tanning and fishing. As a military post the town has for centuries been important. A ruined castle still dominates the place, and fortifications stretch down to the river.

Nikopoli occupies the site of the ancient Asamus, but by some mediaeval confusion bears the name of Nicopolis ad Istrum, which was founded by Trajan several miles down the river, at the inflow of the Iatrus or Yantra, at the spot still called Nikup. The following are the chief points in the modern history of the place:—capture of the fortress by Sigismund of Hungary in 1392 and 1395; defeat of Sigismund and his hosts in 1396 by Bayezid I.; siege of the town by King Ladislaus I. of Hungary in 1444; defeat of the Turks by Bathori in 1595 and by Michael of Walachia in 1598; capture of the town by Pasvan-oglu in 1797; occupation of the fortress by the Russians under Kamensky in 1810; destruction of the Turkish flotilla by Govarov in 1829; capture and burning of the town by the Russians under Krüdener, June 15, 1877.

NIKŠIĆ (pronounced Nikshich), a romantically situated town of Montenegro, Yugoslavia, in the valley of the Zeta, which forms the main source of communication between north and south Montenegro. Pop. (1921) 3,942. Wheat, maize, rye and potatoes are cultivated, and there are two breweries, cloth and cotton mills in the town, which is an important mart for timber, hides, farm produce and livestock. The chief road, to Podgorica (*q.v.*), is entered by a long viaduct, the gift of Russia, to obviate the flooding which formerly often rendered it impassable. The town, of white houses, is built round a square with four radiating streets, and is dominated by the pale yellow cupola of the Byzantine cathedral, another gift from Russia. Close by stands a royal palace and on one of the heights are the ruins of an old Turkish fortress. About 12 m. S.E. is the famous shrine of Ostrog (*see* MONTENEGRO).

NILE, the longest river of Africa, and second in length of all the rivers of the globe, draining a vast area in north-east Africa, from the East African lake plateau to the shores of the Mediterranean. Although falling short of the length of the Mississippi-Missouri (4,194 m. according to the estimate of General Tillo), the Nile is at the head of all rivers as regards the length of its basin, which extends through 35° of latitude or 2,450 m. in a direct line, with a waterway of about 4,000 m. The Nile proper, *i.e.*, from the outlet at Victoria Nyanza to the sea, is 3,473 m. long.

The early Egyptians called this river by a name which was probably pronounced Hapy. This survived as a religious designation down to the fall of paganism. The "great river" was also a frequent name for the main stream, and this became the usual name of the Nile in late times as Ier-'o and continued in use amongst the Copts. In the Bible the Nile is regularly named Yeôr (יאר, יְאֹר), from the contemporary Egyptian Yor, "river." The origin of the Greek and Roman name Νεῖλος, *Nilus,* is quite unknown. Αἴγυπτος in the *Odyssey* is the name of the Nile (masc.) as well as of the country (fem.). The Arabs preserved the classical name of the Nile in the proper name En-Nil النيل, or Nil-Misr نيل مصر, the Nile of Misr (Egypt). The same word signifies indigo.

The modern Egyptians commonly call the river El-Bahr, "the sea," a term also applied to the largest rivers, and the inundation "the Nile," En-Nil; they also call the river Bahr-en-Nil, "the river Nile."

Basin of the River.—The Nile system is a simple one with three principal divisions: (1) the main stream running south to north, and fed by the great lakes of East Central Africa; (2) the equatorial tributary rivers draining the country north-east of the Congo basin; (3) the Abyssinian affluents. The extent of the basin of the Nile is clearly indicated on the map. Its area is estimated at 1,107,227 sq.m., which compares with the 1,425,000 sq.m. area of the Congo basin. The smaller basin of the longer river is due to its narrowness when north of Khartoum. Southward the basin includes the northern part of the plateau between the two "Rift" valleys which traverse that part of Africa, and also that portion of the Albertine (or western) "Rift" valley which lies north of the Mfumbiro mountains. That part of the plateau within the Nile basin is occupied by the Victoria Nyanza and its affluents. These affluents drain a comparatively small part of this plateau, which stretches south to Lake Nyasa. The most remote feeder of the Nile in this direction does not extend farther than 3° 20′ S.W. and W.S.W. of Victoria Nyanza, however, the Nile basin reaches 3° 50′ S. (264 m. south of the equator) and 29° 15′ E., following the crest of the hills which dominate the north-eastern shores of Lake Tanganyika and the eastern shores of Lake Kivu. Turning north-westward from this point the Nile basin crosses the mountainous region of Mfumbiro and includes that of Ruwenzori. Its limit is marked by the western wall of the Albertine Rift valley, in which lie the Albert and Edward lakes. For a considerable distance the water-parting between the Congo and the Nile is close to the Albert Nyanza and to the Nile as it flows from that lake, but not far north of Wadelai (2° 46′ N.) the hills recede and the Nile basin expands westward, over the wide area drained by the Bahr-el-Ghazal and its tributaries. In this region there is no well-marked watershed between the Congo and Nile systems, which interlace. Farther north the limit of the basin is marked by the hills of Darfur. Below that point the valley of the Nile extends but a mile or two from the river banks.

The south-eastern limits of the Nile basin extend nearly to the western escarpment of the eastern Rift valley—the dividing plateau being a narrow one. North of the equator a bend is made westward to Mt. Elgon, which on the north-east sends its water towards Lake Rudolf. From Mt. Elgon the Nile watershed is some distance to the west of that lake, while to its north a turn is made again, the watershed including a great part of the Abyssinian highlands. Beyond 15° N. it follows a line generally parallel to the west shore of the Red Sea, except where diverted to the west by the basin of the Khor Baraka.

Sources of the Nile.—The question of the sources of the Nile opens up a time-honoured controversy (*see* under *Story of Discovery* p. 455). Victoria Nyanza (*q.v.*) is the great reservoir whence issues the Nile on its long journey to the Mediterranean. But if the source of the river be considered to be the most remote headstream (measured by the windings of the stream), the distinction belongs to one of the upper branches of the Kagera. Among the feeders of Victoria Nyanza the Kagera is the most important, both for length of course and volume of water carried, draining the region of greatest rainfall round Lake Victoria.

Three chief branches unite to form the Kagera, and of these the most important for the volume of water carried is said to be the Nyavarongo. (i.) The Nyavarongo is formed by the union of various mountain streams, the Rukarara and the Mhogo being the chief. The Rukarara rises in about 2° 20′ S., 29° 20′ E., at an elevation of some 7,000 ft., in a picturesque and bracing region immediately east of the Albertine Rift valley. The Nyavarongo first flows north to about 1° 40′ S., then turning in a sharp bend east and south, and on again reaching 2° 20′ S., unites with the Akanyaru just west of 30° E. (ii.) The Akanyaru, which comes from the south-west, has been sometimes considered the larger stream, but according to Dr. Richard Kandt it carries decidedly less water, while its course is shorter than that of the Nyavarongo. The combined stream takes an easterly and southerly direction, flowing in a swamp valley and joining a little west of 31° E. the third branch of the Kagera, the Ruvuvu, coming from the south.

(iii.) The source of the Ruvuvu is in about 2° 55′ S., 29½° E., but its most southern tributary, and the most distant stream sending its waters towards the Nile, is the Lavironza. The Lavironza rises in about 3° 45′ S., 29° 50′ E., and flows north-east, joining the Ruvuvu, which has hitherto had an easterly direction, in about 30° 25′ E., 3° 10′ S. From this point the Ruvuvu flows east and north to its junction with the Nyavarongo.

From this confluence the combined stream of the Kagera flows north and north-west in a level valley strewn with small lakes until almost 1° S., when it turns east, and finally empties itself into Victoria Nyanza just north of 1° S., the mouth forming a small projecting delta. Its lower course is navigable by shallow draught steamers. The total length of the Kagera, reckoning from the source of the Nyavarongo, is some 430 miles. The average volume discharged is estimated, from measurements which have been made to be about 350 cu. metres per second. All the other feeders of Victoria Nyanza are small and often intermittent rivers, the largest being probably the Nzoia, which enters on the north-east from the plateaus south of Mount Elgon.

The Victoria or Somerset Nile.—The ridge of high land which forms the northern shore of Victoria Nyanza is broken at its narrowest part, where the pent-up waters of the lake have forced a passage at the northern end of a beautiful bay named Napoleon Gulf. At this spot, 30 m. north of the equator, at an altitude of 3,704 ft., the Nile issues from the lake between cliffs 200 and more ft. high with a breadth of some 500 yds. The scene is one of much grandeur. The escaping water precipitates itself over a rocky ledge with a clear fall of 16½ ft. The falls, some 300 yds. across, and divided into three channels by two small wooded islands, are named the *Ripon Falls*, after Earl de Grey and Ripon (afterwards 1st marquess of Ripon), president of the Royal Geographical Society in 1859.

The Victoria or Somerset Nile, as this section is called, has at first the character of a mountain stream, racing swiftly through a rocky channel often walled in by cliffs (at times 180 ft. high) and broken by picturesque islands and countless rapids. It receives the waters of several streams, which, rising within a few miles of the Victoria Nyanza, flow north. For 133 m. its course is north-north-west, when, on being joined by the river Kafu (on which Fort Mruli stands), about 1° 39′ N., 32° 20′ E., it takes the north-east direction of that channel, and it is not till 2° N. that the river again turns westward towards Lake Albert. Seventy miles below the Ripon Falls the Nile enters a marshy lake of irregular outline, running mainly east and west, and known as Kioga (or Choga). The current of the Nile is clearly discernible along the western shore of this lake, which is 3,514 ft. above the sea. Eastwards the lake breaks into several long arms, which receive the waters of other lakes lying on the plain west of Mount Elgon. One of these, named Lake Salisbury, lies in 1° 40′ N. and 34° E.; east of this lake and connected with it is Lake Gedge. Lake Kioga also receives the Mpologoma, a river which rises in the foothills of Elgon and flows east and north, attaining a width of 1½ m.; and from the south (west of the Nile) a broad lacustrine river, the Seziwa. The Kioga lake system, lying north of the ridge which separates it from Lake Victoria, owes its formation in part to the waters pouring down from the Nyanza, and is in the nature of a huge Nile backwater. The lake itself is rarely more than 20 ft. deep; its greatest length is 85 m.; its greatest width 10 m.

Below Mruli, the fall in the bed levels of the Nile, which up to this point has been comparatively gradual, increases considerably. At Karuma, where the western bend to Lake Albert is made, the river falls over a wall-like ledge of rock, 5 ft. high, which extends across its bed. But the great feature of the Victoria Nile is the *Murchison Falls* (named by Sir Samuel Baker, their discoverer, after Sir Roderick Murchison, the geologist), situated in 2° 18′ N. and 31° 50′ E. At this point the river rages furiously through a rock-bound pass, and, plunging through a cleft less than 18 ft. wide, leaps about 130 ft. into a spray-covered abyss. Downstream from these falls the river flows for some 14 m. between steep forest-covered hills, a wide and noble stream with a current so slow and steady that, at certain seasons, it is only from the scarcely perceptible drifting of the green water-plants called *Pistia stratiotes* that it can be observed. About 24 m. below the Murchison Falls and 254 m. from Lake Victoria the river enters, through a wide delta, and across a formidable bar, the north-east end of Lake Albert. In its passage from the one lake to the other the Nile falls altogether about 1,400 ft. Taking its name from a fort which once existed there, the delta district is known as Magungo.

From Lake Albert to the Plains.—Issuing from the north-west corner of Lake Albert some 5 m. from the spot where it entered that lake, the Nile, which is now known as the *Bahr-el-Jebel*, or Mountain river, flows in a generally northerly direction. As far as Dufile, 130 m. below Magungo, it has a gentle slope, a deep channel and a current generally slight. It forms a series of lake-like reaches often studded with reedy islands. Immediately below Dufile the Kuku mountains on the west and the Arju range on the east close in upon the river, which, from an average width of 700 yd., narrows to 230 yd. Here the hills cause the stream to make a sharp bend from the north-east to the north-west. Four or five miles lower down the river widens to 400 yd., and a large island divides the stream, the eastern channel carrying the main volume of water.

This island marks the beginning of the *Fola Rapids*. At its southern end the water falls some 20 ft., and then, like a gigantic mill-race rushes through a gorge 330 ft. long and nowhere more than 52 ft. wide, to leap into a deep cavity not more than 40 ft. across. Escaping from this cauldron, the waters thunder on in a succession of rapids, which extend beyond the northern end of the island. In all the Fola Rapids are nearly 2 m. long. For the next 80 m. the Nile, save for the great volume of water, resembles a mountain torrent, its course interrupted by continual rapids. The last of these occurs at Bedden, where the river breaks through a line of low hills running athwart its channel.

Below Bedden various stations are established upon the river. Fort Berkeley, in 4° 40′ N. (on the right bank), is the nearest to the rapids. Then follow Rejaf (left bank), Gondokoro (right bank) and Lado (left bank), all within 30 m. of one another. A striking feature of the scenery at Rejaf is a cone-shaped hill, about 370 ft. high, crowned by rocks which have the appearance of the ruins of an ancient castle. At Gondokoro the Nile is clear of the hill country, and enters a vast swamp-like expanse through which it flows with a very low slope and a very tortuous channel.

Between Lake Albert and the swamp region the Bahr-el-Jebel is joined by many streams. The most important of these affluents is the Asua (nearly 200 m. long), which enters the main stream from the east in 3° 50′ N. (19 m. N. of Dufile), but has little water in the dry season. The Asua and its subsidiary streams rise on the western versant of the Karamojo plateau and among the mountain ranges which run off from that plateau to the north-west, the most remote head-stream running originally due south.

The Region of Swamps.—The wide valley which the Nile enters at Gondokoro slopes so gradually towards the north that the river falls only some 182 ft. in a stretch of 475 m. Through this valley the river winds in an extremely tortuous course, and its banks are very low in the middle and lower reaches, so that the overflow has caused extensive swamps which are covered by a mass of papyrus and tall reeds, in which are numerous shallow lagoons or "mayyas." The shape of these lagoons is constantly altering, as also is that of the channels connecting them with the river. About 8 m. below Bor, many of the eastern "spills" unite and form a stream of considerable breadth, with a strong current. This stream, which is known to the Dinkas as the Atem, follows a course generally parallel to the Jebel, being bounded eastward by forest land. Opposite Kanisa (6° 46′ N.), on the main river, the Atem divides into two channels, marshy land extending at this point a great distance to the east. The western branch, or Awai, rejoins the Jebel near Shambe 7° 6′ N. The eastern branch or Myding continues through the marshes, eventually joining the Bahr-el-Zeraf (*see* p. 453) in its lower course.

Except for the Atem divergence the Nile, despite the swamps through which it passes, maintains a fairly definite course, with a considerable depth of water as far as Shambe, where, on the west, is a large lagoon. Five miles lower down the river splits into two great channels. That to the left, the main stream, continues to be

known as Bahr-el-Jebel, but is sometimes called by its Dinka name Kir. The right branch, or *Bahr-el-Zeraf* (Giraffe river), has a more easterly direction, and does not rejoin the main river until 50 m. below its confluence with the *Bahr-el-Ghazal* (*q.v.*). From the point of bifurcation the Bahr-el-Jebel flows for 230 m. in a general north-westerly direction until it is joined by the Bahr-el-Ghazal coming from the south-west. At the junction of the Bahr-el-Ghazal and the Bahr-el-Jebel in 9° 29′ N. the permanently submerged area is usually named Lake No, but the Arabs call it *Moghren-el-Bohur* (meeting of the rivers). Lake No in the rains covers about 50 sq.m.

In the Bahr-el-Jebel occur the great accumulations of "sudd" (*q.v.*), closely packed masses of floating vegetation which obstruct and, if not removed, prevent navigation (*see* p. 455). The aspect of the river throughout the sudd region is monotonous and depressing. On all sides stretch reaches of the reed known as *um suf* or mother of wool (*Vossia procera*), ambach, "bus" and papyrus. These grasses rise 15 to 20 ft. above the water, so as often to close the view like a thick hedge. The level of the flat expanse is broken only at intervals by areas of higher ground on which are mounds of earth erected by the white ants and covered with a clump of brushwood or trees; the moisture in the air is excessive; mosquitoes and other swamp flies swarm in myriads. Yet touches of beauty are not wanting; water lilies (*Nymphaea stellata* and the sacred lotus of Egypt, *Nymphaea Lotus*)—white, blue and crimson—often adorn the surface of the stream. Occasionally the rare and odd-looking whale-headed stork or *Balaeniceps rex* is met with among the reeds, and at night the scene is lit up by innumerable fire-flies.

The White Nile.—From the confluence with the Bahr-el-Ghazal at Lake No, the main stream, which here takes the name of *Bahr-el-Abiad*, or White river, adopts the easterly course of the tributary stream. Forty miles below the point where the Bahr-el-Zeraf reunites with the main branch, the Nile receives its first great eastern affluent—the Sobat (*q.v.*), whose head-streams rise in the mountains of south-west Abyssinia and the region north of Lake Rudolf. Just above the Sobat junction the Nile resumes its northern course. It passes through a great alluvial plain, stretching from the spurs of the Abyssinian highlands in the east, to the hilly districts of Kordofan in the west, and covered with high grass and scattered bush.

About 56 m. below the Sobat mouth, in 9° 55′ N., lies (on the left bank) Kodok (known as Fashoda until 1904), an Egyptian town founded in 1867 on the site of Denab, the old "capital" of the Shilluks, and famous for the crisis between England and France in 1898 through its occupation by the French officer Marchand. For the next 270 m. the scenery takes on a very monotonous appearance. The river flows in a wide channel bordered by a belt of forest on either bank. At Abu Zeid (about 13° 5′ N.) for a distance of nearly 4 m. the river is extremely broad and shallow, being fordable at low water. Fifteen miles lower down, at Goz Abu Goma—which is the northern limit of the sudd vegetation—the river is divided into two channels by Abba Island, wooded, narrow and 28 m. long. On Abba Island lived, for some years before 1881, Mohammed Ahmed, the Mahdi. The White Nile with its volume of about 1,500 cu. metres per sec. in Oct., diminishing to about 550 cu. metres in May, is the main supplier of water to Egypt in the spring and early summer.

The Blue Nile.—Five hundred and twenty miles below the Sobat mouth and 1,652 m. from Ripon Falls, in 15° 37′ N., the White Nile is joined by its greatest eastern confluent the *Bahr-el-Azrak* or Blue Nile. In the fork of the two rivers stands Khartoum, the capital of the Anglo-Egyptian Sudan, whilst on the western bank of the White Nile is Omdurman, the former Mahdist capital. At Khartoum the water of the one river is of a greenish-grey colour, that of the other is clear and blue, except when in flood, when it gains a chocolate brown from the mineral matter in suspension. The Blue Nile, or Abai as it is called in Abyssinia, rises in the Gojam highlands in 11° N. and 37° E., and flowing northwards 70 m. enters Lake Tsana (*q.v.*) near its south-west corner, to issue again at the south-east end. The Abai and its tributaries drain a great part of the Abyssinian plateau. The complicated river system is best understood by a study of the map. The Abai itself on leaving Lake Tsana makes a great semicircular sweep south-east to north-west, from the highlands of Ethiopia to the plains of Sennar. In this section of its course its swirling waters rush over a long series of cataracts and rapids, descending from a height of 5,770 ft. at the outlet to about 1,400 ft. at Fazokl or Famaka (11° 17′ N., 35° 10′ E.), where it crosses the Abyssinian frontier and flows through the plains of Sennar to its confluence with the White Nile at Khartoum, 1,300 ft. above sea-level.

Of the tributaries of the Abai the majority join it on its left bank. The Bashilo, Jamma and Muger, which reach the Abai in the order named, drain the country east of the main stream between the basins of the Takazze and the Hawash. The Guder, with a south to north course, rises in the mountains which form the watershed between the Nile and the Lake Rudolf basin. Next comes the Didessa, a large stream rising near the head-waters of the Baro (the main upper branch of the Sobat) and flowing north-west to the Abai, the confluence being in about 10° N., 35° 40′ E. It has an early rise and a long flood period, being by far the most important tributary of the Blue Nile. The Dabus or Yabus rises about 9° N., 34° 30′ E., and flowing north joins the Abai near the spot where that river breaks through the Abyssinian hills. All these affluents are perennial, as is the Bolassa or Yesien, a right-hand tributary which reaches the Abai below the Yabus.

Four miles below Famaka the river is joined on its left bank by the auriferous Tumat, an intermittent stream. In Sennar it receives on its right bank two considerable tributaries from the Abyssinian heights, the Dinder, a very long but not perennial stream, and the Rahad, waterless in the dry season, copious and richly charged with sediment during the rains from June to Sept. At this period the discharge of the Blue Nile rises from less than 200 to over 6,000 cu. metres per sec., thus greatly exceeding that of the White Nile itself, which is only from about 900 to 1,500 cu. metres during the flood. The length of the Blue Nile is about 850 m. The country, El Gezira, enclosed in the triangle formed by the junction of the White and Blue Niles forms the most fertile portion of the Sudan, and the portion now irrigated from the Blue Nile is producing excellent cotton crops and durra.

The Atbara.—Two hundred miles below Khartoum—at Ed-Damer—the Nile is joined by the last of its tributary streams—the Atbara or Bahr-el-Aswad (Black river). The Atbara, some 800 m. long, rises in the tableland north of Lake Tsana, being formed by the junction of the Angreb, Salaam, Aradeb, Goang and other mountain streams. Making its way towards the Nubian plains, the river flows in a north-westerly direction, joining, in 14° 10′ N., 36° E., the Bahr Setit or Takazze (*see* Abyssinia), a river coming from the east and having a volume of water as large as, if not larger than, the Atbara. The united stream preserves, however, the name of Atbara, and at its confluence with the Nile has a breadth in flood time of over 600 yd. and a volume which exceeds 2,000 cu. metres per sec. in August. The Atbara and its tributaries, like many of those which feed the Blue Nile, rapidly dwindle after the rains. In its lower course the Atbara runs completely dry, but higher up water may be found in deep pools. These pools are full of fish, turtles, crocodiles and hippopotami, which remain imprisoned until the return of the flood. The country between the Nile proper, the Atbara and the Blue Nile is identified with the island of Meroë of ancient history.

The Cataracts.—Below the Atbara junction the Nile continues its course to the Mediterranean, traversing a distance of over 1,600 m. without receiving a single tributary on either bank. Below Khartoum the river makes a great S-shaped bend, and leaving behind the cultivable land, traverses the Nubian desert. In its progress the volume of water suffers continual diminution from evaporation, owing to the extreme dryness of the air. The valley of the river is here very narrow, and the desert land in places comes right to the water's edge. Elsewhere high and barren cliffs shut in the valley. Between Khartoum and Wadi Halfa (the northern end of the great bend), a distance of over 900 m., occurs a series of cataracts, known as the 2nd, 3rd, 4th, 5th and 6th (the 1st cataract is lower down the river at Assuan). That first met with on descending the river from Khartoum is the 6th (or

Shabluka) cataract. The river here (50 m. below Khartoum) is picturesque, flowing rapidly in a narrow gorge for 8 m., but the fall is only 2 ft. After 188 m. of smooth water the 5th cataract is reached. It begins 28 m. below Berber (a town on the right bank at the head of a caravan route to the Red Sea), and with three principal rapids extends for 100 m.—the drop in this distance being rather more than 80 ft. At the foot of this cataract is the town of Abu Hamed, at the eastern end of the middle of the S bend. The 4th cataract begins 60 m. down stream from Abu Hamed. It is 80 m. long and has a drop of 110 ft. Between the 4th and 3rd cataracts there is a stretch of 200 m. on a very gentle slope ($\frac{1}{12,000}$). This reach constitutes the province of Dongola, and here the cultivable land on the western side of the river is of greater extent than usual in the desert zone. The 3rd cataract, 45 m. long, has a drop of some 36 ft. After another smooth reach extending 73 m. the 2nd cataract, which ends just above Wadi Halfa, the northern frontier town of the Anglo-Egyptian Sudan, is reached. This cataract is 124 m. long and has a fall of 216 ft. Between the 2nd cataract and Assuan are 214 m. of smooth water with a scarcely perceptible slope, $\frac{1}{12,800}$. The average breadth of the river here is 1,640 ft.

Lower River and Delta.—For some distance above Assuan the river is studded with islands, including those of Philae and Elephantine. The rapids south of the town used to form the 1st cataract, where, in a length of 3 m., the river fell 16½ ft. Since the completion of the great dam and locks at the head of these rapids they have to a certain extent disappeared, and a navigable channel has been formed. The dam, pierced by 180 sluices, stretches across the river—a wall 2,000 yd. long below which the water rushes between rocks in many channels (these being the relics of the cataract). Upstream from the dam a lake some 100 m. in length has been formed. The Assuan Dam was opened on Dec. 10, 1902 (*see* under IRRIGATION). A ladder of four locks on the western side of the dam permits navigation between the upper and lower reaches. At Assuan the banks of the river are bordered by high granite hills. From this point to the apex of the delta the length of the Nile is 605 m. with a slope ($\frac{1}{18,000}$) even slighter than that above Assuan. The valley is comparatively narrow, being an almost level depression in a limestone plateau and the area of fertility ends where the land ceases to be irrigated by the river. At Esna, 100 m. below Assuan, a barrage, known as the Esna barrage, regulates the flow of the water, and at Assiut, 345 m. below Assuan, is another barrage fulfilling the same purpose, and a third at Nag Hamadi, about 215 m. below Assuan was under construction in 1928. Cairo stands on the eastern bank of the Nile 12 m. north of the apex of the delta.

At the beginning of the delta the Nile separates into two channels, the *Rosetta* and the *Damietta*, which join the Mediterranean at its south-east angle. In ancient times the delta was watered by seven branches; five of these branches are now canals not always navigable. The ancient branches were, beginning at the west, the Canopic, Bolbitine, Sebennytic, Phatnitic, Mendesian, Tanitic and Pelusiac, of which the modern Rosetta and Damietta branches represent the Bolbitine and Phatnitic. At the head of the river is a double barrage, by means of which the water can be dammed to the height required for forcing the water into the canals which irrigate the delta. Of the two branches the Damietta is the more easterly. Both are about the same length—146 m. Behind the coast-line, which is low and sandy, are a number of salt marshes or lagoons. Whilst the Damietta branch is gradually silting up, the Rosetta branch is scouring out a wider channel. At full flood the depth of water in either branch is about 23 ft.

Hydrography.—The fertility and prosperity of Egypt and the northern part of the Sudan being entirely dependent on the irrigation of the land by the waters of the Nile, the variation in the supply at different seasons of the year is of vital importance. (In Egypt the height of the flood has been recorded annually, as the chief event of the year, since at least 3600 B.C.) Above the Sobat confluence the Nile traverses a region of heavy rainfall and the water-supply is super-abundant. It is from Victoria, Albert and Edward lakes and their feeders, and in a very small degree from the Bahr-el-Ghazal, that this river obtains its constant supply of water throughout the year. The great lakes retaining a large proportion of the water they receive, act as natural reservoirs and prevent the lower Nile from ever running dry in summer. The Abyssinian affluents are the source of the Nile flood. In the equatorial regions rainfall varies from 30 to 80 in. during the year with a mean of about 50. It is heaviest in the months of Jan., Feb., March and April, and again in Oct. and November. The most rainy portions of the lake plateau (where alone occurs a rainfall of 60 in. and over) lie along the eastern edge of the Albertine Rift valley, and west and north of Victoria lake. These rains feed Edward and Albert lakes, and, through the Kagera, supply a great part of the water of Victoria lake. The water in Lake Victoria begins to rise in Jan., the rise becomes marked in June, is at its height in July, the level of the water reaching its lowest at the end of November. The Bahr-el-Jebel is at its lowest in March and April and at its highest in September. The seasonal supply of the Bahr-el-Ghazal hardly varies, the maximum levels occurring in Nov. and Dec., and it has but a slight discharge. The Sobat, from Dec. to March, is at its lowest, and is in flood from June to Oct., during which period the water (milky coloured) which it pours into the Nile is two or three times the volume of the main stream. It is the colour of the Sobat water which gives its name to the White Nile. The Blue Nile, at its confluence at Khartoum, begins to rise in June and is in flood from July to Oct.; the Atbara is also in flood during the same months. The great difference in the supply of water from the equatorial regions and from Abyssinia arises from the fact that the first-named district is one of heavy rain practically all the year round, whereas in Abyssinia the season of heavy rain is usually limited to the months of June to September. Reduced to its simplest expression, the Nile system may be said to consist of a great steady flowing river fed by the rains of the tropics, controlled by the existence of a vast head reservoir, and annually flooded by the accession of a great body of water with which its eastern tributaries are flushed.

At Khartoum the Nile is lowest in April and May and highest in Aug. and September. Its minimum depth is 18 ft. and its maximum depth 25 ft. At Assuan the Nile is at its lowest at the end of May, then rises slowly until the middle of July, and rapidly throughout Aug., reaching its maximum at the beginning of Sept.; it then falls slowly through Oct. and November. At Cairo the lowest level is reached about the middle of June, after which the rise is slow in July and fairly rapid in Aug., reaching the maximum at the beginning of October. By using the water stored by the Assuan dam in the months following high Nile, the river lower down has been, since 1902, replenished at times of low water to meet the needs of cultivators (*see* IRRIGATION: *Egypt*). At Assuan the average rise of the Nile is 26 ft., at Cairo it is 23 ft. A rise of 21 ft. only at Assuan is a "bad Nile"; on the other hand, a rise of 30 ft. causes a danger of flood, or rather it used to do so previous to the building of the dam.

When the Nile below the swamps is at its lowest, the water acquires a green colour and a putrid taste and smell due to innumerable microscopic green algae, which grow freely in the conditions of heat and nearly stagnant water which prevail in some reaches of the river at low stage. This "green water" is seen at Cairo about the end of June or beginning of July, and passes away with the first rise in the later month, the algae being unable to live in turbid water. By Aug. the river in lower Egypt is full of dark red-brown sediment brought down by the Blue Nile and the Atbara from the plateaus of Abyssinia. It is estimated to be then carrying 8 cu.yd. per sec.; by Sept. this has been reduced to half the amount, and then diminishes rapidly. It has been calculated[1] that the time taken by the water to travel from Khartoum to the delta barrage varies from 14 days in Sept. to 42 in May.

On the island of Elephantine at Assuan is the famous Nilometer, dating from ancient Egyptian times, altered and extended in Roman times and repaired in 1870 by the Khedive Ismail. It is a stairway in the river quay wall built of hewn stones, marked with scales to record the level of the water of the river. The

[1] By Sir Hanbury Brown, inspector-general of irrigation, Lower Egypt, 1892–1903.

remains of other ancient Nilometers exist at Philae, Edfu and Esna, together with inscriptions recording about forty high Niles in the XXVth Dynasty, discovered on a quay wall of the temple of Karnak. The data furnished by these give about 4½ in. per century as the average rate at which the Nile is silting up its bed north of the 1st cataract. The present level of high Nile at the Semna rapids, between the 2nd and 3rd cataracts is 24 ft. lower than that indicated by the marks sculptured *c.* 2500 B.C. This fall is attributed to the erosive action of the water as it passes over the hard gneiss which at Semna forms a barrier across the stream. The vertical extent of such erosion is equal to about two millimetres a year. There are now gauges for registering the rise of the water at Cairo, Assuan, Berber and Khartoum on the main river; at Wad Medani, Sennar and Roseires on the Blue Nile; El Duem and Malakal on the White Nile; Nasser on the Sobat; Mongalla on the Bahr-el-Jebel; and Ugowe, Jinja and Entebbe on Victoria Nyanza.

Navigation.—At high Nile there is uninterrupted water-communication from the sea to Fort Berkeley in 4° 40′ N.—a distance of 2,900 m. Owing to the cataracts, navigation between Assuan and Khartoum is impossible during low Nile, and from March 1st to Aug. 1st the upper courses of the Damietta and Rosetta branches are closed to navigation; the water being utilized for summer irrigation in the delta. As far as Mansura (60 m.) on the Damietta branch and Kafr-el-Zayat (70 m.) on the Rosetta branch, and between Khartoum and Fort Berkeley (1,090 m.) the river is navigable all the year round, though between the Sobat confluence and Bor, navigation is dependent on the channel being kept clear of sudd. Above Fort Berkeley navigation is interrupted by the rapids and cataracts which extend to Dufile, but from the last-named town to Fajao at the foot of the Murchison Falls (a distance of 150 m.) the river is navigable throughout the year. There is a further navigable stretch between Foweira (just above the Karuma rapids) and the southern end of Lake Kioga. The Blue Nile is navigable for steamers during flood time from its confluence at Khartoum to Roseires at the foot of the Abyssinian hills, a distance of 426 m. At low water small boats only can go upstream. The Atbara is never navigable, the current during flood time being too swift for boats. Including the Sobat and the Bahr-el-Ghazal the navigable waters of the Nile and its affluents exceed 4,000 m. (W. E. G.; F. R. C.)

HISTORY

Story of Discovery.—Few problems in geographical research exercised for so long a period so potent an influence over the imaginations of man as that of the origin of the Nile. The ancient Egyptians, as is apparent from the records on their monuments, were acquainted with the main stream as far south as the junction of the White and Blue Niles. They appear also to have known the Blue Nile up to its source and the White Nile as far south as the Bahr-el-Ghazal confluence. Beyond that point the sudd probably barred progress. The knowledge acquired by the Egyptians passed to the Persians and Greeks. Herodotus (about 457 B.C.) ascended the Nile as far as the First Cataract. He was led to believe that the source of the river was far to the west—in the region of Lake Chad. Eratosthenes, superintendent of the Alexandrian library, in a map made about 250 B.C., showed, with fair accuracy, the course of the river as far as where Khartoum now stands. He showed also the Atbara and Blue Nile. Eratosthenes was the first writer to hint at equatorial lakes as the sources of the river. Juba II., king of Mauretania (who died about A.D. 20), in his *Libyca*, quoted by Pliny, makes the Nile rise in western Mauretania, not far from the ocean, in a lake presenting characteristic Nile fauna, then pass underground for several days' journey to a similar lake in Mauretania Caesariensis, again continue underground for twenty days' journey to the source called Nigris on the borders of Africa and Ethiopia, and thence flow through Ethiopia as the Astapus. This remarkable story received considerable credence, and may be connected with the theory which made the Niger a branch of the Nile (*see* below). Strabo (a contemporary of Juba), who ascended the river as far as Syene, states that very early investigators had connected the inundation of the Lower Nile with summer rains on the far southern mountains, and that their theory had been confirmed by the observations of travellers under the Ptolemies. About the same time Dalion, a Greek, is believed to have ascended the White Nile. Nero despatched two centurions on an expedition for the express purpose of exploring the Nile, and Seneca states that they reached a marshy impassable region, which may be easily identified with the country of the White Nile above the mouth of the Sobat. To what they referred when they reported a great mass of water falling from between two rocks is not so readily determined. During this period more accurate knowledge concerning the Nile sources was obtained from the reports of Greek traders who visited the settlements on what is now called the Zanzibar coast. A merchant named Diogenes returning (about A.D. 50) from the east coast of Africa told a Syrian geographer, Marinus of Tyre, that journeying inland for twenty-five days he reached the neighbourhood of two great lakes and a range of snow mountains whence the Nile drew its sources. Marinus published this report in his geographical works. This book is lost, but the information is incorporated in the writings of Ptolemy, who in his book and map sums up all that was known or surmised of the Nile in the middle of the 2nd century of the Christian era. Ptolemy writes that two streams issuing from two lakes[1] (one in 6° and the other in 7° S.) unite in 2° N. to make the Nile, which, in 12° N., receives the Astapus, a river flowing from Lake Coloe (on the equator). His two southern lakes, he conceived, were fed by the melting of snows on a range of mountains running east and west for upwards of 500 m.—the Mountains of the Moon, τὸ τῆς σελήνης ὄρος, *Lunae Montes*. It will be seen that, save for placing the sources too far to the south, Ptolemy's statements were a near approximation to the facts. The two southern lakes may be identified with the Victoria and Albert Nyanzas, and Lake Coloe with Lake Tsana. The snow-capped range of Ruwenzori occupies—at least in part—the position assigned to the Mountains of the Moon, with which chain Kilimanjaro and Kenya may also be plausibly identified. On all the subsequent history of the geography of the Nile Ptolemy's theory had an enormous influence. Mediaeval maps and descriptions, both European and Arabian, reproduce the Mountains of the Moon and the equatorial lakes with a variety of probable or impossible modifications. Even Speke (*see* p. 456) congratulated himself on identifying the old Ptolemian range with the high lands to the north of Tanganyika, and connected the name with that of Unyamwezi, the "country of the moon."

In the fourteen centuries after Ptolemy virtually nothing was added to the knowledge of the geography of the Upper Nile. Arab writers of the 12th and 13th centuries make mention of the great lakes, and their reports served to revive the interest of Europe in the problem of the Nile. Idrisi made both the Nile and the Niger issue from a great lake, the Niger flowing west, the Nile north. Hence arose much confusion, the Senegal estuary being regarded by its discoverers (1445) as the mouth of a western branch of the Nile. Even until the early years of the 19th century the belief persisted in a connection between the Nile and the Niger (*see* further NIGER). Portuguese explorers and missionaries, who in the 15th and 16th centuries visited the east coast of Africa and Abyssinia, gained some information about the equatorial lake region and the Nile, the extent of the knowledge thus acquired being shown in the map of Africa of Filippo Pigafetta, Italian traveller and historian (1533–1603) published in 1580. It was not, however, till the 17th century that the sources of the Blue Nile were visited by Europeans. In 1615 Pedro Paez, a Portuguese priest, was shown them by the Abyssinians. Ten years later another Portuguese priest, Jeronimo Lobo, also visited the sources and left a vivid description of the rise of the river and its passage through Lake Tsana. An English version of the accounts of Paez and Lobo—written by Sir Peter Wyche—was published in 1669 by order of the Royal Society, of which Sir Peter was an original Fellow. Between 1625 (the date of Lobo's visit) and 1770, some attempts were made by French and other

[1] The two lakes afterwards received the names Lake of Crocodiles and Lake of Cataracts.

travellers to explore the Blue Nile, but they ended in failure. In the last-named year James Bruce (*q.v.*) reached Abyssinia, and in Nov. 1772 he arrived in Egypt, having visited the source of the Blue Nile and followed it, in the main, to its confluence with the White Nile. On returning to Europe Bruce was mortified to find that whilst he was still in Egypt the French geographer D'Anville had (1772) issued a new edition of his map of Africa in which by a careful study of the writings of Paez and Lobo he had anticipated Bruce's discoveries, D'Anville's map is singularly accurate, if we remember the scanty information at his disposal. To Bruce, nevertheless, belongs the honour of being the first white man to trace the Blue Nile to its confluence with the White Nile. He himself, considering the Blue Nile as the main branch of the river, claimed to be the discoverer of the long-sought *caput Nili*.

From the time of Bruce, interest in the Nile problem grew rapidly. The Englishman, W. G. Browne (*q.v.*) when in Darfur (1794–1796) heard that the Abiad rose far south in the Mountains of the Moon, but he makes no mention of the great lakes, and in Major Rennell's map of 1802 there is no hint of equatorial lakes at the Abiad sources. During the French occupation of Egypt the river from the sea to Assuan was accurately surveyed, the results being embodied in Jacotin's *Atlas de l'Égypte* (1807). In 1812–1814 J. L. Burckhardt, the Orientalist, went up the Nile to Korosko, travelled thence across the desert to Berber and Shendi, and crossing the Atbara made his way to the Red Sea. It was, however, due to the initiative of Mohammed Ali, Pasha of Egypt, that the White Nile was explored. In 1820–22 a military expedition under Ismail Pasha, a son of Mohammed Ali, which was joined by the French scientist Frédéric Cailliaud (who had visited Meroë in 1819) ascended the river to the confluence of the White and Blue Niles, founded the city of Khartoum, and ascended the Blue Nile to Fazokl. In 1827 Adolphe Linant, a Belgian in the service of the British African Association, ascended the White Nile 132 m. above Khartoum, being the first white man to do so since the 1st century A.D. Then followed three Egyptian expeditions sent in 1839–41 and 1842 by Mohammed Ali up the White Nile. The first expedition reached, on Jan. 28, 1840, a point 6° 30′ N., the second and third pressed further south, reaching 4° 42′ N.—or the foot of the rapids above Gondokoro. A Turkish officer, Selim Bimbashi, commanded the expeditions, and among the members were the Frenchmen Thibaut (a convert to Islam and for nearly forty years French consular agent at Khartoum), D'Arnaud and Sabatier, and a German, Ferdinand Werne. The last-named wrote a scientific account of the second expedition and drew a map of the Nile between Khartoum and Gondokoro. An Austrian Roman Catholic mission was established in the Sudan, and in 1850 one of its members, Dr. Ignatz Knoblecher, sent to Europe reports, gleaned from the natives, of the existence of great lakes to the south. About the same time two Protestant missionaries, Ludwig Krapf and John Rebmann, stationed on the Zanzibar coast, sent home reports of a vast inland sea in the direction where the Nile sources were believed to be. This sea was supposed to extend from 0° 30′ N. to 13° 30′ S. These reports revived interest in Ptolemy's Geography. The exploration of the Bahr-el-Ghazal by John Petherick, Miss Tinné and her companions, and others followed the opening of the White Nile (*see* BAHR-EL-GHAZAL). The result of the work carried on from the north was that by 1858 the Nile system was known as far south as the rapids at Bedden.

On Aug. 3, 1858 the English explorer J. H. Speke (*q.v.*) discovered the large *nyanza* (lake), which he rightly conceived to be the head reservoir of the White Nile, and which in honour of the queen of England he named Victoria Nyanza. Captain (Sir Richard) Burton and Speke had gone inland from Zanzibar to investigate the reports concerning the vast lake which Rebmann and Krapf had called the Sea of Unyamwezi. These reports proved to be exaggerated accounts of three distinct lakes—Nyasa, Tanganyika and Victoria Nyanza. In 1860 Speke returned to Zanzibar accompanied by J. A. Grant (*q.v.*), bent on solving the problem of the Nile. In spite of great difficulties he made his way to Uganda, on the north-west of Victoria Nyanza and (without exploring the lake) succeeded in reaching its outlet. On the 28th of July 1862 Speke stood by the Ripon Falls—the birthplace of the Nile. In his journey he had discovered the Kagera river, now known to be the most remote headstream of the Nile, a fact of which Speke was uncertain, though he recognized that it was the largest river entering the nyanza. Speke and Grant paddled down the Nile a short distance, but before reaching Lake Kioga they were stopped by hostile natives and compelled to go westward to Unyoro. There they heard of another great lake farther west, but the king of Unyoro refused them permission to visit it. In the end they descended the Kafu river to its confluence with the Nile and then down the main stream to the Karuma Rapids. Here Speke and Grant left the river, and travelled overland east of the stream, which they did not strike again until just above the Ausa confluence. Thence they travelled down the Nile to Gondokoro, reached on Feb. 15, 1863.

This remarkable journey virtually solved the Nile problem so far as the source of the main stream was concerned, but there remained much to be done before the hydrography of the whole Nile basin was made known. At Gondokoro, Speke and Grant met Mr. (afterwards Sir Samuel) Baker and his wife—a Hungarian lady—who had journeyed thither to afford the explorers help. To Baker, Speke communicated the news he had heard concerning the western lake, and this lake Baker determined to find. On the 26th of March 1863 Baker and his wife left Gondokoro, and despite much opposition, especially from slave-dealers, followed, in the reverse direction, the route of Speke and Grant as far as Unyoro, whence they journeyed west. On March 14, 1864, they struck the lake (Albert Nyanza) on its south-east side. They paddled up the lake to the point where a large river coming from the east poured its waters into the lake. This stream, which they rightly conjectured to be Speke's Nile, they followed up to the Murchison Falls. Thence they went overland to the Karuma Rapids, and so back to Gondokoro by their old tracks. It fell to the lot of General C. G. Gordon (when that officer administered the Egyptian Equatorial provinces) and his assistants to fill up the gap left by Speke and Baker in the course of the main stream. In 1874–75 two English engineer officers—Lieut. (afterwards Colonel Sir Charles M.) Watson and Lieut. H. Chippendall—followed the river between Gondokoro and Albert Nyanza; in 1876 an Italian, Romolo Gessi Pasha, circumnavigated that lake, proving Baker's estimate of its size to be vastly exaggerated; Gordon in the same year traced the river between Murchison Falls and Karuma Rapids, and an American, Colonel C. Chaillé-Long followed (1874) the Nile from the Ripon Falls to the Karuma Rapids, discovering in his journey Lake Kioga (which he named Ibrahim). In this manner the identity of the Victoria Nile with the river which issued from the Albert Nyanza was definitely established.

In 1874 H. M. Stanley (*q.v.*) went to Africa with the object of completing the work left unfinished by David Livingstone, who believed, erroneously, that the ultimate sources of the Nile were far to the south (*see* CONGO). Stanley, in 1875, circumnavigated Victoria Nyanza, setting at rest the doubt thrown on Speke's statement that it was a huge sheet of water[1], but proving Speke mistaken in believing the Nyanza to have more than one outlet. On the same journey Stanley encamped at the foot of the Ruwenzori range, not knowing that they were the "Mountains of the Moon," whose streams are the chief feeders of Albert Nyanza. (At the time of his visit the snow-peaks and glaciers were hidden by heavy clouds.) In 1888, however, Stanley saw the mountains in all their glory of snow and ice, discovered Albert Edward Nyanza, and traced the river (Semliki) which connects it with Albert Nyanza. The Semliki had been discovered, and its lower course followed in 1884 by Emin Pasha. Thus at length the riddle of the Nile was read, though much was still to do in the matter of scientific survey, and in the exploration of the valley of the Sobat (*q.v.*). The Kagera had been partly explored by Stanley (1875), by whom it was called the Alexandra Nile, and between 1891–98 its various branches were traced by the German travellers Oscar Baumann, Richard Kandt and Captain H. Ramsay, and by Lionel Décle, a Frenchman. A British officer, Colonel C. Delmé-Radcliffe, made the first accurate survey (1900–1901) of the

[1] In the map issued in 1873 to illustrate Schweinfurth's book, *The Heart of Africa*, Victoria Nyanza is shown as five small lakes.

Nile between Albert Nyanza and Gondokoro. In 1903 an Anglo-German commission under Colonel Delmé-Radcliffe and Captain Schlobach made a detailed survey of the Kagera from 30° E. to its mouth. The Kioga system was surveyed in 1907–08 by Lieut. C. E. Fishbourne. A trigonometrical survey of the upper river was begun by Colonel M. G. Talbot, director of Sudan surveys, in 1900, and since then much has been done by the Sudan Survey Department and the Irrigation Service.

The Removal of Sudd.—The sudd (*see* p. 452, *The Region of Swamps*) above the Sobat confluence seems to have stopped the Roman centurions sent by the emperor Nero to explore the Nile. When the river above the Sobat was again reached by white men (1840) the stream was clear of sudd, and so continued until 1863–1864, when both the Bahr-el-Jebel and the Bahr-el-Zeraf became blocked by floating masses of vegetation. When Baker proceeded to Gondokoro in 1870 he thus described the increase that neglect had caused in the obstruction: "The immense number of floating islands that were constantly passing down the stream of the White Nile had no exit; thus they were sucked under the original obstruction by the force of the stream, which passed through some mysterious channel, until the subterranean passage became choked with a wondrous accumulation of vegetable matter. The entire river became a marsh, through which, by the great pressure of water, the stream oozed through innumerable small channels. In fact, the White Nile had disappeared." Baker, who had to cut through 50 m. of sudd in his passage to Gondokoro, urged the Khedive Ismail to reopen the Nile. This work was efficiently done by Ismail Ayub Pasha, and the White Nile was clear for large vessels when Gordon reached Khartoum in 1874. The river did not long remain free, for in 1878 Emin Pasha was unable to ascend the Bahr-el-Jebel from the south on account of sudd. It was cleared in 1879–80 by officials in the Egyptian service, but had again accumulated in 1884. In consequence of the Mahdist movement nothing could then be done to clear the river, and the work was not taken in hand again until 1899, when, by direction of Sir William Garstin, the under secretary of state for public works in Egypt, an expedition under Major Malcolm Peake, R.A., was sent to cut through the sudd, which then extended from the Bahr-el-Ghazal confluence almost to Gondokoro. During 1900 a channel was cut through the northern and heaviest portion of the sudd. The work was one of much difficulty, some of the blocks being 1 m. long and 20 ft. deep; the water beneath flowed with great velocity. To remove the obstruction the surface was first burnt; then trenches were cut dividing the sudd into blocks 10 ft. square, and each of these was hauled out with wire hawsers and chains by gunboats working from below. For a distance of 172 m. north of Shambe (*i.e.*, about midway between the Ghazal confluence and Gondokoro) the true bed of the river could not, in many places, be found, but Major Peake forced a passage to Gondokoro through a spill channel or series of shallow lakes lying west of the main stream. In 1901 Lieut. Drury, a British naval officer, removed many of the remaining blocks of sudd, opening to navigation a further 147 m. of the river. Beyond this point for a distance of 25 m. the Bahr-el-Jebel could not be traced, so completely was the channel choked by sudd. In 1902, however, Major G. E. Matthews discovered the true bed of the river, which by 1904 was completely freed from obstructions, and freedom of navigation between Khartum and Gondokoro was permanently secured. The effect of the sudd-cutting operations on the supply of water available for irrigation purposes in the lower river was slight but it has made it available for transport, and communication up to Rejaf is now regularly maintained.

Political Relations.—Explored in part by Egyptian government expeditions, the upper Nile as far south as Albert Nyanza became subject, between 1840 and 1882, to Egypt. Possession of the greater part of the river above Wadi Halfa then fell to the followers of the Mahdi. In 1896–98 an Anglo-Egyptian army reconquered the country, and from Victoria Nyanza to the Mediterranean the main river came under British or Egyptian administration. The west bank of the Bahr-el-Jebel, as far north as 5° 30′ N., was in 1894 taken on lease from Great Britain by the Congo Free State during the sovereignty of Leopold II., the territory leased being known as the Lado enclave (*q.v.*), but the lease was terminated in 1910.

BIBLIOGRAPHY.—For the story of exploration, *see* the works of Bruce, Speke, Grant, Baker and other travellers (whose books are mentioned in the biographical notices). Their achievements, and those of ancient and mediaeval explorers, are ably summarized in *The Story of Africa*, vols. ii. and iii., by Dr. Robert Brown (1893–94), and *The Nile Quest*, by Sir Harry Johnston (1903). *See* also J. Partsch, *Des Aristotel's Buch: "Über das Steigen des Nil"* (Leipzig, 1909). For the Kagera region consult *Caput Nili*, by Richard Kandt (Berlin, 1904). Latest additions to geographical knowledge are recorded in the *Geographical Journal* (London) and the *Cairo Scientific Journal*. For the hydrography, geology and climate see *The Physiography of the River Nile and its Basin*, by Captain H. G. Lyons, director-general, survey department, Egypt (Cairo, 1906), an authoritative work, and numerous other publications of the Survey of Egypt and of the Physical Department; "Notes on the History of the Nile and its Valley," by W. F. Hume, in *Geog. Jnl.* (Jan. 1906); *Egyptian Irrigation* (2nd ed., 1899) and the *Nile Reservoir Dam at Assuan and After* (1901), both by Sir William Willcocks; the *Annual Reports* (1899 and after) of the Egyptian Public Works Department. Of special value is the Blue Book *Egypt No. 2, 1904*, which is a report by Sir William Garstin on the basin of the upper Nile, dealing at length with the lake area, the Nile affluents and the main river as far south as Khartum, from the topographical as well as the hydrographical aspect. Sir W. Garstin and Captain Lyons give full bibliographical notes.

The study of the zoology of the Nile valley was the special object of a Swedish scientific expedition in 1901, under the direction of Prof. L. A. Jägerskiöld. The *Results* were published at Uppsala, pt. iii. appearing in 1909. For the botanical and other aspects of the Nile valley, *see* the works of Petherick, Heuglin, Schweinfurth, Junker and Emin. (F. R. C.)

DISTRIBUTION OF WATERS

Although the geographical problems connected with the origin of the river have been solved, the Nile continues to offer problems of extraordinary interest in connection with the conservation and distribution of its waters. The energy formerly directed to exploration has only been diverted to a closer and more scientific study of the hydrography of the river, with a view to determining how the available flow of water in its various tributaries can be most advantageously and economically protected from dissipation and wastage in the swamps of the upper river, and stored in reservoirs for utilisation as required. These studies have mostly been directed by the Egyptian Government to increasing the flow of the river in the early summer months, when its natural flow falls short of requirements for irrigation in Egypt; it has come to be realised that the control of the Nile waters is not wholly an Egyptian question but concerns the countries higher up the river.

The Assuan, Gebel Aulia and Makwar Dams.—The original Assuan dam, which was opened in 1902, was raised in height by seven metres in 1912 and the storage capacity of the reservoir increased from 1,000 million cu. metres to 2,250 million cu. metres of water. Following on Sir William Garstin's report on the basin of the Upper Nile (British Blue Book, *Egypt No. 2, 1904*), schemes for constructing a large reservoir on the lower White Nile by means of a dam at Gebel Aulia some 20 m. south of Khartoum, and for a canal to irrigate the great Gezira plain between the Blue and White Niles, began to take definite form about 1913. Progress with these schemes was necessarily suspended during the World War, and in the meanwhile the increasing tendency towards the development of an independent existence by the Sudan caused all schemes for the control of the river beyond the limits of Egypt proper to be viewed with some apprehension and mistrust in Egypt. The general position was summed up to date by the then adviser to the Egyptian Ministry of Public Works, Sir Murdoch MacDonald, in *Nile Control* (published by the Egyptian Government in 1920), and an international commission was appointed by the Egyptian Government to report on the proposed works.

The commission reported favourably on the general scheme outlined in *Nile Control*, and pointed out that under a carefully considered scheme of control there was sufficient water to meet any possible developments in both Egypt and the Sudan for many years to come. Financial considerations, complicated by the political position, again led to the temporary suspension of the works and to the preparation of further reports on the irrigation programme by Mr. C. E. Dupuis, formerly adviser to the Egyp-

tian Ministry of Public Works (issued by the Egyptian Government in 1925). The construction of the Gezira canal was then resumed by the Sudan Government, and the canal, with its great dam and reservoir, with a capacity of nearly 500,000 million cu. metres of water, at Makwar, near Senaar, on the Blue Nile, was completed to the extent necessary for the irrigation of 300,000 ac. in 1925, and formally opened in 1926. The Egyptian Government also started preliminary work on the Gebel Aulia dam and reservoir (White Nile), with a storage capacity of about 2,500 million cu. metres of water, and is studying the scheme for the canalization of the river through the swamps, on which some preliminary work was done between 1904 and 1913. (*See* DAMS; IRRIGATION.) At present work at Gebel Aulia has been suspended and the heightening of the Assuan Dam by 8 metres is under consideration.

Lake Albert.—It is further recognized that to be fully effective this canalization of the river must be supplemented by further storage works higher up the river, presumably by the conversion of Lake Albert into a reservoir, but this scheme has not yet emerged from the stage of preliminary consideration. The most recent information concerning the physical conditions and régime of the great lakes forming the basin of the upper White Nile, essential to the consideration of this project, has been collected in a report on *The Lake Plateau Basin of the Nile* by Mr. H. E. Hurst (published by the Egyptian Government in 1925).

Lake Tsana.—The study of the possibilities of Lake Tsana as a reservoir for the Blue Nile, originally reported on by Mr. C. E. Dupuis in 1903, has been continued by expeditions visiting the lake under Mr. A. B. Buckley in 1916–17, and under Mr. G. W. Grabham in 1920–21. The results of these studies were published by the Egyptian Government and the *Report of the Mission to Lake Tsana in 1920–21* by Messrs. G. W. Grabham and R. P. Black is particularly full and interesting. All reports agree in emphasising the extreme suitability of Lake Tsana for conversion into a reservoir of a capacity of between 3,000 and 4,000 million cu. metres. The political questions arising from the gradual conversion of the Nile from a natural river into an artificially regulated stream, whose flow is controlled by reservoirs at various points on its course in several different countries, have begun to make themselves felt, and a comprehensive solution of the resulting difficulties has yet to be found.

Navigation and Water Power.—From the point of view of navigation and trade no new developments have taken place on the Nile in recent years. The river remains a most useful highway for local traffic in the various sections into which its length of 4,000 m. is divided by the occurrence of falls and rapids; but the nature of these breaks is such that the development of through traffic on any scale is never likely to be economically possible. There are considerable possibilities for the development of water-power on the Nile especially at the Ripon and Murchison falls in Uganda; and the utilization of the large amount of power running to waste at the Assuan dam has been repeatedly considered and discussed; but the localities in which these opportunities occur are remote, and no useful application of them to practical purposes has yet been devised; in the case of Assuan the intermittent character of the power obtainable, which though very large when the reservoir is full in the early part of the year is practically nil during the flood season, has hitherto proved an insurmountable objection to economic utilization. (C. E. D.)

NILE, BATTLE OF THE. The battle of the Nile was fought in Aboukir Bay, near Alexandria, on Aug. 1, 1798. It arose out of Napoleon's famous Egyptian Expedition, the first news of which had reached Jervis, off Cadiz, earlier in the year, in the shape of rumours of great activity in the port of Toulon. In the previous year the first European coalition against revolutionary France had been finally dissolved by the elimination of Austria, the result being that in 1798 France was at war with England only, and this eastern expedition with its proposed, though unlikely, result of an attack on India, was considered by Napoleon to be the most hopeful means of embarrassing England, while at the same time keeping himself in the limelight. As soon as Jervis heard of the preparations at Toulon, the object of which was, of course, unknown to him, he despatched Nelson with a small force to reconnoitre, and soon afterwards he had an opportunity of reinforcing him. Pitt was trying to build a new coalition against France, and was approaching Austria who made England's re-entry into the Mediterranean, which she had been forced to evacuate, a condition of acceptance. Jervis was thus ordered to send a detachment through the Straits of Gibraltar with instructions to find out whether a re-entry into the Mediterranean was feasible; what he did was to reinforce Nelson so as to bring his strength up to 14 ships, 13 of them seventy-fours and one a fifty.

Before Nelson was joined by his reinforcements and while he commanded only three seventy-fours and some frigates, he was forced from his station, off Toulon, by a gale. He suffered severely in this and—perhaps worst misfortune of all—was separated from his frigates which went to Gibraltar in the expectation that the admiral would go there to refit. The absence of "the eyes of the fleet" during the ensuing search for the French was obviously a great handicap. The remaining ships were repaired somehow and by May 31 they were back off Toulon, having been absent ten days, but the French were gone. The direction of the wind led Nelson to believe that the kingdom of the two Sicilies was the danger-point, and that the French had not made for the Straits of Gibraltar as it was believed in England they would. Consequently he made for the Bay of Naples, and on June 7 was joined by the reinforcements from Jervis. Malta was the next point at which it was decided to aim, but, while the fleet was in the neighbourhood of Cape Passaro, news reached it that the island had fallen to the French. It was this news that shook the public confidence, generally so strong, in Nelson, and for a time it was considered that he was being out-manoeuvred. The problem before him was certainly a hard one. With the intuition, however, for which he was so famous, he decided on Egypt as Napoleon's next stopping-place, and made sail for Alexandria. He found it empty and impetuously left, on June 30, to search elsewhere. On the following day the French arrived, actually sighting the topsails of the last ships of the departing English fleet, which ranged the coast of Asia Minor in its search and finally arrived at Syracuse. Here, by the kind influence of Lady Hamilton with the Neapolitan court, the fleet was entirely revictualled and immediately sailed again for the East. After further searching, Nelson decided to try Alexandria once more, and this time was rewarded by the sight of the republican tricolour floating over the town. A little later the French fleet could be seen anchored in Aboukir Bay. The long search was ended.

Aboukir Bay is situated about fifteen miles north-east of Alexandria and is about fifteen miles wide, extending from Aboukir Point on its westerly side to the Rosetta mouth of the Nile. The bay was silted up and its western curve offered exactly the sort of refuge de Brueys, the French Admiral, was seeking for the protection of his fleet which consisted of nine seventy-fours, three eighties, "L'Orient" of 120 guns, and four frigates. He had hoped to station this fleet in such a manner that it would be impossible for an attacking enemy to do more than fight him from seawards. The curving shoals seemed to offer him such a position, and he had drawn up his fleet facing north and north-west in a very obtuse angle, with his own ship, "L'Orient," at the apex, and the ships at the extremities of the line close to the shallows. The frigates he placed between this line and the shoals. So certain was de Brueys that this arrangement would prevent the British getting between him and the land that his ships were not even prepared for action on the landward side. An ordinary attack on his seaward side would, he thought, favour him, since the enemy would be under sail and, further, he had prepared batteries ashore which would enfilade their position. To Nelson's experienced eye, however, a weakness in these dispositions was at once apparent. The French ships were anchored in such a manner that there was nothing to prevent them swinging, and, as Nelson himself put it, "where there is room for a Frenchman to swing, there is room for a Briton to anchor"; in other words it would, for all de Brueys's care, be possible to attack the French on the landward side, either by cutting in between the leading ship and the shoals, or by breaking through between two ships. The British fleet was approaching from the

north with the wind a little west of north, so that there was nothing to prevent their doing either or both. Nelson's orders were that part of the fleet was to get to landward of the enemy and part was to remain to seaward; the northern end of the line was to be attacked first and the English ships were to anchor only by the stern so that, by merely paying out cable, they would be able, as each French ship was demolished, to move on to deal with others which would, owing to the direction of the wind, have found it impossible to come to the assistance of those attacked first.

It was nearly dark when Captain Foley, of the "Goliath," leading the English line, took his ship between the "Guerrier," the leading French ship, and the shore. Raking the "Guerrier" in passing, he went on to anchor on the port quarter of the next French ship, the "Conquérant." Captain Hood, who followed, in the "Zealous," anchored on the port bow of the "Guerrier." The three following ships, the "Audacious," the "Theseus" and the "Orion" broke through the French line and took up positions between the enemy and the shoals. Next came Nelson, in the "Vanguard," and his was the first ship to take up her station to seaward, anchoring opposite the "Spartiate," the third French ship, which was already receiving the attentions of the "Theseus" on the other side and was thus doomed to an eventual surrender. All the remaining ships took up their positions to seaward of the French, with the exception of the "Majestic" and the "Alexander," which broke through, and of the "Culloden," commanded by Nelson's friend, Troubridge, which was unfortunate enough to run ashore on a projecting sandbank before getting into action. Even this was not without its blessings, since, by hanging out signal lights, Troubridge was able to warn the ships following against suffering a similar fate, and they all escaped it. The enormous "Orient" was engaged first by the "Bellerophon" and then by the "Swiftsure" and "Alexander," which were the last ships into action, one on each side of her. The French flagship fought stubbornly, but she was set on fire and at ten o'clock blew up with a colossal explosion. Surrenders to the British were now becoming frequent, and as each ship was taken, the victors were able to move on and engage others which, no doubt mystified and confused in the darkness, were complacent enough to wait their turn. In this way the entire French fleet was accounted for with the exceptions of the two rear battleships and two frigates which made off in time; it is interesting to note that they were all taken or destroyed in subsequent actions. The victory of the Nile was one of the most complete in the annals of naval history, and was rich in results. It enabled England to capture Minorca and Malta; it completely restored her position and prestige in the Mediterranean; and this, in turn, enabled Pitt to conclude successfully his negotiations for the formation of a new coalition.

See Southey, *Life of Nelson*, ed. G. A. R. Callender (1922, bibl.).

(G. A. R. C.; J. G. B.)

NILES, a city of Berrien county, Michigan, U.S.A., 93 m. E. of Chicago, on the St. Joseph river. It is on Federal highway 31; has a municipal airport; and is served by the Big Four and the Michigan Central railways, and by interurban trolley and motor-bus lines. The population was 7,311 in 1920, 90% native white, and was estimated locally at 12,500 in 1928. It is the shipping and trading point of a rich farming and dairying region; has a mushroom industry which supplies most of the markets of the Middle West; and is an important manufacturing centre, with numerous and diversified industries. The Michigan Central railroad has its largest classification yards here, as well as repair shops and roundhouses. On or near the site of Niles French Jesuits established a mission in 1690, and the French government in 1697 erected Ft. St. Joseph, which was captured from the English by the Indians in 1763 and in 1781 was seized by a Spanish party from Saint Louis. The present city was founded in 1826 and incorporated in 1859.

NILES, a city of Trumbull county, Ohio, U.S.A., on the Mahoning river, 10 m. above Youngstown; served by the Baltimore and Ohio, the Erie and the Pennsylvania railways. Pop. 13,080 in 1920 (25% foreign-born white); estimated locally at 20,000 in 1928. It is an important industrial centre, manufacturing especially steel sheets, glass and fire-brick, with a factory output in 1925 valued at $25,263,634. Niles was settled in 1832, incorporated as a village in 1865 and chartered as a city in 1895. It was named (1834) after Hezekiah Niles (1777–1839), founder and editor of *Niles's Register* (1811–49); and was the birthplace of President McKinley, to whose memory a memorial has been erected.

NILGAI ("blue bull"), the largest antelope (*Boselaphus tragocamelus*) found in India, where it represents the kudu and eland group of Africa. Only the bulls have horns, and these are short. The general colour of old bulls is bluish-grey, but younger bulls and cows are browner. It is about the size of a mule (*see* ANTELOPE).

NILGIRIS, THE (Blue Mountains), a system of hills in southern India, which gives its name to a district of the Madras Presidency. The Nilgiris form a plateau rather than a range, rising abruptly from the plains on most sides, with a general elevation about 6,500 ft. above sea-level.

The DISTRICT OF THE NILGIRIS is the smallest administrative district in Madras. It was formerly confined to the plateau, but was increased by the addition of portions of the Wynaad, making a total area of 982 sq.m. The administrative headquarters are at Ootacamund (*q.v.*). There is an abrupt descent of about 6,000 ft. from the plateau to the plains, save on the north, where the base of the mountains rests upon the elevated land of Wynaad, and Mysore, standing between 2,000 and 3,000 ft. above sea-level. The Ochterlony valley and Wynaad country consist of a series of broken valleys, once forest-clad throughout, but now studded with tea and coffee-gardens. The highest peak is Dodabetta, 8,760 ft. There are six well-known passes or *ghats* by which the district communicates with the neighbouring plains, three of which are practicable for wheeled traffic. The chief rivers are the Moyar, Paikara and Calicut, none of which is navigable. The forests consist of fine timber trees, and eucalyptus and Australian wattle have been extensively planted in the higher grounds of the Wynaad. Large game animals of many kinds are numerous. The hill tribes include Todas, Badagas and Kotas. The population of the district in 1921 was 126,519. The commercially important products are coffee, tea and cinchona. The latter is cultivated by the government, and also in private gardens, and there is a government quinine factory. The climate of the Nilgiri hills is extremely equable. A branch of the Madras railway runs from Podanur to Mettupalaiyam, whence a metre-gauge line on the rack principle goes to Coonoor, where there is a silk-farm, and Ootacamund. The Lawrence Memorial School at Ootacamund is maintained by government. The military quarters are at Wellington.

NILOTES, certain peoples of the Anglo-Egyptian Sudan, of whom the Shilluk and Dinka, best known representatives of these tall "black"-skinned dolichocephals, have an average stature of about 1·78m. (about 70in.) or perhaps a little more, and a cephalic index which varies around 72. In these tribes, as well as in the Nuer and Anuak, there is an Hamitic element, and although the majority have coarse features, with broad noses, among the Shilluk and probably the Anuak men with shapely features, including thin lips, long, relatively high-bridged, narrow noses, and well modelled foreheads are not uncommon.

The languages of the Nilotes form a sub-group of the family of languages called by Meinhof "Sudanic," characterized by the absence of inflection and grammatical gender and by the use of tone rather than accent, while typically each word consists of one syllable (*see* AFRICAN LANGUAGES). Shilluk so closely resembles Anuak that the two peoples can understand one another, and the same probably holds for Dinka and Nuer.

Mode of Life.—The Nilotes are essentially pastoral and largely riverain, their interest in their cattle being so far predominant that they usually grow scarcely enough grain to supply themselves till the next harvest. For the most part the men go absolutely naked, the women wear a pair of leather aprons reaching from waist to knee. The forehead is often scarred, and the lower incisors are generally removed. The skin is commonly smeared with the ash of wood and cattle dung. Ivory armlets are worn and the hair may be worked into elaborate head-dresses. Cannibalism is unknown and human sacrifice is almost entirely absent. The number of cattle constituting the bride price is a matter of

great importance, and this is usually paid in instalments. Certain iron-making groups of Dinka living near the Nile-Congo Divide, having few or no cattle, pay for their wives in iron. Widows are inherited by their husband's heirs, the children that they bear being counted as children of the first husband. Psychically the Nilotes, especially the Dinka, are distinguished from all other groups in their extreme aloofness and pride of race, showing absolutely no desire for European clothes or trade objects.



BY COURTESY OF H. E. ANTHONY

A YOUNG DINKA WOMAN

The social organization of the Shilluk is into a number of exogamous groups, but whether these are totemistic must be left for future investigation. Among the Dinka, who consist of a congeries of independent tribes, there are typical totemistic clans with descent in the male line, the totem being an animal, plant or even a natural object such as a meteor or fire. Almost all the clans whose totem is an animal derive their origin not from the animal itself but from a man born as one of twins, his fellow twin being an animal of the totem species, though sometimes the association is not quite so close, as when the totem animal lays certain commands upon members, offering in return certain privileges.

Religion.—Among the Dinka and Shilluk, the only two Nilotic tribes of whose religious ideas there is definite knowledge, the king (Shilluk *ret*) or chief (Dinka *bain*) is the rain-maker and belongs to the class of rulers called by Sir James Frazer Divine Kings, *i.e.*, there is immanent in each a divine spirit upon which depends the fertility and well-being of the universe. Such divine kings are not allowed to go to battle and were formerly killed ceremonially with their own consent when they showed signs of ill-health, or sometimes even of diminishing strength, lest the decline in vigour of their body—the living shrine of the divine spirit—should entail the weakness of the latter, when the cattle would sicken and fail to bear their increase, the crops would rot in the fields, and men, stricken by disease, would die in ever increasing numbers. The Shilluk king is indeed the classical example of the divine king, and two stages of his treatment can be traced; the earlier, preserved alone in folklore, refers to a time when anyone could kill the king and become his successor until he in turn was killed by a stronger, while in more recent times the killing of the king has become a ceremonial affair, the leading part being assigned to certain families called the Ororo.

In the case of the Shilluk the divine spirit incarnate in each king is *Nyakang*, the historic founder of the Shilluk kingdom and their culture hero. Like so many divine or semi-divine characters he did not die but vanished in a great storm. He has ten cenotaph tombs, the most sacred perhaps being that of Fenikang, the village in which he lived for a great part of his life. It is the presence of the divine spirit of Nyakang in the ruling king which enables the latter to move the High God, Juok, to send rain.

See W. Hofmeyer, *Die Shilluk* (1925); C. G. Seligman, "The Cult of Nyanking," *Fourth Report of the Wellcome Laboratory*, 1911, Vol. B. (C. G. S.)

NILSSON, CHRISTINE (1843–1921), Swedish singer, was born at Wederslöff, near Wexiö, Sweden, on Aug. 20, 1843, of poor parents. She studied in Paris, where she made her début in the rôle of Violetta at the Théâtre Lyrique on Oct. 27, 1864. Between that date and 1872, when she married M. Auguste Rouzaud, she was the leading prima donna. Her first appearance in London was in 1867. A year later, on the 9th of March, she made her first appearance in the Paris Opera House as Ophélie in *Hamlet;* and she visited the United States in 1870. After her marriage her appearances in public were rare. After her second marriage in 1887, with Count A. de Casa Miranda, she retired from the stage.

Madame Nilsson died at Copenhagen on Nov. 22, 1921.

NIMBUS: *see* AUREOLA.

NÎMES, a city of southern France, capital of the department of Gard, 174 m. S. by W. of Lyons on the P.L.M. railway, between Avignon and Montpellier. Pop. (1926) 74,102.

Nîmes, the ancient *Nemausus,* was named from the sacred wood in which the Volcae Arecomici (who surrendered to Rome in 121 B.C.) held their assemblies. Strabo states that it was the metropolis of a district containing 24 dependent towns, and that it was independent of the proconsuls of Gallia Narbonensis. Constituted a colony of veterans by Augustus, and endowed with numerous privileges, it built a temple and struck a medal in honour of its founder. The medal, which afterwards furnished the type for the coat of arms granted to the town by Francis I., bears on one side the heads of Caesar Augustus and Vipsanius Agrippa (the former crowned with laurel), while on the other there is a crocodile chained to a palm-tree, with the legend COL. NEM. Agrippa built the public baths, the temple of Diana and the aqueduct of the Pont du Gard. The city-walls, erected by Augustus, were nearly 4 m. in circuit, 30 ft. high and 10 ft. broad, flanked by 90 towers and pierced by ten gates. Hadrian on his way back from Britain erected at Nîmes two memorials of his benefactress Plotina. In the very height of its prosperity the city was ravaged by the Vandals; the Visigoths followed, and turned the amphitheatre into a stronghold, which at a later date was set on fire along with the gates of the city when Charles Martel drove out the Saracens. Nîmes became a republic under the protection of Pippin the Short; and in 1185 it passed to the counts of Toulouse, who enclosed it with ramparts, less extensive than that of Augustus, still to be traced in the boulevards. The city took part in the crusade against the Albigenses in 1207. Under Louis VIII. it received a royal garrison into its amphitheatre; under Louis XI. it was captured by the duke of Burgundy, and in 1420 was recovered by the dauphin (Charles VII.). On a visit to Nîmes Francis I. enriched it with a university and a school of arts. By 1558 about three-fourths of the inhabitants had become Protestants, and in 1567 a massacre of Catholics took place on St. Michael's day. From the accession of Henry IV. till the revocation of the edict of Nantes (1685) the Protestant community devoted itself to active industry; but after that disastrous event great numbers went into exile or joined the Camisards. Louis XIV. built a fortress (1687) to keep in check the disturbances caused by the rival religious parties. Nîmes passed unhurt through the storms of the Revolution; but in 1815 Trestaillon and his bandit followers pillaged and burned and plundered and massacred the Bonapartists and Protestants.

Nîmes lies at the foot of the Garrigues, a range of barren hills on the north and west. The most prominent of these is the Mont Cavalier, on the summit of which is the Tour Magne, a ruined Roman tower. To the south and east the town overlooks the plain of the Vistre, largely used for the vine. The central and oldest part of the town consists of low buildings and is encircled by boulevards, which occupy the site of the old fortifications. Here are to be found the majority of the Roman remains for which Nîmes is remarkable. The most celebrated is the amphitheatre, the best preserved in France. It dates from the 1st or 2nd century A.D. and was used as a fortress for some time during succeeding centuries. Occupied during the middle ages by a special quarter, with a church, it was cleared in 1809. It is built of large stones fitted together without mortar. In form it is elliptical, measuring approximately 440 by 336 ft. externally; the arena is 227 by 126½ feet. The elevation (70 ft. in all) consists of a ground story of 60 arches, an upper story of 60 arches and an attic with consoles pierced with holes for supporting the *velarium* or awning. The building, which was capable of holding nearly 24,000 persons, has four main gates, one at each of the cardinal points; and 124 doorways gave exit from the 35 tiers of the amphitheatre to the inner galleries. Originally designed for gladiatorial shows, naval spectacles, chariot races, wolf or boar hunts, the arena has in recent times been used for bull-fights. The celebrated Maison Carrée, a Roman temple 82 ft. long by 40 wide, is a famous monument, and according to an inscription is dedicated to Gaius and Lucius Caesar, adopted sons of Augustus, and dates from the beginning of the Christian era. It contains a collection of antique sculptures and coins. The so-called temple of Diana, which adjoins the Fountain

gardens, was probably connected with the baths of which remains are visible near by. Two Roman gates, the Porte d'Auguste, consisting of two large archways flanked by two smaller ones and dating from A.D. 16, and the Porte de France remain. The Tour Magne (Turris Magna) is still 92 ft. in height, and was formerly higher. It is the oldest monument of Nîmes, but its use is not clear. It was turned into a fortress in the middle ages by the counts of Toulouse. Near the Tour Magne has been discovered the reservoir from which the water brought by the Pont du Gard (*see* AQUEDUCT) was distributed throughout the city.

With its capital, the temple of Augustus, the basilica of Plotina erected under Hadrian, the temple of Apollo, the baths, the theatre, the circus, constructed in the reign of Nero, the Campus Martius and the fortifications built by Augustus, Nîmes must have been one of the richest of the Roman cities of Gaul. The cathedral (St. Castor), occupying, it is believed, the site of the temple of Augustus, is partly Romanesque and partly Gothic in style. The churches of St. Paul and St. Baudile are modern. The Fountain gardens owe their name to a spring of water which fluctuates considerably in volume, and discharges into the Vistre; the town water comes from the Rhone. Alphonse Daudet and the Provençal poet Jean Reboul were natives of the town.

The city is the seat of a bishop under the archbishop of Avignon, a prefect, a court of appeal and a court of assizes, and has tribunals of first instance and of commerce, a board of trade-arbitrators and a chamber of commerce. At the close of the middle ages the industries of Nîmes received an impetus from a colony from Lombardy and Tuscany, and maintained their importance, so that before the Revolution about half of the whole community were engaged in manufactures, chiefly that of silk. Upholstery materials, shawls, carpets, handkerchiefs, tapes and braidings, brandy, hosiery, leather, clothes, candles, machinery and boots and shoes are now manufactured, and there are a number of foundries. Nîmes is, besides, a great market for wine and brandy, and there is a good trade in grain, groceries and colonial wares. Quarries of hard limestone, used for the amphitheatre and other Roman buildings, are still worked in the vicinity.

NIMROD is described in Genesis x. 8–12 as the first "to be a mighty one in the earth," which Skinner in his commentary paraphrases as "originator of the idea of the military state, based on arbitrary force." Apart from 1 Chron. i. 10, which quotes this description, the only other reference to Nimrod in the Old Testament is Micah v. 6, where Assyria is called the land of Nimrod. Unlike the other names in the Genesis context, which are names of peoples, Nimrod is that of an individual. He is a son of Cush, which cannot mean, as it usually does, Ethiopia, but possibly stands here for the Kashshu, a people who conquered Babylon in the 18th century B.C. The beginning of Nimrod's kingdom is said to be Babel, Erech, Accad and Calneh, in the land of Shinar. Babel is Babylon; Erech, a city of Babylonia, is the present-day Warka; Accad, "Agade," the royal city of Sargon I., was the capital of a district of the same name in N. Mesopotamia; Calneh is unknown. Shinar, which the O.T. sometimes identifies with Babylonia, was, as Egyptian and Hittite records show, a distinct country, probably in N. Mesopotamia, which was prominent 1500–1200 B.C. Nimrod is said to have built Nineveh, Calah, an Old Assyrian town on the left bank of the Tigris, south of Nineveh, Rehoboth-Ir and Resen, both of which are unknown. It is in accordance with historical truth that Assyria was developed from Babylonia. The description of Nimrod as a "mighty hunter before the Lord," that is, a supreme hero of the chase, is an intrusion in this context, but probably, like the historical notices, derived from some old Babylonian saga. The Assyrian kings were noted for their prowess in hunting. But though we may feel reasonably sure that the Nimrod traditions were derived from Babylonian sources no equivalent of the name has yet been found in the cuneiform records. In character there is a certain resemblance between Nimrod and the hero Gilgamesh. Jensen, and later, with some hesitation, Jirku, suggested that the name NIN-IB of a Babylonian god might be read phonetically Namurtu, and compared with Nimrod. But Clay (*The Origin of Biblical Traditions*, p. 22 *seq.*) seems to have demonstrated that the correct reading is Nin-martu. Meyer points out that the name Nimrod is common in Libya, but his theory that the saga was originally Libyan, and came to Israel via Egypt, seems very improbable. (W. L. W.)

NINEBARK (*Physocarpus opulifolius*), a North American shrub of the rose family (Rosaceae), native from Quebec to Manitoba, south to Georgia and Kansas, and commonly planted for ornament. It grows from 5 to 10 ft. high, with strong, recurving stems, exfoliating bark and small, white or pinkish flowers, in umbel-like clusters, followed by conspicuous, inflated, reddish pods.

NINEVEH. The ancient capital of the Assyrian empire lay on the right bank of the Tigris opposite the modern city of Mosul. It consists of two great mounds, Kouyunjik and that on which today is the reputed tomb of the prophet Jonah (Nebi Yunus). The river has now shifted a short distance to the west so that the mounds are isolated from the present bed, although in ancient times the city abutted on the river. The city is situated on the north west corner of a plain about 25 by 15 miles in extent, formed by the Tigris and its tributaries, the Khosr on which Nineveh was built, which bounds the plain on the northwest, the Gomal, which forms the northeastern boundary, and the Upper Zab on the southeast. The western and south flank is protected by the Tigris itself. The whole plain slopes gently to the Tigris and provides a strong position, being protected by the foothills and the Gomal on the northeastern side, and on the south and west by the Tigris and the Upper Zab. The Khosr, although impassable enough when flooded forms at other times no barrier to attack. The position of Nineveh therefore astride this stream at its confluence with the Tigris is of great strategic importance. The Khosr was used to supply water to fill the protective works of the city and elaborate measures of river conservancy were taken to protect the plain against its most destructive inundations. Although the country is a fertile and prosperous wheat growing land, a fact which no doubt accounts for the many ancient cities so close to one another, owing to the slope of the plain the city itself is badly supplied with water and Sennacherib was compelled to build water conduits to conduct water from the hills into the Khosr and its canal system. The city then, although formerly, as is its modern descendant Mosul, the centre of a rich district, was suited particularly to military efficiency.

The city itself was surrounded by immense walls, which enclosed an irregularly shaped space, about three miles long and about a mile broad at the north where the walls were double, narrowing to about three quarters of a mile at the southern end. The walls were pierced by fifteen gates. As in so many walled cities the actual dwellings did not occupy the whole of the space within the walls, there were parks watered by the elaborate aqueducts which brought water from the Khosr and other open spaces. The two great mounds formed two great fortified strongholds, and were joined together by a wall, part of which formed the west wall of the city. The mound of Kouyunjik, which is at present being explored by Campbell Thompson on behalf of the British Museum, contains an important series of buildings. On the north lay the palace of Ashur-banipal. South of this lay the Temple of Nabu. On this spot a great rectangular building was found, 100 × 80 feet which probably included part of the temple buildings and of the courtyard. Directly south of this again is to-day a broad pit which may possibly represent the site of the temple of Ishtar which is known to have existed on the mound. To the east is a building of Sennacherib, whose purpose does not seem to have been identified. Finally at the southwestern extremity of the mound is the palace of Sennacherib. This palace is of great architectural magnificence and is especially remarkable for the bas-reliefs which have so far been discovered. On the other mound Sennacherib built a military depot; his son Esar-Haddon built himself a palace on this mound, which has not at present been fully explored.

Although the greatness of Nineveh covers a comparatively short period there are indications that the city was Sumerian in origin, and early pottery and obsidian flakes have been found on the site. It has been suggested that possibly the Sumerians occupied this whole area before migrating south. The true history of Nine-

veh however begins at a comparatively late date. Hammurabi restored a temple of Ishtar, probably in Nineveh and Shalmaneser I., nearly a thousand years later, about 1300 B.C. restored the temple again, but although Sennacherib states that some of his ancestors were buried there the city was small and unimportant. He built the great building and walls which have already been described and made a great triumphal way. His son Esar-Haddon rebuilt the temple of Ashur but started to rebuild Babylon, and did not carry out Sennacherib's purpose of making Nineveh the capital city of the Assyrian empire. Ashur-banipal however enriched the city with some of its greatest treasures, including a great library of clay tablets. Finally in 612 B.C. the men of Nineveh were defeated by the Medes and the city was looted and destroyed.

It seems probable that Mespila, referred to by Xenophon in the Anabasis refers to this site, and if so the spot was deserted at this time, but the name of Nineveh was applied to the site even in the middle ages, so an ancient tradition must have existed as to the location of the town. The site however did not become of any importance again till the time of the Arab conquest, when it lay on the opposite bank of the Tigris. (For later history *see* MOSUL.) The site has been attacked by numerous excavators from Layard onwards. In 1903–5 it was excavated by L. W. King and R. Campbell Thompson.

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NINGPO ("City of the peaceful waves"), an important Chinese city and chief commercial centre of the province of Chekiang, lying in a fertile plain backed by mountains on the south side of Hangchow Bay, and about 16 miles upstream from the mouth of the Whangpoo. The district of Ningpo, covering an area of 66 square *li* has a population of about 680,000, of whom 212,397, according to a recent census (1928), live in the city. The city is of great antiquity and has occupied its present site since A.D. 713. It was one of the earliest centres of European settlement in China, the Portuguese arriving there about 1520. The early colony, known as Liampo, flourished until 1545, when the traders, owing to their illegalities, were driven out by the Chinese. Subsequent regulations and restrictions made foreign trade with Ningpo virtually impossible. In 1840 British warvessels blockaded Ningpo and the following year, after the fall of Chinhai, a fortified town at the mouth of the Whangpoo, it was entered without resistance. In 1842, by the Treaty of Nanking, Ningpo was opened to foreign trade, and the question then arose as to whether Shanghai or Ningpo should become the commercial metropolis at the mouth of the Whangpoo. Shanghai assumed that rank and since then has impeded the growth of Ningpo's trade. The opening of Wuhu (1877) and Hangchow (1896) also contributed to the diversion of this trade. Since the War, however, it has increased considerably; the total value, in millions of Haikwan taels, rising from 34·4 in 1921 to 44·9 in 1924.

	Haikwan taels
1926: Net foreign imports	20,270,580
Net Chinese imports	14,090,331
Exports	16,205,494
Total	50,566,405

These figures show an apparently unfavourable trade balance, but the regular remittances of numerous natives of Ningpo in business at Shanghai and elsewhere, more than counterbalance the trade deficit. Ningpo is the port of shipment for cotton grown in the neighbouring districts; the annual export to Shanghai amounting to about 180,000 bales, for native drugs, tea, and more especially, fish and fish products. It has about 1,500 "couples" of junks engaged in the sea-fisheries around the Chusan archipelago and supplies large numbers of fishermen. Ningpo is also noted for its grass mats, made of reed or grass grown locally. These mats find a market even in Japan, despite keen competition, owing to their cheapness. Rush is also specially grown and made into braids for straw hats, while laces are knitted in the neighbourhood and shipped chiefly to Shanghai. On the import side, Shanghai supplies Ningpo with considerable quantities of cotton yarn and cotton piece-goods. There are also large imports of kerosene oil and drugs. The total value of the sugar trade of Ningpo is approximately $1,500,000 a year; 70% of the sugar comes from foreign sources and the remainder from Fukien province.

Inland waterway communication in the vicinity of the city is provided by the Whangpoo and Fenghwa-kiang, as well as by canals. There is a daily steamer service to Shanghai, and regular sailings to Chusan and as far afield as Wenchow. Railway-connection with Hangchow, the capital of Chekiang province and 160 miles distant, is not yet complete, the railway from Ningpo running as far as Tsao-o. The chief crops in the district, in order of importance, are rice, beans, wheat, cotton, rush and reed.

Various modern manufacturing industries have been established in the city. Of the cotton-mills the Ho Fêng is the largest, drawing the bulk of its raw cotton supply from the neighbouring district of Yuyao. Its yarns are sold chiefly on the local market or elsewhere in Chekiang. About 1,000 looms in small factories and households produce each year 30–40,000 pieces of silk, the bulk of which is dyed in Shanghai. There are, in addition, electrical supplies, hardware, knitting and sewing companies, candle, soap, and canning factories, and numerous tin-foil makers.

The city, set amid pleasant surroundings, is encircled by a fine old wall, containing six gates, and from 4–5 miles in length. Among its most prominent features are the numerous tall ice-houses, the picturesque T'ien-fêng-t'a or Ningpo pagoda, a tall white tower rising to a height of 160 feet, and the Drum Tower, many centuries old. The city has long been famous as a centre of learning and religion, and numerous temples, monasteries and colleges are representative of old Ningpo.

NINIAN, ST., a Briton, probably from Strathclyde, who was trained at Rome and founded a church at Whithorn on the west side of Wigtown Bay. Whithorn has been identified with the Leukopibia of Ptolemy, but this is uncertain. Bede, writing three centuries after Ninian, ascribes the name Ad Candidam Casam to the fact that the church of Ninian was built of stone. We are told by Bede that St. Ninian dedicated his church to St. Martin of Tours, who died between 397 and 400, but Ailred of Rievaulx is our only authority for the statement that St. Martin supplied him with masons. The legends of his work in Ireland probably arise from the influence exercised in that country by the church of Whithorn. The date of Ninian's death is given by Archbishop Ussher as 432, but there is no authority for this statement.

See Bede, *Hist. Eccl.* (ed. C. Plummer, Oxford, 1896), iii., iv.; Ailred of Rievaulx, "Life of St. Ninian," in the *Historians of Scotland* vol. v. (Edinburgh, 1874); W. F. Skene, *Celtic Scotland* (Edinburgh, 1877), vol. ii. 2 ff.; J. Rhys, *Celtic Britain* (London, 1904), p. 173; and A. B. Scott, *S. Ninian, Apostle of the Britons and the Picts* (1916).

NIOBE, in Greek mythology, daughter of Tantalus and Dione, wife of Amphion, king of Thebes. Proud of her sons and daughters (numbers variously given by different authors), she boasted of her superiority over Leto, the mother of only two children, Apollo and Artemis. As a punishment, Apollo slew her sons and Artemis her daughters. Their bodies lay for nine days unburied, for Zeus had changed the people to stone; on the tenth day they were buried by the gods. Out of pity for her grief, the gods changed Niobe herself into a rock on Mt. Sipylus in Phrygia, in which form she continued to weep (Homer, *Iliad,* xxiv. 602–617; Apollodorus iii. 5; Ovid, *Metam.* vi. 146–312). This "Niobe," described by Pausanias (i. 21) and Quintus Smyrnaeus (i. 293–306), both natives of the district, was the appearance assumed by a cliff on Sipylus when seen from a distance and from the proper point of view (*see* Jebb on Sophocles, *Antigone,* 831). It is to be distinguished from an archaic figure still visible, carved in the northern side of the mountain near Magnesia, to which tradition has given the name of Niobe, but which is really intended for Cybele.

The tragic story of Niobe was a favourite subject in literature and art. Aeschylus and Sophocles wrote tragedies upon it; Ovid has described it at length in his *Metamorphoses.* In art, the most

famous representation was a marble group of Niobe and her children, taken by Sosius to Rome and set up in the temple of Apollo Sosianus (Pliny, *Nat. Hist.* xxxvi. 4). What is probably a Roman imitation of this work was found in 1583 near the Lateran, and is now in the Uffizi gallery at Florence.

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NIOBIUM, a metal which occurs associated with tantalum (*q.v.*) in the rare mineral tantalite or columbite. It was given this name (from Niobe, the daughter of Tantalus) by H. Rose (1846), but is now usually called *columbium* (*q.v.*).

NIORT, a city of France, chief town of the department of Deux-Sèvres, 42 m. E.N.E. of La Rochelle by rail to Saumur. Pop. (1926) 23,121. Up to the 7th century the Niort plain formed part of the Gulf of Poitou; and the mouth of the Sèvre lay at the foot of the hills now occupied by the town which grew up round the castle erected by Henry Plantagenet in 1155. The place was captured by Louis VIII. in 1224. By the peace of Brétigny it was ceded to the English; but its inhabitants revolted against the Black Prince, and most of them were massacred when his troops recovered the town by assault. In 1373 the French regained the town. Protestantism made numerous proselytes at Niort, and Gaspard de Coligny made himself master of the town, which successfully resisted the Catholic forces after the battle of Jarnac, but surrendered without striking a blow after that of Moncontour. Henry IV. rescued it from the League. It suffered severely by the revocation of the edict of Nantes. Niort is on the Sèvre Niortaise. The tower of the church of Notre-Dame (15th and 16th centuries) has a fine stone spire and a north doorway with a carved balustrade. The donjon of the old castle remains. The old Renaissance hôtel-de-ville contains a collection of antiquities. Near Niort are the feudal ruins of the fortress of Coudray-Salbart. Niort is the seat of a prefect and a court of assizes. Tanning, currying, shammy-dressing, glove-making and the manufacture of brushes and boots are the staple industries.

NIPIGON, a lake and river of Thunder Bay district, Ontario, Canada. The lake is 30 m. N. of the bay of the same name on Lake Superior, at an altitude of 852 ft. above the sea. It is 70 m. long and 50 m. wide; contains over 1,000 islands, is very deep, and has a much-indented shore-line measuring upwards of 580 m. The river, which drains the lake, descends 250 feet in the 40 m. of its course and is the largest stream flowing into Lake Superior. It is widely known for its trout fishing.

NIPISSING, a lake of the district of the same name in Ontario, Canada, situated nearly midway between Lake Huron and the Ottawa river, at an altitude of 644 ft. above the sea. It is of irregular shape, with bold shores, and contains many islands; from the north it receives the waters of Sturgeon river. It is 50 m. in length and 20 in breadth; discharges its waters by French river into Lake Huron, and is separated by a low watershed from the Mattawa river, a tributary of the Ottawa. It has been proposed as the summit level of the projected Ottawa and Georgian Bay canal. With the Ottawa, Mattawa and French rivers it formed the old *voyageur* route from Montreal to the Great Lakes.

NIPPON GINKO (Bank of Japan) was established in 1882 as a joint-stock company and its authorised capital, which was at first 10,000,000 yen was increased three times, in 1927 standing at Y 60,000,000 of which Y 37,500,000 has been paid up.

The Bank of Japan has the privilege of issuing bank-notes against gold and silver coins and bullion and, further of issuing such notes on the security of Government bonds and Treasury bills and other bonds and commercial bills of a reliable nature. One maximum amount allowed to cover the latter style of notes is Y120,000,000. In case of necessity, the Bank may be given authority to issue notes beyond this maximum. If such notes are issued they are subject to a tax of not less than 5% per annum.

The Bank is principally concerned with business of the following types: the discount or purchase of government bills, bills of exchange and commercial bills; the buying or selling of gold and silver bullion; the making of loans on security of gold and silver coins and bullion; the collecting of bills for banks, companies and merchants, who are its regular customers; the receiving of deposits and the acceptance of the custody of articles of value, such as gold, silver, other precious metals and documents, and the making of advances to current accounts, or loans for fixed periods on security of Government bonds, Treasury bills and other bonds guaranteed by the Government. The Bank also manages the receipts and disbursements of the Treasury. The issue of notes in 1926 reached the figure of Y1,631,783,959. (S. YA.)

NIPPON YUSEN KAISHA (Japan Mail Steamship Company Ltd.). The N.Y.K. was founded in 1885, having as its nucleus the Mitsubishi Company, established by the late Mr. Yataro Iwasaki in 1871. When complaints were uttered against the Mitsubishi Company, the *Kyodo Unyu Kaisha* (Union Transport Company) began, in 1882, a competition with it. This struggle became so acute that in 1885 the two were united in the Nippon Yusen Kaisha.

The new Company, maintaining the old services, opened new lines to Korea and north China as well as one between Shanghai and Vladivostok. In 1891 the Company inaugurated a service between Kobe and Manila and began sending steamers to Australia; in the following year the Japan to Bombay Service was opened, this constituting the first regular Japanese Steamship service with a distant oversea country. In 1896 three main services were inaugurated (1) the Yokohama-London-Antwerp line; (2) the Hong Kong-Japan-Seattle line and (3) the Yokohama-Manila-Australia line; the first two were fortnightly and the last-mentioned four-weekly. The company's capital was increased to double the previous amount, viz., 22,000,000 yen. In 1905 the Company owned 73 steamers, gross tonnage 250,100. In 1915 the number had risen to 93 steamers with a gross tonnage of over 428,000 tons gross, and the capital of the Company was increased to Y44,000,000.

In the period 1914–1918 further regular lines (*e.g.*, Japan-Liverpool Line, Japan-Java-Calcutta Line, Calcutta-New York Line, Japan-Calcutta-Seattle Line, South Sea Islands Line, etc.). In 1917, the Company's reserves grew to Y77,000,000, its fleet was 99 vessels (453,000 tons gross), and the share capital was increased to Y100,000,000. A noteworthy addition to the Company's fleet was the s.s. "Nagasaki Maru" followed by the sister ship the s.s. "Shanghai Maru" (1922).

In March 1923 the Company separated the near sea services by the formation of the *Kinkai Yusen Kaisha* (Near Seas Mail S.S. Company) and in May 1926, the N.Y.K. absorbed the two services of the *Toyo Kisen Kaisha* (Pacific S.S. Company) running between Japan and San Francisco, China and Valparaiso; and the N.Y.K. increased its capital to Y106,250,000 (paid up Y64,250,000). With the completion of the new motor vessels under construction in 1928 the company's fleet will consist of 152 vessels with a gross tonnage of 886,000. (J. BLA.)

NIPPUR, an ancient sacred city of Mesopotamia. Nippur lay on the bank of the old course of the Euphrates in 32° N., 45° E. The old bed of the river is represented by present Shatt al Nil, whose dry bed now separates the two main groups of ruins. The city lies in the very heart of Sumeria, between the northern cities of Kish, Cutha and Babylon, to whom it is nearest in position, and the cities of the south. It was the centre of the national cult of the god Enlil, and no doubt owing to its position was the ecclesiastical rival of the southern cities, especially Eridu. The possession of Nippur was an essential for every great dynasty, because the rulers of all the cities throughout the whole of Sumer and Akkad ultimately derived their authority from Enlil, and it is essential in studying the ancient geography of Mesopotamia to remember that the monarchy of the region took its rise from prince-priests, and that even the most powerful monarchs could never afford to separate themselves from the powerful and dominant priesthood. Nippur therefore, although probably never a lay capital, except possibly in later times, throughout its long history always played a very prominent part in Mesopotamian history, and, owing to the passion exercised by the priests for recording every transaction, however minute, on clay tablets, has

left us a most complete record both of its life and of the part which it played in national politics. To-day the wide gap between the two rivers has made the irrigation problem a very difficult one but in ancient times the twin rivers approached one another more closely. The narrow strip between the rivers, scarcely more than thirty miles, could be irrigated by water run from the Euphrates to the Tigris and the land between the Euphrates on which there lay a string of cities and the Tigris was of great agricultural value. Nippur, therefore, apart from its sacred position was a land of great wealth.

The prehistoric city was built on the west bank of the Euphrates, and was grouped about the temple of the earth god. The mound now lies on the east bank of the Shatt al Nil. Extensive remains of cremation have been found in all the earlier pre-Sargonic periods and as a matter of comparison it is interesting to note that in the earliest graves at Ur cremation appears to be a purely ritual survival, and that so far at Kish, even in the earliest graves, no signs of cremation have been found. Painted pottery was also found. In the period of Ur-nina, that is, the end of the fourth millennium B.C., the temple area was enlarged and a great rectangular terrace of plano-convex bricks was built. This terrace extended far beyond the temple area and was large enough to include both the temple and its stage tower (*ziggurat*) at the southern end. There were also store houses, cloisters and priests' rooms on the terrace and a large court north of the temple. This building had an inner court, which was surrounded by thick walls and included rooms in which the temple archives were stored.

The restoration of the original form of the city, especially in later times, is made possible by the discovery of a tablet of the Kassite period, now unfortunately lost, which had upon it a sketch plan of the city. It shows part of the city east of the river and enclosed within its own walls, like the forbidden city of Peking to-day, which lies within its own walls and surrounded by the city itself. This inner city formed an irregular square, with sides about 900 yards long and was surrounded by canals, with quays along the walls. The inner city was itself also divided into two by a canal. The temple enclosure was oriented, its angles pointing towards the cardinal points of the compass. The tower of the pre-Sargonic period was on the north side of the inner court. On the east side, next to the tower, was the temple of Ekur, with its chapels and other buildings.

All the important kings held this temple in great veneration and considered its repair and reconstruction as a very necessary pious duty. Under the Semitic occupation Naram-sin rebuilt the temple and the city walls. His building was partly destroyed by Ur-Engur, whose restoration gave the area the form in which we have it recorded. His terrace of sundried bricks covered an area of about eight acres. The ziggurat at the northwestern edge was approached by an inclined plane on the south-east side and was made of crude bricks faced with burnt bricks, set in bitumen. It contained three stages. The city walls built by Ur-Engur followed the general lines of the walls built by Naram-Sin.

The whole sanctuary was later restored by Ashur-banipal of Assyria in the 7th century. The city had previous to this time been allowed to fall into comparative decay, partly owing to the predominance of Marduk, the god of Babylon, when that city was politically dominant, but it enjoyed a period of renewed splendour under the Kassite dynasty, but this was only a temporary respite. Ashur-banipal's restoration however gave it a form in some ways more magnificent than it had ever enjoyed, his great ziggurat measuring 128×190 feet. This was the end of Nippur's glories.

It gradually fell into decay. In the Seleucid period it became a fortress, and was used as such until the close of the Parthian period, in the middle of the third century A.D. From this time onwards the city ceased to be of any importance. It degenerated into a mere village, while some of the old sacred area was used, as in so many Sumerian cities as a cemetery. In the tenth century A.D. the site again became of some importance as a Jewish settlement, although it is possible that there may have been Jews settled on the site even earlier, possibly at the time of the exile. In the 12th century it was the site of a Christian bishopric.

The condition of the ruins to-day is thus described by Langdon: "They are not so extensive as Kish but more compact and massive. . . . The grandeur of these lofty unbroken lines of mountainous ridges, whose concealed buildings lie deep beneath the plain level, cannot be described to conjure sufficiently the imagination of the reader. They do not belie the fame of Nippur in cuneiform inscriptions."

ANCIENT DOCUMENTS

The excavators of the site were particularly fortunate in the number of ancient documents discovered. The ancient temple library and its archives were not in the temple itself but in a mound to the south. West of the temple there was a commercial and residential quarter, and here, separated from the temple by a canal, were found the important archives of the Kassite kings and business houses of the Neo-Babylonian and Persian periods.

These archives show that the district was a great centre of the cattle industry. Cattle and sheep were driven to Nippur for the different feast days and careful records of every transaction were kept. The details are so full that an issue is recorded of barley porridge to such humble members of the temple staff as the dogs. There were three main sources of revenue for the temple. First there were a series of tolls or dues of various forms. Secondly the temple was a great owner of property and received considerable revenues as rent. Thirdly cattle breeding was carried on. Nippur under the Kassites was an administrative centre, possibly even a capital city. The taxes, which were paid in kind, were either stored here or at the chief city of the district. The record of these taxes is instructive for the side lights thrown on the economic geography of Mesopotamia nearly four thousand years ago. The products which were paid included wheat, sesame, oil, dates, flour and live stock.

The majority of these temple archives of Nippur have been found at Tal Duraihim (Drehem) a city site about six miles south of Nippur, and three miles S.E. of the modern village of Afaj. This city apparently served as the collecting place for the animals used for sacrifices at Nippur. These animals formed part of the taxes payable under the kings of the third dynasty of Ur, and the records are therefore of the greatest value in giving lists of the towns at the time and their assessable value. The ruins of this site to-day consist of a large crescent-shaped mound, some 300 feet from north to south, and 200 feet in width, while the height above the plain is about 40 feet. Langdon is of opinion that whatever the building under this mound may prove to be it is certainly not a temple.

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NIRVĀNA, in Buddhist dogmatics, means literally "blowing out," *i.e.*, the blowing out or extinction of the fire of passion in one who attains release. Whether such a person became extinct at death is classed in the Scriptures among the questions which the Buddha refused to answer. The term is probably originally Buddhist, but it is also found in Vedānta to express union with Brahma. (*See* BUDDHISM.)

NISH, the capital of the Nish department of Serbia, Yugoslavia. Pop. (1921) 25,096, comprising Serbs, Turks, Albanians, Bulgars, Greeks and a Jewish colony. Nish is not only important commercially, but also strategically since (1) it commands the only two valleys affording easy access from Central Europe to the Aegean, (2) it is the meeting-point of several of the chief Balkan highways, and (3) it is the junction on the Belgrade-Nish railway for both Sofia and Salonika, and fortunately, in this respect, is within easy reach of good coal supplies. The town is the headquarters of one of the five Serbian army provinces, and is the principal fortress, the perimeter of the entrenched camp being about 30 m. with outlying modern works. The surrounding heights were fortified after 1886. The Turkish town, on the N. bank of the Nishava, contains the citadel and many mosques and

picturesque old houses among its winding alleys. It is connected by three bridges with the more modern Serbian town on the south bank, which has wide, fairly well-paved streets, a royal palace surrounded by gardens, a cathedral, government offices, banks and several trading associations. Here too, are the government railway repairing sheds, factories for trucks, engines and carriages, an iron foundry, a pork factory, steam flour mills and an electric power station. The barracks are outside the town. Nish is the see of a bishop and the seat of a district prefecture and a tribunal.

The ancient Roman city *Naissus*, which probably superseded a Celtic settlement, was mentioned as an important place by Ptolemy of Alexandria, and the old fortress on the right bank of the river is believed to have been erected on its site. Under its walls in A.D. 269 the Emperor Claudius destroyed the army of the Goths, and within it, in A.D. 274, Constantine the Great was born. The emperor Julian improved its defences but the town was destroyed by the Huns under Attila in the 5th century, and restored by Justinian. In the 9th century the Bulgarians conquered it, but ceded it to the Hungarians in the 11th century, from whom the Byzantine emperor Manuel I. took it in 1173. Towards the end of the 12th century the town was in the hands of the Serbian prince Stephen Nemanya, who there received hospitably the German emperor Frederic Barbarossa and his Crusaders. In 1375 the Turks captured Naissus from the Serbians. In 1443 the Hungarians and the Serbians retook it from the Turks, but in 1456 it again came under Turkish dominion, and remained for more than 300 years the most important Turkish military station on the road between Hungary and Constantinople. In the frequent wars between Austria and Turkey during the 17th and 18th centuries, the Austrians captured Naissus twice (in 1689 and 1737) but were unable to retain it long. In the first Serbo-Turkish rising, the Serbians, defending the approach to Nish in 1809, fired their magazine and destroyed both themselves and the enemy. The Turks built a high brick tower in which they embedded 900 Serbian skulls. The ruins are still called *Tyele-Koula* (Tower of Skulls). In the Russo-Turkish war (1877–8) the Serbians captured Nish and the town was ceded to them by the Treaty of Berlin (1878). Since then the King and the Government have resided there for three months in the year, and here also the National Assembly, before the Constitution of 1901, was regularly held. During the World War (1914–18) the Government withdrew to Nish (1915) when Belgrade was occupied by the enemy, but it was not able to stay there long.

NISHAPUR, a town in the province of Khurasan in Persia, 3,920 ft. above sea-level, in 36° 12′ N., and 58° 40′ E., 50 m. W. of Meshḳed in one of the most fertile districts of Persia, which produces much grain and cotton. The town which has somewhat shifted its position with the lapse of ages has low bastioned walls entered by four gates and enclosing a circuit of two miles. It has moderately good caravanserais and public baths, but the narrow covered lanes forming the bazaars are comparatively ill-equipped with shops. The main mosque, Jami Masjid, is fully 300 years old. Pottery making is a special industry.

Nishapur in the Old Persian is *Nev-shapur-nev*. The second element of the name is that of its traditional founder Shapur—some authorities considering that it refers to the first Shapur (241–272), others to the second (309–379). It was once one of the four great cities of Khurasan (*q.v.*), rivalling Rai (Rhages), "the mother of cities"; but the population is now reduced to 10–15,000. It was an important place in the 5th century, for Yazdajird (438–457) resided there mostly. During the later Sasanids it is seldom mentioned and when the Arabs came to Khurasan (641–642) it was of so little importance that, as the historian Tabari relates, it did not even have a garrison. But under the Tahirids (820–872) it became a flourishing city and rose to great importance during the Samanids (874–999). Toghrul, the first Seljuk ruler, made Nishapur his residence in 1037. In 1153, the Ghuzz Turkmans overran the country and partly destroyed it. In 1208 most of the town was destroyed by earthquake and was hardly rebuilt when it was again destroyed by the Mongols. It was rebuilt, suffered again at the hands of the Mongols (1269) and from another earthquake in 1280, and never rose again to its former greatness.

Four m. S.E. of the town, in a chamber adjacent to the mosque of the Imam-zadeh Mahruk (a Moslem saint of the eighth century), is the tomb of the astronomer-poet Omar Khayyam. The sarcophagus is a simple case of brick and cement. Nearby is the grave of the celebrated poet and mystic Farid ud Din Attar. At Madan, 32 m. N.W. of Nishapur, at an elevation of 5,100 ft. are the famous mines which have supplied the world with turquoises for at least 2,000 years.

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NISIBIS (Nisibin), a frontier fortress and trading town of Turkey on the Syrian border about 130 m. N.W. of Mosul, Iraq. It lies on the borderland between the mountains and the plain in 37° N. 41° E. at the point where the Yaghyagha (called in ancient times the Mygdonius) passes through a narrow canyon and enters the plain. In ancient times, and indeed until the 11th century A.D., the plain regions below the town are said to have been wooded and the town was famous for its agricultural products. Strategically, like Edessa (*q.v.*) it commanded the entrance of the valley country from the mountains and has been the site of fighting since Assyrian times to even as late as the 19th century. It also lies on the upper trade route from Mosul to the west and in times of peace has been of importance on this line.

Nisibis has been directed east or west according to the dominant empire of the time. During the Assyrian empire it formed a frontier fort against aggressions from the north, and occupied a similar position in Seleucid times. From the middle of the second century B.C. until the early years of the Christian era it was the residence of the kings of Armenia. Owing to its strength the fortress was of considerable importance during the struggle between Rome and Parthia. It became in early Christian times a religious centre with a Nestorian and a Jacobite bishop. Under the Caliphs it was a frontier fortress and the scene of continuous fighting. Finally it lost most of its prosperity owing to internal troubles, and according to the Arab chroniclers, the compulsory substitution of wheat for fruit crops. It is probable that an insufficient control of the Bedouins of the desert was responsible for much of Nisibis' lost prosperity. To-day it is still a large town of probably over 50,000 inhabitants and the railway to Konia has rendered the site of significance.

NISI PRIUS, in English law, a term used to denote generally all actions tried before judges of the king's bench division. For the history and meaning of this term *see* ASSIZE. As a rule King's Bench actions only are tried at *nisi prius*, and a judge is said to sit at *nisi prius* when he sits for the trial of actions.

NISUS, the name of two Greek legendary figures. (1) Son of Pandion of Athens and king of Megara. He had a purple lock of hair, and as long as it grew on his head the city was safe against all attacks. When Minos (*q.v.*) was besieging the city, Scylla (*q.v.*), daughter of Nisus, was bribed by him or fell violently in love with him, and to gain his favour, cut off the purple lock and gave it to him, thus betraying the city. Nisus fell, or killed himself, during the sack and was turned into a sea-eagle; Scylla swam after Minos' ship, or in punishment for her treachery was tied to the stern and dragged after it, and became a creature called κεῖρις or κίρρις (*ciris*), usually said to be a bird, as yet unidentified, but sometimes a fish; she is constantly pursued by her father. Nisus is the eponym of Nisaea, the harbour of Megara; Scylla is sometimes confused with the monster of the same name (*see* ODYSSEUS); the story is one quite common in Greek and other folklore; a combination of External Soul (*see* Frazer, *Golden Bough* 3rd ed., xi., chap. x.) with Maiden Castle (*see* Rose, *Handbook of Mythology*, chaps. viii., ix.).

See Roscher's *Lexikon, s.v.*, for identification of the *ciris;* and D'Arcy Thompson in *Class. Quart.*, xix., 155 ff.

(2) A Trojan, son of Hyrtacus, friend of Euryalus, with whom he is killed in an attempt to get through the besieging force and communicate with Aeneas, Virgil, *Aen.* ix.

NITHARD (d. 844), Frankish historian, was the illegitimate son of Angilbert, the friend of Charlemagne, by Bertha, a daughter of the great emperor. He was educated at the imperial court and became abbot of St. Riquier *in commendam*, never taking the vows. He fought for Charles the Bald at Fontenoy in June 841, and died as the result of wounds received whilst fighting against the Northmen near Angoulême. The date of his death was probably June 14, 844. In the 11th century his body, with the fatal wound still visible, was found in the grave of his father, Angilbert. Nithard's historical work consists of four books on the history of the Carolingian empire under the turbulent sons of the emperor Louis I., especially during the troubled period between 840 and 843. This *Historiae* or *De dissensionibus filiorum Ludovici pii*, dedicated to Charles the Bald, is valuable for the light which it throws upon the disintegration of the Carolingian empire.

The *Historiae* has been printed several times. Perhaps the best edition is in Band ii. of the *Monumenta Germaniae historica: Scriptores;* it has also been edited by A. Holder (Freiburg, 1882). It has been translated into German by J. von Jasmund (1851; new edition by W. Wattenbach, Leipzig, 1889); and into French in tome iii. of Guizot's *Collection des mémoires* (Paris, 1824).

See O. Kuntzemüller, *Nithard und sein Geschichtswerk* (Jena, 1873); G. Meyer von Knonau, *Über Nithards vier Bücher Geschichten* (Leipzig, 1866); and W. Wattenbach, *Deutschlands Geschichtsquellen*, Band i. (1904).

NITHSDALE, WILLIAM MAXWELL, 5TH EARL OF (1676–1744), Jacobite leader, son of Robert the 4th earl (d. 1696), served the exiled house of Stuart in secret, and was suspected as a Jacobite conspirator. In 1712 he resigned his estate to his son William (d. 1776), reserving a life rent to himself. In 1715 he joined the Jacobite rebels in the north of England and was taken prisoner at Preston, being sent to London for trial. His wife followed him to London. The earl and the other Jacobites were brought to trial in Westminster Hall on Jan. 19, 1716, and condemned to death Feb. 9. The execution was fixed for the 24th. The countess presented a petition to George I. which he refused to receive. With the help of two Jacobite ladies, the countess arranged the escape of her husband from the Tower on the eve of the day fixed for his execution. They lived thenceforward in Rome. The earl died on March 20, 1744, and the countess in 1749.

See Sir A. Fraser, *The Book of Carlaverock* (Edinburgh, 1873).

NITON: *see* RADON.

NITRE, a name given to naturally occurring potassium nitrate; "cubic nitre" is sodium nitrate. The word is adapted from Lat. *nitrum*, which is itself adapted from Gr. *νίτρον*. These terms were originally applied to the naturally occurring sodium carbonate; the connection with potassium nitrate (*sal petrae* or *sal petrosum*) may be traced to Raymondus Lullius's name *sal nitri*, which he distinguished from *nitrum*. In the 16th century the ancient nitrum became altered to natron, a term still used for native sodium carbonate, while *nitrum*, and its adaptation nitre, were retained for potassium nitrate or saltpetre (*q.v.*).

NITRIC ACID (*aqua fortis*), an important mineral acid, HNO_3. It is mentioned in the *De inventione veritatis* ascribed to Geber, wherein it is obtained by calcining a mixture of nitre, alum and blue vitriol. It was again described by Albert le Grand in the 13th century and by Raimon Lull, who prepared it by heating nitre and clay and called it "eau forte." Glauber devised the process in common use for many years, viz., by heating nitre with strong sulphuric acid. Its true nature was not determined until the 18th century, when A. L. Lavoisier (1776) showed that it contained oxygen, whilst in 1785 H. Cavendish determined its constitution and showed that it could be synthesized by passing a stream of electric sparks through moist air. The acid is found to exist to a slight extent in the free condition in some waters, but chiefly occurs in combination with various metals, as nitrates, principally as nitre or saltpetre, KNO_3, and Chile saltpetre, $NaNO_3$. It is formed when a stream of electric sparks is passed through moist air, and in the oxidation of nitrogenous matter in the presence of water.

For experimental purposes it is usually obtained by distilling potassium or sodium nitrate with concentrated sulphuric acid. The acid so obtained usually contains more or less water and some dissolved nitrogen peroxide which gives it a yellowish red colour. It may be purified by redistillation over barium and silver nitrates and then under diminished pressure over urea. On the large scale it is obtained by three methods: (1) from saltpetre and concentrated sulphuric acid; (2) by the catalytic oxidation of ammonia; and (3) by the direct oxidation of nitrogen in the electric arc. In the first and oldest method, Chile saltpetre is distilled with concentrated sulphuric acid in horizontal cast iron stills, the vapours being condensed in a series of stoneware Woulfe's bottles. In practice the theoretical quantity of acid and Chile saltpetre is not used, but the charge is so regulated that the mixture of acid and neutral sodium sulphate formed in the retort remains liquid at the temperature employed, and consequently can be readily removed. (2) The oxidation of ammonia is effected by passing this gas mixed with air or oxygen over a thin coating of spongy platinum deposited on a supporting material and kept at about 600° C. Platinum gauze may replace the sponge, and the gases may be pre-heated at 300–400° C, the heat of reaction then being sufficient to maintain the whole at the required higher temperature. Other catalysts may be used and each has an appropriate suitable temperature; thus, with iron oxide the best temperature is 650–700°. Often a mixture of oxides is more efficient, one acting as a "promoter" for the other. The ammonia must be free from impurities such as phosphine, and a fairly rapid stream of gas is used. The yields may exceed 95% of the theoretical. (3) For the production of nitric acid from air *see* NITROGEN, FIXATION OF. Fuming nitric acid consists of a solution of nitrogen peroxide in concentrated nitric acid and is prepared by distilling dry sodium nitrate with concentrated sulphuric acid.

Nitric acid is a colourless strongly fuming liquid, having a specific gravity of 1·50394 (24·2° C) (V. Veley 1898). It is exceedingly hygroscopic and corrosive. On distillation, the pure acid begins to boil at 78·2° C (W. Ramsay), partial decomposition into water, oxygen and nitrogen peroxide taking place. The acid solidifies when strongly cooled, the solid melting at −47° C. Concentrated nitric acid forms with water a constant-boiling mixture, the composition of which varies according to the pressure at which it is distilled: if distillation is at atmospheric pressure, the resulting acid boils at 120·5° C, contains 68% of HNO_3 and possesses a specific gravity of 1·414 (15·5° C). If a more dilute acid than this be distilled, water passes over in excess and the residue in the retort reaches the above composition and boiling point; on distillation of a stronger acid, excess of HNO_3 passes into the distillate and the boiling point rises until the values of the constant-boiling mixture are reached. On the hydrates of nitric acid *see* V. Veley, *Jour. Chem. Soc.*, 1903, 83, p. 1015, and F. W. Kuster, *Zeit. anorg. Chem.*, 1904, 41, p. 1. On mixing nitric acid with water there is a rise of temperature and a contraction in volume.

The acid is a powerful oxidizing agent. It attacks most metals readily, usually with production of a nitrate or hydrated oxide of the metal and one or other of the oxides of nitrogen, or occasionally with the production of ammonium salts; magnesium, however, liberates hydrogen from the very dilute acid. Its action on metals depends in most cases on the temperature, strength of the acid, and the nature of the products of reaction. Thus in the case of copper, it is found that the diluted acid acts very slowly upon the metal at first, but as the reaction proceeds the copper dissolves more rapidly up to a certain point and then the rate of solution again diminishes. This is possibly due to the accelerating action of the nitrous acid which is produced in the direct action of the copper on the nitric acid and which, when a certain amount has been formed in the system, begins to decompose, thus

$$3HNO_2 = HNO_3 + 2NO + H_2O.$$

Iron when brought into contact with nitric acid under certain conditions, remains passive to the acid. Thus at 55° C it is passive to an acid of specific gravity 1·42 and at 31° C to an acid of specific gravity 1·38. The cause of this passivity was for long a matter of dispute, but V. R. Evans in 1927 (*J. Chem. Soc.*, p. 1020) succeeded in isolating an actual protective film from passivated iron. Nitric acid is without action on gold, platinum, iridium and rhodium.

A. Hantzsch (*Berichte*, 1925, 55, p. 941) believes that con-

centrated nitric acid is chiefly composed of "nitronium" nitrate, $[N(OH)_3](NO_3)_2$. (*See* also ACIDS.)

The salts of nitric acid, known as *nitrates*, are nearly all readily soluble in water and crystallize well. They are all decomposed when heated to a sufficiently high temperature, with evolution for the most part of oxygen and nitrogen peroxide, leaving a residue of oxide of the metal. They may be recognized by the fact that on the addition of a solution of ferrous sulphate, followed by that of concentrated sulphuric acid (the mixture being kept quite cold), the ferrous sulphate solution becomes of a deep brown colour, owing to the reducing action of the ferrous sulphate on the nitric acid which is liberated by the action of the sulphuric acid on the nitrate. As an alternative method the nitrate may be warmed with some fragments of copper and sulphuric acid which has been diluted with its own volume of water, when characteristic brown vapours will be seen.

Nitric acid finds extensive application in the manufacture of sulphuric acid, certain coal-tar colouring matters, explosives, and in the production of various nitrates.

In medicine, nitric acid is used externally in a pure state as a caustic to destroy chancres, warts and phagadenic ulcers, and diluted preparations are employed in the treatment of dyspepsia, etc. Poisoning by strong nitric acid produces a widespread gastro-enteritis, burning pain in the oesophagus and abdomen and bloody diarrhoea. There may also be blood in the urine. Death occurs from collapse or from secondary destructive changes in the intestinal canal. Characteristic yellow staining of the skin round the mouth from the formation of xanthoproteic acid serves to distinguish it from poisoning by other acids. The antidotes are mild alkalis, together with the use of opium to relieve pain.

(*See* A. Cottrell, *The Manufacture of Nitric Acid and Nitrates*, London, 1923.)

NITROBENZENE, the simplest aromatic nitro-compound, $C_6H_5NO_2$, was first isolated in 1834 by E. Mitscherlich, and is prepared commercially by the gradual addition of benzene to a well-cooled mixture of concentrated nitric and sulphuric acids, the oily product being separated, washed with alkali, and then distilled. It is a yellowish liquid possessing a strong smell of oil of bitter almonds. It boils at 209° C, and melts at 5·7° C. The products of its electrolytic reduction vary with the conditions: in sulphuric acid solution it yields para-aminophenol (L. Gattermann, 1893); in alcoholic alkaline solution it yields azoxybenzene; in acid alcoholic solution, benzidine; in ammoniacal alcoholic solution, phenylhydrazine. With chlorine, in the presence of iodine or antimony chloride, it yields meta-chloronitrobenzene. It occasionally acts as an oxidizing agent, as in the preparation of quinoline and fuchsine (magenta, *q.v.*). It is used commercially for the preparation of aniline (*q.v.*) and of benzidine (*q.v.*); and in perfumery (oil of mirbane).

Dinitrobenzenes, $C_6H_4(NO_2)_2$.—Ortho-dinitrobenzene, produced in small quantity in the preparation of meta-dinitrobenzene, forms colourless crystals which melt at 116·5° C and boil at 319° C (773 mm.). When boiled with aqueous caustic soda, it yields ortho-nitrophenol. Meta-dinitrobenzene is formed by the direct nitration of nitrobenzene with fuming nitric acid, the product being poured into water and recrystallized from dilute alcohol. It forms practically colourless needles which melt at 89·7° C, and boil at 302·8° C. It is used for the preparation of meta-phenylenediamine. Para-dinitrobenzene results from the action of nitrogen peroxide on an ethereal solution of quinone dioxime; it crystallizes in colourless needles, which melt at 171°–172° C.

Trinitrobenzenes, $C_6H_3(NO_2)_3$.—Asymmetrical (1:2:4) trinitrobenzene results from the action of fuming nitric and sulphuric acids on para-dinitrobenzene. It forms yellow crystals, which melt at 57·5° C. When boiled with dilute aqueous caustic soda it yields 2:4-dinitrophenol. Symmetrical (1:3:5) trinitrobenzene is formed by the further nitration of meta-dinitrobenzene with fuming sulphuric and nitric acids; or by the action of water on 2:4:6-trinitrobenzoic acid (German patent 77,353). It crystallizes in prisms which melt at 121° C.

NITRO-CELLULOSE POWDER: *see* GUN COTTON.

NITRO-CELLULOSE SILK: *see* SILK, ARTIFICIAL.

NITRO-COMPOUNDS, in organic chemistry, compounds containing the univalent radical NO_2 directly combined with carbon.

Aromatic Nitro-compounds.—The most important nitro-compounds are those of the aromatic series derived from benzene, toluene, xylene and naphthalene, since they find extensive use either in the manufacture of synthetic dyes (*q.v.*) or in the production of high explosives. (*See* articles under EXPLOSIVES and T.N.T.) These aromatic nitro-compounds are manufactured by the direct action of nitric acid on the hydrocarbon, this reaction being generally carried out in the presence of concentrated sulphuric acid which absorbs the water formed during nitration. In this way benzene can be nitrated in three stages to furnish nitrobenzene (*q.v.*), 1:3-dinitrobenzene and 1:3:5-trinitrobenzene. Toluene gives rise to *ortho-* and *para*-nitrotoluene with a small amount of *meta*-nitrotoluene. (*See* CHEMISTRY: *Organic.*) These three isomeric nitro-toluenes undergo further nitration yielding various di- and tri-nitrotoluenes. Of these higher nitration products the most important is 2:4:6-trinitrotoluene or T.N.T.

Naphthalene on nitration yields almost exclusively α-nitronaphthalene, and energetic nitration of this product gives 1:5- and 1:8-dinitronaphthalenes. These dinitro-compounds and their higher nitration products have been utilised in explosives. (*See* also NAPHTHALENE.)

Nitrobenzene (*q.v.*) and *ortho*-nitrotoluene (m.p. 10·5° C, b.p. 218° C) are pale yellow oils distilling without decomposition and having characteristic odours (artificial oil of mirbane) recalling that of oil of bitter almonds. *Para*-nitrotoluene melts at 54° C and boils at 230° C.

These nitro-compounds yield on reduction in acid media the aromatic amines, nitrobenzene giving aniline and the nitrotoluenes furnishing the corresponding toluidines. In alkaline media the reduction leads successively to azoxy-, azo- and hydrazo-compounds. Thus nitrobenzene passes successively into azoxybenzene, azobenzene and hydrazobenzene. The last of these on treatment with acid changes into benzidine (*q.v.*). This series of chemical changes constitutes an important use for nitrobenzene, and in a similar manner *ortho*-nitrotoluene is employed in the manufacture of tolidine, a valuable colour intermediate.

The aromatic dinitro-compounds are also reducible to aromatic bases, 1:3-dinitrobenzene giving *meta*phenylenediamine, and 2:4-dinitrotoluene giving 2:4-tolylenediamine. Both these diamines are used in colour making. The partial reduction of 1:3-dinitrobenzene with sodium disulphide gives *meta*nitroaniline, $NO_2{\cdot}C_6H_4{\cdot}NH_2$, this base being useful in the colour industry and also in the production of an exceptionally powerful high explosive, tetranitroaniline or T.N.A., $C_6H(NO_2)_4{\cdot}NH_2$. Nitrobenzene reduced in neutral solution furnishes β-phenylhydroxylamine, and this is readily transformed to *para*-aminophenol, which is both a colour intermediate and a photographic developer ("Rodinal").

The aromatic nitro-compounds are employed as oxidising agents. Nitrobenzene or *ortho*-nitrotoluene is employed with a ferrous chloride catalyst to oxidise a mixture of aniline and toluidine in the manufacture of magenta. Nitrobenzene and its homologues are also used as the oxidising agent in the Skraup reaction for quinoline and allied bases.

Aliphatic Nitro-compounds (Nitro-paraffins).—In this series the nitro-group is attached directly to an alkyl radical. These aliphatic nitro-compounds are chiefly of academic interest but they are also useful in the diagnosis of the various types of alcohols (*q.v.*). They are prepared by the action of alkyl iodides on silver nitrite (V. Meyer, 1874). They are also produced by the action of sodium nitrite on the α-halogenated fatty acids; the α-nitro- fatty acids first formed readily lose carbon dioxide and yield the nitro-paraffin (H. Kolbe, 1872).

Among the higher paraffins, for example normal hexane and octane, nitro-paraffins are obtainable by direct nitration as in the aromatic series (M. Konowalow, 1892; R. A. Worstall, 1898). The nitro-paraffins are colourless, fragrant liquids distilling without decomposition. Primary and secondary aliphatic nitro-compounds containing respectively the groups $\cdot CH_2{\cdot}NO_2$ and $>CH{\cdot}NO_2$ form metallic derivatives, for example sodium salts, which according to A. Hantzsch are derived from the isomeric *iso*-nitro-compounds, R:NO·OH. This variety is the truly acidic form and the ordinary primary and secondary nitro-paraffins are

to be regarded as *pseudo*-acids. The reactions of the nitro-paraffins with nitrous acid are characteristic and utilisable in discriminating between primary, secondary and tertiary alcohols (V. Meyer, 1875). The alcohols are converted successively into iodides and nitro-paraffins. The primary paraffin yields a colourless *nitrolic* acid, $R{\cdot}C(NOH){\cdot}NO$, which forms a red alkali salt; the secondary paraffin gives a blue *pseudonitrole*, $RR'C(NO_2){\cdot}NO$, whereas the tertiary nitro-paraffin, $RR'R''{\cdot}C{\cdot}NO_2$, is not acted on by nitrous acid and no colour effect is observed.

The nitro-paraffins are reduced by stannous chloride to β-alkylhydroxylamines and thence to aliphatic amines.

Nitromethane, $CH_3{\cdot}NO_2$, a colourless oil boiling at 101° C, is obtained by the action of methyl iodide on silver nitrite.

Chloropicrin, $CCl_3{\cdot}NO_2$, a substance employed in chemical warfare (*q.v.*), is a liquid of suffocating odour, boils at 112° C, and is obtained by the action of calcium chlorohypochlorite (chloride of lime) on picric acid.

Phenylnitromethane, $C_6H_5{\cdot}CH_2{\cdot}NO_2$, an interesting example of a nitro-compound of mixed aliphatic-aromatic type and isomeric with the nitrotoluenes (*v. supra*), prepared by the action of benzyl chloride on silver nitrite, is a colourless oily liquid boiling at 225–227° C and somewhat soluble in water. It does not give a coloration with ferric chloride. It forms a sodium salt, however, from the aqueous solution of which mineral acid precipitates a solid isomeric form of phenylnitromethane melting at 84° C. This solid form gradually passes into the oily variety. The solid isomeride gives a reddish-brown coloration with ferric chloride and reacts with other reagents which serve to identify the hydroxyl group. Hence it is to be regarded as the *aci*-form of phenyl-nitromethane having the constitution $C_6H_5{\cdot}CH{:}NO{\cdot}OH$, and its existence affords support to Hantzsch's theory that the ordinary primary and secondary aliphatic nitro-compounds are *pseudo*-acids. (G. T. M.)

NITROGEN, is a colourless, odourless, tasteless gas, which is incombustible and does not support combustion, and is one of the most widespread and indispensable elements. Symbol N, atomic number 7, atomic weight 14·008. Its existence was first recognized by Scheele (1772) who showed that common air consists of at least two gases, which he called *foul air* and *fire air*. He obtained the foul air (nitrogen) on removal of the fire air (oxygen) by exposure to various combustible or oxidizable substances, and found that the residue would not support respiration or combustion. Lavoisier confirmed Scheele's experiments and gave to foul air the name *azote*, because of its inability to support life. The name nitrogen was introduced later by Chaptal to indicate that the element is a constituent of nitre.

Nitrogen is present in the atmosphere to the extent of approximately 78% by volume and 75·5% by weight, and serves to dilute the oxygen. It is also found in the free state in many meteorites and in volcanic gases, whilst its presence in the atmosphere of the sun and in certain stars and nebulae is revealed by the spectroscope. Large quantities of nitrogen occur in combination with other elements, *e.g.*, in potassium nitrate (nitre or saltpetre), sodium nitrate (Chili saltpetre), ammonium salts, in rain, soil and guano, and as complex organic compounds (proteins) in all living organisms.

Preparation and Uses.—Nitrogen may be prepared (1) from the atmosphere by removal of the oxygen, or (2) from its compounds.

(1) The oxygen may be removed from air either by exposure to phosphorus in the cold (burning phosphorus is not so effective), to moist iron filings, an alkaline solution of pyrogallol, an acid solution of chromous chloride or cuprous chloride, or metallic copper in the presence of hydrochloric acid or ammonia, or by passing the air over red-hot copper.

On the large scale nitrogen is manufactured almost entirely by the fractional distillation of liquid air. Since it is more volatile than oxygen it evaporates first, and is marketed in grey cylinders under a pressure of about 120 atm. This gas contains most of the helium and neon present in the air (*see* ATMOSPHERE), but the argon is left with the oxygen. Some industrial nitrogen may be made by passing air over heated copper, the copper oxide being afterwards reduced by heating in a current of water gas.

(2) Pure nitrogen is prepared from its compounds: (*a*) By heating a slightly acid solution of ammonium nitrite (or a mixture of sodium nitrite and ammonium chloride), $NH_4NO_2 = N_2 + 2H_2O$; (*b*) by heating ammonium dichromate, $(NH_4)_2Cr_2O_7 = Cr_2O_3 + 4H_2O + N_2$; or (*c*) by passing a mixture of nitric oxide and ammonia gas over red-hot copper, $6NO + 4NH_3 = 5N_2 + 6H_2O$.

Nitrogen gas is used in filling electric lamps to prevent the blackening of the bulb by volatilized metal from the filament and to enable the latter to be run at a higher temperature, but argon (*q.v.*) is superior for this purpose. High-temperature thermometers are sometimes filled with compressed nitrogen. Large quantities of nitrogen are also employed for the production of synthetic ammonia and other nitrogen compounds which are finally converted into dyes, drugs, explosives or fertilizers.

Properties.—Nitrogen gas is only slightly soluble in water, but one volume of liquid oxygen dissolves about 450 volumes of the gas. When the gas is strongly cooled under pressure, nitrogen is obtained as a colourless liquid boiling at $-195{\cdot}81° \pm 0{\cdot}02°$ C (Henning and Heuse, 1924), at which temperature it has a specific gravity 0·8042. The critical temperature is $-147{\cdot}13°$ C and the critical pressure is 33·49 atm. When evaporated quickly under reduced pressure, the liquid yields a colourless solid melting at $-210{\cdot}5°$ C under a pressure of 86mm. The density of pure nitrogen at 0° C and 760mm. pressure is 1·25051gm. per litre (Moles and Clavera, 1924); the mean value of a number of different workers is 1·25056gm. per litre under standard conditions (0° C, 760mm., g=980·665).

The accepted value for the atomic weight of nitrogen is 14·008 (1927, O=16); according to Aston the element has no isotopes and is an exception to the whole-number rule. Rutherford has shown that the nitrogen atom is disintegrated by the impact of swift α-particles, and hydrogen atoms are expelled from its nucleus.

Nitrogen gas is somewhat inert, but it can unite directly under certain conditions with several elements: oxygen, hydrogen, boron, silicon, tungsten, titanium, manganese, vanadium, calcium, barium, magnesium, lithium, tantalum and (probably) carbon. The compounds with metals (nitrides) are generally decomposed by water with evolution of ammonia or some other gas.

The Nitrogen Cycle.—Nitrogen is an essential constituent of animal and vegetable tissues. Animals derive the nitrogen of their tissue proteins partly from other animal proteins and partly (sometimes wholly) from plant proteins. Plants build up their proteins from inorganic nitrogen compounds in the soil and to some extent from free nitrogen in the atmosphere. Berthelot found that sterilized soils do not take up nitrogen from the air, whilst unsterilized soils do, and he concluded that assimilation is due to micro-organisms. These were found (Winogradsky, 1895; Beijerinck, 1901) to be a *Clostridium* (*C. Pasteurianum*), anaërobic, *i.e.*, incapable of functioning in presence of oxygen unless protected by certain bacteria, and several varieties of bacteria of which the most active is *Azotobacter chroöcoccum*. The amount of nitrogen fixed by these bacteria increases by 30% if certain protozoa are present in the soil, although protozoa feed on bacteria.

Atmospheric nitrogen is also fixed by the co-operative action of bacteria and certain plants, chiefly *Leguminosae*, such as peas, beans and clover. The parasitic bacteria are present in small nodules on the roots of the plants, which are grown on a large scale in order to restore the nitrogen content of soils.

Large quantities of nitrogen are also fixed as oxides by electrical discharges in the atmosphere, and conveyed to the soil as nitric and nitrous acids by rain, nitrates and nitrites being formed in the soil. Altogether about 250,000 tons of nitric acid are said to be formed in this way in 24 hours. Nitrites and ammonium compounds are frequently of little use as plant foods and hence they must first be oxidized to nitrates by special soil bacteria, the process being known as "nitrification." Various other kinds of bacteria bring about denitrification in the soil and by their agency considerable quantities of gaseous nitrogen are returned to the air. The combined nitrogen content of cultivated soil is generally

enriched and renewed by means of nitrogenous fertilizers, such as nitrates and ammonium salts.

Compounds of Nitrogen and Hydrogen.—Nitrogen combines with hydrogen to form three compounds—two bases, ammonia (*q.v.*), NH_3, and hydrazine, N_2H_4; and an acid, hydrazoic acid or azoimide (*q.v.*), N_3H. Secondary compounds of ammonia and hydrazine with hydrazoic acid are known, such as N_4H_4 and N_8H_8.

Hydrazine (diamide), N_2H_4, was originally obtained by Curtius (1887) from organic compounds containing two nitrogen atoms combined together. It is prepared commercially by a process due to Raschig (1907). Sodium hypochlorite solution is mixed with a small quantity of glue and warmed with an excess of concentrated ammonia. After addition of sulphuric acid and cooling, hydrazine sulphate, $2N_2H_4{\cdot}H_2SO_4$, crystallizes out. When the sulphate is distilled under reduced pressure with concentrated potash solution, a colourless fuming liquid is obtained, called hydrazine hydrate. Anhydrous hydrazine is obtained by distilling the hydrate with solid caustic soda or barium oxide under reduced pressure. It is a colourless liquid, b.p. 113·5° C, which solidifies to white crystals, m.p. 1·4°, is poisonous, decomposes on heating ($3N_2H_4 = N_2 + 4NH_3$), and reacts violently with the halogens. In solution hydrazine acts as a weak base and forms two series of salts, *e.g.*, $N_2H_4{\cdot}HCl$; $N_2H_4{\cdot}2HCl$. Hydrazine and its salts are the most powerful reducing agents known, precipitating many metals from solutions of their salts. It rapidly destroys rubber and cork and when hot attacks glass.

Hydrazoic acid, also discovered by Curtius (1890), is formed by the action of an oxidizing agent, *e.g.*, nitric acid, on hydrazine; its sodium salt is formed by passing nitrous oxide over heated sodamide, $NaNH_2 + N_2O = NaN_3 + H_2O$; when pure it is a colourless liquid (b.p. 37°, f.p. −80°) with an exceedingly irritating odour. It is very poisonous and dangerously explosive, decomposing with a blue flash on heating. The solution is strongly acid and dissolves many metals with evolution of hydrogen and ammonia, forming salts called azides. These salts, especially those of the heavy metals, are explosive, and lead azide (*q.v.*) is sometimes used as a detonator. The compounds N_4H_4 and N_5H_5 are colourless explosive crystals obtained by neutralizing hydrazoic acid with ammonia and hydrazine respectively.

Oxides of Nitrogen.—Five oxides of nitrogen are known, and the series is an excellent example of the Law of Multiple Proportions: Nitrous oxide, N_2O; nitric oxide, NO; nitrogen trioxide, N_2O_3; nitrogen peroxide, NO_2 and N_2O_4; nitrogen pentoxide, N_2O_5. Nitrogen in a still higher state of oxidation exists in an unstable pernitric acid.

Nitrous oxide, N_2O, was obtained by Priestley (1772) by exposing "nitrous" air (NO) to moist iron filings. A decrease in volume occurred, and the remaining gas supported combustion better than common air. It was studied by Davy (1799), who gave it the name nitrous oxide, prepared it by the method now employed, viz., by heating ammonium nitrate ($NH_4NO_3 = 2H_2O + N_2O$), and also discovered its anaesthetic properties. It is also produced by the reduction of nitric acid under certain conditions, *e.g.*, by the action of zinc on the dilute acid. Pure nitrous oxide may be obtained by mixing solutions of hydroxylamine hydrochloride and sodium nitrite in equimolecular proportions: $NH_2OH + HNO_2 = N_2O + 2H_2O$. Nitrous oxide may be synthesized from the elements under special conditions (Chapman, Goodman and Shepherd, 1926).

The gas is colourless, and has a sweetish odour and taste. Its density is 1·9777 gm. per litre, and at 15° C one volume of water dissolves 0·7778 volume of nitrous oxide. The solution, however, is neutral, showing that the gas is not the true anhydride of hyponitrous acid, $H_2N_2O_2$. It is more soluble in alcohol. Nitrous oxide supports combustion better than air because it decomposes into its elements at moderately low temperatures (beginning at 520° C) and yields a gas of which one-third by volume is oxygen. It is endothermic, that is, contains more energy than the elements from which it is formed, and can be decomposed into nitrogen and oxygen by the explosion of a detonator.

Nitrous oxide on cooling or under a pressure of 50 atm. at 15° C forms a colourless liquid, which boils at −88·7° C and on rapid evaporation yields a white solid, m.p. −102·3° C. The critical temperature is 36·5° C and the critical pressure 71·66 atm. The chief use of nitrous oxide is as an anaesthetic for operations of short duration, but prolonged inhalation causes death. About 22 litres of the gas are required to produce insensibility and if mixed with about one-quarter of its volume of oxygen an intoxicating effect often results, hence the name "laughing gas." The decomposition of ammonium nitrate is usually employed as the manufacturing process but the temperature needs careful regulation to avoid the formation of nitrogen, ammonia and nitric oxide. One kilogram of ammonium nitrate gives 182 litres of the gas, which is purified by passage through solutions of ferrous sulphate, caustic potash and milk of lime. The product is marketed in the liquid form under pressure in steel cylinders.

Nitric oxide, NO, was probably first obtained by Van Helmont, but was first recognized as a definite gas by Priestley (1772), who prepared it by the action of dilute nitric acid on copper or mercury: $3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 2NO + 4H_2O$. When prepared in this way the gas is liable to contain free nitrogen and nitrous oxide. The pure gas is obtained by dropping a mixture of potassium nitrite and potassium ferrocyanide solutions into dilute acetic acid: $K_4FeC_6N_6 + KNO_2 + 2CH_3{\cdot}COOH = K_3FeC_6N_6 + 2CH_3{\cdot}COOK + H_2O + NO$. The gas may be collected over water or, if required pure, over mercury. It is colourless and has a density of 1·3402gm. per litre, slightly greater than that of air. At 15° C one volume of water dissolves only 0·051 volumes of the gas. It is not very easily liquefied and has a boiling point of −150·2° C and a melting point of −163·6° C. The critical temperature is −96° and the critical pressure 64 atmospheres.

Nitric oxide is the most stable oxide of nitrogen and is only dissociated into its elements to about 3·5% at 1,000° C. Consequently, burning substances will only continue to burn in the gas if they previously attain this temperature. A mixture of nitric oxide and carbon disulphide vapour burns with a brilliant lilac-coloured flame, very rich in actinic rays. Nitric oxide combines readily with oxygen to form the dioxide, NO_2, which appears as red fumes, but a short time of contact between the gases is required for complete oxidation. The oxidation of nitric oxide is of technical importance (*see* NITROGEN, FIXATION OF) and has been the subject of a considerable amount of research. Nitric oxide is absorbed by cold ferrous sulphate solution forming a black compound, but it is readily expelled again by heating. The best absorbent for the gas is a mixture of caustic soda and sodium sulphite solutions, sodium nitrososulphate, $Na_2(NO)_2SO_3$ being formed. Nitric oxide and all the higher oxides of nitrogen are poisonous. At the temperature of liquid oxygen, nitric oxide reacts with fluorine ($4NO + F_2 = 2NO_2F + N_2$) to form *nitryl fluoride,* the only known halide of nitric acid. It melts at −139° C and boils at −63·5° C.

Nitrogen trioxide (nitrous anhydride), N_2O_3, was discovered by Glauber. When nitric acid (56%) is distilled with arsenious oxide or starch, and the vapours are cooled with a freezing mixture, a dark blue liquid is obtained which is crude nitrogen trioxide: $2HNO_3 + As_2O_3 = As_2O_5 + H_2O + N_2O_3$. On evaporation, the liquid decomposes almost completely into nitric oxide and nitrogen peroxide, but the two gases recombine on cooling: $NO + NO_2 \rightleftarrows N_2O_3$. H. B. Baker has shown that when the liquid is dried by long exposure to phosphorus pentoxide it may be evaporated without decomposition, but the molecules in the vapour are N_4O_6. Nitrogen trioxide is the anhydride of nitrous acid, but only traces of this are formed by the action of water, since it is very unstable and the blue solution decomposes, partly into water and the anhydride (to which the colour is due) and partly with evolution of nitric oxide and formation of nitric acid: $3HNO_2 = HNO_3 + 2NO + H_2O$. Although the gas is largely composed of nitric oxide and nitrogen peroxide, it is rapidly absorbed by solutions of alkalis with formation of nitrites, *e.g.*, sodium nitrite, and by concentrated sulphuric acid with formation of nitroso-sulphuric acid ("chamber crystals"), $SO_2(OH){\cdot}O{\cdot}NO$.

Sodium nitrite, $NaNO_2$ is an important salt used in many organic preparations, *e.g.*, of dyestuffs, and is manufactured by heating molten sodium nitrate with metallic lead, by reducing sodium nitrate in presence of sodium hydroxide with sulphur

($3NaNO_2+S+2NaOH=Na_2SO_4+3NaNO_2+H_2O$), or, usually, by absorbing higher oxides of nitrogen obtained by the oxidation of air in the arc process or by the oxidation of ammonia, in sodium hydroxide or carbonate solutions. Nitrites are reducing agents, being converted to nitrates, but they also liberate iodine from potassium iodide, being reduced to nitric oxide.

The chloride of nitrous acid, *nitrosyl chloride*, NOCl, is a yellow gas formed by the direct union of nitric oxide and chlorine, by the action of phosphorus pentachloride on sodium nitrite, or by heating nitroso-sulphuric acid with sodium chloride.

Nitrogen peroxide (dioxide or tetroxide), NO_2 or N_2O_4, is formed as a reddish-brown gas by the direct union of nitric oxide and oxygen. The later stages of this reaction are somewhat slow. It is more conveniently obtained by heating lead nitrate, $2Pb(NO_3)_2=2PbO+4NO_2+O_2$, and condensing the nitrogen peroxide to a liquid in a tube cooled in a freezing mixture, or (most conveniently and in a very pure state) by heating chamber crystals with potassium nitrate: $SO_2(OH)\cdot O\cdot NO+KNO_3=KHSO_4+2NO_2$. Nitrogen peroxide in a freezing mixture solidifies to nearly colourless crystals, melting at −9·04°C to a honey-yellow liquid. With rise of temperature this becomes reddish-brown and boils at 21·9° C, giving a reddish-brown vapour. The colour of the gas becomes deeper on heating; at 140°C it is nearly black. These colour changes are due to the existence of two forms of nitrogen peroxide: a colourless form, N_2O_4, and a strongly coloured form, NO_2. The conversion of N_2O_4 into NO_2 occurs in the liquid; in the vapour the change may be followed by the decrease in the vapour density due to dissociation: $N_2O_4\rightleftarrows 2NO_2$. The dissociation is complete at 140°C; at higher temperatures NO_2 decomposes into NO and oxygen. On cooling the reverse changes occur.

Nitrogen peroxide supports the combustion of strongly burning phosphorus; it is decomposed at the temperature of the flame with formation of oxygen. A mixture of the gas with hydrogen is reduced to ammonia in contact with heated platinum. In contact with water, nitrogen peroxide is absorbed with the production of nitrous and nitric acids; the former then decomposes with formation of N_2O_3 and NO as explained above. The absorption of the gas with the formation of nitric acid, in presence of air or oxygen, which is an important industrial process, is therefore attended with difficulty. In presence of alkalis, nitrogen peroxide is absorbed with production of nitrite and nitrate: $2KOH+N_2O_4=KNO_3+KNO_2+H_2O$. Liquid nitrogen peroxide forms a violently explosive mixture with petrol or other liquid hydrocarbons, and bombs filled with the mixture have been used in aerial bombardment. The gas, largely diluted with air, is used in bleaching flour.

Hyponitrous acid, $H_2N_2O_2$, $(HON)_2$, is produced in the form of a salt by reducing nitrites with sodium amalgam (Divers, 1871), $2NaNO_2+4Na+2H_2O=Na_2N_2O_2+4NaOH$. The free acid is obtained in the form of explosive crystals by the decomposition of the silver salt with hydrogen chloride in dry ether. The acid and its salts are powerful reducing agents. Salts of an acid $H_2N_2O_3$ (*nitrohydroxylamic acid*), intermediate between hyponitrous acid and nitrous acid, are also known. There is an isomeride of hyponitrous acid, *nitramide*, $NO_2\cdot NH_2$.

Nitrogen pentoxide (nitric anhydride), N_2O_5, first prepared by Deville (1849), is best obtained by the removal of water, by means of phosphoric oxide, from cooled, concentrated nitric acid: $2HNO_3=N_2O_5+H_2O$. The product is distilled in a current of ozonized oxygen, dried over phosphoric oxide and condensed in a vessel cooled by solid carbon dioxide and ether. An alternative method is to pass ozonized oxygen through cooled, liquid nitrogen tetroxide: $N_2O_4+O_3=N_2O_5+O_2$. Crystals of nitrogen pentoxide are stable below 0°C but are very hygroscopic. At ordinary temperatures, especially on exposure to light, slow decomposition occurs into nitrogen peroxide and oxygen, while on heating the crystals melt with decomposition at 29·5°C. Sudden heating causes explosion. Nitrogen pentoxide dissolves in water forming nitric acid. Phosphorus and potassium burn in the liquid pentoxide on warming, and charcoal burns if previously ignited.

Nitroso-nitrogen trioxide $(N_2O_3)_x$, is a greenish solid obtained by passing nitric oxide through liquid oxygen, or by the action of air on solid nitric oxide at the temperature of liquid air. It decomposes into nitrogen trioxide and nitric oxide above the temperature of liquid air (R. L. Hasche, 1925).

Nitrogen Halides.—*Nitrogen trichloride*, NCl_3. Nitrogen does not combine directly with halogens, but compounds may be obtained indirectly. Nitrogen trichloride was obtained by Dulong (1811) by the action of chlorine on ammonium chloride solution. It can also be produced by the electrolysis of concentrated ammonium chloride solution or by treating ammonia with excess of chlorine. Gattermann showed that the latter reaction takes place in three stages: $NH_4+Cl_2=NH_2Cl+HCl$; $NH_2Cl+Cl_2=NHCl_2+HCl$; $NHCl_2+Cl_2=NCl_3+HCl$. The intermediate compound NH_2Cl, monochloramine, has been isolated and forms colourless crystals melting at −66° C. It is unstable and explosive.

Nitrogen trichloride is a very dangerously explosive, volatile, yellow oil, boiling at 71°C. The vapour has a pungent odour and attacks the eyes and mucous membranes. The liquid explodes on contact with many substances or on exposure to bright light, but its solution in benzene may be safely handled in the dark. It is destroyed by ammonia.

Nitrogen iodide. Courtois (1812) obtained a black explosive powder by adding iodine to ammonia solution. This so-called "nitrogen iodine" was proved by Chattaway and Orton (1900) to be really the compound $NI_3\cdot NH_3$ and NI_3 is not known. When dry the substance explodes violently even when touched with a feather; in some cases the moist substance also explodes. It is an active oxidizing agent, and in all probability first forms hypoiodous acid, HOI, in presence of water. It is decomposed on exposure to light.

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NITROGEN, FIXATION OF. Compared with the enormous quantity of nitrogen contained in the atmosphere, estimated at about 5·8 metric tons over each square yard of the earth's surface, the amount circulating in animals and plants is small, perhaps 1 in 500,000. Continual interchange takes place between atmospheric and combined nitrogen; some is returned to the soil as nitric acid in rain, some is fixed by the bacilli in the nodules formed on the roots of leguminous plants. Much of this nitrogen finds its way into the bodies of animals and plants; on the decay of such bodies ammonia is produced, and some of this is acted on by denitrifying bacteria which return the nitrogen to the air in an elementary condition. Until recent years the only artificial nitrogenous fertilizers used on an extensive scale were sodium nitrate from Chile and ammonium sulphate recovered from the ammoniacal liquors of gas-works and coke-ovens.

In ordinary circumstances, nitrogen is somewhat inert, but Henry Cavendish (1785) discovered that it unites with oxygen when electric sparks are passed through a mixture of the gases, and W. F. Donkin later obtained ammonia by the action of a silent electric discharge on a mixture of nitrogen and hydrogen. Any idea of using these reactions technically was abandoned for many years and more attention was paid to the possibility of synthesizing cyanides. As early as 1828 Desfosses found that a cyanide was produced when nitrogen was passed over a heated mixture of carbon and an alkali or alkaline carbonate, $N_2+4C+K_2CO_3=2KCN+3CO$. If baryta be used in place of an alkali, barium cyanide is formed, and since this compound gives ammonia on heating strongly in steam, leaving a residue from which the baryta may be recovered, the reactions afford a possible technical process for the fixation of nitrogen (Margueritte and Sourdeval, 1860).

The establishment of the calcium carbide industry has made it

possible to combine nitrogen with carbon commercially, the calcium cyanamide produced giving calcium carbonate and ammonia as ultimate products of hydrolysis (A. R. Frank and N. Caro, 1895–8), $CaC_2+N_2=C+CaCN_2$ and $CaCN_2+3H_2O=CaCO_3+2NH_3$. This method underwent rapid development after the discovery that calcium cyanamide might be used directly as a nitrogenous fertilizer (1901). Certain metals form compounds with nitrogen which yield hydroxides and ammonia on treatment with water, *e.g.*, (a) $Li_3N+3H_2O=3LiOH+NH_3$; (b) $Mg_3N_2+6H_2O=3Mg(OH)_2+2NH_3$; (c) $AlN+3H_2O=Al(OH)_3+NH_3$. The price of the metals precludes their employment, but the discovery of O. Serpek, that aluminium nitride is formed when aluminium oxide (or bauxite) and carbon are heated in an atmosphere of nitrogen was actually used on a technical scale.

The development of nitrogen fixation during the present century has been made possible by a better understanding of the thermodynamics of chemical change and increased engineering resources. The manufacture of cyanamide was established rapidly as the necessary carbide was available and its production thoroughly understood. The actual reaction between carbide and nitrogen is exothermic (heat is evolved), and when initiated proceeds to completion. Nitrates and nitrites were manufactured on a large scale after 1903 by combining nitrogen and oxygen to nitric oxide at the temperature of the electric arc, and subsequently oxidizing the nitric oxide to nitric acid in the presence of water. Although the nitric oxide formation is endothermic (heat is absorbed), the large supply of energy was obtained at a cheap rate where water-power was available, notably in Norway. The exothermic synthesis of ammonia was the last fixation process to be developed technically; this was due to the slowness of the reaction $N_2+3H_2\rightleftarrows 2NH_3$.

Production.—Until the outbreak of the World War, the production of nitrates from ammonia had no apparent technical advantage. W. Ostwald had succeeded in greatly improving the yield of nitric oxide by the combustion of ammonia, $4NH_3+5O_2=4NO+6H_2O$, and, with the shortage of nitrates, the process found adoption. The production of nitric acid from ammonia has now attained great importance, for whilst both ammonium salts and nitrates are used as fertilizers, the latter act more readily and hence enjoy considerable demand. It seems now to be more economical to use a given amount of electrical energy in the synthesis of ammonia and to burn this to nitric oxide rather than to use it in the direct formation of the latter compound. Thus in 1913 the greater portion of the combined nitrogen used in agriculture and the arts was derived either from Chilean nitrate or from ammonia compounds recovered from coke-ovens or gas-works, whilst at the present time synthetic nitrogen compounds predominate. The following figures for production of combined nitrogen are given on the authority of J. H. Lucas, *L'Industrie Chimique* (Jan. 1928, p. 11).

	1913–14		1925–26		1926–27	
	Tons	%	Tons	%	Tons	%
Chilean nitrate	425,000	56·66	400,000	30·0	210,000	16·8
Recovered ammonia	265,000	35·34	345,000	25·9	345,000	27·6
Synthetic compounds	60,000	8·00	589,000	44·1	695,000	55·6
	750,000		1,334,000		1,250,000	

The set-back in Chilean nitrate seems to have been temporary, for there was a recovery in consumption in 1928. A further increase took place in the fixation of nitrogen. Statistics given by F. A. Ernst and M. S. Sherman of the U.S.A. Fixed Nitrogen Laboratory (*Industrial and Engineering Chemistry*, Feb. 1927) assign the nitrogen fixed by synthetic processes in 1925 as follows:

	Tons	%
By arc process	41,000	6·7
As cyanamide	188,000	30·3
As ammonia	390,000	63·0
	619,000	100·0

The figures for cyanamide are possibly too low.

According to Ernst and Sherman, fixation of nitrogen has attained the largest proportions in Germany, where the annual capacity of plants is stated to be:—(a) arc process, 4,500; (b) cyanamide, 94,000; (c) synthetic ammonia, 402,500 in tons of nitrogen. France, Italy, Japan, Norway and Canada are also noted for large plant capacity. Respecting the United States, M. S. Sherman (*Ind. and Eng. Chem.*, Jan. 1928) states that 12,800 tons were fixed in 1926 whilst the probable figure for 1927 is 23,000 tons. Production is rapidly increasing in Great Britain and the Billingham Works which were making about 65 tons of ammonia *per diem* in 1926 are expected to attain an annual output of 750,000 tons of ammonium sulphate (over 150,000 tons of nitrogen) in 1930. The sulphate radicle is now frequently obtained from natural calcium sulphate (anhydrite or gypsum) by utilizing the reaction, $CaSO_4+2NH_3+CO_2+H_2O=CaCO_3+(NH_4)_2SO_4$. Combined nitrogen is also being supplied for agricultural purposes as urea (from ammonia and carbon dioxide) and in many fertilizers containing potash and phosphates.

Synthesis of Ammonia.—The combination of nitrogen and hydrogen is accompanied by the evolution of heat, the equation for the formation of ammonia at ordinary temperature being

$$N_2+3H_2=2NH_3+11{,}890 \text{ calories},$$

according to the measurements of Julius Thomsen. (*See* also papers by Haber and his co-workers between 1903 and 1915.) The heat evolved at higher temperatures is progressively less, and the amount of ammonia existing in true equilibrium with a mixture of one volume of nitrogen and three volumes of hydrogen diminishes, as temperature is raised. If ammonia, nitrogen and hydrogen co-exist in an enclosed space, each gas can be considered as occupying the whole volume but exercising a partial pressure proportional to the number of its molecules present. For any given temperature, certain concentrations of the different gases will be in equilibrium when

$$\frac{(p_{NH_3})^2}{(p_{N_2})\times(p_{H_2})^3} = \text{a constant}$$

the p's representing the respective partial pressures of the gases whose formulae are put down as suffixes. It is more convenient in practice to take the square root and write

$$\frac{p_{NH_3}}{p_{N_2}^{\frac{1}{2}}\times p_{H_2}^{\frac{3}{2}}} = K_p.$$

If a mixture of these three gases be compressed, ammonia must be formed in order to preserve the above relationship, so that rise of temperature and of pressure act in contrary directions, the first diminishing the equilibrium amount of ammonia, the latter increasing it.

Since nitrogen and hydrogen react to form ammonia very slowly, no change is observed if these gases are mixed at ordinary temperature and pressure and left for years. In order to get appreciable change the reaction must be accelerated, and the two ways in which this is possible are by increase in temperature and use of a catalyst. In Haber's earlier experiments (with G. van Oordt), ammonia was passed over a heated catalyst and the ammonia which had escaped decomposition absorbed and estimated. The residual nitrogen and hydrogen were passed over another portion of catalyst at the same temperature and the ammonia formed estimated: the two sets of experiments showed fair agreement but were found later to be too high as regards ammonia formation. (Haber and R. le Rossignol, also F. Jost, 1908.) From a knowledge of heats of formation and specific heats of reacting gases, the equilibrium constant can be calculated theoretically.

Catalysts.—Ultimately agreement between theoretical and practical results was obtained and it became obvious that, for practical working, a catalyst would have to be found which was sufficiently rapid in its action about 500° C and not too susceptible to "poisoning" by impurities in the gases employed. Theoretically, the following approximate percentages of ammonia may be attained.

Temperature	500°	550°	600°
At 100 atmospheres	11·0	7·0	4·5
At 200 atmospheres	18·0	12·0	8·0

Haber used various catalysts in the course of his work. In the early stages, osmium and ruthenium were found to give good results but price and rarity preclude their use. The catalysts usually contain iron with a basic oxide (introduced by fusion) as a promoter. A large number of patents have been taken in the first quarter of the 20th century, and the firms concerned do not divulge the nature of the catalysts they employ. The Badische Co. have been supposed to use an iron catalyst with (possibly) molybdenum as promoter. In the war plant of the U.S. Government, pumice was impregnated with nickel or iron sulphate, heated to 550°, reduced by hydrogen and treated with sodium and ammonia gas at 450°; sodamide was formed in the spongy metal, and such a mass is said to act at 500° and 70 atmospheres. Synthetic Ammonia and Nitrates Ltd. claim that calcium ferrite, prepared in the electric furnace, gives an active catalyst on subsequent reduction (Brit. Pat. 237,394). Norsk-Hydro mix compounds of metals of the iron group with cyanides in liquid anhydrous ammonia, remove the excess of ammonia and heat in a non-oxidizing atmosphere (U.S. Pat. 1,570,333). F. Uhde (Brit. Pat. 247,225) carefully avoids water. In an example, anhydrous ferric chloride and potassium ferrocyanide react in glycol solution, the precipitate is dried *in vacuo*, filled into the furnace and treated with nitrogen and hydrogen, first without and then with increased pressure at 350–450°. The hydrogen used in the synthesis is chiefly produced from coke and steam but electrolytic, coke-oven and by-product hydrogen are also used. Nitrogen is obtained by rectification of liquid air or from producer-gas.

Haber-Bosch Process.—This process was developed by the Badische Co. (now part of I. G. Farbenindustrie A.-G.) and is carried out at about 500° and 200 atmospheres. The necessary mixture of nitrogen and hydrogen is obtained from water-gas and producer-gas. Air is blown through a coke fire, shut off and steam blown through when the reaction, $C+H_2O=CO+H_2$, takes place. The mixture actually contains about 50% hydrogen, 42–45% carbon monoxide and a small balance, chiefly carbon dioxide and nitrogen. The producer-gas from air and coke contains hydrogen, 5–15%; nitrogen, 65–50%; carbon monoxide, 20–30% and residue of carbon dioxide, methane, etc. Suitable proportions give a gas mixture with 22–23% nitrogen and remainder mostly hydrogen and carbon monoxide. By passage over a catalyst with excess of steam, the reaction $CO+H_2O=CO_2+H_2$ is driven as far as possible to the right to give a gas mixture with about 17% N_2, 52% H_2, 27 to 29% CO_2, 2 to 4% CO and small amounts of argon, methane, etc. The carbon dioxide can be reduced to under 1% by water scrubbing under pressure, the remainder is washed out with cold alkali solution. Removal of carbon monoxide and residual sulphur compounds is essential as they are catalyst poisons; for the former, a solution of cuprous ammonium carbonate (or formate) may be employed. Treatment with ammonia is also used (*e.g.*, Synthetic Ammonia and Nitrates Ltd., Slade and Parkes, Brit. Pat. 240,350; Casale, Brit. Pat. 231,417). F. Uhde finally cleanses and dries the gas-mixture by passage through a melt of sodium amide containing a metal of the alkali or alkaline earth class. 20% sodium and 80% sodamide can be used at 200–250° C, the contact of the gas and melt lasting 20 to 60 seconds. (Brit. Pat. 247,226.)

According to Waeser, the gas mixture passes a three-stage compressor and the reaction is carried out in tubular vessels of special steel. Once the reaction is started, further heating is unnecessary and heat may have to be taken away. The gases leave the catalyst with about 10% of ammonia which is removed after cooling by washing with water.

Other Processes.—G. Claude increases the pressure to 600 or 1,000 atmos.; this so displaces the equilibrium towards ammonia formation that higher temperatures (500–600°) can be employed, at which the catalysts are more active and less sensitive to poisoning. Up to 20% of ammonia may be attained and if the issuing gases are cooled under this pressure, the ammonia is mostly liquefied and may be removed in an anhydrous condition. Usually three contact units are used in series. After passage through each unit, the gas is cooled and the liquefied ammonia removed, the remaining nitrogen and hydrogen being passed on to the next unit. A suitable steel for the high pressure apparatus is said to contain Si, 0·018%; S, 0·09%; C, 0·098%; and Mn, 0·93%. Chrome-vanadium steel is also employed for reaction chambers. The process is worked with hydrogen from water-gas or coke-ovens whilst electrolytic hydrogen is also employed, as at Bussi (Italy). Claude gives the following equilibria for ammonia at 536°.

Atmospheres pressure	200	400	600	800	1,000
Ammonia per cent	12·5	21·0	28·5	36·0	41·0

Discrepant statements have been made as to the pressure employed by L. Casale in the process named after him; it is probably about 800 atmos., the gases circulating in a closed circuit. A characteristic of the process is that a certain percentage of ammonia is returned with the nitrogen-hydrogen mixture in order to avoid overheating the catalytic mass. Only a portion of the ammonia is removed from the gas after leaving the synthetic tube and uncombined gases are made to pass repeatedly over the catalyst. Many important details have been worked out with respect to heat-interchangers and the maximum temperature of the pressure containers. This process has been largely adopted and is worked with nitrogen from various sources.

Cyanamide.—The ultimate raw materials are limestone, some form of carbon (charcoal, anthracite or coke) and atmospheric nitrogen. The limestone is burnt to lime, the latter heated in an electric furnace with carbon and the resultant calcium carbide brought to reaction with nitrogen (99·8% purity). Henri Moissan found that pure calcium carbide did not react with nitrogen on heating but Frank and Caro obtained cyanamide from commercial, impure carbide. The reaction is one which may be catalysed and calcium fluoride has been used for this purpose. Calcium chloride is also effective but undesirable as it attracts moisture.

The ovens in which the reaction between carbide and nitrogen is effected are either discontinuous or continuous in action. In the first case they are usually cylindrical in shape and charged with finely ground carbide around a carbon pencil. The covers are placed in position, nitrogen admitted under slight pressure and the carbon pencil heated electrically. The carbide surrounding the pencil soon attains the necessary temperature; when the reaction has well started further electrical heating is unnecessary and the reaction spreads from the core outwards until the entire charge is converted. This may take 24 to 40 hours.

The crude product contains about 60% calcium cyanamide (21% nitrogen), 20% lime, 12% free carbon and a small amount of aluminium and iron oxides, silica, etc. Cyanamide is manufactured on a large scale in Germany and France and in substantial quantities in other countries. It is largely used as a fertilizer; a certain amount is converted into ammonia and then into ammonium sulphate.

Oxidation of Nitrogen.—(*a*) At a high temperature, nitrogen and oxygen partially combine to form nitric oxide, the reaction being reversible.

$$N_2+O_2 \rightleftarrows 2NO.$$

The reaction is endothermic, *i.e.*, heat is absorbed, so that the higher the temperature, the greater the quantity of nitric oxide in equilibrium with nitrogen and oxygen. At ordinary temperatures, the amount of nitric oxide is negligible for true equilibrium, but the rate of decomposition of nitric oxide is so slow that, if the mixture of gases be rapidly cooled, most of the nitric oxide formed at a high temperature may be preserved.

(*b*) Nitric oxide unites directly with oxygen at ordinary temperatures to form nitrogen peroxide, $2NO+O_2=2NO_2$.

(*c*) Nitrogen peroxide reacts with water to form nitric acid and nitric oxide, $3NO_2+H_2O=2HNO_3+NO$. If excess of oxygen be present, the nitric oxide is again oxidized to nitrogen peroxide,

so that the net result will be given by the equation, $4NO_2+O_2+2H_2O=4HNO_3$.

On the theoretical side, the equilibrium between nitrogen oxygen and nitric oxide is given by

$$\frac{[NO]^2}{[N_2]\times[O_2]}=\frac{x^2}{\left(79{\cdot}2-\frac{x}{2}\right)\left(20{\cdot}8-\frac{x}{2}\right)}=\text{constant } k.$$

The square brackets indicate the concentrations of the respective gases and the expression involving x represents the values if atmospheric air be taken as initial material. It is known that k is related to the heat of formation (q) thus,

$$\frac{d\log k}{dT}=-\frac{q}{RT^2}$$

so that if x be determined at an absolute temperature T, k may be calculated for that temperature and a value of q obtained. W. Nernst used the heat of formation of nitric oxide determined by J. Thomsen, viz.—43,200 cal., and compared theoretical and practical values of x. Thus at 1,811°, x was observed to be 0·37 and calculated as 0·35, whilst at 2,675° the respective values were 2·23 and 2·35. Nernst and his fellow-workers used external electric heating, but in 1903 W. Muthmann and H. Hofer had obtained 3·6 to 6·7% of nitric oxide when the air was exposed directly to the arc. 7% would correspond to a temperature of 3,750°, but experiments by Haber and A. Koenig point to a specific influence of the arc; there seems to be an "electric equilibrium" in addition to the thermal equilibrium.

Patents for the synthesis of nitric acid were taken by Mme. Lefebre (1859) and McDougall (1899), but manufacturing on a commercial scale was first started by C. S. Bradley and R. Lovejoy (Brit. Pat. 8,230/1901; U.S.PP. 709,867; 709,869). The air was driven through a vertical iron cylinder containing a rotating steel shaft, both tube and shaft were provided with electrodes and between them, 6,900 arcs were struck and broken per second. The process was not operated after 1904, more efficient processes having made an appearance.

Another method of exposing air to the arc is due to O. Schönherr (1905). An arc (which may be from direct current) of 16 to 23 ft. in length is set up in a vertical tube: the lower electrode is an iron rod which is gradually worn away, the wastage is small and the expense of renewal trifling. A water-jacket surrounding the upper part of the tube serves as the other electrode; since the arc varies in length, it does not always strike the same area and wear and tear are small. Air passes upwards along this tube, returns downwards through a concentric outer tube and serves partially to heat the incoming air.

After leaving the electric furnace, the gases are cooled (much heat may be usefully recovered) and pass on to an oxidation tower. By treatment in a succession of towers with water in counter-current, a weak nitric acid is recovered which may be concentrated or, more usually, neutralized with lime or ammonia for the production of calcium or ammonium nitrate. The former is utilized as a fertilizer, the latter finds a use in explosives. The washing with water does not remove all the oxides of nitrogen; more complete exhaustion is effected by spraying the remaining gas with solution of soda ash, sodium nitrate (fertilizer) or sodium nitrite (dyestuff industry) being recovered.

The Birkeland and Eyde process was established in 1903 and utilized largely by the Norsk-Hydro Co. at Notodden and later at Rjukan. The Schönherr process was largely developed by the Badische Co. and introduced at the above mentioned Norwegian works. The German capital was afterwards withdrawn from the Norsk-Hydro owing to the development of the Haber process. The Pauling process was used in France, Austria and Italy, whilst another arc process, the invention of Mosicki, was established in Switzerland.

Several methods for the recovery of oxides of nitrogen formed at high temperatures in combustion processes have been suggested; of these, that due to F. Häusser with respect to internal combustion engines has received most publicity.

Oxides of Nitrogen from Ammonia.—When ammonia is burnt under ordinary conditions, nitrogen and water vapour are the chief products. That oxides of nitrogen may be formed was observed in the eighteenth century and in 1839 Kuhlmann found the reaction was catalysed by platinum. Shortly before the war, W. Ostwald fixed the conditions by which fair yields can be obtained.

The usual catalyst is platinum gauze (80 to 150 mesh per in., wire diameter 0·001 to 0·003 in.), four layers being frequently employed. A pre-heated mixture of ammonia and air is blown through the catalyst; the time of contact with the platinum is 0·0001 sec. and the temperature 1,000° C; the speed is important. With good conditions the reaction, $4NH_3+5O_2=4NO+6H_2O$, can be realized to the extent of about 95%. If all the ammonia is not oxidized it subsequently reacts with the oxides of nitrogen. It is reported that a granular iron oxide mixed with other oxide promoters has been used successfully in place of platinum. The oxidation of the nitric oxide and recovery as nitrates and nitrites follows, as previously described.

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UNITED STATES

While the industrial fixation of atmospheric nitrogen had its birth in the United States when the Atmospheric Products Company was organized at Niagara Falls, N.Y., to exploit the Bradley and Lovejoy patents, little nitrogen was fixed in the United States until after the World War. A Pauling furnace was operated at Nitrolee, S.C., from 1913 to 1916. Another plant was operated by the arc process at Le Grande, Wash., for ten years. The excessive cost of electric energy, however, made it impossible for these plants to compete with the synthetic ammonia plants. The American Cyanamid Company began the operation of the process, for which it is named, in 1907, and has increased its capacity from time to time. The U.S. Nitrate Plant No. 2 at Muscle Shoals, Ala., was also erected to operate the cyanamide process, but has never produced commercially. ("Muscle" is the common spelling of "mussel" in the Colonial period.)

The first attempt in the United States to synthesize ammonia directly was at U.S. Nitrate Plant No. 1, Sheffield, Ala., but this was an experimental plant, the continuous operation of which was never realized. Following the war the Atmospheric Nitrogen Corporation began operations at Syracuse, N.Y., reaching in 1927 an annual capacity of 11,550 tons. A number of small plants followed, using for the most part by-product hydrogen. These were soon followed by a plant at Seattle, Wash., using electrolytic hydrogen, and Lazote, Inc., at Charleston, W. Va., employing water-gas hydrogen, with a production capacity of 6,350 tons in 1927. In 1928, at Hopewell, Va., the first unit of a plant of some 30,000 tons capacity began the manufacture of synthetic sodium nitrate, having the distinction of being the first plant to produce directly a synthetic material identical with Chilean nitrate. Synthetic ammonia processes operating in the United States are for the most part modifications of the Haber, Casale and Claude processes. However, there has been developed a modification so extensive as to entitle it to be known as an "American Process." This has proved such an efficient method for fixing atmospheric nitrogen as to be installed in the newer plants erected both at home and abroad. (H. E. H.)

NITROGEN HARDENING, a process of hardening alloy steel at low temperature in ammonia gas. This process was first described in 1926 by Dr. A. Fry, a German metallurgist at Krupp's and has since been widely used for parts requiring high strength, resistance to wear and toughness, a combination of properties not

easy to obtain in similar degree by any other process. Medium carbon steels containing up to 1% aluminium are required for the process. It has been found that a little chromium is of advantage, while about half of 1% molybdenum is added to prevent brittleness. This steel is first normalized to remove strain and give easy machineability; it is then machined and ground to finished dimensions, next placed loosely in a closed pot, heated 10 to 15 hours in a slow stream of ammonia gas at 500° C and cooled without removing from the pot. The temperature is so low that no warping will occur; the surface is unscaled but extremely hard. Hardness at a depth of 0·01 in. is as high as is obtained from the ordinary case hardening pots. The aluminium in the steel is a good corrosion repellent, and this together with the natural chemical inactivity of a hardened surface lends interesting possibilities for using ammonia treated members in rust-resisting structures. (*See* CASE HARDENING; CEMENTATION; IRON AND STEEL.) (E. E. T.)

NITROGLYCERIN, an explosive first obtained in 1846 by Ascanio Sobrero by acting with a mixture of strong nitric and sulphuric acids on glycerin at the ordinary temperature. It is in fact the ester (*see* ESTERS) of glycerol and other molecules of nitric acid, having the constitutional name of glyceryl trinitrate and the formula $C_3H_5(NO_3)_3$ or $CH_2NO_3{\cdot}CHNO_3{\cdot}CH_2NO_3$.

It is a very pale yellow oil of sp. gr. 1·614 at 4° C and 1·60 at 15° C. One gram requires for solution between 800 and 1,000 c.c. of water, 4 c.c. of absolute alcohol or 18 c.c. of wood spirit. It is scarcely soluble in glycerin, but mixes in all proportions with ether, acetone, ethyl acetate and benzene. (*See* EXPLOSIVES.)

Therapeutics.—Nitroglycerin has a sweet burning taste and is decidedly poisonous. Its vapour produces violent headache, and the same effect is often caused by handling compositions containing it. Although a nitrate, its pharmacological actions resemble those of nitrites such as amyl nitrite, taken internally. The explanation is that in an alkaline medium at body heat nitroglycerin yields a nitrite, probably as a preliminary stage of resolution. This gradual conversion in the tissues is a valuable property of nitroglycerin, as its effects take longer to manifest themselves than is the case with amyl and other nitrites. Nitroglycerin is valuable as a preventive in cases of cardiac pain, such as angina pectoris.

NITROSOBENZENE, C_6H_5NO, first obtained by the action of nitrosyl bromide or chloride on mercury diphenyl, is prepared by the oxidation of β-phenylhydroxylamine with chromic acid. It results from the oxidation of aniline by monopersulphuric acid (H. Caro). It exists in two crystalline forms. It melts at 68° to an emerald-green liquid which solidifies to colourless crystals melting at 57–59°. It is very volatile and its solutions are green. Nitric acid oxidises it to nitrobenzene. It condenses with aromatic amines to form azo-compounds, with arylhydroxylamines to form azoxy-compounds, and with hydroxylamine it gives isodiazobenzene hydroxide.

NITTI, FRANCESCO SAVERIO (1868–), Italian statesman, was born at Melfi (Potenza). He had already become known as a barrister and as professor of financial science at the University of Naples when he entered parliament in 1904. He made his reputation as an authority on economic and financial questions, and was minister of agriculture, industry and trade in the Giolitti cabinet of 1911–14. When the United States entered the World War in 1917, he was entrusted with an economic mission to that country, and certain of his utterances and acts in this connection were severely criticised. He became minister of the treasury in the Orlando cabinet from Oct. 1917 to Jan. 1919. On the fall of the Orlando ministry, which he helped to bring about, he succeeded as premier.

Nitti's adoption of the system of proportional representation resulted in an important increase in the Socialist and Popolari deputies at the elections of Nov. 1919, but he failed to conciliate either group. The epidemic of revolutionary strikes and disorders, seriously weakened his position, and he felt forced to resign on March 12, 1920. But no other statesman being willing to assume the succession, he reconstructed his cabinet; defeated in the Chamber after the San Remo meeting of the Supreme Council presided over by him, to prepare the peace with Turkey, he resigned a second time but again reconstructed his cabinet. The arrest ordered by him of the Dalmatians and Fiumani in Rome provoked further irritation, and while he at first reduced the bread subsidy for financial reasons, he revoked the decree immediately afterwards from fear of the Socialist menaces, and resigned for the last time on June 9, 1920, leaving the door open for Giolitti's return.

On retiring from office he returned to journalism and business. In parliament he opposed Giolitti, but was still more hostile to the Fascists. He was re-elected in 1921, but did not stand in the 1924 elections held under Mussolini's auspices. His house was looted by Fascists, and he himself subsequently left Italy.

Nitti wrote several books on economic questions, including one entitled *Nord e Sud* (1900), dealing with what he regards as the unfair treatment of South Italy by the wealthier North, and *L'Italia all' alba del secolo XX.* (1901). Among his other works, the following have been translated into English: *L'Europa senza pace* (Eng. trans. 1922); *La Decadenza dell' Europa* (Eng. trans. 1923); *La Tragedia dell' Europa* (Eng. trans. *They Make a Desert*, 1924). In 1925 his son Vincenzo Nitti published a vindication of his father's policy, *L'opera di Nitti.*

NITZSCH, KARL IMMANUEL (1787–1868), Lutheran divine, was born near Leipzig on Sept. 21, 1787. He studied at Wittenberg, where he began to teach in 1809. From 1820 to 1822 he was superintendent in Kemberg, and in the latter year he was appointed professor of theology at Bonn where he remained until called to succeed Marheineke at Berlin in 1847. Subsequently he became university preacher, rector of the university, provost of St. Nicolai (in 1854) and member of the supreme council of the church, in which last capacity he was one of the ablest and most active promoters of the Evangelical Union. He died on Aug. 21, 1868. He represented the *Vermittelungstheologie* of the school of Schleiermacher, holding "that religion is not doctrine but life, direct consciousness, feeling."

His principal works are: *System der christlichen Lehre* (1829; 6th ed., 1851; Eng. trans., 1849), *Praktische Theologie* (1847–60; 2nd ed., 1863–68), *Akademische Vorträge über christliche Glaubenslehre* (1858) and several series of *Predigten.*

NIUÉ (SAVAGE ISLAND): *see* PACIFIC ISLANDS.

NIVELLE, ROBERT GEORGE (1856–1924), French soldier, was born on Oct. 15, 1856, at Tulle, Corrèze. He entered the Polytechnic in 1876, and left two years later to join the artillery. He served in China in 1900, and then for many years in Algeria. When the World War broke out he was in command of the 5th Artillery at Besançon.

Appointed a general of brigade on Oct. 24, 1914, he fought successfully on the Aisne, and in Jan. 1915 took a prominent part in the attack on Quesnevières. On Dec. 23, 1915, he was placed at the head of the III. Corps, and in March 1916 was sent to Verdun, where after some remarkable fighting he succeeded in checking the Crown Prince's first attack. On May 2 he succeeded General Pétain in the command of the II. Army, and definitely held the enemy before that glorious citadel. It was he who, in orders which have become famous, made the unforgettable declaration: "Ils ne passeront pas." On March 12, 1916, he succeeded General Joffre as commander-in-chief of the armies of the north and north-east. In conjunction with the British armies he prepared the great offensive of April 16 between Soissons and Auberive. After this semi-defeat he was replaced by General Pétain in the command of the French armies. On May 15, 1917, he was appointed commander of the armies "chargé de mission," and on Dec. 23, 1917, took over the French troops in North Africa.

On Oct. 14, 1918, General Nivelle was confirmed in his command despite the rules of superannuation, and on Jan. 30, 1920, was nominated a member of the Supreme War Council. On March 5, 1920, he gave up the command of the XIX. Corps, and in Nov. 1920 he was ordered to represent France in the United States at the tercentenary of the arrival of the "Mayflower." He was placed on the retired list on Oct. 11, 1921; he died on March 23, 1924. (M. Gu.)

NIVELLES (Flem. *Nyvel*), town, province of Brabant, Belgium, on the Thines 19 m. south of Brussels. Pop. (1925) 12,966

It manufactures parchment, cardboard and paper. The town is supposed to owe its origin to the foundation of a convent by Itta or Iduberge, wife of Pippin of Landen, and it is the cradle of the Carlovingians. The Romanesque church of St. Gertrude, named after Itta's daughter, dates from the 11th century. On the top of the tower is the effigy of a man in iron who strikes the hours with a hammer. He is called by the townspeople Jean de Nivelles, a celebrated baron of the 15th century whose title eventually became merged in that of the count de Hornes (Horn). Close to Nivelles is Seneffe, where Condé defeated William of Orange in 1674. At Nivelles the French under Marceau defeated the Austrians in 1794.

NIVERNAIS, formerly a province and duchy of France, bounded on the north by Gâtinais-Orléanais and Auxerrois, on the south by Bourbonnais, on the east by Burgundy, on the west by Berri. It is embodied almost entirely in the present department of Nièvre. The capital of Nivernais was Nevers. At the Roman conquest Nivernais was a part of the territory of the Aedui. Nivernais was included in the jurisdiction of the *parlement* of Paris, and was a *gouvernement militaire*. From the time of the Merovingians it comprised the diocese of Nevers.

See Guy Coquille, *Histoire du Nivernais* (1612); F. Gillois, *Chronique du Nivernais* (1867).

NIXIE or **NIXY,** a female water-sprite. The word is adapted from Ger. *Nixe*, the male water-sprite being *Nix*. The general term covering both the male and female is "nicker," a kelpie. This also appears in Dutch *nikker*. The Old Teutonic *nikus* may be connected with the root which appears in Gr. *νίζειν* or *νίπτειν* "to wash."

NIXON, JOHN (1815–1899), English mining engineer and colliery proprietor, was born at Barlow, Durham, on May 10, 1815, the son of a farmer. He was a mine-surveyor on the South Wales coalfield, and he then became engineer to a French coal and iron company. Returning to England, he noticed while travelling on a Thames steamer that the Welsh coal in use gave off no smoke, and was preferred to north country coal both on this ground and because of its greater power-producing efficiency. His experience in France suggested that a profitable market for this coal might be established among the French iron-founders and manufacturers generally who had hitherto imported English north country coal. Eventually he freighted a small craft, and sent it across to Nantes, where he persuaded the local manufacturers to try it on the understanding that he bore the expense of the experiments. These tests, under his direction, proved successful, and his visit to Nantes laid the foundations of the Welsh steam-coal trade, English manufacturers and shipowners imitating the example of their French rivals. Nixon eventually acquired a colliery, known as Nixon's Navigation collieries in the Aberdare valley, and later acquired or developed other South Wales steam collieries. He invented many mechanical improvements in colliery working. He died in London on June 3, 1899.

See J. E. Vincent, *John Nixon, Pioneer of the Steam Coal Trade in South Wales* (1900).

NIZĀMĪ (1140–1—1202–3). Nizām-uddīn Abū Mohammed Ilyās bin Yūsuf, Persian poet, was born A.H. 535 (A.D. 1140–1). His native place, or at any rate the abode of his father, was in the hills of Kum, but as he spent almost all his days in Ganja in Arrān (the present Elizavetpol) he is generally known as Nizāmī of Ganja or Ganjawī. Nizāmī abandoned himself at an early age to a stern ascetic life, as full of intolerance to others as dry and unprofitable to himself. The first poetical work in which Nizāmī embodied his thoughts on God and man, and all the experiences he had gained, was *Makhzanul Asrār* (*c.* 1165–6) or "Storehouse of Mysteries," and bears the unmistakable stamp of Sūfic speculations. His claim to the title of the earliest Persian romanticist he fully established only a year or two after the *Makhzan* by the publication of his first epic masterpiece *Khosrau and Shīrīn* (*c.* 1175–6), reciting the ancient tale of the loves of Chosroes and Shirin. It was composed, according to the oldest copies, in A.H. 576 (A.D. 1180), and inscribed to the reigning atābeg of Azerbaijān, Abū Ja'far Mohammed Pahlavān, and his brother Kizil Arslān, who, soon after his accession to the throne in A.H. 582, showed his gratitude to the poet by summoning him to his court, loading him with honours, and bestowing upon him the revenue of two villages, Hamd and Nijān. In 1188 Nizāmī completed his *Dīwān,* or collection of kasīdas and ghazals (mostly of an ethical and parenetic character), which are said to have numbered 20,000 distichs, although the few copies which have come to us contain only a very small number of verses. About the same time he commenced, at the desire of the ruler of the neighbouring Shīrvān, his second romantic poem, the famous Bedouin love-story of *Laila and Majnūn* (*c.* 1188–9). His *Iskandarnāma* (1191) or "Book of Alexander," also called *Sharafnāma* or *Iqbālnāma-i-Iskandarī* ("The Fortunes of Alexander"), is split into two divisions, the first based on the historical career of Alexander, which is embroidered by many magical tales, among others the voyage of Alexander to the fountain of life in the land of darkness; the second describing him as prophet and philosopher. Nizāmī's last romance *Haft Paikar* (1198–9), or the "Seven Beauties," comprises seven tales in verses related by the seven favourite wives of the Sassānian king Bahrāmgūr. Among these is the tale of the Russian princess used by Gozzi and Schiller, "Turandot." The five mathnawīs, from the *Makhzan* to the *Haft Paikar*, form Nizāmī's so-called "Quintuple" (*Khamsa*) or "Five Treasures" (*Panj Ganj*), and have been taken as pattern by all the later epic poets in the Persian, Turkish, Chaghatāi and Hindustāni languages. Nizāmī died at Ganja in his sixty-fourth year, A.H. 599 (A.D. 1202–3).

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NIZHEGOROD (an abbreviation from Nijni-Novgorod), a province of the Russian S.F.S.R., bounded on the east by Vyatka, the Marii autonomous area and the Chuvash Autonomous Socialist Soviet Republic, on the south of Ulianovsk, Penza and Ryazan, on the west by Vladimir, Ivanovo-Vosnesensk and Kostroma, and on the north by the North Dwina province. Area 78,208 square kilometres. Pop. (1926) 2,736,221. It is smaller than the pre-1917 province of Nijni-Novgorod. The northern portion consists of a pine forest area lying along each side of the Vetluga river from the point where it curves sharply to the south, though the lower course of the Vetluga, and its junction with the Volga, lie in the Marii area. The forest approaches the left bank closely, but along the right bank there are a series of settlements in the forest free strip. South of the Volga is a fertile black earth area, between the Oka on the west, which forms the boundary of the province in the south-west, and then flows through the province of Vladimir, finally turning sharply to the east and flowing through the Nizhegorod province to its junction with the Volga, and the Sura on the east, which flows through the Chuvash Autonomous Socialist Soviet Republic in the south, but forms the boundary between that republic and the Nizhegorod province in the north of its course. This southern part has little forest and consists of high plains, with river valleys entrenching them, and the valley black earth is the most fertile soil in entire area of the province.

The southern part is not favourable to grass and meadow cultivation, so that dairying has not developed. Grain cultivation occupies 85% of the ploughed land, the chief crops being rye and

oats, with a little wheat, millet and buckwheat. Potatoes, flax and a little hemp are grown. Fruit and vegetables are cultivated along the Oka and Volga and find a ready market in Nizhniy-Novgorod. Sheep, cattle, horses, pigs and goats are reared. The province is sparsely peopled, especially in the north; the population is mainly Great Russian, though there are Mordvinian and Tatar colonies in the south-east. Bog iron ores, sand, salt and phosphorite are found. The province is rich in peat, and the electric station opened in 1925–26 at Balakhna, on the Volga, north of Nizhniy-Novgorod, works on peat fuel and has a power of 20,000 kilowatts. Factory industries include the making of machinery for railway and river transport, and for local peasant industries, flour-milling, distilling, saw-milling and the manufacture of cardboard and paper, brewing and the making of leather goods. The poor guarantee for agriculture has led to a great development of koustar (peasant) industry, especially the making of wooden articles (41%) and textiles, including woollen goods and felt (30%). Special peasant industries are wooden spoons in Semenov, cutlery and locks in Gorbatov, spindles in Balakhna, fancy boxes in Makaryev, and furs and leather goods.

NIZHNE-TAGILSK, popularly known as Tagil, a Russian town in the Uralsk area, in 57° 27′ N., 59° 54′ E. Pop. (1926) 38,828. It is situated in a valley on the eastern slope of the Ural Mountains, within a few miles of the place where the Tagil escapes to the lowlands to join the Tura, a tributary of the Tobol. The southern part of this valley is occupied by the upper Tagil, and its northern portion by the upper Tura, from which the Tagil is separated by a low watershed. The town is connected by railway (the first in Siberia) with Perm and Sverdlovsk, and with mines to the east and west. It was founded in 1725 by the Russian mine-owner Demidov. Nizhne-Tagilsk is a central foundry for iron-mines and other works. Gold, platinum and copper are mined at Nizhne-Tagilsk, and there is a brick-making industry. Wagon works with an output of 5,000 wagons per annum were under construction in 1928.

NIZHNIY NOVGOROD: *see* NIJNI NOVGOROD.

NOAH appears in Genesis v. 29 as son of Lamech and tenth in descent from Adam. The hazardous attempt of the verse to find an etymology for the name in the Hebrew verb "comfort" is an extract from another tradition, and views Noah as repairing in some measure by his discovery of vine-culture, Gen. ix. 20, the disaster of the curse pronounced upon the ground by Yahweh in consequence of the Fall. The story of the Deluge has Noah for its hero. He is represented as the patriarch who, because of his blameless piety, was chosen by God to perpetuate the human race after his wicked contemporaries had perished in the Flood. He receives a divine warning of the impending disaster, and is instructed to build an ark, in which he and his family are preserved alive. In accordance with God's instructions Noah took into the ark specimens of all animals, from which the stocks might be replenished. The story has close affinities with Babylonian traditions, in which Ut-napishtim plays the part corresponding to that of Noah (*see* DELUGE). The narrative of Gen. ix. 18–27 belongs to a different cycle, which seems to know nothing of the Flood story. In the latter Noah's sons are married, and their wives accompany them in the ark; but in this narrative they would seem to be unmarried, living in the tent with their father; nor does the shameless drunkenness of Noah accord well with the character of the pious hero of the Flood story. Three different motives may be traced in Gen. ix. 18–27: first the passage explains to whom agriculture, and in particular the culture of the vine, was due; secondly it attempts to provide in the persons of Noah's three sons, Shem, Ham and Japheth, ancestors for three of the races of mankind, and to account in some degree for their historic relations; in the third place, by its censure of Ham—for whom it is almost certain that Canaan stood in the original text—it reprobates the licentious Canaanite civilization.

(W. L. W.)

NOAILLES, the name of a great French family, derived from the castle of Noailles in the territory of Ayen, between Brive and Turenne in the Limousin, and claiming to date back to the 11th century. In the 16th century, its head, ANTOINE de Noailles (1504–1562), became admiral of France, and was ambassador in England during three important years, 1553–1556, maintaining a gallant but unsuccessful rivalry with the Spanish ambassador, Simon Renard. HENRI (1554–1623), son of Antoine, was a commander in the religious wars, and was made comte d'Ayen by Henry IV. in 1593. ANNE (d. 1678), the grandson of the first count, played an important part in the Fronde and the early years of the reign of Louis XIV., became captain-general of the newly won province of Roussillon, and in 1663 was made duc d'Ayen, and peer of France.

ADRIEN MAURICE (1678–1766), the third duke, served in the wars of Louis XV. in Italy and Germany, and became a marshal in 1734. In the war of the Austrian succession he was beaten by the English at the battle of Dettingen in 1743. He married Françoise d'Aubigné, a niece of Madame de Maintenon, and two of his sons became marshals of France. The elder, LOUIS (1713–1793), who bore the title of duc d'Ayen till his father's death in 1766, when he became duc de Noailles, served in most of the wars of the 18th century, and was made a marshal in 1775. He refused to emigrate during the Revolution and died in Aug. 1793, before the Terror reached its height. On the 4th Thermidor (July 22) the aged duchesse de Noailles was executed with her daughter-in-law, the duchesse d'Ayen, and her granddaughter, the vicomtesse de Noailles. JEAN PAUL FRANÇOIS (1739–1824), the fifth duke, was in the army, but his tastes were scientific, and for his eminence as a chemist he was elected a member of the Academy of Sciences in 1777. He became duc d'Ayen in 1766 on his grandfather's death, and duc de Noailles on his father's in 1793. He lived in Switzerland from 1792 until the Restoration in 1814, when he took his seat as a peer of France.

One other branch of the family deserves notice. PHILIPPE (1715–1794), comte de Noailles, afterwards duc de Mouchy, a younger brother of the fourth duke, served at Minden and in other campaigns, and was made a marshal on the same day as his brother. He was long in great favour at court, and his wife was first lady of honour to Marie Antoinette, and was nicknamed by her Madame Étiquette. This court favour brought down punishment in the days of the Revolution, and the old marshal and his wife were guillotined on June 27, 1794.

PHILIPPE LOUIS MARC ANTOINE, duke of Noailles and prince of Poix (1752–1819), was born on Nov. 21, 1752. In 1789 he was elected deputy of the States-General by the nobility of the *bailliages* of Amiens and Ham, but was compelled to resign in consequence of a duel with the commander of the Garde Nationale at Versailles. He left the country but returned and took part in the revolution of Aug. 10, 1792, after which he again escaped until 1800. At the Restoration he was brought again into favour and became a peer of France. He died at Paris on Feb. 17, 1819.

LOUIS MARIE (1756–1804), vicomte de Noailles, was the second son of the marshal. He served brilliantly under La Fayette in America, and concluded the capitulation of Yorktown. He was elected to the states-general in 1789. He began the famous "orgie," as Mirabeau called it, on Aug. 4, when all privileges were abolished, and with d'Aiguillon proposed the abolition of titles and liveries in June 1790. When the Revolution became more pronounced he emigrated to America. He accepted a command against the English in San Domingo, under Rochambeau. He made a brilliant defence of the mole St. Nicholas, and escaped with the garrison to Cuba; but in making for Havana his ship was attacked by an English frigate, and after a long engagement he was severely wounded, and died on Jan. 9, 1804.

NOAKHALI, a district and town of British India, in the Chittagong division of eastern Bengal and Assam, the town also known as Sudharam is on a small river channel 10 m. from the sea. The DISTRICT OF NOAKHALI has an area of 1,644 sq.m. It consists of an alluvial tract of mainland together with several islands at the mouth of the Meghna. In general, every homestead is surrounded by a thick grove of betel and coco-nut palms. Rice is the great staple of cultivation. The district is very fertile and is under continuous cultivation. The delta was swept by a storm wave on Oct. 31, 1876, and it is estimated that 100,000 lives were lost. The district is served by the Assam-Bengal railway.

NOBEL, ALFRED BERNHARD (1833–1896), Swedish chemist and engineer, was born at Stockholm on Oct. 21, 1833. On his return to Sweden after a stay in St. Petersburg he devoted himself to the study of explosives, and especially to nitroglycerin. He found that when that body was incorporated with an absorbent, inert substance like *kieselguhr* it became safer and more convenient to manipulate, and this mixture he patented in 1862 as dynamite. He next combined nitro-glycerin with another high explosive, gun-cotton, and obtained a transparent, jelly-like substance, which was a still more powerful explosive than dynamite. Blasting gelatin, as it was called, was patented in 1876. Some 13 years later Nobel produced ballistite, one of the earliest of the nitro-glycerin smokeless powders, and a precursor of cordite. Nobel's claim that his patent covered the latter was the occasion of vigorously contested lawsuits between him and the British Government in 1894 and 1895; the question was complicated, but eventually the courts decided against Nobel. From the manufacture of dynamite and other explosives, and from the exploitation of the Baku oil-fields, he amassed an immense fortune; at his death on Dec. 10, 1896 at San Remo, he left the bulk of it in trust for the establishment of five prizes (*see* below).

NOBEL PRIZES. These are awarded from the Nobel Foundation, a fund established under the will of A. B. Nobel (*q.v.*), who in his will directed that the interest of the bulk of his huge fortune should be "apportioned as follows: one share to the person who shall have made the most important discovery or invention in the domain of physics; one share to the person who shall have made the most important chemical discovery or improvement; one share to the person who shall have made the most important discovery in the domain of physiology or medicine; one share to the person who shall have produced in the field of literature the most distinguished work of an idealist tendency; and, finally, one share to the person who shall have most or best promoted the fraternity of nations and the abolition or diminution of standing armies and the formation and increase of peace congresses. The prizes for physics and chemistry shall be awarded by the Swedish academy of science in Stockholm; the one for physiology or medicine by the Caroline medical institute in Stockholm; the prize for literature by the academy in Stockholm and that for peace by a committee of five persons to be elected by the Norwegian Storting. I declare it to be my express desire that, in the awarding of prizes, no consideration whatever be paid to the nationality of the candidates."

As the will was drawn up by Nobel without legal aid, it was interpreted by a code of statutes, approved by the Swedish Government and consented to by the heirs. The distribution of prizes was begun on Dec. 10, 1901, the anniversary of Nobel's death. The amount of each prize varies with the income from the fund. In 1928 the amount was $42,060.

The statutes provide for the establishment of Nobel institutes, one for each of the five sections, and one-fourth of the amount which falls to each section from the main fund is deducted for its expenses before prize distribution is made.

Provision is made that any prize may be reserved for one year; if not then distributed, the amounts revert to the main fund, or special reserves for each section. The peace prize has been reserved most frequently and special Nobel institutes have been created from the surplus funds. Another provision is: "The amount allotted to one prize may be divided equally between two works submitted, should each of such works be deemed to merit a prize." In 1904 the peace prize was awarded to the Institute of International Law, which marked the beginning of bestowing a prize upon a society rather than an individual.

The only individual who has received prizes from more than one section is a woman, Mme. Marie Curie, who has received the prize both in physics and chemistry. The British and American prize winners since the establishment have been: *Physics*, British—Lord Rayleigh (1904), J. J. Thomson (1906), W. H. Bragg (1915), W. L. Bragg (1915), Charles G. Barkla (1917), C. T. R. Wilson (1927); American—A. A. Michelson (1907), R. A. Millikan (1923), A. Compton (1927). *Chemistry*, British—Sir Wm. Ramsay (1904), Sir E. Rutherford (1908), F. Soddy (1921), F. W. Aston (1922); American—T. W. Richards (1914). *Medicine*, British—Sir Ronald Ross (1902), A. V. Hill (1922), F. G. Banting and J. J. R. McLeod (Canada, 1923); American—A. Carrel (1912). *Literature*, British—R. Kipling (1907), Rabindranath Tagore (Indian, 1913), W. B. Yeats (Irish, 1923), G. Bernard Shaw (1925); American—none. *Peace*, British—Sir W. R. Cremer (1903), Sir A. Chamberlain (1925); American—T. Roosevelt (1906), Elihu Root (1912), Woodrow Wilson (1919), C. G. Dawes (1925). The awards announced in Dec. 1928 were: in physics, award reserved; in chemistry the award reserved from 1927 to Heinrich Wieland, for 1928 to Adolf Windaus; in medicine to Dr. Charles Nicolle of the Pasteur institute; in literature for 1927, Henri Bergson, and for 1928, Sigrid Undset; the peace prize for 1928 was reserved.

See *Nobelstiftelsen, The Nobel Foundation Code of Statutes* (Stockholm, 1901); A. R. Marble, *The Nobel Prize-winners in Literature* (1925).

NOBILE, UMBERTO (1885–), Italian explorer, was born at Avellino. He was educated at the Naples Polytechnic, and became an engineer. Later he obtained a post in the railway department of the ministry of public works in Rome. As a result of plans for airship construction made by him, he was given a post in the war ministry, and was entrusted with the construction of the airship "Roma," with the assistance of Uselli. His airship, the "Norge," was used for the flight with Amundsen to the Pole, in May 1926, when a landing was made at Teller, Alaska. Nobile was promoted to the rank of general, was made a marquis and appointed a professor at the Naples Technical College. A controversy subsequently arose both with Lincoln Ellsworth and Amundsen with reference to the credit for leadership of the expedition. In May 1928 Nobile set out on a second expedition to the North Pole, in the airship "Italia," but shortly after passing over the Pole on May 24, 1928, the airship crashed on the ice (May 25). The gondola and main cabin were smashed, and the 10 men in them thrown out on the ice. Seven of the party were carried away with the balloon, and were never traced. On May 30, three of the party, Malmgren, Mariano and Zappi, set out on foot, hoping to reach Cape North. After their departure on June 9, the remainder of the expedition managed to establish wireless communications with rescue parties, and on June 23 Nobile was rescued by an aeroplane belonging to the Swedish expedition. The six men remaining with the party were rescued. Mariano and Zappi were located on July 12, by the Russian airman Tchuknovsky. Malmgren (*q.v.*) died near Brock Island.

Nobile was found responsible for the loss of the "Italia" by an Italian Commission of Enquiry in 1929 and resigned his rank in consequence.

NOBLE, SIR ANDREW, 1ST BART., cr. 1902 (1832–1915), British physicist and artillerist, was born at Greenock on Sept. 15, 1832, and was educated at Edinburgh Academy and at the Royal Military Academy, Woolwich. In 1849 he entered the Royal Artillery, attaining the rank of captain in 1855, and in 1857 became secretary to the Royal Artillery Institution. About this time the question of the supersession of the old smooth-bores by rifled guns was coming to the fore, and on the appointment of the select committee on rifled cannon in 1858 to report on the matter, he was chosen its secretary. He devised an ingenious method for comparing the probable accuracy of the shooting attainable with each type of gun. In 1859 he was appointed assistant-inspector of artillery, and in the following year he became a member of the ordnance select committee and of the committee on explosives, serving on the latter until its dissolution 20 years later. About the same time he was prevailed upon by Sir William, afterwards Lord, Armstrong to leave the public service and take up a post at Elswick. Here he became chairman of the company. About 1862 he invented his chronoscope for the measurement of exceedingly small intervals of time, and began to apply it in ballistic experiments for ascertaining the velocity with which the shot moves along the barrel of a gun with different powders and different charges. Then he joined Sir Frederick Abel in a classical research on "fired gunpowder," the experimental work being largely carried on at Elswick. The conclusions they reached

had a great effect on the progress of gunnery, for they showed creased pressures in the gun. Noble advocated nitro or "smokeless" powders, and the Elswick works provided facilities, which were not offered by the Government, for the necessary experimental work of the committee on cordite. Noble was the recipient of many honours. His scientific papers were collected as *Artillery and Explosives* (1906). He died in Argyllshire on Oct. 22, 1915.

NOCERA INFERIORE, formerly NOCERA DEI PAGANI (anc. city *Nuceria Alfaterna,* town and episcopal see, Campania, Italy, province of Salerno, at the foot of Monte Albino, 23 m. E.S.E. of Naples by rail, 135 ft. above sea-level. Pop. (1921) 22,504 (town); 24,404 (commune). In the old castle Helena, widow of Manfred, died after the battle of Benevento. Two miles east near the village of Nocera Superiore is the circular domed church of Sta Maria Maggiore, dating from the 4th century.

The city early became an episcopal see, and in the 12th century it sided with Innocent II. against Roger of Sicily, suffering severely for its choice. A colony of Saracens introduced by Frederick II. probably gave rise to the epithet ("of the pagans"), as well as to the town of Pagani, about 1 m. west.

NOCTILUCA, the organism which is the main and most usual cause of the "phosphorescence" of the sea. *Noctiluca* is a protozoan reaching a length of a millimetre, *i.e.*, it may be visible to the naked eye. (*See* PROTOZOA; PHOSPHORESCENCE, ANIMAL.)

NOCTURN or **NOCTURNE,** in music a term meaning "night-piece," a dreamy, soft, musical composition. The name is almost inseparably connected with John Field (*q.v.*), who invented this form, although Chopin is also well-known as a nocturne-writer. The nocturne is usually associated with the pianoforte, especially in Northern Europe. The underlying idea of this type of composition is that the mood becomes of a more melancholy nature, as though to present definitely the vision of night. "Notturno" (Italian) was used originally as a term for a type of serenade (*q.v.*). This was employed with signal success by Mozart in his three-movement opus for strings and two horns.

In the form "nocturn" the word is used as a form of *Nocturnae* or Watches of the night. On Sundays there are three nocturns; the first contains 12 psalms and the two others contain three psalms each. A lesson is read at the end of each nocturn and each lesson is divided into three portions.

NODDY, the name applied to a sea-bird, *Anous stolidus,* one of the Terns (*q.v.*), from its showing so little fear of man as to be accounted stupid. It is heavier in flight than most terns, with shorter wings and less forked tail. The plumage is of a uniform sooty hue, except the light grey crown of the head. The noddy is very generally distributed throughout tropical and sub-tropical oceans. It breeds in astounding numbers, on low cays and coral-islets, making a nest composed of sea-weed or small twigs. Other birds of the same genus are: the darker Pacific noddy (*A. s. sidgwayi*), the still darker Galapagos noddy (*A. s. galapagoensis*) and the white-headed noddy (*A. leucocapillus*). There is also the white noddy (*Gygis alba*).

See J. B. Watson in *Papers from the Tortugas Laboratory,* No. 8.

NODE [Lat. *nodus,* a loop], in astronomy, one of two opposite points at which a heavenly body passes through the principal co-ordinate plane to which its motion is referred. In the case of the heavenly bodies this plane is commonly that of the ecliptic, but, in special cases, the plane through the origin parallel to the earth's equator or the plane of a planet's orbit is used. The ascending node is that at which the body moves from the south or negative towards the north or positive side of the plane. The moon's nodes are the points in which its path intercepts the plane of the ecliptic. In the geometry of curves, a node is the name given to the loop formed by a continuous curve crossing itself, the point of crossing is termed a "double point," and at it there are two non-coincident tangents to the curve; the remaining species of double points, termed "acnode," "spinode" or "cusp," admits of two coincident tangents (*see* CURVE).

NODIER, CHARLES (1780–1844), French author, was born at Besançon. His father, on the outbreak of the Revolution, was appointed mayor of Besançon and Charles is said to have been a member of the Jacobin club when he could not have been more than 12 years old. He was sent to Strasbourg, where he lived in the house of Eulogius Schneider, the notorious Jacobin governor of Alsace, but a good Greek scholar. He became librarian in his native town, but his exertions in the cause of suspected persons brought him under suspicion. For a skit on Napoleon, in 1803, he was imprisoned for some months. He then lived a very unsettled life at Besançon, Dôle, where he married, and in other places in the Jura. During these wanderings he wrote *Le Peintre de Salzbourg, journal des émotions d'un coeur souffrant, suivi des Méditations du cloître* (1803). He continued to lead an unsettled life until in 1824 he was appointed to the librarianship of the Bibliothèque de l'Arsenal. He was elected a member of the Academy in 1833, and died on Jan. 27, 1844. During his 20 years at the arsenal he was able to supply a centre and rallying place to a knot of young literary men of greater individual talent than himself—the so-called Romanticists of 1830—and to colour their tastes and work very decidedly with his own predilections. Victor Hugo, Alfred de Musset and Sainte-Beuve all acknowledged their obligations to him. He was a passionate admirer of Goethe and of Shakespeare. The best examples of his work are to be found in the volume entitled *Mélanges tirés d'une petite bibliothèque.*

His *Description raisonnée d'une jolie collection de livres* (1844), which is a catalogue of the books in his library, contains a life by Francis Wey and a complete bibliography of his numerous works. *See* also Sainte-Beuve, *Portraits littéraires,* vol. ii.; G. Brandes, *Main Currents in 19th Century Literature* (1871); Prosper Mérimée, *Portraits historiques et littéraires* (1874); A. Estignard, *Correspondence inédite de Charles Nodier, 1796–1844* (1876); J. Larat, *Bibliographie critique des oeuvres de Charles Nodier, 1780–1844* (1923); and *La Tradition et l'exotisme dans l'oeuvre de Charles Nodier* (1925); J. Vodoz, *La Fée aux Miettes, Essai sur le rôle du subconscient dans l'oeuvre de Charles Nodier* (1925).

NŌ DRAMA. In Japan in the beginning of the 15th century, the *Saru-gaku* (lit. "monkey music," consisting of juggling feats and comic remarks with actions to suit) of Yamato province was revolutionized by Kan-nami Kiyotsugu and his son Se-ami Motokiyo, and what is now known as *nō-gaku,* or *nō* music or drama resulted. Not only did these two geniuses, under the encouraging patronage of the Shogun Yoshimasa, build on what was best in their own *Saru-gaku,* but they drew freely from *Den-gaku* (lit. "rice-field music") which had much in common with the *Saru-gaku.* What was graceful in them was ennobled to profundity in the *nō,* while their comical elements developed into *kyogen* (comic performance) usually given in conjunction with the *nō.*

The *nō-gaku* constituted the principal form of entertainment among aristocrats and the warrior class in the feudal Japan. It was sometimes given in the presence of the emperors, and there prevailed a custom for a time to invite the common people to the performances given in commemoration of some happy events by the Tokugawa Shoguns, who used the *nō* on all ceremonial occasions.

Staging.—The *nō* is performed on a wooden stage built above the ground, the regular size of which now is 18 ft. square, open on three sides, with a narrow extension on one side for the singers, and another on the back of the stage for the musicians and attendants. To that rear extension is attached aslant a passage called *hashigakari* (a bridge). The players appear from under the curtain at the one end of which the passage slightly slopes down. The stage, too, is very slightly tilted to the front. For acoustic purposes, big ceramic jars are placed, generally seven under the stage and two or more under the passage according to its length. Three pine saplings are planted at intervals along the front of the bridge. The wooden wall called *kagami-ita* (mirror board) on the back of the rear extension, forming a background to the stage, is always decorated with a painting of a pine tree, and the narrow panel adjoining it on the side with that of bamboo. These paintings, together with the saplings, may be taken to indicate that originally the *nō* was performed in the woods.

Character of the Nō Pieces.—The *nō* pieces, which number more than 250, are classified into five groups for convenience: (1) *waki-nō* (pieces in which *waki,* the secondary character,



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CHARACTERS IN THE NO DRAMA

1. Celestial being in dancing costume; in *Hagoromo*. Hōshō school
2. Hanako looking at her lover's keepsake; throwing the dress off one shoulder in this instance signifies insanity; in *Hanjo*. Hōshō
3. The ghost of a daughter of the well, dancing in the form of Narihira, her lover; in *Izutsu*. Hōshō
4. The ghost of Rokujo-no-Miyasudokoro, as conceived by Aoinouye; in *Aoinouye*. Hōshō
5. A god being pleased with the filial son of a wood chopper, who is rewarded by the Emperor; in *Yōrō*. Kita school
6. Geni of Atago Mountain and saintly priest of Sagano engaged in discourse; in *Kurumazō*. Hōshō
7. Mother praying for the spirit of her dead son, in *Sumita-gawa*. Kita school
8. Tomonori's ghost attacking his living enemy; in *Funabenkei*. Hōshō
9. Soga brothers about to set out to avenge their father; in *Youchi Soga*. Hōshō
10. Atsumori's ghost narrating the fate of his clan; in *Atsumori*. Hōshō
11. The god Inari assisting at the forging of a sword; in *Kokaji*. Hōshō









BY COURTESY OF JIRO HARADA

SCENES FROM THE NO DRAMA

1. Soga brothers taking leave of their mother before setting out to avenge their father; in *Kosode Soga*. On the Hōshō stage
2. Out in a boat to scare away birds from rice fields; in *Tori Oi*. Hōshō school
3. Benkei and Ushiwaka on the Gojō bridge in Kyoto; in *Hashi Benkei*. Hōshō school
4. Two brothers discussing Buddhistic principles with their enemy; in *Hōkazō*. Kongō school

MASKS WORN IN THE NO PERFORMANCES

1. "Okina" used by the principal character in *Okina*. Hōshō
2. "Magojiro" used by a young woman character. Kongo family in Kyoto
3. "Sanko" used for elderly man of common class. Kongo
4. "Daiakujō" used for an elderly man of fierce character. Marquis Maeda's collection
5. "Zō" used for young woman. Marquis Maeda's collection
6. "Hannya" for woman demon. Marquis Maeda's collection
7. "Yamamba" used by the heroine in *Yamamba*. Marquis Maeda's collection

assumes preponderance in the play) generally dealing with Shinto or Buddhist deities; (2) *Shura-mono,* which commonly deals with ghosts of warriors; (3) *Kazura-mono,* with noble ladies acting the main parts; (4) *Genzai-mono,* or present-day piece, dealing with love, insanity and other manifestations of human nature; (5) pieces dealing with demons or goblins as subjects, or those of congratulatory nature with gay and joyous elements. For each programme of *nō* performance, which generally lasts a whole day, one from each of the above-mentioned five classes is given in the order mentioned, with a *kyogen* between each and generally a dance in an ordinary dress in addition. The whole programme is preceded by a piece called "Okina," which is held in special reverence, the person acting its chief character, Okina, symbolizing the radiant sun-goddess.

Construction of Nō Pieces.—The construction of the *nō* piece, though by no means uniform, is generally as follows. A *waki* (the secondary *rôle*), generally a monk or a minister of State, first appears and tells who he is. Then he walks a while, singing, suggesting that he is travelling. Coming to a standstill, he announces his arrival at a certain famous spot and takes his place by the post at the front right-hand corner facing the stage. Then the *maye jite* (the principal character in the first appearance) comes in the form of a farmer, fisherman or priest, etc., describing the scenery of the place, or speaking to *waki* resting at the post. The *waki* questions him, and the *maye jite* gives an historical account of the place and of heroes connected with it, or relates the origin of the temple or shrine as the case may require, thus furnishing the audience with a necessary background to the play. The *maye jite* then retires in a hurry. He was in reality no other than a Shinto or Buddhist deity, or a ghost of a warrior, in disguise. While *waki* is startled by the sudden disappearance, there come to the stage common farmers or wood-choppers and give in plain language, spoken more or less in the ordinary way, all detailed information concerning the place, generally reiterating what was already given in intonation, and retire. This allows a necessary time for the principal character to change for reappearance. While waiting, the *waki* sings, indicating a lapse of time. When it comes to an end, the *nochi jite* (the principal character in the latter appearance) in proper form and attire as a Shinto or Buddhist deity, or a spirit of a hero, comes to the stage and dances as if in a night stroll, revealing some spiritual attributes. In words and in action he recounts his bravery, his death struggle, or his suffering in the underworld, asking for the prayer of the *waki* for the peaceful repose of his soul. The *shite* tells his story as he performs, or he merely dances without any intonation. Generally there is a chorus who intonate either alone or with the performers.

Music and Accessories.—Generally several persons sitting on the side extension sing either in chorus, by themselves, or together with the performer. The musicians on the rear extension consist ordinarily of a player each on the transverse flute, the *tsuzumi* (small drum struck with tips of fingers over the shoulder), the *ōkawa* (a slightly larger drum struck on the knee also with tips of fingers) and the drum beaten with two sticks.

The accessories used on the stage in connection with the play are very simple. A fan is much in evidence in the dance (*see* FANS), the studied use of which is very effective with the manipulation of big sleeves. Costumes used in the *nō* are marvels of textile fabrics, refined taste being revealed in bold yet harmonious designs and colours. Above all, the mask to be worn by the principal character (*shite*) and the assistant (*shite-zure*) is a very important part of the *nō* performance (*see* MASKS). There have been great masters among carvers of *nō* masks in the feudal Japan whose works still remain in a large number.

Main Schools.—Ever since the great reformation at the beginning of the 15th century, the *nō* has had four main acknowledged schools or houses: Kwanze, Komparu, Hōshō and Kongō, all of which are still thriving. Later, another school, Kita won official recognition, while still another, Umewaka, also has many followers, the variation upheld by each school being but slight. On the whole, the *nō* performance may well be compared to a masterful oriental picture in black monochrome, both being guided by highly idealistic aims and with artistic aspirations with many points in common, possessing alike great impelling qualities that thrill the devotee and weary the uninitiated. It has greatly influenced the Japanese stage and ordinary forms of dance known as *mai,* or *odori,* and it is bound to continue to do so. (*See* THEATRE; JAPANESE ART; PANTOMIME.)

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(J. HAR.)

NOEGGERATH, JOHANN JACOB (1788–1877), German mineralogist and geologist, was born at Bonn on Oct. 10, 1788. In 1814–15 he became commissioner of mines for some of the Rhine Provinces, and in 1818 professor of mineralogy and afterwards professor of geology, director of the museum of natural history and chief of the mining department in the university at Bonn. He obtained a very fine collection of minerals for the museum and achieved a wide reputation among mining engineers. The Carboniferous plant *Noeggerathia,* allied to the *Zamias* and cycads, was named after him. He died at Bonn on Sept. 13, 1877.

The following are his more important publications: *Über aufrecht im Gebirgsgestein eingeschlossene fossile Baumstämme und andere Vegetabilien* (1819–21); *Das Gebirge in Rheinland-Westphalen, nach mineralogischem und chemischem Bezuge* (4 vols., 1822–26); *Die Entstehung der Erde* (1843); and *Der Laacher See und seine vulkanischen Umgebungen* (1870).

NOEL, RODEN BERKELEY WRIOTHESLEY (1834–1894), English poet, son of Noel, Lord Barham, afterwards earl of Gainsborough, was born on Aug. 27, 1834. He was educated at Trinity college, Cambridge, and spent two years in the East. His works include *A Little Child's Monument* (1881), *Behind the Veil, and other Poems* (1863), *Beatrice, and other Poems* (1868), *The Red Flag* (1872), *Livingstone in Africa* (1874), *Songs of the Heights and Deeps* (1885), *A Modern Faust, and other Poems* (1888), *Poor People's Christmas* (1890) and *My Sea, and other Poems* (1896). Roden Noel's versification was unequal and sometimes harsh, but he has a genuine feeling for nature, and the work is permeated by philosophic thought. He died at Mainz, on May 26, 1894.

His *Collected Poems* were edited (1902) by his sister, Victoria Buxton, with a notice by J. Addington Symonds.

NOGALES, a city on the southern boundary of Arizona, U.S.A., adjoining Nogales, Mexico (*q.v.*); a port of entry, headquarters of the Arizona customs district, and the county seat of Santa Cruz county. It is the southern terminus of Federal highway 89, and is served by the Southern Pacific railroad. The population was 5,199 in 1920 (49% foreign-born white) and was estimated locally at 6,500 in 1928. The international boundary is a barbed-wire fence down the middle of the main street of the two cities. Nogales has an altitude of 3,869 ft., and is surrounded by the Patagonia mountains, and is the site of Camp Stephen D. Little, an infantry post. The commerce of the customs district with Mexico in 1927 amounted to $25,057,175 (58% imports). Stock-raising and mining (lead, silver and copper) are the leading occupations of the region. The old Spanish mission of Tumacacori is 18 m. N. In 1880 Nogales was a trading post. In 1893 it was incorporated as a town, and in 1919 as a city.

NOGARET, GUILLAUME DE (d. 1313), councillor and keeper of the seal to Philip IV. of France, was born between 1260 and 1270, the son of a citizen of Toulouse. The family took its name from a small property near Saint Félix de Caramon. In 1291 Guillaume was professor of jurisprudence at the University of Montpellier, and in 1296 became a member of the Curia Regis at Paris. His name is connected with Philip IV.'s quarrel with Pope Boniface VIII. (*q.v.*), to whom Nogaret was sent with an embassy in 1300. In Feb. 1303 Nogaret persuaded Philip to agree to a plan to seize Boniface and bring him to a council in France which should depose him. Nogaret went to Italy, and captured Boniface, with the help of Sciarra Colonna, but was eventually defeated by a rising of the townsmen of Anagni. The pope's death at Rome, on Oct. 11, saved Nogaret. The election of the timid Benedict XI. was the beginning of that triumph of France which

lasted through the Avignon captivity. Early in 1304 Nogaret was sent by Philip to demand from Benedict XI. absolution for the enemies of Boniface VIII. Benedict refused to receive Nogaret, and he was excepted from the general absolution of May 13, 1304, and issued against him and his associates the bull *Flagitiosum scelus*. A Frenchman, Bernard de Got (Clement V.) was elected pope on Benedict's death in 1304. The threat of proceedings against the memory of Boniface had forced Clement to absolve Nogaret. When Philip proposed an enquiry into the condition of the Templars as a preliminary to their arrest and the seizure of their property, Nogaret persuaded the renegade members to give evidence against their fellows. Clement's ineffective resistance still further delayed an agreement with Philip. Nogaret became keeper of the seal in 1307, and his talents as *advocatus diaboli* had further scope in the trial (1308–13) of Guichard, bishop of Troyes, charged with crimes which included witchcraft and incontinence. Clement feared similar proceedings against Boniface, and gave Nogaret absolution on April 27, 1311.

See E. Renan in *Histoire littéraire de la France*, xxvii. 233; R. Holzmann, *Wilhelm von Nogaret* (Freiburg, 1898). For the sources consult Dom Bouquet, *Recueil de historiens des Gaules et de la France*, vols. xx.–xxiii.; *Annales regis Edwardi primi* in Rishanger ("Rolls" series), pp. 483–491, which gives the fullest account of the affair at Anagni.

NOGENT-SUR-MARNE, a suburb 11 kilometres east of Notre Dame de Paris, in the department of Seine, on a hill on the right bank of the Marne. Pop. (1926) 19,331. The Eastern railway here crosses the Marne valley by a viaduct 875 yd. in length. Nogent has a Gothic church, with a tower of the Romanesque period, in front of which there is a monument to Watteau, who died here in 1721. Chemical products are manufactured. The fine situation of the town gained it the name of Beauté, and Charles V. built a château here (demolished in the 18th century) which was presented by Charles VII. to Agnes Sorel with the title of Dame de Beauté. An island in the Marne to the south of the town is still known as the Île de Beauté. The increase of population here in recent years is very notable.

NOGUCHI, HIDEYO (1876–1928), Japanese bacteriologist, was born in Inawashiro, Yama, Fukushima, Japan, Nov. 24, 1876. He received the degree of M.D. in 1897 from the Tokyo Medical college and subsequently did post-graduate work in the United States and Europe, becoming connected with the Rockefeller Institute for Medical Research in New York in 1904. He was the first to obtain pure cultures of the spirochaete of syphilis and to establish the syphilitic nature of general paralysis and *tabes dorsalis* by demonstrating the organism in the cells of the central nervous system of persons dying of these diseases. He did considerable work on the analysis of the Wassermann reaction for the diagnosis of syphilis and devised a skin test for syphilis and a method for the detection of syphilitic and other pathological conditions in the spinal fluid. One of the first to recognize the germicidal properties of certain compounds of unsaturated fatty acids for acid-fast micro-organisms, *e.g.*, the tubercle bacillus, he discovered the parasite of yellow fever in 1918 and prepared a prophylactic vaccine and a curative serum for combating this disease. He also isolated the parasite of Oroya fever and *Verruga peruviana*. During his investigations he contracted yellow fever and died in British West Africa on May 21, 1928.

His published works include *Snake Venoms* (1909), *Serum Diagnosis of Syphilis and Luetin Reaction* (1910) and *Laboratory Diagnosis of Syphilis* (1923).

NOISE AND ITS CONTROL. No rigid definition of noise is possible. By analogy with "dirt," it has been called "sound out of place," and it is usually a medley of individual sounds. For measuring noise the instrument most widely used, especially in America, is the audiometer devised by the Bell Telephone Laboratories, in which the noise is matched in the observer's ear against a standard noise produced by the instrument. In England measurements have been made with an electric audiometer invented by Mr. A. M. Low. "Noise units" have been used to express such measurements but most of these are of comparative value only. For scientific purposes the units should be purely physical; for example, to dynes per square centimeter.

A comprehensive survey of the intensity and sources of city noise was made in 1925 and 1926 in New York city. Partial surveys have been made in London, Chicago, Boston, Washington and other cities. The noisiest normal street corner so far discovered anywhere in the world is the corner of Sixth avenue and Thirty-Fourth street in New York city; an intersection of three main highways, three surface car lines and a double-track line of the elevated railway. At this corner the noise intensity is sufficient to make the normal individual about two-thirds deaf. Noise intensity in exceptional places, like railway subways or noisy factories, may be twice or three times greater than this. On the average busy street of an American city the day-time noise is sufficient to render the normal individual one-fourth to one-third deaf. The ebb and flow of noise from hour to hour during the 24-hour day parallels precisely the increase and decrease of vehicular traffic on the streets. In physical units the New York city street noise was found to vary between 0·001 dynes per square centimeter and 20 dynes, averaging about 5 dynes.

Approximately 40% of the noise could be traced to the automobile trucks used for commercial deliveries; 25% to the elevated railway, and 20% to the surface cars. The remaining 15% was supplied by private automobiles, taxicabs, automobile horns, horse-drawn vehicles, riveting and excavating machines, alarm signals of the fire and police departments and other occasional noise-producers. At no place on city streets do human speech and human feet make measurable contributions to the noise. At windows street noise decreases with height, but much less so than would be expected from the physical law of attenuation of sounds in the open air, the discrepancy being due to reflection of the noise between the buildings on the two sides of the street.

The usual assumption that noise is harmful to man is by no means proved. Noise is known to affect the human heart beat as well as the rate at which heat energy is set free in the human body, but the details of these effects have not been studied. Most individuals accustom themselves to living or working in noisy surroundings and only nervous individuals who fail to make this adjustment suffer harmful effects. It has been urged that the greater use of bodily energy in noisy surroundings may cause bodily ills. Searching investigations of these problems are now (1929) under way in several American laboratories of psychology. Contrary to the usual opinion, there is no dependable evidence that life or work in noisy places decreases the acuteness of hearing, except during the first few minutes after the noise ceases.

Much noise could be prevented by denying use of the streets to vehicles improperly cared for, and which rattle or squeak, especially automobile trucks; also by preventing loose, rattling parts on surface cars and by removing loose or wide crossings in the rails of street railways and by restricting the blowing of horns. It is possible that the average street noise of a city could be reduced at least one half by adequate enforcement of such regulations. The construction of noise-proof rooms or noise-proof houses is possible on well-known principles of architectural acoustics but is too expensive for general use. (E. E. F.)

Law.—In law noise may be defined as an excessive, offensive, persistent or startling sound. By the common law of England freedom from noise is essential to the full enjoyment of a dwelling house, and acts which affect that enjoyment may be actionable as nuisances. But it has been laid down that a nuisance by noise, supposing malice to be out of the question, is emphatically a question of degree (*Gaunt* v. *Finney*, 1872, 8 Ch. Ap. 8). The noise must be exceptional and unreasonable. The ringing of bells, building operations, vibration of machinery, fireworks, bands, a circus, merry-go-rounds, collecting disorderly crowds, dancing, singing, etc., have been held under certain circumstances to constitute nuisances so as to interfere with quiet and comfort, and have been restrained by injunction. Noise occasioned by the frequent repetition of street cries is frequently the subject of local by-laws, which impose penalties for infringement.

NOLA, an ancient city and see of Campania, Italy, province of Naples, pleasantly situated in the plain between Mount Vesuvius and Apennines, 16¼ m. E.N.E. of Naples by rail, 121 ft. above sea-level. Pop. (1921) 8,333 (town); 15,672 (commune). There is an ancient Gothic cathedral with its lofty tower. July

26 is devoted to a great festival in honour of St. Paulinus (*q.v.*). The church erected by him in honour of St. Felix in the 4th century is extant in part. Giordano Bruno (*q.v.*) was born at Nola in 1548. The Etruscans were in Nola about 500 B.C. They helped Neapolis against the Roman invasion (328 B.C.). The Romans made themselves masters of it in 313 B.C. In the Social War it was betrayed into the hands of the Samnites. Sulla in 80 B.C. subjected it with the rest of Samnium. Seven years later it was stormed by Spartacus. Nola became a Roman colony under Augustus, who died there. It was sacked by Genseric in 455, by the Saracens in 806 and 904, captured by Manfred in the 13th century, and damaged by earthquakes in the 15th and 16th.

Nola lay on the Via Popillia from Capua to Nuceria and the south, and a branch road ran from it to Abella and Abellinum. While independent it issued an important series of coins, and in luxury it vied with Capua. Its territory was very fertile. A large number of vases of Greek style were manufactured here of pale yellow clay with shining black glaze, decorated with skilfully drawn red figures. Of the ancient city, numerous ruins, an amphitheatre, still recognizable, a theatre, a temple of Augustus, etc., existed in the 16th century. The neighbourhood was divided into pagi or villages, the names of some of which are preserved to us (Pagus Agrifanus, Capriculanus, Lanitanus). (T. A.)

NÖLDEKE, THEODOR (1836–), German Semitic scholar, was born at Harburg on March 2, 1836, and studied at Göttingen, Vienna, Leyden and Berlin. In 1859 his history of the Koran won for him the prize of the French Académie des Inscriptions, and he rewrote it in German with additions (*Geschichte des Korans,* Göttingen, 1860). He has taught at Göttingen (1861), Kiel (1868) and Strassburg (1872). In the main his work deals with Semitic languages, and the history and civilization of Islam.

Among his best-known works are: *Das Leben Mohammeds* (1863); *Beiträge zur Kenntnis der Poesie der alten Araber* (1864); *Die alttestamentliche Literatur* (1868); *Untersuchungen zur Kritik des Alten Testaments* (1869); *Zur Grammatik des klassischen Arabisch* (1896); *Fünf Mo'allaqat, übersetzt und erklärt* (1899–1901); *Beiträge zur semitischen Sprachwissenschaft* (1904); *Neue Beiträge zur semitischen Sprachwissenschaft* (1910). In the *Encyclopædia Britannica,* he wrote on Persia, the Koran and other subjects.

NOLLEKENS, JOSEPH (1737–1823) British sculptor, was born on Aug. 11, 1737, in Dean Street, Soho, London, where his father, a native of Antwerp, the "old Nollekens" of Horace Walpole, was a painter of some repute. In his thirteenth year he entered the studio of the sculptor Peter Scheemakers for drawing and modelling. In 1760 he went to Rome, and his marble bas-relief, "Timoclea before Alexander," brought him a prize of fifty guineas from the Society of Arts in 1762. Garrick and Sterne were among the first English visitors who sat to him for busts; another important piece belonging to this early period is the "Mercury and Venus chiding Cupid." On his return to England he became an associate of the Royal Academy (1771), and in 1772 a member. By this time he had become known to George III., whose bust he shortly afterwards executed, and henceforward, until about 1816, he was the most fashionable portrait sculptor of his day. He himself thought highly of his early portrait of Sterne. Others were those of Pitt, Fox, the prince of Wales (afterwards George IV.), Canning, Perceval, Benjamin West and Lords Castlereagh, Aberdeen, Erskine, Egremont and Liverpool. Among his numerous marble groups and statues are the "Bacchus," "Venus taking off her Sandal," "Hope leaning on an Urn," and (his own favourite performance) "Venus anointing Herself." His work is remarkable for delicacy of workmanship, but deficient in vigour and originality. A later characteristic of Nollekens was his miserliness. He died in London on April 23, 1823, leaving a large fortune.

NOLLE PROSEQUI, a term of English law now only used of a stay of proceedings by indictment or by information entered by the attorney general. The *nolle prosequi* is a matter purely for his discretion, and will not be granted unless very good ground be shown for his interference. The object of it generally is to obtain a stay of proceedings against an accomplice in order to procure his evidence. This object is, however, more usually effected by the prosecution offering no evidence and the judge directing an acquittal.

In the United States the attorney general has not always the same discretion with which English law invests him. Although in some States the prosecuting officer may enter a *nolle prosequi* at his discretion, in others the leave of the court must be obtained.

NOMADS, "wanderers," primitive pastoral people who have no settled territory.

Nomads seem to exist in every large territory. Some, like the gypsies (*q.v.*), becoming international. There are Asiatic nomads of all types, the chief being the Mongols whose nomadism became highly specialized. The Basques (*q.v.*) are generally supposed to have been nomads from a remote corner of Asia and the report that shifting colonies of *Euskera* stock are to this day found in South America supports this view.

Northern Asia is the wide home of numerous wandering tribes whose very names have only recently been recorded. These tribes have a definite relation with the settled peoples over whose territory they roam, as is the case with the African nomads (*see* below). Indo-China (*q.v.*), has its nomad peoples, and South-west China is an area over which several nomad stocks wander. The change from nomadism to a settled state of occupation in well-defined areas is rare but not unknown.

Nomads proper are those who roam over different territories in actual quest of sustenance; as the name implies, they are pastoral people depending on grazing for their animals and edible roots and fruits for themselves. (*See* BUSHMEN.) These nomads have extraordinary powers of adaptability and can support long periods of hunger. The Australian aborigines are sufficiently skilled in woodcraft to trap animals by simply stealing upon them quietly and using the most primitive weapons. The pampas Indians are horseback nomads and wander to and fro over large tracts of territory.

The Bedawin (Bedouins) or Arabs of the desert are among the most familiar of all pastoral nomads, and their nomadism has no known beginning. In times of drought and food shortage such nomads as these and the Hottentots (*q.v.*), are compelled to raid their agricultural settled neighbours. The Kirghiz, an Altai people, are the prominent nomads of Central Asia and their ballads tell of their love of wandering and their passion for their horses, their only tangible possessions.

In recent years much attention has been directed to the nomads of East Africa, as it is believed that from these sprang the original individual peoples of Africa. Some of these nomads are pygmies.

It is probable that at one time they all spoke a distinct language and that many still preserve their own language, while using the language of the tribes among whom they reside. The pygmies of the upper Welle speak the Mbuba language in a manner markedly different from the Mbuba pronunciation, substituting for certain consonants a curious gasp or hiatus almost approximating to a click. The Sanya of north-east Kenya and certain of the Watta are also said to use clicks. The Sandawe (*q.v.*) of Tanganyika Territory, whose skulls possess distinctly Hottentot characters, retain the typical Bushman clicks and gutturals. Rarely has the tribal name been ascertained, the different nomadic groups being called by the names bestowed on them by neighbouring tribes, but the persistence of some of these appellations is remarkable. Some form of the name Twa is widespread among the Bantu: thus the Bushmen of South Africa are known to their neighbours as Abatoa and Batwa is common throughout the Congo and Uganda. The word is said to mean "Bushdwellers," and is probably unconnected with the Watta of southern Abyssinia which is derived from an old Cushitic root meaning "Wanderers." Aka is a name, given to geographically distinct groups of nomads.

In the mountainous forest country of south-west Uganda we find semi-pygmy hunters known as Batwa, and the name reappears on the upper slopes of mount Elgon at an altitude of from 9,000–11,000ft., where they build earth-roofed huts and live principally on rats, other small mammals and honey.

The Sanya and Chonl, hunting tribes living on the banks of the Sabaki and the Tana in Kenya, are also known as Watta to the Galla. They are similar to the Boni of Jubaland, and together with the Midgan and the Sandawe, who also practise circumcision.

are the only nomad communities who practice clitoridectomy.

The Doko pygmies were first described in 1842 by Sir W. C. Harris and later by Borelli and Donaldson Smith, and Rigby also in 1842 reported from hearsay evidence the existence of some pygmies called Berikimo about six weeks inland from Mombasa. The latter are probably the pygmies near Lake Baringo, and the former may be the dwarf Dume who are found in the vicinity of Lake Stephanie. Another group of pygmy nomads exists on the slopes of Mt. Kilimanjaro known as Wapare.

Among the Turkana to the west of Lake Rudolf we find the Teuth, who live on roots and grubs and hunt the smaller mammals, and farther south the Ogiek, known to the Masai as Doroba from the Masai word for tsetse fly to which their arrows are likened, wander over a wide area of forest and bush country between Lake Victoria and the eastern lowlands, maintaining a livelihood by hunting and trapping. Among the Nandi the Ogiek are the hunters, but the Kunono fulfil this menial role for the Masai. The Embu speak of pre-Embu inhabitants of Kenya as "Agumba" or "Asi," pygmies, forest-dwellers and hunters. The northern Watta of Lake Tana are fishers and skilled watermen, who use papyrus rafts, and on Lake Kwanya the Kenyi, a Bantuized type of nomad, live on the papyrus marshes and are completely aquatic without any interests on the land, being reminiscent culturally of the Batwa on Lake Bangweulu.

Wherever the nomads are found in East Africa they are treated as pariahs and are engaged in trades or occupations which are considered ignoble, such as hunting, fishing, metallurgy, leather-tanning and pottery. Among the Kaffa and the Galla they provide the executioners. They are dispossessed rather than conquered, and though among the Kaffa they perform menial services like the collection of fuel it is just among the Kaffa that their tribal organization is most developed under an independent chief.

They adopt the language of the tribes among whom they live, and in many cases their social organization, costume and even religion. Thus the Sanya have a clan organization based on Galla clans with Galla clan names, and have imitated the Galla initiations and system of age-grades. The Somaliland nomads use Mohammedan invocations and celebrate the Mohammedan feasts in addition to their own pagan ritual. But, generally speaking, their religion is a vague ancestor-worship. Except when, like the southern Watta, they build temporary villages they are monogamous, and the family wanders from place to place erecting no more than a rude shelter for the night. When anything more permanent is built the little huts are situated close to river banks and are roughly thatched with palm fronds. The northern Watta have portable cane huts which they carry with them in their wanderings. Caves are also used as dwellings and others build hiding-places in trees. They possess no domesticated animals except dogs, and few practise agriculture, and that only of the most elementary kind. Their weapons are the bow and arrow with sometimes a spear in addition, and poison is applied to all weapons. The northern Watta, like the Ogiek, use a hunting spear with a detachable head, which carries the owner's distinctive mark enabling him to claim the kill. Game pits are used also.

Usually they are naked, but they may adopt some of the costume of their neighbours. Thus among the Kaffa the nomads have adopted the Kaffa headdress, a conical hat of monkey fur, and wear the large skin aprons worn by their Kaffa overlords. The Fuga, adjacent to the Watta, now clothe themselves with the typical Galla kilt. The Midgan women plait their hair after the Somali fashion, but long, plaited hair is an indigenous characteristic among several groups, particularly in the Bantu zone, as among the Amba negrillos on the Western flanks of Ruwenzori. The Ogiek plait their hair like the Nandi and wear a skull-cap made from the stomach of a goat like their Kamasia neighbours.

Everywhere the nomads, despite their low status, are respected and feared, both for their knowledge of poisons and of sorcery in which they are thought to be most proficient. This attitude points to the probability that they were the original owners of the country, their conquerors recognizing their greater spiritual affinity with the soil together with its magical implications; and tends to discredit a Watta legend (of doubtful authenticity) that the Watta were banished from Egypt and on arrival at their present habitats were subjected by the Hamites who were already in possession of the country.

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NOME, an Alaskan town on the shore of Seward peninsula, 115 m. from St. Michael; in 1900 the largest settlement in the Territory. Pop. (1900) 12,488; (1920) 852. Gulch gold was found near Nome on Anvil creek in Sept. 1898, and diggings on the ocean beach were first worked in July 1899. The rush to Nome in 1900 was one of the most remarkable stampedes in American mining history; the town soon had hotels, banks, stores, several newspapers and weekly mails from the United States; for part of the year there were, it was estimated, 20,000 inhabitants. By 1903 the population had greatly decreased, and in subsequent years the winter population averaged about 3,500, the summer population from 7,000 to 8,000. In 1905 the gold output of the Nome region amounted to about $2,500,000, nearly all from placers, though some quartz mining was done. The output in 1926 in Nome and vicinity (Seward peninsula) was $1,873,000. The nearest harbour is at Point Clarence, 80 m. west. At Nome, the winter ice-floes are sometimes 30 ft. high on the beach. It was first called Anvil City; the name "Nome" is derived from Cape Nome, first so called on a chart dated 1849, and said to have been a draughtsman's mistake for the query "?Name" on the original chart.

NOMENOË or NOMINOE (d. 851), duke of Brittany. To pacify Brittany, Louis the Debonair named him count of Vannes in 819 and governor or duke of Brittany in 826. Throughout the reign of Louis, Nomenoë maintained peace in Brittany. But in 841 he resolved to make himself independent of Charles the Bald. In 843 Charles made a vain attempt to subdue Brittany. In 844 Nomenoë invaded Maine, and in 845 the emperor was completely defeated at Ballon near Bain-de-Bretagne. In 846 Charles recognized the independence of Brittany. Having resolved to detach the duchy from the ecclesiastical province of Tours, Nomenoë accused the Frankish bishops of Vannes, Quimper, Dol and Léon of simony at the council of Coëtlouh in 848, replaced them by Bretons, and erected Dol into a metropolitan see. In 849 Nomenoë attacked the Frankish county of Anjou. Charles established a garrison at Rennes. Nomenoë seized Rennes, Nantes and Upper Brittany, and ravaged Maine. In 851 he seized Anjou and invaded Beauce. He died suddenly, leaving as his successor his son Erispoë.

See A. de la Borderie, *Histoire de Bretagne*, vol. ii. (1898); R. Merlet, "Guerres d'indépendance de la Bretagne," in the *Revue de Bretagne, de Vendée et d'Anjou* (1891).

NOMINALISM, the name of one of the two main tendencies of mediaeval philosophy, the other being Realism (from Lat. *nomen*, name). The controversy between nominalists and realists arose from a passage in Boëthius' translation of Porphyry's *Introduction to the Categories of Aristotle*, which propounded the problem of genera and species, (1) as to whether they subsist in themselves or only in the mind; (2) whether, if subsistent, they are corporeal or incorporeal; and (3) whether separated from sensible things or placed in them. The Realists held that universals alone have substantial reality, existing *ante res;* the Nominalists that universals are mere names invented to express the qualities of particular things and existing *post res;* while the Conceptualists, mediating between the two extremes, held that universals are concepts which exist in our minds and express real similarities in things themselves. Though a strong realist tendency is evident in the system of Erigena (9th century), the controversy was not definitely started till the 11th century: it lasted till the middle of the 12th, when the first period of scholastic philosophy ends. Under an appearance of much vain subtlety the controversy about universals involved issues of the greatest speculative and practical importance: realism represented a spiritual, nominalism an anti-spiritual, view of the world; while realism was evidently favourable, and nominalism unfavourable, to the teaching of the Church on the dogmas of the Trinity and the Eucharist. Nominalism was a doctrine of sceptics and suspected heretics, such as

Berengar of Tours and Roscellinus. Even Abelard's mediating doctrine of conceptualism (*q.v.*) was sufficiently near to obnoxious ideas to involve him in lifelong persecution. The principles of the great orthodox philosophers of the later scholastic period which begins in the 13th century, Albertus Magnus and Thomas Aquinas, were those of moderate realism. When nominalism was revived in the 14th century by the English Franciscan, William of Occam, it gave evidence of a new tendency in thought, a distrust of abstractions and an impulse towards direct observation and inductive research, a tendency which had its fulfilment in the scientific movement of the Renaissance. Occam's dictum "Entia non multiplicanda sunt praeter necessitatem" was inspired by a spirit similar to that of Bacon. Though nominalism is properly a mediaeval theory, the tendency has passed over into modern philosophy: the term "nominalist" is often applied to thinkers of the empirical, sensationalist school, of whom J. S. Mill may be taken as the chief representative. (H. St.)

NOMOGRAPHY, a comparatively recent development in applied geometry, analogous to descriptive geometry or to graphical statics. Its object is the general study of the representation, by means of diagrams call *nomograms*, of mathematical laws (Gr. *nomos*, a law) which are expressed analytically by means of equations with any number of variables. The principle involved in representations of this kind was first applied, in the case of a law involving only two variables, by Descartes when, by means of co-ordinates, he showed that every equation in two variables corresponds to a plane curve.

In constructing such a graph we may neglect all measurements, simply drawing on squared paper, divided, say, into millimetres and having two graduated axes, OX and OY. A simple reading is then sufficient to give the different values of the variables as thus connected. This method of representation is now perfectly familiar even to those who are not mathematicians.

Thus, to represent the law, $f(z_1\ z_2)=0$, trace a curve whose cartesian equation is, $f(x, y)=0$, on squared paper where $x=z_1$ and $y=z_2$. In the case of a law involving three variables, $f(z_1, z_2, z_3)=0$, the solution that first suggests itself is to give to z_3 any arbitrary value and then to proceed as in the example above. If, however, we give to z_3 a series of sufficiently contiguous values, and for each of these construct the lines to represent the laws of z_1 and z_2, then it suffices to write beside each line the value of z_3 which served in its construction; for then the lines $x=z_1$ and $x=z_2$, parallel to the axes of the diagram, and the line z_3, pass through the same point if the values of z_1, z_2, and z_3, satisfy the given equation. Margetts applied such an idea in his *Longitude* and *Horary Tables* (published in London in 1791). It was also put into systematic use by Pouchet and published in his *Arithmétique linéaire* (an appendix to his *Métrologie terrestre* [Rouen, 1797]). Since that time the idea has gained wide usage.

It should be observed that it is arbitrary to take z_1 and z_2 and that we can as well replace the axes by two simply infinite systems of lines, the one determined by the values of z_1, and the other by the values of z_2. At the outset, one will be tempted to see in this only a useless complication, since representation by means of rectangular axes in a plane does not lend itself to equations in three variables. However, there are many instances where, in replacing the rectangular axes by other systems of lines made to correspond to z_1, and z_2, we obtain straight lines also for z_3, which formerly had to be traced out point by point on the ordinary squared paper. Hence arises a greater rapidity, simplicity and precision of the new construction.

The underlying idea of such a transformation was formulated in 1842 by Lalanne, under the name, *the principle of anamorphosis*. This transformation was generalized to a high degree in 1884 by Massau. M. d'Ocagne also helped to generalize this transformation when, recognizing the ease of drawing circles, he developed a theory of representation of equations by three systems of circles (S.52 in the first edition of his *Traité de Nomographie*, 1899).

By means of concurrent lines it is impossible to represent equations of more than three variables, since it is not possible to represent on a plane any system of lines of more than two parameters. Nevertheless, it was possible to use this method for certain equations in more than three variables if, by introducing auxiliary variables, one could replace the given equation by a series of equations in three variables. A particular example of this device was proposed by Lallemand, in 1885, in the form of *binary scales* which he introduced in his *abaques hexagonaux* (an ingeniously combined variation, in view of certain practical ends, of Lalanne's *abaques* with their three pencils of parallel lines). In view of the nature of a nomographic diagram, Lalanne applied to it the name *abacus* (ἄβαξ), and the term has remained.

But to obtain an *intrinsic* representation of an equation of more than three variables, without introducing auxiliary variables, it is necessary to make use of some other principle of representation. The first principle of this kind to appear was that of *collinear points*, which was introduced by M. d'Ocagne in 1884, and has proved to be so usable that, for equations with four variables, such as are found in practical work, it is employed almost universally. The method was derived from a particular application of Chasles's principle of duality, together with a special system of tangential co-ordinates (called *parallels*); it substituted for the concurrent lines of the older anamorphosic diagrams the collinear points; and where in the older method it was only possible to represent a simply infinite system of lines, one could diagrammatize a doubly infinite system of points. This explains why, with concurrent lines, intrinsic representation was limited to three variables, and why it is now possible to include as many as six variables.

As a typical example of an equation which it was not possible to represent by means of concurrent lines, which can easily be treated by means of collinear points, there may be mentioned quadrinomial equations, or more particularly, a complete cubic equation, which we meet with in certain problems of hydraulics and resistance of materials; also the fundamental formulas of spherical trigonometry (which leads to the nomographic solution of all problems in astronomy of position and in navigation); d'Ocagne has also shown that all such problems can be resolved by means of a special unique nomogram. (*Comptes Rendus de l'Académie des Sciences*, vol. 138, p. 70, 1904; and *Bulletin de la Société Mathématique de France*, vol. 32, p. 196, 1904.)

In 1891, under the name *Nomography*, then used for the first time, M. d'Ocagne worked out a synthesis of all the methods of graphic representation proposed up to that date, taking the various points of difference and welding them into a unity of conception. Since then he has continued to search for means of extending these methods into various fields of practice.

In considering a number of planes superimposed upon each other, each with its given geometrical elements numbered or not (called *constants*), among which is established a certain graphic liaison, he has been able to extend these methods and make them as general as possible with a given number of variables. To develop this idea, let us call E_1 a geometrical element (point or line) defined by the parameter z_1. Now, the aggregate of elements E_1 constitutes the system (E_1), and each element is determined by the corresponding value of z_1.

If such systems as (E_1), (E_2), ..., (E_n), fixed or subject to displacement, one with respect to another, co-exist in a plane, and if they are placed in such a way as to realize between the elements a given graphic liaison, this liaison will be expressed by an analytical relation of the corresponding values of the variables, z_1, z_2, . . . , z_n such as $f(z, z_2 \ldots, Z_n)=0$. This aggregate of numbered systems, completed at the moment when graphic liaison is realized between them, constitutes a nomogram of the equation. Such a nomogram permits, by a simple reading (which guides the graphic liaison in question), the determination of the values of any one of the variables entering into the equation considered, when the values of the other $n-1$ are given.

After these explanations it is easy to perceive what the object is in the more general problems of nomography; one might formulate it thus: one equation being given, to construct a nomogram by means of systems (E_1), (E_2) ... (E_n) as quickly and easily as possible (*i.e.*, by means consisting exclusively, if possible, of points, straight lines, or circles); a graphic liaison would be established at once between them.

To do this, it is necessary at the outset by a kind of inverse process, to study the types of nomograms conceived *a priori* as the most simple for obtaining the canonical forms of the corresponding equations; for recognizing the conditions necessary for an equation to be reduced to one of these forms; and when this reduction is possible, for deciding the simplest and most direct means of constructing the corresponding systems. It was the need for presenting the nature of mathematical problems that gave rise to nomography, problems into the details of which we need not enter here.

However, without entering into detail, one can take account, more or less, of the manner by which one forms rationally the fundamental types of nomograms. To do this it is first necessary to understand what, being immediately discernible, constitutes a graphic liaison. The only relation of position between two geometrical elements that one can judge at a glance with sufficient exactness is a contact and, more specifically, a contact between line and point; in this connection the parallelism of two straight lines (which one can also judge with some precision) may also be considered, for it is in effect the contact of one of the straight lines with the point at infinity of the other.

The notion of the *graphic contact* being thus understood, we come easily to the conviction that *every graphic liaison intervening in a nomogram consists simply in the simultaneity of many contacts between numbered elements or constants.* Such is the postulate that is to be found at the base of nomography. While we must occasionally consider intervening contacts, confined in practice almost always to contacts between points and lines (parallelism included), the contacts between lines are so infrequent that we may neglect them in this sketch.

It is proper to recall here, as we have noted above, that we can only consider, on a plane, those systems of lines which depend upon a single parameter; on the other hand, it is possible to consider a doubly infinite system of points which has been formed by the mutual intersections of lines taken in two simply infinite systems. The aggregate of these two systems forms what is known as a *reseau* (net). From this it follows that the maximum number of variables directly intervening in the same contact is, at most, three; two being affected by the point, the third by the line entering into the contact. But there must be three contacts, from one plane to the other, to fix the position of a moving plane in reference to a fixed plane. The position being thus fixed, it is then possible to establish a contact between elements belonging to each of the planes; we may then secure an intrinsic representation for equations having as many as 12 variables. This principle was communicated to the Académie des Sciences de Paris by M. d'Ocagne in 1893 (*Comptes Rendus*, vol. 117, p. 216 and 277). If one of four intervening contacts is reduced to a parallelism of the axes OX and $O'X'$ of the two planes, the orientation of the moving plane remains constant in relation to the fixed plane, and can be treated by a type of nomogram which permits intrinsic representation of as many as nine variables. This problem was made the subject of a profound study by Margoulis under the title *L'abaque à transparent orienté.*

If we consider a case where n moving planes are fixed simultaneously on a fixed plane, the fixation of each of them is made by three contacts, and it can be seen that we thus arrive at the most general type of nomogram permitting the intrinsic representation of equations up to 3 $(3n+1)$ variables.

Nomography reached its full development in the comprehensive *Traité* of M. d'Ocagne, published in 1899, and crowned with the Prix Poncelet (in 1902) by the Académie des Sciences. Since the appearance of this work, later theoretical developments have been made by Soreau, Farid Boulad, Clark, Gercevanoff, Margoulis and others, and the applications have multiplied to an extraordinary degree. Among these applications, the most numerous are those derived from the principle of the collinear points, relating moreover to all kinds of technical fields. The library of the Ecole des Ponts et Chausées in Paris has a considerable collection of material, brought together for most part by M. d'Ocagne. Next to the above method, the orientation of transparents, due to Margoulis, seems to be the most fruitful. Indeed, he has opened up a large number of interesting applications relating to hydrodynamics, aerodynamics, aviation, etc.

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NONCONFORMIST, a term denoting historically (*a*) those persons who at the beginning of the 17th century refused to conform to certain practices, *e.g.*, the wearing of the surplice, kneeling at the reception of the Sacrament, etc., of the Church of England; (*b*) those who, after the passing of the Act of Uniformity 1662, refused to conform to that act and ceased to be members of the church. In current usage the term "nonconformist" is applied in Great Britain to any member of a church not conforming to the ceremonies, worship and doctrines ("forms") of the Church of England, but is generally used of a member of the so-called Free Churches, or Protestant Dissenters, and is not usually applied to Roman Catholics.

NONCONFORMITY, LAW RELATING TO. *See* ENGLISH HISTORY; BAPTISTS; CONGREGATIONALISM; METHODISM; FRIENDS, SOCIETY OF, etc.; also OATH. It is proposed here to note the matters in which the law as to nonconformists still differs from that applicable to members of the Church of England.

(1) *Judicial Notice.* Where the tenets and authorities of a nonconformist body come in question they must be proved by evidence. By Lord Lyndhurst's act, the Nonconformist Chapels Act, 1844, where no particular religious doctrine or mode of worship has been prescribed by the deed or instrument of trust the usage of the congregation for 25 years is to be taken as conclusive evidence of the doctrine and worship which may be properly observed in such meeting-houses. (2) *Tribunal.* Matters arising in nonconformist bodies can only be tried by the ordinary secular courts, and generally depend upon the question whether a minister has done any act which is not in accordance with the rules governing the particular body of which he is a minister. A nonconformist body is in law nothing more than a voluntary association, whose members may enforce discipline by any tribunal assented to by them, but must be subject in the last degree to the courts of the realm. (3) *Status of Ministers.* A nonconformist minister is not in holy orders, and his chapel is not a consecrated building. His status is, however, recognized to a limited extent. By the Toleration Act, 1 Will. and Mar., c. 18, a minister, preacher or teacher of a nonconformist congregation is exempt from certain parochial offices, as that of churchwarden. He is also exempt from serving in the reserve forces or on a jury. These privileges only attach

where the place of worship of which he is a minister has been duly registered (the Places of Worship Registration Act, 1855), unless in the case of bodies subject to special legislation as Quakers. By the Municipal Corporations Act, 1882, s. 12, a nonconformist minister (as is a clerk in holy orders) is disqualified from being elected an alderman or councillor of a town council, but under the Local Government Act, 1888, a clerk in holy orders, or other minister of religion, may be a councillor or alderman of a county council, and, under the London Government Act, 1899, of a metropolitan borough. (4) *Marriage.* The first act of parliament relieving dissenters (other than Jews and Quakers) from restrictions was the Marriage Act of 1836. By that act the ceremony of marriage might be performed in a nonconformist place of worship, but it must be after due notice to the superintendent registrar and in his presence or in that of a registrar, and the building must be one that is duly certified for marriages. The Marriage Act, 1898, dispensed with the necessity of the attendance of a registrar at marriages celebrated at a nonconformist place of worship, substituting in place thereof a person duly authorized by the trustees of the place of worship, if the persons intending to be married so desire; but the parties may, if they wish, still require the presence of the registrar. Marriage by banns, licence or special licence cannot take place except in a church. (*See* MARRIAGE.) (5) *Burial.* By the Burial Laws Amendment Act, 1880, burial may take place in a churchyard without the rites of the Church of England. But in such a case notice must be given in a specified form, which is unnecessary where the burial service is conducted by a clergyman of the Church of England. (*See* BURIAL.) (6) *Parish Offices.* By 1 Will. and Mar., c. 18, s. 5, a dissenter chosen churchwarden and scrupling to take the oaths may execute his office by deputy. His acceptance of office is made optional by the act; there is nothing to prevent his discharging it if he see fit to do so. This seems to be still the law, although a declaration was substituted for the oath by the Statutory Declarations Act, 1835, s. 9. (*See* DISSENTER; JEWS; ROMAN CATHOLICS.)

NONFEASANCE, MISFEASANCE, MALFEASANCE. The expressions "nonfeasance" and "misfeasance," and occasionally "malfeasance," are used in English law with reference to the discharge of public obligations existing by common law, custom or statute. The rule of law laid down is that no action lies for nonfeasance, *i.e.*, for failure or refusal to perform such obligation, but that an action does lie for damage resulting from misfeasance or malfeasance, *i.e.*, for negligently and improperly performing the obligation. (*See* NEGLIGENCE.) At present the terms misfeasance and nonfeasance are most often used with reference to the conduct of municipal authorities with reference to the discharge of their statutory obligations. In the case of nonfeasance there is a remedy by indictment or *mandamus* or by the particular procedure prescribed by the statutes. This rule is fully established in the case of failure to repair public highways; but in other cases the courts are astute to find evidence of carelessness in the discharge of public duties, and on that basis to award damages to individuals who have suffered thereby. Misfeasance is also a term used with reference to the conduct of directors and officers of joint-stock companies.

NONIUS MARCELLUS, Latin grammarian and lexicographer, flourished at the end of the 3rd or the beginning of the 4th century A.D. He is the author of a sort of lexicon called *De compendiosa doctrina,* in 20 sections or chapters, the first twelve of which deal with language and grammar, the remaining eight with special subjects (navigation, costume, food, arms). It is valuable as preserving fragments from old dramatists, annalists, satirists and antiquarian writers. In the quotations from the authors cited Nonius always follows the same order, beginning with Plautus and ending with Varro and Cato. In the 5th century Julius Tryphonianus Sabinus brought out a revised and annotated edition.

Editions by L. Müller (1888); J. H. Onions, bks. i.–iii. (1895); W. M. Lindsay (1903).

NONJURORS, the name given to those beneficed clergy of the Church of England who refused to take the oaths of allegiance to William and Mary in 1689. They were about 400 in number, and included William Sancroft, archbishop of Canterbury, and four others of the "seven bishops": Thomas Ken of Bath and Wells, John Lake of Chichester, Thomas White of Peterborough and Francis Turner of Ely, together with the bishops of Gloucester, Worcester and Norwich. Other distinguished nonjurors were: William Sherlock, master of the Temple, Jeremy Collier, the ecclesiastical historian, George Hickes, dean of Worcester, Nathanael Spinckes, John Fitzwilliam, canon of Windsor, Henry Dodwell, Camden professor of history at Oxford, Henry Hyde, second earl of Clarendon, and Roger North, the lawyer. Afterwards their number was augmented by refusals to swear the oaths of allegiance to George I. Ken, the most eminent of the nonjurors, disapproved of their subsequent proceedings, and Sherlock and Dodwell afterwards took the required oaths, the former becoming dean of St. Paul's.

Believing in the doctrine of non-resistance to established authority, the nonjurors argued that James II. was still the rightful king, and likened the position of William to that of Cromwell. With the approval of William III., Gilbert Burnet, bishop of Salisbury, attempted to reconcile them to the new order; and it was only when the generous terms offered by Burnet had been refused, that, in Feb. 1690, they were deprived of their sees and other benefices. Although they had only a small following among the mass of the people, who were not required to take the oaths of allegiance, Sancroft and his colleagues claimed to represent the true Church of England, and requested James II. in his exile to nominate two new bishops to carry on the episcopal succession. James chose Hickes and Thomas Wagstaffe (1645–1712), who were consecrated in 1694 as bishops of Thetford and Ipswich respectively. A further consecration took place in 1713 when Collier, Spinckes and Samuel Hawes (d. 1722), were consecrated "bishops at large." In 1718 the introduction of a new communion office with some "usages" taken partly from primitive liturgies, and partly from the first prayer-book of Edward VI. caused a schism among the nonjurors, dividing them into "Usagers" and "Non-Usagers." The four "usages" were: The mixed chalice, prayers for the faithful departed, prayer for the descent of the Holy Ghost on the consecrated elements, and the Oblatory Prayer, offering the elements to the Father as symbols of His Son's Body and Blood. Accepting the "usages" the two bodies united in 1731, but other dissensions followed, although the episcopal succession was maintained until the death of a bishop named Charles Booth in 1805. The last nonjuror was probably James Yeowell, who died in 1875. Public worship was conducted in chapels or "oratories," and in private houses.

In Scotland the nonjurors included the greater part of the clergy of the Episcopal Church, which ceased to be the state church in 1689. The Scottish clergy maintained their opposition to the government until the death of Prince Charles Edward Stuart in 1788, when the bishops met at Aberdeen, and unanimously agreed to submit to the government of King George III. A large number of the Presbyterians in Scotland, principally found among the Cameronians, also refused to take the oaths of allegiance to William and Mary; but as their reasons for this refusal were quite different from those of the episcopalian nonjurors, they are not usually referred to by this name (*see* CAMERONIANS).

For the history of the nonjurors, *see* Macaulay, *History of England* vol. ii. (1805); T. Lathbury, *History of the Nonjurors* (1845); J. H. Overton, *The Nonjurors* (1902), a defence of the sect.

NONNUS (Egyptian for "saint"), Greek epic poet, a native of Panopolis (Akhmim) in the Egyptian Thebaid, probably lived at the end of the 4th or beginning of the 5th century A.D. His principal work is the *Dionysiaca,* an epic in 48 books, the main subject of which is the expedition of Dionysus to India and his return, a subject convenient at the time owing to the popular comparison of Alexander with Dionysus. In its luxuriance and preoccupation with action, it resembles the Indian epics. His chief merit consists in the systematic perfection to which he brought the Homeric hexameter, but this very quality tends to monotony. His influence on later poetic vocabulary was considerable.

We also possess under his name a paraphrase (μεταβολή) of the

Gospel of St. John, which is chiefly interesting as apparently indicating that Nonnus in his later years was a convert to Christianity. His style, in this content, produces an impression of extreme bombast and want of taste. According to an epigram in the Palatine Anthology (ix. 198), Nonnus was also the author of a *Battle of the Giants*, and four lines of the *Bassarica* (also on Dionysus) have been preserved in Stephanus of Byzantium.

Editio princeps (1569); H. Köchly ("Teubner" series, with critical introduction and full index of names, 1858); the most generally useful edition is that by the comte de Marcellus (1856), with notes and prolegomena, and a French prose translation. On the metre, *see* J. G. Hermann, *Orphica* (1805), p. 690; A. Ludwich, *Beiträge zur Kritik des Nonnus* (1873), critical, grammatical and metrical; C. Lehrs, *Quaestiones epicae* (1837), pp. 255–302, chiefly on metrical questions; on the sources, R. Köhler, *Über die Dionysiaka des Nonnus* (1853), a short and connected analysis of the poem, with a comparison of the earlier and later myths; *see* also I. Negrisoli, *Studio critico . . . Nonnus Panopolita*, with short bibliography (1903). The paraphrase on St. John (editio princeps, *c.* 1505) is edited by F. Passow (1834) and A. Scheindler (1881), with complete index.

NONPAREIL (*see* PRINTING; TYPE), a size of type smaller than minion and larger than ruby. It is also known as 6-point. It is mainly used for footnotes. The following matter is printed in nonpareil:

> In Europe, as late as the second half of the 14th century, every book and every public and private document was written by hand; all figures and pictures, even playing cards and images of saints, were drawn with the pen or painted with the brush.

NONPAREIL or **PAINTED BUNTING,** a small, brilliantly coloured finch (*Passerina ciris*) with blue head, green-yellow back, scarlet body and black wings and tail. After wintering in Central America, the painted bunting arrives in the southern states of the U.S.A. in April, and breeds north to Virginia, Ohio and Kansas. The "pin-tailed nonpareil" of Africa (*Erythrura prasina*) is blue in colour; the male has a long tail. It belongs to the *Ploceidae*. (*See* WEAVER-BIRD.)

NONPARTISAN LEAGUE, an American political and economic organization of farmers founded by Arthur C. Townley at Bismarck, N.D., in Feb. 1915. For years the farmers of the State had complained of exploitation by grain speculators, bankers and politicians. The 1915 session of the legislature, at which members of the Equity Society—a farm organization—received scant attention, fanned agrarian discontent into immediate flame. The Nonpartisan League, applying modern sales methods, rapidly organized the farmers into a cohesive political body, which captured control of the State Republican Party and elected its candidates for State offices and Congress. In 1916 the league began work outside North Dakota, and eventually established active organizations in 12 other Western and Middle Western States, where influence was exerted in behalf of sympathetic candidates with varying degrees of success. Though confining its own membership to farmers, the league regularly co-operated with urban labour in political action. During the World War the league was bitterly attacked on the ground of the socialist connection of some of its leaders and its advocacy of conscription of wealth to pay for the hostilities. In 1919 the league put its economic programme into effect in North Dakota. A State-owned bank, mill and terminal elevator, home-building association, and hail, fire and tornado insurance constituted the principal enterprises. All of these, except the home-building association, were still in operation in 1928. The league, as such, gradually disintegrated, though not before it had given birth to the Farmer-Labor Party in Minnesota and had stimulated many farmers to "non-partisan" voting.

BIBLIOGRAPHY.—Because of the bitter controversy over the league, little unbiased discussion exists. *See* H. E. Gaston, *The Nonpartisan League* (1920), and C. E. Russell, *Story of the Nonpartisan League* (1920) both sympathetic, while A. A. Bruce, *The Nonpartisan League* (1921) is hostile. The files of the *Nonpartisan Leader* (later the *National Leader*), which was published up to July 1923, give a running account of the league's work. (N. A. C.)

NON-SHATTERABLE GLASS: *see* GLASS, SAFETY.

NONSUIT, in law, the name given to a judgment whereby an issue is determined against the plaintiff. It was a term peculiar to the English common-law courts before the Judicature Acts, and was simply the expression of the opinion of the court that, apart from the merits, the plaintiff's case was incomplete. It did not in any way act as a bar to his bringing another action for the same cause. Although judgment of nonsuit still exists, it has, since the Judicature Acts, the same effect as a judgment on the merits, unless the court otherwise directs.

In the United States, litigants often take a "nonsuit" when a case has been settled out of court or they realize the futility of further proceedings.

NORD, the most northern department of France. Area 2,228 sq. miles. Pop. (1926) 1,969,159. Bounded for 21 m. by the North sea, it has Belgian territory on the north-east and east. It lies below, and parallel to, the chalk scarp of Artois, famous for its defence in the War of 1914–18. The coast is formed largely of sand-dunes drained by canals. The department is crossed by the Scheldt (Escaut) with its tributaries and by the Sambre, the chief tributary of the Meuse. The climate of Nord is colder than that of France in general, the mean temperature being 49° or 50° F. The average annual rainfall is about 28 inches.

In agricultural and industrial importance Nord is the first of French departments. In the south-east stock-raising flourishes; in the central zone beetroot is characteristic, while mixed farming prevails in the north-west. Cereals (especially wheat and oats) and potatoes are grown in abundance, while flax, tobacco, chicory, colza and hops are minor crops. Market-gardening and horticulture are practised in some localities. There are mineral springs, notably at St. Amand, where the mud baths are used in the treatment of rheumatism. The mineral wealth lies chiefly in coal mines forming part of the Valenciennes basin, the most important in France, which extends into Belgium and Pas-de-Calais. The textile industry centres in Lille, Roubaix and Tourcoing, which spin and weave cotton, linen and wool, as also around Fourmies. Other centres are Armentières (cloth-weaving), Dunkirk (flax, jute and hemp-spinning), Cambrai (batiste and other delicate fabrics; also chicory), Douai, Avesnes, le Cateau and Caudry. Other great industries are glass, brick, pottery and sugar manufacture, alcohol-distilling, dyeing, iron-founding and steel production. Branches of the metallurgical industry are at Denain, Hautmont, Maubeuge, Valenciennes, Douai, Raismes, etc. Dunkirk and Gravelines equip fleets for the cod and herring fisheries. Dunkirk is the chief port. Its system of inland navigation is highly developed, comprising a line of waterways from the Scheldt to the North sea at Dunkirk, with which the coal basin of Valenciennes is linked by the canalized Scheldt and the textile region of Lille by means of the Deûle canal and the canalized Lys.

The department is divided into six arrondissements (Avesnes, Cambrai, Douai, Dunkirk, Lille, Valenciennes) with 68 cantons and 668 communes. It forms the archiepiscopal diocese of Cambrai and part of the region of the I. army corps (headquarters at Lille) and of the educational division of Lille. Its court of appeal is at Douai.

NORDAU (originally **SÜDFELD**), **MAX SIMON** (1848–1923), Jewish-Hungarian author, was born at Budapest on July 29, 1849, and practised medicine in his native town. He made his name by his pseudo-philosophical *Entartung* (Eng. trs. *Degeneration*, 1895), which was translated into many languages, and had a great vogue. Other works were *The Conventional Lies of Society* (Eng. version 1895), and *Biologie der Ethik* (1921). Nordau was an ardent Zionist, and took Herzl's side in wishing to accept the British Government's offer of land for a Jewish settlement in East Africa. In 1903 an attempt was made on his life by a Jew opposed to the scheme. He died on Jan. 22, 1923.

His works include novels and stories: *Gefühlskomödie* (1892); *Die Drohnenschlacht* (1897), *Morganatisch* (1904), etc.; dramas: *Das Recht zu lieben* (2nd ed. 1894), *Doktor Kohn* (1898), and others; some books of travel; and the critical works *Zeitgenössische Franzosen* (1901), and *Von Kunst und Künstlern* (Leipzig, 1905).

NORD DE FRANCE, COMPAGNIE DES CHEMINS DE FER DU. This company was one of the earliest formed for general transport in France. It was founded on Sept. 18, 1845, and in the following year its rolling stock totalled 175 locomotives, 420 trains and 1,600 trucks. The mileage in that year was 355 km., necessarily confined to a very limited area. Year by year the company made new departures and put out new branches exploiting new territories, and in 1928 the rolling stock

had increased to 2,857 locomotives, 7,322 trains, and 88,742 trucks. The length of lines operated had increased tenfold to 3,830 kilometres. The company's activities were somewhat limited by the area it professed to serve, and the formation of other railway companies, whose tracks hedged in the field already occupied by the Compagnie du Nord.

The company serves the industrial area north of Paris to the English Channel, and is the main artery system of communication from the big manufacturing plants to Paris. It is, from its closeness to England, much concerned with the cross-Channel ferry steamers, making connections with express train and boat services for visitors to Paris. Express passenger and freight services are constantly maintained, and the company arranges special programmes of trains for the holiday season, to connect at Paris with the trains of other lines for Switzerland, Italy, etc. The total invested capital of the company had reached (in Dec. 1927) the sum of 6,642,499,000 francs. (GIR.)

NORDDEUTSCHER LLOYD STEAMSHIP COMPANY. The Norddeutscher Lloyd was founded on Feb. 20, 1857, by Consul Hermann Heinrich Meier. The first steamer line was between Bremen and England. On June 19, 1858, Lloyd's first ocean steamer, the "Bremen," commenced the first trip to New York. The following years were chiefly devoted to building up traffic from Bremen to North America; in 1868 the boats of the Norddeutscher Lloyd already served all the large ports of the east coast of North America; in 1870 the West Indian and Baltimore lines were called into existence. Under the management of Lohmann, the company advanced in the year 1890 to the position of the fourth largest shipping company in the world. In the year 1881 the company, following English examples, introduced the first fast steamer in the New York line. The year 1886 brought about the opening of the Government mail steamer line to East Asia and Australia. The credit for having made the company the leading passenger shipping company of the pre-war period is due to Heinrich Wiegand, who took over the management of the company on Lohmann's death. Under Wiegand the twin-screw system was introduced and the existing line further extended. The fast steamers of the Kaiser class were by the turn of the century the most perfect which had been employed up to then in the territory of ship construction. The Lloyd fleet attained in hold-capacity shortly before the outbreak of the World War nearly 1,000,000 Gr.R.T.

The Peace Treaty then destroyed with one blow the results of 60 years' efforts. Of the fleet existing in 1914, 135 sea steamers, 358 lighters, river barges and other auxiliary vessels, of altogether 982,951 Gr.R.T. there remained to the company only their seaside steamers, small coast vessels, lighters and tugs. The steamer "Grüssgott" (781 Gr.R.T.) was then the company's largest steamer. Added to the ship losses were the losses to buildings, docks and firm inventory abroad. In America there were lost in particular the very valuable dock installations in Hoboken.

In the meantime the company has succeeded by extensive reconstruction activity, the purchase and re-purchase of foreign tonnage and the admission of the fleets of the Roland-Line, Hamburg-Bremen Afrika-Line and the Dampschiffahrtsgesellschaft Horn, in once more bringing their tonnage up to 93% of the pre-war position and again displaying their house-flag on all seas. Among the vessels of the new Lloyd fleet, which numbered on January 1, 1929, about 928,109 Gr.R.T. (including the two four-screw turbine fast steamers "Bremen" and "Europa" also a number of re-constructed freight steamers), the s.s. "Columbus" (32,400 Gr.R.T.) working between Bremen and New York occupies a special position in her capacity as the present largest vessel of the German trading fleet. For the purpose of building up this important service the reconstructed "Bremen" and "Europa" will also find application in this direction after their completion.

The share capital of the Norddeutscher Lloyd amounted in 1928 to 160,000,000 marks ordinary capital and 5,000,000 marks preference shares. (EH.)

NORDENSKIÖLD, NILS ADOLF ERIK, BARON (1832–1901), geographer and Arctic explorer, was born at Helsingfors, on Nov. 18, 1832. He was the son of Nils Gustav Nordenskiöld, a mineralogist and a traveller. Compelled to leave Russia for political reasons, he settled at Stockholm. He received an offer from Otto Torell, the geologist, to accompany him on an expedition to Spitsbergen. To the observations of Torell on glacial phenomena Nordenskiöld added the discovery at Bell Sound of remains of Tertiary plants, and on his return became professor and curator of the mineralogical department of the Swedish State Museum. In 1861 he took part in Torell's second Spitsbergen expedition. Of the further expedition to the same quarter promoted by the Swedish academy of science in 1864, Nordenskiöld was the leader. Three years later he headed an expedition in the iron steamer "Sofia," and reached the highest northern latitude (81° 42′) then attained in the eastern hemisphere. In 1870, with three young naturalists, he visited the vast inland ice-sheet of Greenland. On his next expedition in 1872 the tenders were caught in the ice, and the crews of the three vessels were forced to winter in Spitsbergen. In 1875–1876, however, a successful voyage eastwards, including the ascent of the Yenisei, led him to attempt the discovery of the long-sought North-East Passage. Starting from Karlskrona on June 22, 1878, in the "Vega," he doubled Cape Chelyuskin in the following August, and after being frozen in at the end of September near Bering Strait, completed the voyage successfully in the following summer.

On his return to Sweden he received an enthusiastic welcome, and in April 1880 was made a baron and a commander of the Order of the Nordstjerna. In 1883 he again visited the east coast of Greenland, and succeeded in forcing through the great ice barrier, a feat attempted in vain during more than three centuries. He died at Stockholm on Aug. 12, 1901.

Baron Nordenskiöld also published *Facsimile Atlas* (1889) and *Periplus* (1897). The former contains reproductions of geographical documents printed during the 15th and 16th centuries, and the latter, a work of far greater research, deals with the history of early cartography and the sailing charts in use among mariners during the middle ages.

NORDENSKJÖLD, OTTO (1869–1928), Swedish explorer, was born in 1869; his father was a brother of Baron A. E. Nordenskiöld (*q.v.*). He specialized in geology in the University of Uppsala and after travels in Tierra del Fuego and Alaska, he led an expedition (Oct. 1901) to the South Polar regions. He landed at Snow Hill island, off the east coast of Graham Land. Weather conditions made it impossible for the "Antarctic," which had continued her course to Tierra del Fuego, to relieve them in 1902–03, and she sank in the attempt. After several attempts at rescue had been made, they were eventually brought back by a vessel sent by the Argentine Government in Nov. 1903. (*"Antarctic" Två år bland sydpolens isar*, 2 vols. Stockholm, 1904; Eng. trs. *Antarctica*, 1905). In 1920–21 Professor Nordenskjöld explored the Peruvian and Chilean Andes. He died on June 3, 1928.

NORDERNEY (*i.e.*, "northern island"), the largest of the East Friesland group, belongs to Hanover. Pop. (1925) 5,406. It is 8 m. long and about 1½ m. broad and is reached by steamer from Norddeich, Bremerhaven or Hamburg, and at low tide by road. The village is a popular resort. Norderney is associated with Heinrich Heine's *Nordseebilder*.

NORDHAUSEN, a town in the province of Prussian Saxony. It is situated on the Zorge to the south of the Harz mountains, at the west end of the Goldene Aue (Golden Plain), a fruitful valley watered by the Helme. Pop. (1925) 34,987. Nordhausen possessed a royal palace in 874 and a convent was founded here in 962. It was destroyed by Henry the Lion in 1180, but was soon rebuilt and was made a free imperial town in 1253. In this and the following century several diets and other assemblies were held here. The protector (*Vogt*) of the town was the elector of Saxony and from 1702 to 1715 the elector of Brandenburg. Nordhausen accepted the reformed doctrines in 1522. It was annexed by Prussia in 1803 and again in 1815, having in the meantime belonged to the kingdom of Westphalia. The upper and lower parts of the town are connected by flights of steps. Among its churches the most noteworthy are the Roman Catholic cathedral, late Gothic with a Romanesque crypt, and the Protestant church of St. Blasius. Near the mediaeval town hall stands a Roland's

column, the ancient symbol of free commercial intercourse and civic liberty. The chief importance of the place arises from its distilling of "Korn Schnapps," a spirit somewhat akin to whisky.

NORDICA, LILLIAN (1859–1914), American operatic soprano, was born at Farmington (Me.), May 12, 1859, trained at Boston, and later at Milan, under Sangiovanni. She made her début at Brescia in 1879, sang at Covent Garden, London (1887–93), and at the Metropolitan Opera House, New York, after 1895. She died at Batavia, Java, May 10, 1914.

NÖRDLINGEN, a town of Germany, in the republic of Bavaria, on the Eger. Pop. (1925) 8,589. From 898, when first mentioned, to 1215 Nördlingen was subject to the bishops of Regensburg, but about 1215 it became a free city of the Empire. It was annexed to Bavaria in 1803. It is still surrounded with walls and towers. The church of St. George is a Gothic structure erected in the 15th century and restored in 1880. The Late Gothic town hall has a collection of pictures and antiquities.

Military Operations.—Nördlingen was the scene of two great battles in the Thirty Years' War (*q.v.*). In the first, which was fought on Sept. 5 and 6, 1634, the hitherto invincible Swedish army, commanded by Duke Bernhard of Saxe Weimar and Marshal Horn, was defeated with great loss by a somewhat superior army of Imperialists and Spaniards under Gen. Gallas, Horn being taken prisoner. In the second battle, fought 11 years later (Aug. 3, 1645), Condé (then duke of Enghien) and Turenne were the leaders on the one side, and Mercy and Johann von Weert, the dashing cavalry commander whose onset had decided the battle of 1634, on the other. The Germans were posted some 5m. to the east of Nördlingen, about Allerheim. In rear of the village the plain was occupied by Mercy's army in the customary two lines, foot in the centre, horse in the wings. The French army, similarly arrayed, was more heterogeneous than the German. After a cannonade in which it suffered more severely than its entrenched enemy, the French centre furiously attacked the village of Allerheim; the fighting here was very heavy, and on the whole in favour of the Germans, although Mercy was killed. The right wing of the French cavalry was swept off the field by Johann von Weert's charge, but the German troopers, intoxicated with success, dispersed to plunder. On the French left, meanwhile, Turenne saved the day. Fighting cautiously at first with his leading line to gain time for his second to come up, he then charged and broke up the hostile right wing of cavalry, while some battalions of infantry scaled the hill and captured the Bavarian guns. Unlike Weert the marshal kept his troops in hand, and swung round upon the Bavarian infantry behind Allerheim, who were at the same time cannonaded by their lost guns. A prolonged fight now ensued, in which the Bavarians had the worst of it, and Weert, returning at last to the field, dared not attempt to engage afresh. The armies faced one another all night with their sentries 50 paces apart, but in the morning the Bavarians were found to have retreated. Nothing was gained by the victors but the trophies and the field of battle, and the losses of both sides had been enormous. Nördlingen, therefore, is a classical instance of the unprofitable and costly *bataille rangée* of the 17th century.

See Beyschlag, *Geschichte der Stadt Nördlingen* (Nördlingen, 1851), and Mayer, *Die Stadt Nördlingen, ihr Leben und ihre Kunst im Lichte der Vorzeit* (Nördlingen, 1856).

NORE, THE, sandbank at the mouth of the river Thames, England, marked by buoys and a lightship, with revolving light. This ship lies 3 m. from the Kent coast, about the same from the Essex coast, and 47¾ m. below London Bridge. The first light was placed as an experiment by Mr. Hamblin, its patentee, in 1731.

NORFOLK, EARLS AND DUKES OF. The 1st earl of Norfolk was RALPH DE GUADER, a follower of William the Conqueror, who forfeited the earldom when he revolted against William in 1075; the 2nd was HUGH BIGOD (d. 1177), one of Stephen's supporters, to whom the earldom was granted by this king before 1141. Hugh's grandson, HUGH (d. 1225), the 3rd earl of this line, married Matilda, daughter of William Marshal, earl of Pembroke, and from the Marshals their son ROGER (d. 1270), the 4th earl, inherited the office of marshal of England. This powerful family of Bigod retained the earldom until ROGER, the 5th earl, died childless in Dec. 1306.

The next earl of Norfolk was THOMAS OF BROTHERTON (1300–1338), a younger son of Edward I., to whom the earldom was granted in 1312 by his half-brother, Edward II. In addition to the estates which had formerly belonged to the Bigods Thomas received the office of marshal. He joined Queen Isabella when she landed in England in 1326, and was one of the group of nobles who brought about the deposition of Edward II. He died in August 1338, leaving no son. The survivor of his two daughters, Margaret (*c.* 1320–1400), who was countess of Norfolk in her own right, married John de Segrave, 3rd Lord Segrave (d. 1353), and their only child Elizabeth (d. *c.* 1375) became the wife of John de Mowbray, 4th Lord Mowbray (d. 1368), and the mother of two sons John and Thomas. In 1397 the countess Margaret was created duchess of Norfolk, and at the same time her grandson Thomas Mowbray was made duke of Norfolk.

On the death of John Mowbray, 4th duke of this creation, in 1476 the dukedom became extinct, but the earldom passed to his daughter Anne, wife of the young Richard, duke of York, who was murdered in the Tower with whom the earldom became extinct.

The dukedom was given in 1483 to John Howard whose mother, Margaret Mowbray, was a daughter of Thomas Mowbray the 1st duke. The dukedom has remained in the Howard line until the present day. (*See* HOWARD.)

NORFOLK, HENRY FITZALAN HOWARD, 15TH DUKE OF (1847–1917), was born in London on Dec. 27, 1847, and succeeded his father, the 14th duke, in 1860. He was educated at the Oratory School, Edgbaston, and then spent some time with his uncle, Lord Lyons, in Constantinople. The duke was postmaster-general from 1895 to 1900, first Lord Mayor of Sheffield in 1895, and served in the yeomanry in the South African War. His position as head of the English Roman Catholics and as premier duke and Earl Marshal made him for many years conspicuous in public life. He was throughout his life in close connection with the Vatican, and was sent by Queen Victoria in 1887 on a special mission to Leo XIII. He did not always agree with the policy of the Irish Catholic hierarchy, but he did much for Catholic education in Ireland. He was keenly interested in education generally; was one of the founders of Sheffield University, and its first vice-chancellor. The duke was concerned in the building of many Catholic churches in England, notably the church of St. John the Baptist at Norwich. He died in London on Feb. 11, 1917.

NORFOLK, JOHN HOWARD, 1ST DUKE OF (of the Howard line) (*c.* 1430–1485), was the son of Sir Robert Howard by his wife Margaret, daughter of Thomas Mowbray, the first duke of that family. In 1455 John Howard was sent to parliament as member for Norfolk, although he "hadde no lyvelode in the shire"; in 1461 he was knighted; and in 1470, although he appears to have been a consistent Yorkist, he was created a baron by Henry VI. He was treasurer of the royal household from 1467 to 1474, and went to France with Edward IV. in 1475. After Edward's death, however, he supported Richard III., who created him duke of Norfolk and made him earl marshal of England in June 1483. He was killed at Bosworth whilst fighting for this king on Aug. 22, 1485, and the title thus suffered attainder.

NORFOLK, THOMAS HOWARD, 2ND DUKE OF (1443–1524), son of the preceding, shared his father's fortunes; he fought at Barnet for Edward IV. and was made steward of the royal household and created earl of Surrey in 1483. Taken prisoner at Bosworth he was attainted and remained in captivity until January 1489, when he was released and restored to his earldom but not to the dukedom of Norfolk. He was then entrusted with the maintenance of order in Yorkshire and with the defence of the Scottish borders; he was made lord treasurer and a privy councillor in 1501, and he helped to arrange the marriage between Margaret, the daughter of Henry VII., and James IV. of Scotland. Henry VIII., too, employed him on public business, but the earl grew jealous of Wolsey, and for a short time he absented himself from court. He commanded the army which defeated the Scots at Flodden in September 1513, and was created duke of Norfolk in February of the following year, with precedency as

of the creation of 1483. In his later years Norfolk worked more harmoniously with Wolsey. He was guardian of England during Henry's absence in France in 1520, and he acted as lord high steward at the trial of his friend Edward Stafford, duke of Buckingham, in 1521. Among his sons were William, 1st Lord Howard of Effingham (1510?–1573), and Sir Edward Howard (*c.* 1477–1513), lord high admiral, who defeated the French fleet off Brest in August 1512, and died during an engagement in April 1513.

NORFOLK, THOMAS HOWARD, 3RD DUKE OF (1473–1554), eldest son of the 2nd duke, married in 1495 Anne (1475–1512), daughter of Edward IV., thus becoming a brother-in-law of Henry VII., who had married Anne's sister Elizabeth. He became lord high admiral in 1513, and led the van of the English army at Flodden in September, being created earl of Surrey in February 1514. In 1513 he took for his second wife Elizabeth (d. 1558), daughter of Edward Stafford, duke of Buckingham. In 1520 Surrey went to Ireland as lord-deputy, but soon vacated this post to command the troops which sacked Morlaix and ravaged the neighbourhood of Boulogne in 1522; afterwards he raided and devastated the south of Scotland. He succeeded his father in May 1524, and as the most powerful nobleman in England he headed the party hostile to Cardinal Wolsey. He favoured the divorce of Henry VIII. from Catherine of Aragon, and the king's marriage with his niece Anne Boleyn. In 1529 he became president of the council, but in a few years his position was shaken by the fate of Anne Boleyn, at whose trial and execution he presided as lord high steward. But his military abilities rendered him almost indispensable to the king, and in 1536, just after the rising known as the Pilgrimage of Grace had broken out, he was despatched into the north of England; he temporized with the rebels until the danger was past, and then, as the first president of the council of the north, punished them with great severity. Sharing in the general hatred against Thomas Cromwell, Norfolk arrested the minister in June 1540. He led the English army into Scotland in 1542 and into France in 1544; but the execution of Catherine Howard, another of his nieces who had become the wife of the king, had weakened his position.

His son Henry Howard, earl of Surrey (*q.v.*), was arrested on a charge of treason; Norfolk himself suffered the same fate as accessory to the crime. In January 1547 Surrey was executed; his father was condemned to death by a bill of attainder, but owing to the death of the king the sentence was not carried out. Norfolk remained in prison throughout the reign of Edward VI., but in August 1553 he was released and restored to his dukedom. Again taking command of the English army he was sent to suppress the rebellion which had broken out under Sir Thomas Wyat, but his men fled before the enemy. He acted as lord high steward at the trial of John Dudley, duke of Northumberland; and he died on Aug. 25, 1554. Norfolk was a brutal and licentious man, but was a supporter of the Roman church, being, as he himself admits, "quick against the sacramentaries."

NORFOLK, THOMAS HOWARD, 4TH DUKE OF (1536–1572), son of Henry Howard, earl of Surrey, was born on March 10, 1536. His tutor was John Foxe, the martyrologist. Norfolk, who had already been married three times, was regarded as a suitable husband for Mary queen of Scots, who had just taken refuge in England. He presided over the commission appointed by Elizabeth to inquire into the relations between the Scottish queen and her subjects; and although he appears to have believed in Mary's guilt he was anxious to marry her. Among the Scots Maitland of Lethington favoured the proposed union; Mary herself consented to it; but Norfolk was unwilling to take up arms, and while he delayed, Elizabeth ordered his arrest and he was taken to prison in October 1569. In August 1570, after the suppression of the rising in the north of England, the duke was released; but he entered into communication with Philip II. of Spain regarding the proposed invasion of England by the Spaniards. After some hesitation Norfolk placed himself at the head of the conspirators; and in return for his services he asked the king of Spain "to approve of my own marriage with the Queen of Scots." But the plot failed; Norfolk's treachery was revealed to Lord Burghley, and in September 1571 he was arrested. He was beheaded on June 2, 1572. He always regarded himself as a Protestant. Norfolk's first wife, Mary (1540–1557), daughter and heiress of Henry Fitzalan, 12th earl of Arundel, bore him a son, Philip, who in consequence of his father's attainder was not allowed to succeed to the dukedom of Norfolk, but became 13th earl of Arundel in succession to his maternal grandfather in 1580. Norfolk left two other sons, Thomas Howard, created earl of Suffolk in 1603, and Lord William Howard (*q.v.*).

NORFOLK, THOMAS MOWBRAY, 1ST DUKE OF (*c.* 1366–1399), son of John de Mowbray, 4th Lord Mowbray, was created marshal of England for life in 1385. He was then Lord Mowbray and earl of Nottingham. In 1387 Nottingham began to act with Thomas of Woodstock, duke of Gloucester, his own brother-in-law, Richard Fitzalan, earl of Arundel, and the party of nobles who wished to deprive the king of his power. They routed the royal favourite Robert de Vere, earl of Oxford, at Radcot Bridge, and Richard was at their mercy. Owing partly to Nottingham's moderate counsels the suggestion to depose him was not carried out, but in the "merciless parliament" of 1388 his favourites were "appealed" of treason and were sentenced to death. For nearly two years the chief power was in the hands of the lords appellant, as Nottingham and his friends were called, but in 1389 the king regained his authority. He detached Nottingham from his colleagues and made him warden of the Scottish marches; later he became captain of Calais and the royal lieutenant in the north-east of France. Richard took him to Ireland in 1394 and soon afterwards sent him to arrange a peace with France and his marriage with Isabella, daughter of King Charles VI. But the earl's supreme service to the king was in 1397 when Richard took a tardy but severe vengeance upon three of the appellants. In their turn these lords were "appealed" of treason before the parliament, and as on the former occasion Nottingham was one of the accusers. He was present when Gloucester was arrested at Pleshey, and Froissart says that he actually beheaded Arundel himself. Gloucester was entrusted to his keeping at Calais, and in September 1397 he reported that his prisoner was dead. The duke had been murdered, and Nottingham was probably responsible, although the evidence against him is not conclusive. As a reward he received most of Arundel's lands in Surrey and Sussex, and was created duke of Norfolk. He now began to fear for his own safety, and took the duke of Hereford, afterwards King Henry IV., into his confidence. Hereford carried his words to the king, who summoned him to his presence, and at Oswestry Norfolk accused Hereford of speaking falsely. A court of chivalry decided that the dispute should be referred to the arbitrament of single combat at Coventry; but when everything was ready (Sept. 16, 1398) for the fight Richard interposed and ordered both combatants into banishment. Norfolk was deprived of his offices, but not of his titles; he left England for Dordrecht, and after passing some months in wanderings he reached Venice, where he died on Sept. 22 or 27, 1399. The concluding scene of the duke's life in England forms the staple material of act i. of Shakespeare's *Richard II.*

NORFOLK, an eastern county of England, bounded north and east by the North sea, south-east and south by Suffolk and west by Cambridgeshire and Lincolnshire. The area is 2,044·4 sq.m., the county being the fourth in size in England.

Physical Features.—The county as a whole is low-lying, no point reaching up over 350 feet. In the extreme west we have the flat fens composed of recent alluvium, which is crossed by various dykes and ditches which help to drain the district; windmills used for this purpose are a conspicuous feature, though they are being replaced by pumping engines. To the east of the Ouse the land rises somewhat, where we have the north easterly extension of the chalk hills of England. These form the oldest rocks in the county, except for a few small patches of Kimeridge clay lying along their western side. The cretaceous rocks dip eastward under various glacial deposits such as boulder clay and gravel. The indeterminate nature of the drainage is due to glacial action. The heights also die away southward and eastward, and here the land is generally fertile and well wooded, with occasional expanses of heath. The rivers follow rather irregular courses, what

watershed there is lying across the centre of the county from south-east to north-west; the Cromer Morainic ridge forms a secondary parting at right-angles to the first. The largest rivers in the east of the county are the Yare and its tributaries the Bure and the Waveney, which forms a large part of the boundary with Suffolk. In the river valleys are large stretches of alluvial deposits.

Nearly two-thirds of the boundary of the county is formed by tidal water, but there are few bays or inlets. For the most part the coast-line is flat and low, and has been greatly encroached on by the sea, several villages having been engulfed since the Conquest. At certain points, however, blown sand is filling up some arms of the sea. From the mouth of the Yare to Happisburgh the shore is skirted by sandbanks. Thence for 20 m. it is formed of cliffs consisting of clay and masses of embedded rocks. These cliffs are succeeded by a low shingly or sandy coast stretching as far as St. Edmund's point. The shores of the Wash are formed of mudbanks, which are left dry at low water. At various points off the coast there are submarine forests, especially in Brancaster bay and in the neighbourhood of Cromer and Happisburgh.

Archaeology and History.—Palaeolithic implements have been found in the county in the valley of the Little Ouse and near Cromer. The county, because of the low rainfall and fairly strong winds, was never very heavily forested, and as such it offered a suitable home for Neolithic man, who has left extensive traces of his occupation on the chalk of the west and along the gravels in the east. A few miles north-east of Brandon there are extensive pits in the chalk dug by early man when quarrying for flint (Grimes' Graves), and in them were found numerous deer antlers used by him as picks. Bronze weapons are fairly numerous, and their distribution tallies generally with those of Neolithic artefacts. Evidence of probable contacts across the North sea is borne out by the fact that 11 beakers have been discovered in the county. Finds of the early Iron age are not numerous, but towards the end of the pre-Christian era and for some time after, Norfolk was part of the lands of the Iceni. This tribe accepted the suzerainty of the Romans at the Conquest, but at the death of their ruler, Prasutagus, and following the injustice of the Romans to his wife, Boudicca (Boadicea), and his daughters, they rebelled. Successful at first, they were finally completely defeated, and their territories ravaged by the victors. Of Roman remains in the county we have the settlement of Caister-by-Norwich, perhaps a small village at Caister-by-Yarmouth and a fort at Brancaster which guarded the Wash and the north coast, and which was the headquarters of the Count of the Saxon shore. A Roman road, known as the Péddar way, probably following a more ancient track, crosses the Little Ouse a few miles east of Thetford, and runs north-north-west across the country to near Hunstanton; another road from Colchester to Caister-by-Norwich enters the county by Scole. The eastward continuation of the pre-Roman Icknield way also crossed the county.

The district was invaded in the second half of the 5th century by Angle tribes from north Germany, who, having secured the coast districts, worked their way inland along the river valleys. East Anglia owned successively the supremacy of Kent, of Mercia and Northumbria, until in 827 the whole land was united under the rule of Egbert. In 867 the Danes under Inguar and Ubba defeated and killed King Edmund at Thetford, and Norfolk formed an integral part of the Danelaw. In the renewed Danish attacks of the 11th century Norwich and Thetford were destroyed. At the time of the Norman invasion Norfolk formed part of Harold's earldom. Norfolk formed part of the diocese of East Anglia from its foundation in 630, and in 1075 the bishop's see was placed at Thetford, whence it was transferred to Norwich in 1093. (*See* NORWICH.)

Architecture.—With a few exceptions, the majority of the churches are Decorated or Perpendicular, or a mixture of both styles. The churches of the marshes in the north-west are noteworthy, especially those of Tilney All Saints and Walpole St. Peter's, the finest Perpendicular edifice in Britain; the rich Norman church of Castle Rising should also be mentioned. At Northwold remains one of the rare Easter sepulchres. Apart from the churches in the towns, those of Worstead, Hingham, Cawston and Terrington St. Clement may be quoted as typical examples of the numerous fine later Gothic churches. Norfolk possessed an unusually large number of monastic foundations, but of these the remains are few and comparatively unimportant. The cathedral church of Norwich was originally connected with a very richly endowed Benedictine monastery. A foundation of almost equal importance was that of Augustinian canons at Walsingham, where there are remains of an Early English and Decorated church, a Decorated refectory and a Perpendicular gateway. The shrine of Our Lady of Walsingham was the resort of great numbers of pilgrims. Other monastic remains are Bromholm priory near North Walsham; slight Early English fragments of Beeston Augustinian priory, west of Cromer; good Norman and later remains at Binham (Benedictine) north-east of Walsingham; the Benedictine nunnery of Carrow near Norwich; the fine church (Norman and later) of the Benedictine priory at Wymondham; and the remains at Castle Acre and Thetford.

The shire-system was not definitely established in East Anglia before the Conquest, but the Domesday boundaries of Norfolk were practically those of the present day. The 36 Domesday hundreds were subdivided into leets, of which no trace remains, and the boroughs of Norwich and Thetford ranked as separate hundreds, while Yarmouth was the chief town of three hundreds. Norfolk and Suffolk were united under one sheriff until the reign of Elizabeth, the shire court for the former being held at Norwich.

In the war between John and his barons Roger Bigod garrisoned Norwich castle against the king. In the rising of 1381 Norwich was plundered by the insurgents, and in the rising of 1549 against enclosures Norwich was again captured by the rebels under Ket. In the Civil War of the 17th century Norfolk as a whole adhered to the parliamentary cause, forming one of the six counties of the Eastern Association. Lynn, however, was held for the king, and Norwich was one of the first cities to welcome back Charles II.

There are several old mansions of interest, such as the Jacobean brick building of Blickling hall, Barningham hall (1612), Hunstanton, the moated Oxburgh hall, and Cressingham manor, both of the 15th century. The larger mansions, however, such as Sandringham, are of modern date. Paston and Oxnead were successively the seats of the Paston family whose Letters are famous.

Politics and Agriculture.—Norfolk returned members to parliament in 1290, and in 1298 the county and the boroughs of Lynn, Norwich and Yarmouth returned each two members. Thetford acquired representation in 1529, and Castle Rising in 1558. Under the Reform Act of 1832 the county returned four members in two divisions, and Castle Rising was disfranchised. Under the act of 1868 the county returned six members in three divisions, and Thetford and Yarmouth were disfranchised.

At the time of the Domesday survey sheep-farming flourished almost throughout Norfolk, a flock of 1,300 being mentioned at Walton, and horses were extensively bred; numerous beehives, nearly 600 water-mills and valuable river fisheries are mentioned; and salt was made in the hundreds of Freebridge and East Flegg. There was also, after the Conquest, a well developed trade with Flanders in wool. The worsted trade was introduced by Flemish immigrants as early as the 12th century, and the woollen trade became especially prosperous in the hundreds adjoining the Wash. This immigration and those of religious refugees from the Continent in later times have introduced into the population an element which has enabled the county to produce a large number of notable men. Linen was manufactured at Aylsham in the 14th century. Fuller, writing in the 17th century, describes Norfolk as abounding in all good things, and especially rabbits, herrings and worsteds. The leather industry flourished in Norman times.

The great variety of the soils in the county has helped to make it rich agriculturally, and where the land is not suitable for ploughing it is usually good for pasture. It was at Holkham, in this county, that Thomas Coke, earl of Leicester, carried out experiments in the cultivation of wheat and began to improve the standard of livestock in Britain. In 1926 the total acreage under crops and grass was 1,007,803, of which one-tenth was under wheat, nearly a fifth under barley, while oats occupied more than half the acreage of wheat. Rye covered 7,824, beans and peas

over 13,000 acres. The area of sugar beet was 32,384 ac., of potatoes 19,000 ac., and of root crops 127,381 acres. Clover and rotation grasses for hay occupied 115,503 ac., and orchards over 8,000 acres.

Industries, Communications, etc.—The weaving of silk and wool is still carried on at Norwich and also shawl weaving, although the staple trade of the town is now boots and shoes. Silk is also manufactured at Yarmouth, Wymondham and North Walsham. Flour-mills are numerous all over the county, and there are agricultural implement works at Norwich, Lynn, Thetford, East Harling, North Walsham, Walsingham and East Dereham. Lime-burning, brick-making, tanning, malting and brewing are carried on in various districts. There are extensive mustard and starch works at Norwich. The sea-coast is of a dangerous nature and there is a lack of harbours. A large trade, however, is carried on at Yarmouth, which is also famous for its herring fishery. The other principal port is Lynn, and there is a small trade at Wells.

The L.N.E. railway serves King's Lynn, Thetford, Norwich, Swaffham and Yarmouth, and has numerous branches. The M. and Gt.N.Jt. railway runs from Lynn to Cromer, Norwich and Yarmouth. The eastern rivers afford water communication with Great Yarmouth, while the Great and Little Ouse and some of the drainage cuts communicate with Lynn.

The area of the administrative county is 1,315,064 ac., with a population (1921) of 504,293. The municipal boroughs are—King's Lynn; Norwich, a city and county borough and the county town; Thetford; and Yarmouth, properly Great Yarmouth, a county borough. The county is in the south-eastern circuit, and assizes are held at Norwich. There are two courts of quarter sessions. Each of the four municipal boroughs has a separate court of quarter sessions. Norfolk is mainly in the diocese of Norwich, with small parts in those of Ely and Lincoln. For parliamentary purposes the county is divided into five divisions—King's Lynn, South-Western, Northern, Eastern and Southern—and also includes the parliamentary borough of Norwich (two members), and part of the parliamentary borough of Great Yarmouth (one member). Of the three boys' public schools in the county, two are in Norwich, viz., King Edward VI.'s school and the City of Norwich school. The third, Gresham's school, was founded at Holt, near Sheringham, in 1555, by Sir Thomas Gresham (*q.v.*).

Broads and Rivers.—The rivers and broads (lakes) of Norfolk, together with the few in Suffolk, form over 200 m. of navigable waterway. They are now, however, chiefly used by pleasure craft, though a diminishing number of trading wherries still carry coal and other goods between the large towns, such as Yarmouth, and the villages. The southern rivers are wider and deeper than the northern, and the Yare can be navigated by sea-going trading vessels as far as Norwich.

The formation of a broad may be due either to the widening of a river or to a sea-estuary becoming completely enclosed by sand-banks. The broads tend to become overgrown with reeds which, if they are not cut (they can be utilized to make a very durable thatch), rot and fall to the ground, and, aided by the general silting up, they may cause the broad to be replaced by dry land. Several of the broads have to be dredged to preserve a navigable channel, some of them (*e.g.*, Hickling broad) being extremely shallow.

Some of the broads are extremely beautiful; notably Wroxham, Salhouse and South Walsham (up the Bure), which are surrounded by wooded country; Barton broad (up the Ant); and Horsea mere (up the Thurne, not far from the sand dunes and near to Hickling broad), which is of quite a different character, being surrounded by reedy marshland, the haunt of hundreds of different species of wild birds. The bittern (*q.v.*) was saved from extinction at an island on Hickling broad, and now flourishes in considerable numbers. The bearded tit (*see* TITMOUSE) has also been saved from the same fate. The fishing is good, and wild duck are shot from a "Breydon duck-punt" which carries a heavy gun aimed by manoeuvring the boat itself.

See *Victoria County History; Norfolk;* F. Blomefield, *Essay towards a Topographical History of . . . Norfolk* (1739–75 and 1805–10); W. Rye, *History of Norfolk* (1885); P. H. Emerson, *Pictures of East Anglian Life* (1888); and other works; Rev. A. Jessopp, *Arcady* (1887), and other works; *Quarterly Review* (1897), where other literature is cited; G. C. Davies, *Norfolk Broads and Rivers* (Edinburgh, 1884); Christopher Marlowe, *People and Places in Marshland* (1927).

NORFOLK, a city of Madison county, Nebraska, U.S.A., in the north-eastern part of the State, on the Elkhorn river, at an altitude of 1,525 feet. It is on Federal highway 81, and is served by the Chicago and North Western, the Chicago, St. Paul, Minneapolis and Omaha and the Union Pacific railways. The population was 8,634 in 1920 (88% native white) and was estimated locally at 12,500 in 1928. The city was founded in 1866, incorporated in 1881, and chartered in 1886.

NORFOLK, a seaport of Virginia, U.S.A., on the Hampton Roads. It is on Federal highways 17 and 117, and is served by the Atlantic Coast Line, the Chesapeake and Ohio, the Norfolk Southern, the Norfolk and Western, the Pennsylvania, the Seaboard Air Line, the Southern and the Virginian railways (all interconnected by an industrial belt line), and by interurban trolleys, motor-bus and trunk lines, several ferries and about 60 steamship lines. Pop. 115,777 in 1920 (108 males to 100 females, and 37% negroes); estimated at 184,200 in 1928.

The city has a land area of 27 sq.m. and 50 m. of water front on Hampton Roads, Chesapeake bay, the Elizabeth "river" (which is a tidal estuary, not a river), and the Lafayette river (another estuary). Immediately opposite is the city of Portsmouth. The town of Berkley was annexed to Norfolk in 1906, and lying beyond it is the still independent town of South Norfolk.

The waters about Norfolk, Portsmouth and Newport News (officially known as the Port of Hampton Roads, and under the jurisdiction of the State Port Authority created in 1926) form one of the finest natural harbours of the world, where a thousand ships at a time have found berthing space or anchorage without taxing its capacity. The part known as Norfolk harbour (which includes the Portsmouth waters) is 15·5 m. long, varies from ¼ to 2 m. in width, and is connected with the bay by a 40 ft. channel. On the Norfolk water front there are 154 piers, largely owned by railroads, steamship lines and ship-building companies. The army supply base, north of the Lafayette river, established in 1917 and representing an investment of $30,000,000, was leased by the city from the United States in 1919, and beyond it a modern municipal terminal has been constructed (at an expenditure of $6,000,000) including a grain elevator with a capacity of 800,000 bushels, a dock specially equipped for shipping garden and farm produce and a general merchandise pier 1,210 ft. long, with transit sheds and warehouses. The business section of the city is compactly built up with hotels, stores and office-buildings that seem tall in proportion to the width of the streets.

Some beautiful ante-bellum homes and interesting old buildings remain, including St. Paul's church (1737) which has a British cannon-ball embedded in its walls; the Old Norfolk academy (built in 1840), now used temporarily by the juvenile and domestic relations court; and the colonnaded city hall (1847). There are public parks covering 500 ac., 22 playgrounds, 40 public-school buildings, 181 churches, 2 newspapers, a public library with six branches, a municipal market built in 1923 at a cost of $500,000 and a picturesque municipal armoury, around which an open-air flower market is held the year round. Virginia beach, a popular resort on the Atlantic, 5 m. below Cape Henry, is 20 m. east of Norfolk, and there are many other recreation spots in the vicinity. The water-supply, sufficient for a much larger city, comes partly from works built in 1872–73, which for some time had been seriously inadequate, and partly from Lake Prince (20 m. W.) through a new system constructed since 1920 at a cost of $6,000,000. Since 1919 the city has operated under a commission-manager form of government. The assessed valuation for 1927 was $175,818,039.

Norfolk is the centre of many activities of the Federal Government. The Norfolk navy yard is on the Portsmouth side of the Elizabeth river (*see* PORTSMOUTH), and the naval hospital is also in Portsmouth. In Norfolk (directly opposite the navy yard) is the St. Helena naval reservation, now used as a naval air-landing

field. Within the city are also a U.S. Public Health Service hospital, a branch of the U.S. Hydrographic Office, district headquarters of the Coast Guard; headquarters of the customs district of Virginia and various other offices. At Sewall point, on the northern edge of Norfolk, is the Hampton Roads naval operating base, comprising a training station where nearly 50,000 men were trained for the navy during the World War; a supply station with warehouse floor-space of 55 ac. and the navy's principal fuel-reserve depot; a naval air station and a submarine base.

Since the opening of the World War, Hampton Roads has become one of the important ports of the United States in respect of foreign trade, handling in 1925 5,644,675 tons of imports and exports, over 5% of the total of the country. More than half the tobacco exported from the United States moves through Hampton Roads, and in 1927 the railroads dumped altogether 19,816,806 tons of coal at this port, for coastwise and foreign trade and for bunkering purposes. It is also an important oil-bunkering port, with a storage capacity of 2,500,000 barrels. About $\frac{3}{4}$ of the total tonnage of Hampton Roads moves through the Norfolk harbour. Norfolk is surrounded by one of the finest truck-farming districts of the United States, and is the shipping point for immense quantities of potatoes, spinach, kale, beans, cauliflower, tomatoes and strawberries. Norfolk's industries had an output in 1925 valued at $35,454,752. Shipbuilding is perhaps the most important. Among products are fertilizers (1,000,000 tons a year), peanut and cotton seed oil, sea-foods, textiles, automobiles, cement and lumber.

Norfolk was laid out in 1688 (on 50 ac. of land bought from Nicholas Wise, a carpenter, for 10,000 lb. of tobacco) to be a centre of trade, and was incorporated as a borough in 1736. On Jan. 1, 1776, it was furiously bombarded by the British under Lord Dunmore. Sailors set fire to the warehouses along the water front, and the town burned for three days, until all the buildings except St. Paul's church were destroyed. After the Revolution it was rebuilt, and grew rapidly until the Embargo Act of 1807 ruined its commerce at a single stroke. In the War of 1812 Norfolk was attacked and successfully defended. It was chartered as a city in 1845. In 1855 there was a disastrous epidemic of yellow fever, brought in by a man-of-war. At the outbreak of the Civil War Norfolk had a population of 14,620. The navy yard was burned and abandoned by the Federals in April 1861, and the city was held by the Confederates until May 10, 1862. Recovery after the war was gradual until 1880, when the population was 21,966. After that growth was more rapid, to 34,871 in 1890, 46,624 in 1900, and 67,452 in 1910. The Ter-Centennial Exposition, celebrating the founding of Jamestown, was held here in 1907, on ground now within the city limits and occupied by the naval base. During the World War Norfolk had a period of intoxicating prosperity, due at first to heavy shipments of orders to the Allies, and after 1917 to the activities at the army supply base and the naval operating base and navy yard. Correspondingly severe was the post-war deflation, when the army base was closed down, the fleet transferred to the Pacific coast and the naval training station reduced to a skeleton organization; but in the following years substantial foundations were laid for a healthy commercial, civic and industrial development.

NORFOLK AND WESTERN RAILWAY COMPANY, THE, primarily a coal carrier, with a total investment of $425,614,646·55 and a total capitalization of $162,998,600 on Dec. 31, 1927, employed in 1928, 30,000 persons and operated 4,477 m. of track in six States in the United States, namely: Virginia, West Virginia, North Carolina, Maryland, Ohio, and Kentucky. Its main line runs from Norfolk and Lambert Point, Va., the eastern terminus, on the Port of Hampton Roads, through agricultural, livestock and mineral sections of Virginia, through vast coal fields in West Virginia and thence into Ohio to Cincinnati and Columbus, the western terminals. A line from Roanoke, Va., to Hagerstown, Md., makes connections for the east and north; two lines into North Carolina, one from Roanoke, Va., to Winston-Salem and the other from Lynchburg, Va., to Durham, make connections with the south. One of the first railroads in the country to employ electric traction, the N. and W. greatly increased its operating efficiency by electrifying 210 m. of track on mountain grades in West Virginia. The coal traffic of the road has grown from 70,000 tons in 1883 to almost 43,000,000 tons in 1927.

The road had its beginning in Virginia in 1837 as the City Point Railroad running between Petersburg and City Point, a distance of ten miles. The South Side (which purchased the City Point), Norfolk and Petersburg, and Virginia and Tennessee railroads, all in Virginia and built between 1849 and 1858, running from Norfolk to the Tennessee line at Bristol, consolidated in 1870 as the Atlantic, Mississippi and Ohio R.R. Co., with a total trackage of 479 miles. This road was sold in 1881 and became the Norfolk and Western Railroad Company. Between 1881–91 it built three lines into the coal fields of Virginia and West Virginia extending beyond to Ohio and acquired by purchase two other roads, one running from near Ironton, Ohio to Columbus, and the other, from Roanoke to Hagerstown. In Sept. 1896, the railroad was organized as the Norfolk and Western Railway Company. Later in the year it purchased the two lines running from Virginia into North Carolina. In 1901 it bought a second line in Ohio, from Sciotoville to Cincinnati. Since that time the road has had a steady development, with double tracking, branch construction and the complete modernization of all its facilities. (A. C. N.)

NORFOLK ISLAND: *see* PACIFIC ISLANDS.

NORICUM, a district south of the Danube, corresponding to part of Styria and Carinthia, Austria, Bavaria and Salzburg. The population was Illyrian afterwards subordinate to various Celtic tribes. The country is mountainous and the soil poor, but it was rich in iron, and the famous Noric steel was used for Roman weapons. The inhabitants were warlike and paid more attention to cattle-breeding than to agriculture. Gold and salt were found in considerable quantities; the wild nard grew in abundance, and was used as a perfume. Noricum was the southern outpost of the Celtic peoples and the starting-point of their attacks upon Italy. The cemeteries of Hallstatt (*q.v.*), less than 40m. from Noreia, contained weapons and ornaments from the bronze age up to the fully developed iron age. Prof. Ridgeway (*Early Age of Greece*, i. ch. v.), holds that here was the cradle of the Homeric Achaeans. For a long time the Noricans enjoyed independence under princes of their own, and carried on commerce with the Romans. In 16, having joined with the Pannonians in invading Histria, they were defeated by Publius Silius, proconsul of Illyricum. From this time Noricum was called a province, although not organized as such, but remaining a kingdom with the title *regnum Noricum*, under the control of an imperial procurator. In the reign of Marcus Antoninus the Legio II. Pia was stationed at Noricum, and the commander of the legion became governor.

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NORMAL SCHOOLS: *see* TEACHERS, TRAINING OF.

NORMAN, SIR HENRY WYLIE (1826–1904), field-marshal and colonial governor, was born on Dec. 2, 1826, and entered the Indian army at the age of seventeen. Norman served in numerous frontier campaigns between 1850 and 1854, and in the suppression of the Sonthal rebellion of 1855–56. In the Mutiny campaign he was constantly engaged, being present at the siege of Delhi, the relief of Lucknow and a number of other affairs. As adjutant-general of the Delhi Field Force, he was one of the leading spirits of the siege, and afterwards became its chief chronicler. Altogether he was mentioned twenty-five times in despatches. He held various important positions at Simla and at Whitehall until 1883. He was then governor of Jamaica (1883–88), governor of Queensland (1888–95), agent-general for Queensland, and in 1901 governor of the Royal Hospital, Chelsea. In 1902 he was made a field-marshal. He died on Oct. 26, 1904.

See Sir William Lee Warner, *Memoirs of Field-marshal Sir Henry Wylie Norman* (1908).

NORMAN, MONTAGU COLLET (1871–), British financier, was educated at Eton and King's college, Cambridge. He served in the South African War, 1900–01 and was awarded

the D.S.O. He afterwards became connected with the financial side of business, and his active association with the Bank of England began during the World War. In 1918 he was appointed deputy-governor and in 1920 governor of the Bank of England. He was re-elected for the seventh time in 1926, having held the post for longer than any previous governor. In 1922 he accompanied Mr. Baldwin, then chancellor of the exchequer, to the United States to arrange for the funding of the British war debt. During his governorship the gold standard was restored. In 1923 he was made a privy councillor.

NORMAN, a city of central Oklahoma, U.S.A., 18 m. S. of Oklahoma City, on a plateau 1,170 ft. above sea-level, overlooking the valley of the South Canadian river; county seat of Cleveland county. It is on Federal highway 77, and is served by the Oklahoma and the Santa Fe railways. Pop. (1920) 5,004 (98% native white) estimated locally at 10,000 in 1928. It is the seat of the University of Oklahoma (opened in 1892) with 5,000 students in winter and 2,500 in summer; and of the State Hospital for mental diseases, with 1,400 patients. The university occupies a campus of 177 acres. Its grounds and buildings are valued at about $4.000,000; its revenues for the year ending June 30, 1927, were $1,418,465. The faculty numbers about 280. Norman was founded in 1889 and chartered as a city in 1902. Since 1919 it has had a commission-manager form of government.

NORMAN, in architecture, the Romanesque style developed in Normandy and England during the 11th and 12th centuries, up to the time of the general adoption of Gothic architecture in both countries. As it was only shortly before the Norman conquest of England that Normandy became settled and civilized enough to produce an architecture, the origin in both countries is the same, and early types extremely similar. This common early Norman differed from Romanesque in its love of geometric ornament such as zig-zags, general crudeness in carving figures and leaves, and a daring originality in construction ideas, probably owing much to the fact that Lanfranc of Pavia (d. 1089) had introduced Lombard ideas into many Norman abbeys.

Although the English and French phases of the style were thus identical at the start, they soon became different. The French was characterized by careful, structural articulation (Abbaye-aux-Dames and Abbaye-aux-Hommes, Caen, both founded in 1062, but altered later), and elaboration of tower and spire (S. Michel de Vaucelles, Caen, 12th century). In England the chief characteristics are enormous length of church plan, the frequent use of great round columns for the nave arcade (Gloucester cathedral, 1089–1100; Tewkesbury abbey, 1123; and Durham cathedral, alternate piers, 1099–1128) and great decorative richness (Prior's door, Ely cathedral, late 12th century; S. Mary's chapel, Glastonbury abbey, 1186; the front of Iffley church, 12th century; and the Galilee porch at Durham, *c.* 1175). The general Norman structural genius is most markedly shown in the ribbed vault of Durham cathedral, whose date is much debated, being placed as early as 1133 and as late as the 13th century. (*See* BYZANTINE AND ROMANESQUE ARCHITECTURE.)

NORMANBY, CONSTANTINE HENRY PHIPPS, 1ST MARQUESS OF (1797–1863), British statesman and author, son of Henry, 1st earl of Mulgrave (1755–1831), was born on May 15, 1797. The 1st earl (who was created baron in 1794 and earl in 1812) was a distinguished soldier, and Pitt's chief military adviser; and he held the offices of chancellor of the duchy of Lancaster (1804), secretary for foreign affairs (1805), first lord of the admiralty (1807–10), and master of the ordnance (1810–18). In 1792 he inherited the earlier Irish barony of Mulgrave—created in 1767 for his father, Constantine (1722–75) grandson of Sir Constantine Phipps (1656–1723), the lord chancellor of Ireland—from his elder brother Constantine (1744–92), a naval captain.

His son, the 1st marquess, was governor of Jamaica (1830–35) and lord-lieutenant of Ireland (1835–39). He was created marquess of Normanby in 1838, and held successively the offices of colonial secretary and home secretary in the last years of Lord Melbourne's ministry. From 1846 to 1852 he was ambassador at Paris, and from 1854 to 1858 minister at Florence. The publication in 1857 of a journal kept in Paris during the stormy times of 1848 (*A Year of Revolution*), brought him into violent controversy with Louis Blanc, and he came into conflict with Palmerston and Gladstone, on French and Italian policy. He died on July 28, 1863. He was succeeded as 2nd marquess by his son George (1819–90), a liberal statesman, who became governor of Queensland (1871–74), New Zealand (1874–79), and Victoria (1879–84).

NORMANDY, a province of old France, bounded on the N.E. by the river Bresle, which falls into the Channel at Tréport and separates Normandy from Picardy, and then roughly by the Epte, which divides the Vexin into two parts.

Under the feudal régime, the energy of the Norman dukes prevented the formation of many powerful lordships, and there are few worthy of note, save the countships of Eu, Harcourt, Le Perche and Mortain. The duchy of Normandy, which was confiscated in 1204 by King Philip Augustus of France, formed in the 16th century the *gouvernement* of Normandy; the extent of this *gouvernement* did not, as a matter of fact, correspond exactly to that of the duchy, for Le Perche, which had been part of the duchy, was annexed to the *gouvernement* of Maine, while the Thimerais, which had belonged to the countship of Blois, was joined to the *gouvernement* of Normandy. In the 17th century this *gouvernement* was divided into three *généralités* or *intendances:* those of Rouen, Caen and Alençon. For judicial purposes Normandy was under the jurisdiction of the parlement of Rouen, created in 1499. Since 1791 the territory of the old duchy has composed, roughly speaking, the departments of Seine-Inférieure, Eure, Calvados, Manche and Orne.

History.—The province of *Lugdunensis Secunda,* which included Normandy, was conquered by Clovis before 506, and during the Merovingian times followed the fortunes of Neustria. In the 9th century this country was ravaged by the Northmen, and at length was formally ceded to them. The definitive establishment of the Normans, to whom the country owes its name, took place in 911, when by the treaty of Saint-Clair-sur-Epte, concluded between King Charles the Simple of France and Rollo, chief of the Normans, the territory comprising the town of Rouen and a few *pagi* situated on the sea-coast was ceded to the latter. Later, Rollo received from the king of France Bessin and Maine. Although baptized, he seems to have retained many pagan customs. The legend that he married Gisela, daughter of Charles the Simple seems to be unfounded.

History is here obscure. The first two dukes, Rollo and his son William "Longsword," displayed a certain fidelity to the Carolingian dynasty, and in 936 William did homage to Louis IV. d'Outremer. He died on Dec. 17, 942, assassinated by the count of Flanders. During the minority of his successor, Duke Richard, King Louis IV., who was making an expedition into Normandy, was captured by the inhabitants of Rouen and handed over to Hugh the Great. From this time onwards the dukes of Normandy began to enter into relations with the dukes of France; and in 958 Duke Richard married Hugh the Great's daughter. He died in 996. At the beginning of the reign of his son, Richard II. (996–1026), there was a rising of the peasants, who formed assemblies with a view to establishing fresh laws for the management of the forests. This attempt at insurrection, described by William of Jumièges, and treated by many historians, on the authority of the poet Wace, as a sort of democratic movement, was put down with an iron hand. Richard III. reigned from 1026–27 and Robert the Magnificent or the Devil (1027–35). In 1031 Robert supported King Henry I. of France against his brother Robert, who was laying claim to the throne, and in return for his services received the French Vexin. The duke died on a pilgrimage to Jerusalem, leaving as his heir an illegitimate son, William, born of his union with the daughter of a tanner of Falaise and left under the protection of the king. In 1047 Henry I. had to defend the young duke against an army of rebellious nobles, whom he succeeded in beating at Val-ès-dunes. In the following year the king of France was in his turn supported by the duke of Normandy in his struggle against Geoffrey Martel, count of Anjou; the two allies besieged Mouliherne (1048); and the war was continued between the duke of Normandy and the count of Anjou by the

siege of Alençon, which was taken by Geoffrey Martel, then retaken by William, and that of Domfront, which in 1049 had to surrender to Duke William.

In 1054 the duke married Matilda, daughter of Baldwin V., count of Flanders. The king of France before long became alarmed at William's ambitions, and encouraged William Busac, count of Eu and Montreuil, in his claim to the ducal crown. In 1054 he invaded Normandy with his brother Odo and this count, but Odo was beaten at Mortemer. In 1058 the king of France, joined by Geoffrey Martel, count of Anjou, tried to revenge himself, but was beaten at the ford of Varaville.

Towards the same time occurred the temporary annexation of Maine to Normandy. Herbert II., the young count of Maine, who was a vassal of the count of Anjou, did homage to William between 1055 and 1060, perhaps after the defeat of Geoffrey Martel; he promised to marry one of William's daughters, and betrothed his sister Margaret to the duke's son, Robert Curthose, on the understanding that, if he died leaving no children, the countship was to fall to William. After his death, the people of Maine revolted (1063), choosing as their lord Walter of Mantes, count of Vexin; but William, after one campaign, succeeded in imposing Norman authority. Three years later, he took possession of England, of which he was crowned king in 1066. Normandy now became the scene of William's quarrels with his son, Robert Curthose, who laid claim to Normandy and Maine, and with the aid of King Philip I. of France succeeded in defeating his father at Gerberoi in 1079.

After the death of William (Sept. 7, 1087), his eldest son, Robert Curthose, kept Normandy and Maine, and his second son, William Rufus, became king of England. In 1096 Robert departed on a crusade and pledged the duchy to his brother for 10,000 livres. When Robert returned, William Rufus had just died, and his youngest brother, Henry, had already taken possession of the crown. Henry was ambitious of uniting Normandy to England; in 1105, with the aid of Helias, count of Maine, and the son of Geoffrey Martel, count of Anjou, he took and burnt Bayeux, but failed to take Falaise. On Sept. 28, 1106, he defeated his brother at Tinchebrai, took him prisoner, and seized Normandy. Thus the centre of gravity was changed; England had at first been dependent on Normandy, Normandy was now subordinate to England.

Union with England.—From 1106 to 1204 Normandy remained united to England. Henry I. carried on hostilities against the king of France and William Clito, son of Robert Curthose, whose claim to the duchy of Normandy was upheld by Louis VI., and won an important victory over his opponents at Brémule (1119). After the disaster of the White Ship (1121), in which the Atheling William lost his life, Henry's only surviving child was a daughter, Matilda, widow of the emperor Henry V. In 1127 Matilda married Geoffrey the Fair, eldest son of Fulk V., count of Anjou. After the death of Henry I. in 1135, a struggle arose between Matilda, who claimed the kingdom of England and the duchy of Normandy in the name of her son Henry, and Theobald, count of Champagne, grandson of William the Conqueror on the side of his mother Adela, the candidate of the Normans of Normandy, while the Norman party in England supported Stephen, brother of Theobald. In 1144 Theobald, whose position had been much weakened since the taking of the castle of Rouen, gave up his rights in Normandy to Matilda's husband Geoffrey, count of Anjou, in favour of Henry Plantagenet. Between 1139 and 1145 Geoffrey, with French and Flemish help, gradually subdued Normandy, and on his death, in 1151, his son Henry Plantagenet was master of Normandy as well as count of Anjou. In 1152, by his marriage, Aquitaine also was secured to himself and his descendants, and in 1153 he was recognized as heir to the throne of England. The duchy of Normandy, though nominally in feudal dependence on the king of France, thus became part of the great Angevin empire, of which the power and resources were more than equal to that of the French kings (*see* FRANCE: *History*, and ENGLISH HISTORY).

From the first the French kings were fully conscious of the menace of the Angevin power. The reign of Louis VII. was occupied by the struggle against Henry II. Philip Augustus (1180–1223) pursued the same policy with greater tenacity and success. He began by taking part against Henry II. with his son and successor, Richard, who obtained the throne on the death of Henry II. in 1189. From the point of view of Normandy, the most important events of Richard's reign were: the truce of Issoudun, by which Philip Augustus kept the Norman Vexin which he had just conquered (1195), the building by Richard of Château-Gaillard (1196), and finally the defeat of Philip Augustus by Richard at Courcelles, near Gisors (1198). On the death of Richard at Chalus in 1199 the position of Philip Augustus was critical. The situation was modified under the reign of John Lackland, Richard's brother, who had himself crowned duke of Normandy at Rouen (April 25, 1199). Philip Augustus set up in opposition to him Arthur of Brittany, son of Geoffrey and grandson of Henry II., and the first phase of the struggle between the kings of France and England continued until the treaty of Goulet (1200). But in 1202 Philip made a fresh attempt to seize the Continental possessions of the kings of England. An excuse for reopening hostilities offered itself in the abduction, by John, of Isabel of Angoulême, the betrothed of Hugh le Brun, son of the count of La Marche. The barons appealed to Philip Augustus, who summoned John to appear before the royal judges; he failed to appear, and was consequently condemned by default, as a disloyal vassal, to have all the fiefs which he held in France confiscated (April 1202). The confiscation, a purely formal operation, was followed by the actual conquest.

In June 1202 Philip Augustus invaded Normandy and besieged the castle of Arques, near Dieppe; at the same time Arthur of Brittany was taken prisoner by John at Mirebeau in Poitou, and imprisoned in the castle of Falaise, from which he was removed to Rouen and died, probably assassinated by John's orders. The conquest of Normandy began with the occupation of Château-Gaillard after an eight months' siege (Sept. 1203–April 1204); the rest of Normandy was taken during the following months, Rouen surrendering in 1204 but obtaining a guarantee of her privileges. The conquest of Normandy by the French was not, however, recognized officially till the treaty of Paris (1259). In 1329 the duchy of Normandy was revived in favour of John, son of King Philip VI.

The Hundred Years' War.—Owing to her geographical position, Normandy suffered heavily during the Hundred Years' War. In 1346 Edward III., at the instance of Godefroi d'Harcourt lord of Saint-Sauveur, invaded Normandy, landing at Saint-Vast-la-Hougue (July 12); and arriving at Caen on July 25, he laid waste the country as far as Poissy. After the accession of John II. (1350), Normandy was given as an appanage to the dauphin Charles. The treaty of London (1359) stipulated for its cession to England, but the provisions of the treaty were modified by those of the treaty of Brétigny (1360), and it remained in the possession of France.

The most striking event of the war in Normandy during the reign of Charles V. (1364–80), was the siege of Saint-Sauveur-le-Vicomte, which was occupied by the English, and only surrendered after a siege of several years. The opening years of the reign of Charles VI. (1380–1422) were disturbed by a revolt which broke out in Rouen against the *aides* which the royal Government had tried to impose (1381). In 1415 the war with England was resumed: an English army of 60,000 men landed on Aug. 14 at the mouth of the Seine, took Harfleur on Sept. 16, and finally defeated the army of the king of France at Agincourt. During the following years the whole of Normandy was occupied, Rouen holding out for nearly six months (July 29, 1418–Jan. 13, 1419), and Henry V. of England entrusted the administration of Normandy to a special council. After the expeditions of Joan of Arc and the treaty of Arras the position of the English in Normandy became insecure; at the end of 1435 the whole district of Caux, and in 1436 that of the Val de Vire revolted; Mont-Saint-Michel, which had never been taken by the English, continued to resist, and in order to keep guard over it the English built Granville. But Normandy was not recovered by the French till after the sack of Fougères (1449). Cotentin was reconquered by Richmond (*see* ARTHUR, duke of Brittany) and the duke of Brittany;

Rouen surrendered on Oct. 29, 1449. An English army was sent into Normandy under the leadership of Thomas Kyriel; it landed at Cherbourg and marched across Cotentin to Bayeux, but was met at Formigny (April 15, 1450) by the count of Clermont and utterly routed. Caen, and finally Cherbourg, capitulated.

After the French conquest, the history of Normandy is less eventful. The kings of France maintained the provincial Estates and the University of Caen, founded by the kings of England, and transformed the Exchequer of Normandy into a permanent court of justice (1499) which was called the parlement of Normandy. Among the measures which contributed to the increase of the prosperity of Normandy should be noted the construction in 1752 of the Hâvre de Grace.

During the 16th century the Protestant Reformation met with some success in Normandy. The Reforming movement began with Pierre Bar in 1528, and the first apostle of the Reformation at Rouen was François Legay, called Boisnormand. Caen received the Reformed religion in 1531, and Alençon in 1582. In the massacre of St. Bartholomew's day (1572) more than 500 victims were slaughtered by the Catholics. After 1588 the Catholic party of the League established itself in Normandy, and King Henry IV. had to conquer it by force of arms. The most famous engagements during this expedition were the king's victories at Arques and Ivry, but he failed to take Rouen, which was defended by Alexander Farnese, duke of Parma, and only surrendered after the abjuration of the king.

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(R. LA.; F. M. S.)

NORMANS, the softened form of the word "Northman," applied first to the people of Scandinavia in general, and afterwards specially to the people of Norway. In the form of "Norman" it is the name of those colonists from Scandinavia who settled in Gaul, founded Normandy, adopted the French tongue and French manners, and from their new home set forth on new errands of conquest, chiefly in the British islands and in southern Italy and Sicily. Normans and Northmen must be carefully distinguished. For these Normans began to adopt a new religion, a new language, a new system of law and society, new thoughts and feelings on all matters. To all outward appearance the Norman conquest of England was an event of an altogether different character from the Danish conquest. The one was a conquest by a people whose tongue and institutions were still palpably akin to those of the English. The other was a conquest by a people whose tongue and institutions were palpably different from those of the English. The Norman settlers in England felt no community with the earlier Danish settlers in England. In fact the Normans met with the steadiest resistance in a part of England which was largely Danish. But the effect of real, though unacknowledged, kindred had none the less an important practical effect. There can be no doubt that this hidden working of kindred between conquerors and conquered in England, as compared with the utter lack of all fellowship between conquerors and conquered in Sicily, was one cause which made so wide a difference between the Norman conquests of England and of Sicily.

Character of the Normans.—The English and the Sicilian settlements form the main Norman history of the 11th century. The new creed, the new speech, the new social system, had taken such deep root that the descendants of the Scandinavian settlers were better fitted to be the armed missionaries of all these things than the neighbours from whom they had borrowed their new possessions. With the zeal of new converts they set forth very much in the spirit of their heathen forefathers. The same spirit of enterprise which brought the Northmen into Gaul seems to carry the Normans out of Gaul into every corner of the world. Their character is well painted by a contemporary historian of their exploits, Geoffrey Malaterra. He sets the Normans before us as a race specially marked by cunning, despising their own inheritance in the hope of winning a greater, eager after both gain and dominion, given to imitation of all kinds, holding a certain mean between lavishness and greediness—*i.e.*, perhaps uniting, as they certainly did, these two seemingly opposite qualities. Their chief men, he adds, were specially lavish through their desire of good report. They were, moreover, a race skilful in flattery, given to the study of eloquence, so that the very boys were orators, a race altogether unbridled unless held firmly down by the yoke of justice. They were enduring of toil, hunger, and cold whenever fortune laid it on them, given to hunting and hawking, delighting in the pleasure of horses, and of all the weapons and garb of war. Love of imitation is marked. Little of original invention can be traced to any strictly Norman source; but no people were ever more eager to adopt from other nations, to take into their service and friendship from any quarter men of learning and skill and eminence of every kind. To this admirable quality is perhaps to be attributed the fact that a people who accomplished so much, who settled and conquered in so large a part of Europe, has practically vanished from the face of the earth.

Their Faculty of Adaptation.—But Geoffrey hardly did justice to the Normans if he meant to imply that they were simple imitators of others. Their position was very like that of the Saracens. In no department of science or art did any Saracen, strictly speaking, invent anything; but they learned much both from Constantinople and from Persia, and what they learned they largely developed and improved. The Normans did just the same. They adopted the French tongue, and were presently among the first to practise and spread abroad its literature. They adopted the growing feudal doctrines of France, and worked them, both in Normandy and in England, into a harmonious system. From northern Italy, as it would seem, they adopted a style of architecture which grew in their hands, both in Normandy and in England, into a marked and living form of art. Settled in Gaul, the Scandinavian from a seafaring man became a landsman. Even in land-warfare he cast aside the weapons of his forefathers; but he soon learned to handle the weapons of his new land with greater prowess than they had ever been handled before. He welcomed the lore of every stranger. Lanfranc brought law and discipline; Anselm brought theology and philosophy. The gifts of each were adopted and bore fruit on both sides of the Channel. And no people ever better knew how to be all things to all men. The Norman power in England was founded on full and speedy union with the one nation among whom they found themselves. The Norman power in Sicily was founded on a strong distinction between the ruling people and the many nations which they kept in peace and prosperity by not throwing in their lot with any one among them.

The quality which Geoffrey Malaterra expresses by the word "effrenatissima" is also clearly marked in Norman history. It is, in fact, the groundwork of the historic Norman character. It takes in one case the form of ceaseless enterprise, in another the form of that lawlessness which ever broke out, both in Normandy and in every other country settled by Normans, when the hand of a strong ruler was wanting. But it was balanced by another quality which Geoffrey does not speak of, one which is not really inconsistent with the other, one which is very prominent in the Norman character, and which is, no less than the other, a direct heritage from their Scandinavian forefathers. This is the excessive litigiousness, the fondness for law, legal forms, legal processes, which has ever been characteristic of the people. If the Norman was a born soldier, he was also a born lawyer. But nothing so well illustrates this formal side of the Norman character as the whole position of William the Conqueror himself. His claim to the crown of England is something without earlier precedent, something as far as possible removed from the open violence of aggressors who have no pretexts with which to disguise their aggression. It rested on a mass of legal assumptions and subtleties, fallacious indeed, but ingenious, and, as the result proved,

effective. His whole system of government, his confiscations, his grants, all that he did, was a logical deduction from one or two legal principles, arbitrary certainly in their conception, but strictly carried out to their results. Even Norman lawlessness in some sort took a legal shape. In the worst days of anarchy, in the minority of William or under the no-reign of Robert, the robber-baron could commonly give elaborate reasons for every act of wrong that he did.

The Normans were, therefore, crusaders before crusades were preached. Norman warriors had long before helped the Christians of Spain in their warfare with the Saracens of the Peninsula, and in Sicily it was from the same enemy that they won the great Mediterranean island. Others had done a kindred work in a more distant field as helpers of the Eastern emperors against the Turks of Asia. All these might pass for religious wars, and they might really be so; it needed greater ingenuity to set forth the invasion of England as a missionary enterprise designed for the spiritual good of the benighted islanders. The Norman, a strict observer of forms in all matters, attended to the forms of religion with special care. No people were more bountiful to ecclesiastical bodies on both sides of the Channel; the foundation of a Benedictine monastery in the 11th century, of a Cistercian monastery in the 12th seemed almost a matter of course on the part of a Norman baron. On the other hand, none were less inclined to submit to encroachments on the part of the ecclesiastical power, the Conquerer himself least of all.

Neither England nor Sicily has become a Norman land, and the tongue which the Norman brought with him into both has not for ages been spoken in either. Norman influence has been far stronger in England than in Sicily, and signs of Norman presence are far more easily recognized. But the Norman, as a distinct people, is as little to be seen in the one island as in the other, a result due to different and almost opposite causes. The whole circumstances of the conquest of England constrained the conquerors to become Englishmen in order to establish themselves in the conquered land. In William's theory, the forcible conquest of England by strangers was an untoward accident. The lawful heir of the English crown was driven against his will to win his rights by force from outside. But he none the less held his crown as an English king succeeding according to English law. Moreover, every Norman to whom he granted lands and offices held them by English law in a much truer sense than the king held his; he was deemed to step into the exact position of his English predecessor, whatever that might be. This legal theory worked together with other causes to wipe out all practical distinction between the conquerors and the conquered in a wonderfully short time. By the end of the 12th century the Normans in England might fairly pass as Englishmen, and they had largely adopted the use of the English language. The fashionable use of French for nearly two centuries longer was far more a French fashion than a Norman tradition. When the tradition of speaking French had all but died out, the practice was revived by fashion. Still the tradition had its effect. The fashion could hardly have taken root except in a land where the tradition had gone before it.

The Normans in England therefore became Englishmen, because there was an English nation into which they could be absorbed. The Normans in Sicily could hardly be said to become Sicilians, for there assuredly was no Sicilian nation for them to be absorbed into. While the Normans in England were lost among the people of the land, the Normans in Sicily were lost among their fellow-settlers in the land. The Normans who came into Sicily must have been much less purely Norman than the Normans who came into England. Indeed, we may doubt whether the Norman invaders of Sicily were Norman in much more than being commanded by Norman leaders. They were almost as little entitled to be called pure Scandinavians as the Saracens whom they found in the island were entitled to be called pure Arabs. The conquest of England was made directly from Normandy, by the reigning duke, in a comparatively short time, while the conquest of Sicily grew out of the earlier and far more gradual conquest of Apulia and Calabria by private men. The Norman settlements at Aversa and Capua were the work of adventurers, making their own fortunes and gathering round them followers from all quarters. They fought simply for their own lands, and took what they could by the right of the stronger. They started with no such claim as Duke William put forth to justify his invasion of England; their only show of legal right was the papal grant of conquests that were already made. The conquest of Apulia, won bit by bit in many years of what we can only call freebooting, was not a national Norman enterprise like the conquest of England, and the settlement to which it led could not be a national Norman settlement in the same sense. The Sicilian enterprise had in some respects another character. By the time it began the freebooters had grown into princes. Still there was a wide difference between the duke of the Normans and the duke of Apulia, between an hereditary prince of 150 years' standing and an adventurer who had carved out his duchy for himself.

The characteristic point of Norman rule in Sicily is that it is the rule of princes who were foreign to all the inhabitants of the island, but who were not more foreign to the inhabitants of the island than different classes of them were to one another. The Norman conqueror found in Sicily a Christian and Greek-speaking people and a Muslim and Arabic-speaking people. The relations between the two differed widely in different parts of the island, according to the way in which the Saracens had become possessed of different towns and districts. In one place the Christians were in utter bondage, in another they were simply tributary; still, everywhere the Muslim Saracen formed the ruling class, the Christian Greek formed the subject class. We speak of the Saracen very much as we speak of the Norman; for of the Muslim masters of Sicily very many must have been only artificial Arabs, Africans who had adopted the creed, language and manners of Arabia. In each case the Arab or the Norman was the kernel, the centre round which all other elements gathered and which gave its character to the whole. Besides these two main races, Greek and Saracen, others came in through the Norman invasion itself. There were the conquerors themselves; there were the Italians, in Sicily known as Lombards, who followed in their wake; there were also the Jews, whom they may have found in the island, or who may have followed the Norman into Sicily, as they certainly followed him into England. The special character of Norman rule in Sicily was that all these various races flourished, each in its own fashion, each keeping its own creed, tongue and manners, under the protection of a common sovereign, who belonged to none of them, but who did impartial justice to all. Such a state of things might seem degradation to the Muslim, but it was deliverance to the native Christian, while to settlers of every kind from outside it was an opening such as they could hardly find elsewhere. But the growth of a united Sicilian nation was impossible; the usual style to express the inhabitants of the island is "omnes" or "universi Siciliae populi." In the end something like a Sicilian nation did arise; but it arose rather by the dying out of several of the elements in the country, the Norman element among them, than by any such fusion as took place in England.

Normans in Scotland, Wales and Ireland.—From England, the Norman spread into Scotland, Wales and Ireland. In Scotland he was not a conqueror, but a mere visitor, and oddly enough he came as a visitor along with those whom he had himself overcome in England. Both Normans and English came to Scotland in crowds in the days of Margaret, Edgar and David, and Scottish national feeling sometimes rose up against them. In Scotland again the Norman settlers were lost in the mixed nationality of the country, but not till they had modified many things in the same way in which they modified things in England. They gave Scotland nobles and even kings; Bruce and Balliol were both of the truest Norman descent; the true Norman descent of Comyn might be doubted, but he was of the stock of the Francigenae of the Conquest. In Wales the Norman came as a conqueror, more strictly a conqueror than in England; he could not claim Welsh crowns or Welsh estates under any fiction of Welsh law. The Norman settler in Wales, therefore, did not to any perceptible extent become a Welshman. In Ireland the Norman was more purely a conqueror than anywhere else; but in Ireland his power of adaptation caused him to sink in a way in

which he sank nowhere else. While some of the Norman settlers in Ireland went to swell the mass of the English of the Pale, others threw in their lot with the native Irish, and became, in the well-known saying, *Hibernis ipsis Hiberniores* (see BURGH).

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(E. A. F.; F. M. S.)

NORMANTON: *see* CARPENTARIA, GULF OF.

NORMANTON, an urban and colliery district of Yorkshire, England, 3 m. N.E. of Wakefield, on the L.M.S. and L.N.E. railways. Pop. (1921), 15,858. It is situated at an altitude of about 150 ft., in the Calder valley, 1½ m. from the right bank of the river, and is a railway junction for the line from Manchester to Leeds via Wakefield, and for the main line from the south via Chesterfield. A mound in the neighbourhood, called Haw hill, is believed to be a barrow. Traces remain of a moat surrounding the town. Altofts, a neighbouring parish, was the home of Sir Martin Frobisher in the 16th century.

NORNS, in Northern mythology, the female divinities of fate, like the Gr. Μοῖραι generally represented as three in number, and said to spin, or weave, the destiny of men. They dwell beside the "Spring of fate," beneath the "world-tree," Yggdrasil's ash, which they water from the spring. Sometimes the Norns are indistinguishable from the Valkyries (*q.v.*). They appear as prophetesses (*völur*) at the birth of children. The most famous story is contained in the *Thâttr af Nornagesti.* (*See* TEUTONIC PEOPLES.)

NORRIS, FRANK (1870–1902), American novelist, was born in Chicago (Ill.), March 5, 1870. Believing that America ignored her own national epic, he devoted himself to his uncompleted trilogy of the wheat. *The Octopus* (1901) shows with a striking use of symbolism the raising of the wheat in California and the hold of the railway upon the ranchmen; *The Pit* (1903) is a powerful portrayal of the lure of board of trade gambling; the author's early death prevented completion of the third volume, dealing with consumption in Europe. Reared in Chicago (Ill.), educated at the San Francisco high school, the University of California, and Harvard, he studied art in Paris and served in South Africa as war correspondent for the San Francisco *Chronicle.* In 1896–97 he was associate editor of the San Francisco *Wave;* and in 1898 he was war correspondent in Cuba for *McClure's Magazine.* He died Oct. 25, 1902.

Besides the wheat trilogy, Norris's most important works are: *A Deal in Wheat, and Other Stories of the New and Old West* (1903); *The Third Circle* (1909), another collection of tales; *The Responsibilities of the Novelist, and Other Literary Essays* (1903); *Moran of the Lady Letty* (1898), a tale of adventure off the California coast; *Blix* (1899), a love story; *McTeague* (1899), a story of the San Francisco slums; and *Vandover and the Brute* (1914), a repulsive study of degeneration, issued with an introduction by Charles G. Norris. For a bibliography *see* F. T. Cooper's *Some American Story Tellers* (1911).

NORRIS, GEORGE WILLIAM (1861–), American legislator, was born on a farm in Sandusky county, Ohio, on July 11, 1861. The death of his father and only brother while he was very young left the family in straitened circumstances, and Norris was required to work out among the farmers in the summer and attend school only in the winter. He afterwards taught school and studied law, and earned enough to finish his law course at Valparaiso university. He was admitted to the bar in 1883. In 1885 he moved to McCook, Neb., and began to practise. He was later elected prosecuting attorney of Furnas county, and in 1895 district judge of the 14th judicial district; re-elected in 1899, he was serving in this position when in 1902 he became a U.S. representative. He was re-elected for five successive terms and in 1910 was the leader of the insurgent group which successfully held out for a reform of House rules, and thus put an end to the autocratic control of the speaker. He also led the fight against secret committee meetings. He was elected to the Senate in 1912, 1918 and 1924. He was one of the few who voted against the entrance of the United States into the World War, against the selective draft and anti-sedition acts, and he denounced the Versailles Treaty. He fought for the direct election of senators, and for presidential primaries. He was the author of a proposed amendment to abolish "lame-duck" Congresses. The Norris bill for retention of the Muscle Shoals power development by the Government, which passed the Senate in March 1928, marked the first indication of success in his six year fight to prevent Muscle Shoals from being acquired by private power interests. He was a leader in the demand for farm relief legislation, advocating a Government marketing corporation. He became the accepted leader of the independent group in Congress. Though nominally a Republican, party ties have rested lightly upon him, his dictum being that the people "ought to be independent of all parties." In 1926, outraged by Republican campaign expenditure in Pennsylvania, he entered that State to speak in favour of the Democratic nominee. In 1928 he supported Smith for the Presidency.

NORRIS, HENRY NORRIS or **NORREYS, BARON** (*c.* 1525–1601), belonged to an old Berkshire family, many members of which had held positions at the English court. His father, Henry Norris, was a grandson of Sir William Norris, who commanded the royal troops against Lambert Simnel at the battle of Stoke in 1487. Like his brother John (d. 1564), the elder Henry Norris obtained a post at the court of Henry VIII.; he gained the king's favour and was rewarded with many lucrative offices. He belonged to the party which favoured the elevation of Anne Boleyn; but in May 1536 he was arrested on the charge of intriguing with her, and though he was probably innocent of any serious offence, he was beheaded on May 17, 1536. His son Henry regained some of his father's lands and entered upon court life, being a member of parliament under Edward VI. During Mary's reign he was one of those who were entrusted with the custody of the princess Elizabeth, and when the princess became queen she amply repaid the kindness which Norris had shown to her when he was her guardian at Woodstock. In 1566 he was knighted and sent as ambassador to France, where he remained until 1570, and in 1572 he was created Baron Norris of Rycote. He died in June 1601.

The eldest of his six sons, Sir WILLIAM NORRIS, died in Ireland in Dec. 1579, leaving a son Francis (1579–1623), who succeeded to his grandfather's barony and also to the estates of his uncle Sir Edward Norris. In 1621 Francis was created earl of Berkshire. He left no sons and the earldom became extinct, but the barony descended to his daughter Elizabeth (d. 1645), the wife of Edward Wray (d. 1658). Their daughter Bridget (1627–57) married as his second wife Montagu Bertie, 2nd earl of Lindsey, and their son James Bertie (1654–99) became Baron Norris (or Norreys) in 1657, and was created earl of Abingdon in 1682. His descendants the Berties, earls of Abingdon, still hold this barony.

Sir EDWARD NORRIS (d. 1603), the 1st Lord Norris's third son, served with the English troops in the Netherlands from 1585 to 1588. He is chiefly remembered owing to his fierce quarrel with Philip, count of Hohenlohe (1550–1606), called Hollock by the English, in August 1586 at Gertruydenberg.

NORRIS, SIR JOHN (*c.* 1547–1597), English soldier, was the second son of Henry Norris, Baron Norris of Rycote, and gained his earliest military experience in the civil wars in France. In 1573 he went to Ulster with Walter Devereux, earl of Essex, winning fame by his conduct in the guerrilla wars against the Irish, and being responsible for the massacre on the island of Rathlin in July 1575. He was again in Ireland in 1584, but the greater part of these years was spent in service in the Netherlands. In 1588, when the Spanish Armada was expected, he was marshal of the camp at Tilbury; later in the same year he served the queen as ambassador to the Dutch states, and in 1589 he and Sir Francis

Drake led the fleet which ravaged the coasts of Spain and Portugal. In 1591, and again in 1593, he aided Henry IV. of France in his struggle with the League in Brittany; and in May 1595 he landed again in Ireland, where he was lord president of Munster. He was to assist the lord deputy, Sir William Russell, in subjugating Ulster. After fighting and negotiating with the O'Neills in Ulster, and warring in Connaught, he asked for his recall. This was not granted, but he was supplanted in his military command; and he retired to Munster and died at Mallow on July 3, 1597. His monument is in the church of Tattendon, Berkshire.

See J. L. Motley, *The United Netherlands*, vol. ii. (1904); and R. Bagwell, *Ireland under the Tudors*, vol. iii. (1890).

NORRIS, JOHN (1657–1711), English philosopher and divine, was born at Collingbourne-Kingston in Wiltshire. He was educated at Winchester and Exeter college, Oxford, being subsequently elected to a fellowship at All Souls'. His first original work was *An Idea of Happiness* (1683), in which, with Plato, he places the highest happiness or fruition of the soul in the contemplative love of God. He studied the works of Malebranche and of Descartes and his followers and opponents. Of English thinkers, More and Cudworth, the so-called Cambridge Platonists, had influenced him most; and in 1685 his study of their works led to a correspondence with More, published after his death by Norris as an appendix to his Platonically conceived essay on *The Theory and Regulation of Love* (1688). He also corresponded with Mrs. Astell (*q.v.*) and Lady Masham, the friend of Locke, to whom he addressed his *Reflections upon the Conduct of Human Life* (1689). In 1689 Norris was presented to the living of Newton St. Loe, in Somersetshire. In 1690 he published a volume of *Discourses upon the Beatitudes*, followed by three more volumes of *Practical Discourses* between 1690 and 1698. In an appendix to his *Discourses* he gave "Cursory Reflections" on Locke's *Essay on the Human Understanding* which anticipate many later criticisms of Locke's philosophy, though he was at one with Locke in dismissing the "grey-headed, venerable doctrine" of innate ideas. The last 20 years of Norris's life were spent at Bemerton, to the living of which he had been transferred in 1691. In 1691–1692 he was engaged in controversy with his old enemies the "Separatists," and with the Quakers, his Malebranchian theory of the divine illumination having been confounded by some with the Quaker doctrine of the light within. In 1697 he wrote *An Account of Reason and Faith*, one of the best of the many answers to Toland's *Christianity not Mysterious*. Reason, according to Norris, is nothing but the exact measure of truth, that is to say, divine reason, which differs from human reason only in degree, not in nature. In 1701 appeared his most important work, *An Essay towards the Theory of the Ideal or Intelligible World*. The first volume treats the intelligible world absolutely; the second, which appeared in 1704, considers it in relation to human understanding. It is a complete exposition of the system of Malebranche, in which Norris refutes the assertions of Locke and the sensualists. In 1708 Norris wrote *A Philosophical Discourse concerning the Natural Immortality of the Soul*, defending that doctrine against the assaults of Dodwell. He died at Bemerton, and a monument was erected to his memory in the church. He occupies a place in the succession of ecclesiastical and mystical thinkers of whom Coleridge is the last eminent example.

See Wood, *Athenae Oxonienses* (ed. Bliss), iv.; *Biographia Britannica;* Leslie Stephen in *Dictionary of National Biography;* J. Tulloch, *Rational Theology and Christian Philosophy in England in the 17th Century* (1874), who calls Norris "as striking and significant a figure in the history of English philosophy," as Berkeley, another idealist.

NORRIS, WILLIAM EDWARD (1847–1925), English novelist, was born on Nov. 18, 1847, the son of Sir W. Norris, chief justice of Ceylon. He was educated at Eton, and called to the bar at the Inner Temple in 1874. His first story, *Heaps of Money*, appeared in 1877, and was followed by *Mademoiselle de Mersac* (1880), *Matrimony* (1881), *No New Thing* (1883), *My Friend Jim* (1886), *The Despotic Lady* (1895), *Matthew Austin* (1895), *The Widower* (1898), *Pauline* (1908), *Not Guilty* (1910); *The Rt. Hon. Gentleman* (1913); *Barbara and Company* (1914); *The Triumphs of Sarah* (1920); *Sabine and Sabina* (1922); *Next of Kin* (1923) and *Trevalion* (1925). He died on Nov. 19, 1925.

NORRISTOWN, a borough of Pennsylvania, U.S.A., the county seat of Montgomery county; on the Schuylkill river, 17 m. N.W. of the centre of Philadelphia. It is served by the Pennsylvania and the Reading railways. Pop. 32,319 in 1920 (82% native white); estimated locally at over 39,000 in 1928. Across the river is the borough of Bridgeport (pop. 4,680 in 1920). Norristown is a residential suburb of Philadelphia, and its industries are textile machinery and stockings for children. The Eastern Pennsylvania State hospital for the insane is located here. Valley Forge (*q.v.*) is 7 m. S.W. of the city. The site of Norristown is part of a manorial estate purchased from William Penn in 1704 by Isaac Norris. The borough was incorporated in 1812.

NORRKÖPING, the fourth town of Sweden, in the district (*län*) of Östergötland, 113 m. S.W. of Stockholm by the Malmö railway. Pop. (1927), 60,400. A bull of Pope Lucius III. shows that Norrköping existed in 1185. In the 17th century, Duke John of Östergötland introduced German craftsmen into Norrköping. Under Charles XII. the town suffered not only from war but from pestilence, 2,700 of its inhabitants perishing in 1710–1711. After the Russian invasion of 1719 the population was only 2,600. Norrköping occupies both banks of the Motala, the wide and rapid emissary of lake Vetter. Fires in 1719, 1812, 1822 and 1826 have caused rebuilding on modern lines. The falls in the river afford motive power to the cloth and cotton mills (spinning and weaving)—the staple industries—and to factories for sugar, paper, lithography, tobacco and carpets, joinery works and breweries. There are also shipbuilding yards and docks. Fine granite is quarried at Grafversfors, 7½ m. north. The inlet of Bråvik affords excellent harbour facilities for vessels up to 18½ ft. draught near the quay, and safe anchorage up to 30 ft. in the Pampas roads, 6 m. from the town.

NORSE LANGUAGE. The *Old Norwegian* language (till the Reformation) was not, like the modern language, confined to Norway and the Färoe islands, but was for some time spoken in parts of Ireland and the north of Scotland, the Isle of Man, the Hebrides, Shetland and Orkney (where it continued to the end of the 18th century), and also in certain parts of western Sweden.

The runic inscriptions in Old Norse are few in number (about 150) and of trifling philological importance, since they belong almost wholly to the period between 1050 and 1350, and are consequently not much earlier than the earliest literature. The whole literature preserved is written in the Latin alphabet. The earliest manuscripts are not much later than the oldest Old Icelandic ones and are of the greatest interest. The masses of charters which occur throughout the whole middle age of Norway from the beginning of the 13th century give information, especially of dialect.

In Old Norwegian the most primitive forms occur in old poems from times as remote as the days of Þorbiorn Hornklofi (end of the 9th century). The language at this epoch differed very little from other Scandinavian dialects. From the 13th century, Norwegian, owing to geographical and political circumstances, is considerably influenced by the eastern Scandinavian languages. The tendency in Norwegian to reduce the use of the so-called *u*-Umlaut has already appeared. There appears another kind of vowel-assimilation, almost unknown to Icelandic, the vowel in terminations being in some degree influenced by the vowel of the preceding syllable. Thus, for instance, we find in some manuscripts that the vowels *e, o, ø*, and long *a, æ*, are followed in terminations by *e, o; i, u, y* and short *a, æ*, on the other hand, by *i, u*—as in *bøner*, prayers, *konor*, women; but *tiðir*, times, *tungur*, tongues. The same fact occurs in certain Old Swedish manuscripts. When Norway had been united later with Sweden under one crown (1319) we meet pure Suecisms in the Norwegian literary language. In addition to this, the 14th century exhibits several differences from the old language: *rl, rn* are sometimes assimilated into *ll, nn*—as *kall* (elder *karl*), man, *konn* (*korn*), corn, *prestanner* (*prestarnir*), the priests; *i* passes into *y* before *r, l*—as *hyrðir* (*hirðir*), shepherd, *lykyl* (*lykill*), key; final *-r* after a consonant is changed into *-ar, -er, -ir, -or, -ur* or *ær*, sometimes only *-a, -e, æ*—as *hester* (*hestr*), horse, *bøker* (*bøkr*), books, the names Þolleifær (Þorleifr), Guðlæifæe (Guðleifr). About the beginning of the 15th cen-

tury initial *kv* occurs for old *hv* (not, however, in pronouns, which take *kv* only in western Norway), as the local name *Qvíteseið* (*hvítr*, white). During the 15th century, Norway being united with Denmark, and at intervals also with Sweden, a great many Danisms and a few Suecisms are imported into the language. Towards the end of the middle ages the Danish influence shows an immense increase, until at last Norwegian as a literary language is supplanted by Danish. Many Norse dialects developed in the 13th, 14th and 15th centuries. The language of western Norway resembles Icelandic, and the language of eastern Norway is still nearer to contemporary Old Swedish. The present dialectical division was in all essentials accomplished about the year 1600.

NORTH, BARONS. The English title of Lord North of Kirtling was created for Edward North (*c.* 1496–1564), son of Roger North, a London citizen, in 1554; he was a successful lawyer, clerk of the parliament (1531) and chancellor of the court of augmentations (1545). His second son was Sir Thomas North (*q.v.*), and he was succeeded as 2nd baron by his son Roger, a courtier and soldier of Queen Elizabeth's day, who married the daughter of Lord Chancellor Rich.

DUDLEY NORTH, 3rd Baron North (1581–1666), son of Sir John North and of Dorothy, daughter and heiress of Sir Valentine Dale, was born in 1581 and succeeded his grandfather, the 2nd Baron North, at the age of 19. He was educated at Cambridge, and married in 1599 Frances, daughter of Sir John Brockett of Brockett Hall, Hertfordshire. He travelled in Italy, took part in the campaign of 1602 in the Netherlands, and on his return became a conspicuous figure at court, excelling in athletic exercises as well as in poetry and music, and gaining the friendship of Prince Henry. In 1606, while returning from Eridge to London, he discovered the springs of Tunbridge Wells, which cured North himself of a complaint and quickly became famous. He also recommended the Epsom springs to the public. He supported and subscribed to the expedition to Guiana made by his brother Roger North (*c.* 1582–*c.* 1652) in 1619, and when Roger departed without leave Dudley was imprisoned for two days in the Fleet. In 1626 he attached himself to the party of Lord Saye and Sele in the Lords, who were in sympathy with the aims of the Commons; and when the civil war broke out he was on the side of the parliament. In 1641 he was a member of the Lords' committee on Religion, and served on the committee to consider Laud's attainder in 1644, finally voting for the ordinance in Jan. 1645. He was placed on the admiralty commission in 1645, and acted as lord lieutenant for Cambridgeshire. He was one of the small group of Lords who continued attendance in the House of Peers, and on Dec. 19, 1648, with three others, visited Fairfax, when they "cast down their honours at his Excellency's feet" and protested their desire not to retain any privileges prejudicial to the public interest. (Gardiner's *Civil War*, iv. 285.) He passed the rest of his life in retirement at Kirtling in Cambridgeshire, with his family, finding "employment with many airy entertainments as poetry, writing essays, building, making mottoes and inscriptions as well as in music." He wrote *A Forest of Varieties* (1645), a miscellany of essays and poems, another edition of which was published in 1659 under the title of *A Forest promiscuous of various Seasons' Productions*. He died on Jan. 16, 1666. North is described as "full of spirit and flame," of imperious temper but of well-balanced judgment, Lord Holland declaring that "he knew no man less swayed with passion and sooner carried with reason and justice." He left, besides one daughter, two sons, the elder of whom, Sir Dudley, succeeded him as 4th Baron North.

DUDLEY NORTH, 4th Baron North (1602–77), increased the family fortune by marrying the daughter of Sir Charles Montagu, brother of the 1st earl of Manchester. He was an accomplished man, of studious bent, and had 14 children, of whom the third son, Francis, became lord chancellor as Lord Guilford; the fourth was Sir Dudley North (*q.v.*), the economist; the fifth, John (1645–83), master of Trinity, Cambridge, and professor of Greek in the university; and the sixth, Roger (*q.v.*), the lawyer and historian.

The eldest son, Charles (d. 1691), was created Lord Grey of Rolleston during his father's life, and succeeded his father as 5th Baron North; and on the death of his son, William, 6th Lord North, without issue, in 1734, the barony of North went to a cousin, Francis North, 3rd baron, afterwards 1st earl of Guilford. The title of Lord North is that by which the 2nd earl of Guilford, prime minister from 1770–82, is best known in history. (*See* GUILFORD, BARONS AND EARLS OF.)

George Augustus, 3rd earl of Guilford (d. 1802), left three daughters, and the barony of North fell into abeyance till 1841 when it vested in Susan, Baroness North (1797–1884), wife of John Sidney Doyle, who took the name of North; at her death her son William Henry John North (b. 1836) succeeded as 11th baron, the title now being separate from that of Guilford.

NORTH, SIR DUDLEY (1641–1691), English economist, was 4th son of Dudley, 4th Lord North, who published *Passages relating to the Long Parliament*, of which he had himself been a member. He was born on May 16, 1641, and in his youth was carried off by gipsies and recovered with some difficulty by his family. He engaged in foreign trade, especially with Turkey, and spent many years at Constantinople and Smyrna. During the Tory reaction under Charles II. he was one of the sheriffs forced on the city of London with an express view to securing verdicts for the Crown in state trials. He was knighted, and was appointed a commissioner of customs, afterwards of the treasury, and again of the customs. Under James II., "he took," says Roger North, "the place of manager for the Crown in all matters of revenue." After the Revolution he was called to account for his alleged unconstitutional proceedings in his office of sheriff. He died on Dec. 31, 1691.

His tract entitled *Discourses upon Trade, principally directed to the cases of the interest, coinage, clipping and increase of money*, was published anonymously in 1691, and was edited in 1856 by J. R. M'Culloch in the *Select Collection of Early English Tracts on Commerce* printed by the Political Economy Club of London. In this emphatic assertion of the free-trade doctrine against the prevailing system of prohibitions, North shows that wealth may exist independently of gold or silver, its source being human industry, applied either to the cultivation of the soil or to manufactures. The export of money in the course of traffic, instead of diminishing, increases the national wealth, trade being only an exchange of superfluities. Nations are related to the world just in the same way as cities to the State or as families to the city. North emphasizes more than his predecessors the value of the home trade. With respect to the interest of capital, he maintains that it depends, like the price of any commodity, on the proportion of demand and supply, and that a low rate is a result of the relative increase of capital, and cannot be brought about by arbitrary regulations. In arguing the question of free trade, he urges that every advantage given to one interest over another is injurious to the public and that no trade is unprofitable to the public.

North, Locke and Petty are named by Wilhelm Roscher as the "great triumvirate" of English economists of the period.

NORTH, MARIANNE (1830–1890), English naturalist and flower-painter, was born at Hastings on Oct. 24, 1830, the eldest daughter of a Norfolk landowner, descended from Roger North (1653–1734). She trained as a vocalist under Madame Sainton Dolby, but her voice failed, and she then devoted herself to painting flowers. After the death of her parents she resolved to paint the flora of distant countries and with this objective she went to Canada, the United States and Jamaica, and spent a year in Brazil, where she did much of her work at a hut in the depths of a forest (1871–72). Later, she visited Teneriffe, California, Japan, Borneo, Java, Ceylon, Australia, New Zealand, South Africa, the Seychelles and Chile; and the scientific accuracy with which she represented plant life gives her work a permanent value. In 1882, her gallery at Kew Gardens was opened. It contains her paintings. She died at Alderly in Gloucestershire on Aug. 30, 1890.

NORTH, ROGER (1653–1734), English lawyer and biographer, was the sixth son of the 4th Baron North. He acquired a good practice at the bar, being helped by his elder brother Francis, who became lord chancellor and was created Baron Guil-

ford (*q.v.*), and in 1684 he became solicitor-general. But the Revolution stopped his advancement, and he retired to his estate of Rougham in Norfolk, and increased his fortune by marrying the daughter of Sir Robert Gayer. He collected books, and was constantly occupied in writing. He is best known for his *Lives of the Norths*, published after his death, together with his own autobiography (*see* the edition in Bohn's *Standard Library*, 1890, by Jessopp), a classic authority for the period. He died at Rougham on March 1, 1734.

He is to be distinguished from Roger North (1585–1652), brother of the 3rd baron, one of the captains who sailed with Raleigh in 1617, and who projected the plantation of Guiana.

NORTH, SIR THOMAS (1535?–1601?), English translator of *Plutarch*, second son of the 1st Baron North, was born about 1535. He is supposed to have been a student of Peterhouse, Cambridge, and was entered at Lincoln's Inn in 1557. In 1574 he accompanied his brother, Lord North, on a visit to the French court. He served as captain in the year of the Armada, and was knighted about three years later. He was a justice of the peace for Cambridge in 1592 and again in 1597, and he received a pension (£40 a year) from the queen in 1601. He translated, in 1557, Guevara's *Reloj de Principes* (commonly known as *Libro Aureo*) (*see* GUEVARA) under the title of *Diall of Princes*. The English of this work is one of the earliest specimens of the ornate, copious and pointed style for which educated young Englishmen had acquired a taste in their continental travels and studies. With its mannerisms and constant use of antithesis, it set the fashion which was to culminate in Lyly's *Euphues*. His next work was *The Morall Philosophie of Doni* (1570), a translation of an Italian collection of eastern fables. The first edition of his translation of *Plutarch*, from the French of Jacques Amyot, appeared in 1579. The first edition was dedicated to Queen Elizabeth, and was followed by other editions in 1595 and 1603, containing in each case fresh *Lives*. The influence of North's vigorous English on contemporary writers was very great, and some critics have called him the first master of English prose. The book formed the source from which Shakespeare drew the materials for his *Julius Caesar*, *Coriolanus* and *Antony and Cleopatra*. It is in the last-named play that he follows the *Lives* most closely, whole speeches being taken direct from North.

See Plutarch's Lives of the Noble Grecians and Romans: English ed. by Sir T. North (in Tudor Translations, 1895); *Shakespeare's Plutarch* (a selection ed. C. F. T. Brooke, 1909); *The Diall of Princes* (reprinted 1921); F. Bushby, *Three Men of Tudor Times* (1911).

NORTH, THE, originally those of the English Colonies in America north of the Mason and Dixon line (*q.v.*), as distinguished from those south. They were New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania. With the extension of settlements across the Alleghenies, the Ohio river was considered as a continuation of the Mason and Dixon line to the Mississippi river. Missouri, west of the Mississippi, was before the Civil War, considered part of the South because it was a slave-holding State, but after the Civil War it became a part of the North in its political and economic life. West of Missouri the boundary between the two sections followed the southern boundary of Kansas (37° N. lat.) to the Great Plains. Beyond were the Western States which, because they supported the North, were usually considered part of it during the great struggle over slavery. The characteristic Northern life and settlement was broken, however, by the Great Plains which may, therefore, be considered to form the western boundary of the section.

The division between the North and the South was in no slight degree a natural one. In the North land and climate made small farms with diversified crops the only profitable type of agriculture. In the older sections the limited supply of farm land and the abundant amount of water-power stimulated manufacturing and the growth of town life. In the South, large plantations growing only cotton, or only tobacco, and dependent upon slave labour came into existence. As these economic systems with their attendant social differences grew in power and clashed in conflict over the virgin lands of the West, an intense struggle developed for supremacy, a struggle fought first, but vainly, in the halls of Congress, and later on the battlefields of the Civil War. The North through its victory gained undisputed political, economic and cultural supremacy. Politically, the North has always been the stronghold of the Republican Party which has fostered its industrial interests.

NORTH ADAMS, a city of Massachusetts, on the Hoosac river and at the west end of the Hoosac tunnel, served by the Boston and Albany and the Boston and Maine railways. Pop. (1920) 22,282 (23% foreign-born white); 1928 local estimate, over 25,000. The city has a beautiful situation, 700 ft. above sea-level, in the foot-hills of the Berkshires, at the west end of the Mohawk trail. Within its limits is a natural bridge 50 to 60 ft. high, across Hudson Brook. It is the seat of a State normal school (1897) and has extensive manufactures (chiefly cotton print, woollen goods, cotton cloth, boots and shoes, and machinery) with an output in 1925 valued at $50,000,000. In the western part of the city are the ruins of Ft. Massachusetts, built in 1745 by the Massachusetts Bay Colony as a frontier defence, and captured in 1746 by French and Indians under the Chevalier de Vaudreuil. North Adams was set off from Adams and incorporated as a town in 1878, and in 1895 it was chartered as a city.

NORTHALLERTON, an urban district, market town and administrative capital of the North Riding of Yorkshire, England, 30 m. N.N.W. of York by the L.N.E. railway, on which it is an important junction. Pop. (1921) 4,794. It is situated on a slight eminence at the foot of the Cleveland and Hambleton Hills, 3 m. from the bank of the Swale. It thus avoids the flood land of the Vale of York. Here the western scarp of the Wolds causes the Vale to narrow to a width of 10 m., forming the Northallerton Gate.

Northallerton (Alvetune, Allerton) is believed to have been a Roman station, and the importance of the Gate is marked by two Roman roads, one running north from Catterick, the other from York. It was probably later a Saxon "burgh," and a Danish settlement, but nothing is known with certainty about it before the account given in the Domesday Survey, which shows that the Normans had destroyed the manor so utterly that it was still waste in 1086. In mediaeval times, the Gate was an obvious way south into England for the Scottish army. The Battle of the Standard was fought near the town in 1138 and the castle was destroyed in 1174. In 1317, the town was burnt by the Scots under Robert Bruce. Soon after his accession, William Rufus gave Northallerton to the Bishop of Durham, whose successors continued to hold it until it was taken over by the ecclesiastical commissioners in 1865. There are now no traces of the fortified palace of the bishops. A priory was founded here in 1341, and a White Friars monastery in 1354, and all trace of these also has been lost. The Mount Grace priory, a Carthusian foundation of 1397, remains.

According to an inquisition taken in 1333, the town, markets and fairs were held by the burgesses who were governed by two reeves and the bishop's bailiff. This form of government continued until 1851, when a local board was formed, and this was superseded by an urban district council in 1894. As a borough by prescription, Northallerton returned two members to the parliament of 1298, but it was not represented again until 1640 when its earlier privileges were restored. The Municipal Reform Act of 1832 reduced the number of members to one, and in 1885 representation of the town was merged in that of the district. It is now in the Richmond parliamentary division.

The town has a considerable trade in dairy farming and has held a weekly market since 1205. A fair held on St. Bartholomew's day was famous for cattle in the 16th century, but it is no longer held. Northallerton is to-day the railway focus of the Gate. It now has an important motor-engineering industry.

See C. J. D. Ingledew, *History and Antiquities of Northallerton in the County of York* (1858); J. L. Saywell, *History and Annals of Northallerton* (1885); *Victoria County History, Yorkshire.*

NORTH AMERICA. The continent of North America has a mean altitude of about 2,000 ft., and an area of some 8,000,000 sq.m., 16% of the earth's land area and 4% of the earth's entire surface. Certain correspondences of its geological structure and history with those of the greater part of Europe and Asia, sym-

metrically disposed, right and left, with respect to the Atlantic, support the view that Eurasia is a single continent: furthermore they controvert the idea that the New World of discovery is an old world geologically; and that the Old World of history is geologically new. Both worlds are in part old, in part new; both share structures and changes of similar dates from the most ancient to the most modern periods.

PHYSICAL FEATURES

The Laurentian Region.—The general structural features of North America are as follows: the extensive area of ancient crystalline rocks, stretching from Labrador past Hudson bay and thence north-westward to the Arctic ocean, is of disordered structure; the surface now seen must have been originally buried at a considerable depth beneath a higher and mountainous surface; but that higher surface was reduced to low relief at a remote period. The Laurentian part of this great region has been described as the first emerged land area of North America, around which many later additions on the south and west built up the present continent; but a more modern interpretation shows that the worn-down Laurentian region is only part of a much larger land mass which in pre-Palaeozoic time extended more or less continuously as far as Texas and parts of the Rocky mountain region, and on which marine deposits were unconformably deposited as the land mass was progressively submerged beneath the Palaeozoic ocean. Hence the Laurentian region differs from other parts of North America more in having escaped later deformation than in being of earlier origin. In Pleistocene time, the Laurentian region became the centre from which ice sheets spread out on all sides. As a result the weathered soils were swept away, together with an unknown measure of unweathered rock, leaving scattered boulders and gravelly drift upon a rugged upland without mountains (except in Labrador), but diversified by innumerable knobs and hollows, and here and there covered by clay belts that are arable though of severe winter climate. The drainage of the region, which in pre-glacial times was probably accomplished by well-ordered rivers, was thus thrown into great disorder; large and small lakes abound, and some of the lakes have two outlets; the streams are repeatedly interrupted by rapids and not infrequently split into two channels, enclosing islands many miles in length. The region remains a forest wilderness, except at mining centres (several of which have produced large quantities of nickel, silver and gold), pulp mills and on the sparsely settled clay belts.

The Appalachian Area.—This is a hilly and mountainous belt, stretching from Newfoundland to Alabama, with a western branch in Arkansas. It seems to have belonged in the earliest times to the great pre-Palaeozoic land mass, but it must be set aside from the undisturbed Laurentian region because of repeated movements of depression, deformation and elevation that it has suffered, generally along a northeast-southwest trend, causing alternations of heavy deposition and almost equally heavy degradation. These movements took place with generally decreasing intensity, through nearly the whole stretch of geological time covered by the fossiliferous record. The Appalachian mountains of today were formerly regarded as unconsumed residuals of greater mountains formed at the close of the Palaeozoic period; but it is now generally agreed that Mesozoic erosion reduced most of that ancient range to a lowland of moderate or small relief, leaving only isolated groups of subdued mountains in the areas of the most resistant rocks; and that the altitude and form of the mountains to-day, as well as of a belt of horizontal strata on the west, now known as the Allegheny plateau, are largely the result of Tertiary elevation and dissection of the previously worn-down mass; the additional height thus given to the subdued mountain groups made them the loftiest parts of the range to-day, as in the White mountains of New Hampshire (Mt. Washington, 6,295 ft.) and the Black mountains of North Carolina (Mt. Mitchell, 6,711 ft.). The Ozark plateau of Missouri and the Ouachita mountains of Arkansas and farther west are related to each other in much the same way as the Allegheny plateau and the middle and southern Appalachians. Numerous coal seams occupy discontinuous basins in the Appalachians from Nova Scotia to Pennsylvania and in the Allegheny plateau from Pennsylvania to Alabama, and in the extension of the same strata across the Ohio basin. The eastern coast of the continent has a rocky and irregular shore line from Greenland and Labrador to Massachusetts, with numerous submerged valleys forming bays and as many uplands and ridges outstanding in promontories and islands; this being the result of an increasing measure of depression to the north, where an archipelago now replaces what was probably once a corner of the continent. A coastal plain of gently inclined and imperfectly consolidated strata, which still borders the Gulf and part of the Atlantic coast of the United States formerly extended north-east, probably at least as far as Nova Scotia; the same depression that has brought the ocean upon the older rocks from Massachusetts northward, has diminished the breadth of the coastal plain and embayed its shore line from North Carolina to the mouth of the Hudson, and has submerged it from the Hudson mouth, north-eastward.

The Western Highlands.—The great complex of mountains in the Western highlands, sometimes styled the Cordilleras of North America (of which the Rocky mountains are eastern members in the United States and Canada), differs from the Eastern highlands in having suffered strong deformation in late geological periods. On the other hand, the transition from Palaeozoic to Mesozoic times, when mountain-making disturbances were so general in western Europe and eastern North America that the older geologists thought them to be of world-wide extent, was here generally accomplished in relative quiet, so that in certain districts a conformable succession of stratified formations was accumulated in great thickness from Cambrian to late Mesozoic or early Tertiary time. Further, the Carboniferous period was marked by the deposition of marine limestones in the Cordilleran region. In contrast to the long quiescent Atlantic coast, the Pacific coast of North America is bordered for a good part of its length by mountains of late origin.

Volcanoes of commanding height here and there dominate the Western plateaux and mountains. Orizaba (18,240 ft.), Popocatepetl and their neighbours crown the southern portion of the Cordilleran system in Mexico; Mt. San Francisco rises over the desert plateau of Arizona and bears snow and Arctic plants; Shasta has small glaciers in northern California; Rainier, bearing large glaciers, surmounts the Cascade range in Washington; Wrangell is a lofty volcanic mass in Alaska. Vast lava floods have been poured out at various periods; those of the Snake and Columbia river basins in Washington, Oregon and Idaho are the most extensive. Similar lava-flows in British Columbia have been broadly uplifted and are now deeply dissected by Frazer river and its branches, leaving only disconnected highland patches.

As in all regions of great altitude, the erosion of valleys has progressed on a magnificent scale in the Cordilleran region. The plateaux of northern Arizona are traversed by the canyons of the Colorado river and its branches, at places over a mile in depth; yet upon the plateaux themselves, long and ragged cliffs of recession attest a vastly greater erosion before the uplift of the plateaux than is demanded by the canyons after uplift. Along the Pacific coast, as well as in the higher ranges of the northwest interior, intense glacial erosion during the Glacial period excavated huge cirques at the valley heads and deep troughs along the valley courses; on the coast these troughs are now occupied by sea water as fjords. Fitting complements to the deep erosion of the mountain masses are found in the great accumulations of mountain waste in various intermont and piedmont basins, of which the so-called valley of California is the finest example. Similar basin deposits of Tertiary date abound in the Cordilleran region.

Central Plains.—Between the lower Eastern highlands and the higher Western highlands lies a great extension of medial plains, stretching in moderate altitude from the Arctic ocean to the Gulf of Mexico and having at their mid-length a breadth of 1,500 miles. They are composed throughout of nearly horizontal strata and mark a region long exempt from deformation. The eastern plains, best represented in the Ohio valley, are underlain by Palaeozoic strata, already mentioned as having been laid down on the subsiding Archaean continent; the western plains are com-

posed of Mesozoic and Tertiary strata. Both east and west large areas of the plains do not owe their present evenness to the preservation of their originally smooth surface, but to the degradation of that surface from the considerable altitude of its first uplift to low relief. The degraded surface has, however, been smoothed by veneers of till plains in the Ohio and upper Mississippi valleys, and by the addition of extensive piedmont detrital deposits in the central-western plains.

The Cordilleras of North and South America are not only far out of line with each other, but are separated by some 1,200 m. in Central America, where, in association with the West Indies, an Antillean system of late geological deformation with east and west trends is believed to prevail, with abundant volcanic additions on the Pacific border and along the curved range of the Lesser Antilles, while in an intermediate space the calcareous lowlands of Yucatan resemble those of Florida in being the emerged parts of a larger area, much of which is still below the waters of the Gulf of Mexico. The warm waters that bathe the West Indies permit the growth of coral reefs in the Caribbean; the Bahamas are the slightly overtopping parts of broad platforms of calcareous deposits, of which the greater area constitutes extensive shallow banks which descend steeply to great depths.

Rivers.—The successive crustal movements by which North America has been developed have determined the growth of several great river systems. The broad upheavals which developed the medial plains had the effect of engrafting many rivers from the Eastern and Western highlands upon trunks of unusual dimensions. Thus the Mississippi system, some of whose eastern tributaries probably date from early Mesozoic times, received great reinforcement by the addition of many long western branches in late Tertiary time, roughly contemporaneous with the uplift of the southern coastal plain, by which the lower trunk of the river was extended from its mid-length into the gulf. The present headwaters of that river-trunk to which the name of Mississippi has been rather arbitrarily applied are of very modern date, as they are consequent upon the abundant glacial deposits of northern Minnesota; and relatively modern courses appear to have been taken by the earlier-born Ohio and Missouri around the margin of invading Canadian ice sheets, which displaced them from earlier courses. The evolution of the Mackenzie resembles that of the Mississippi in a general way, but it has presumably been much affected by Glacial erosion and deposition, in consequence of which it, like the St. Lawrence, has many large lakes in its course. The régime of this great north-flowing river is strikingly unlike that of its south-flowing analogue on account of its course being from a warmer to a colder climate; hence while Mississippi floods have a free southward discharge, the floods of the Mackenzie have an obstructed northward discharge due to ice dams. Indeed, but for the complications that appear to be related to the outspread of Laurentian ice sheets, the areas drained by the Nelson and the St. Lawrence, now flowing to Hudson bay and St. Lawrence gulf, would be discharged by the Mackenzie and Mississippi. For a time, during the presence of the ice sheets that simpler system was realized for the Mississippi, when it carried to the Gulf of Mexico much drainage now received by the St. Lawrence and Nelson; the flood plain of its lower trunk was probably given its great breadth at that time. Lake Superior is peculiar in apparently owing its great depth to a somewhat pronounced displacement of its basin floor, in addition to whatever deepening it gained by glacial erosion.

The chief rivers that discharge to the Pacific rank below those that discharge to the Atlantic; but the Yukon, flowing from farther Canada and inner Alaska is one of the great rivers of the world. The Columbia, of hardly inferior rank, drains a large area of the Cordilleran system in Canada and the United States; it is peculiar in having one of its head branches rise at the eastern base of the Rocky mountains in Montana, so that its waters flow westward through all the Cordilleran ranges of its latitude. The Colorado discharges a muddy current into the Gulf of California.

Climate.—The climate of North America exhibits modifications of general conditions resulting from the globular form and eastward rotation of the earth. In January a mean temperature of zero or less invades the region north-west of Hudson bay, which thus resembles north-eastern Asia in departing greatly from the more temperate mean prevailing in similar latitudes on the northern oceans. In July the great middle area of the continent becomes warmer than the oceans on the east and west, having a mean temperature above 80° and in part above 90°. Consequently the annual range between the means of January and July exceeds 40° for a large part of the continent, and exceeds 70° for much of the northern lands; the range of extreme temperatures is much greater. On corresponding northern oceanic areas, the temperature range is little more than 20°; and in the Southern Hemisphere it is probably less than 10°.

The several members of the terrestrial wind system, including therein the trades of a broadened torrid zone, the prevailing and stormy westerlies of middle latitudes, and the irregular winds of the polar region, are well exemplified over North America; but they are better seen in the drift of clouds than in the movements of the surface winds. In consequence of the dominance of westerly winds, a great stretch of the Pacific coast, even as far north as Alaska, has a small annual temperature range (generally less than 20°); while a range appropriate to continental interiors is experienced over most of the eastern coast of the continent in temperate latitudes; hence the extraordinary unlikeness between the climates of western Europe and eastern North America, where habitable Great Britain faces almost uninhabitable Labrador. The distribution of rainfall is likewise largely controlled by the general wind system. The West Indies, especially the mountainous islands, receive abundant precipitation from the passing trade winds. In Mexico and Guatemala the eastern slopes are for the most part better watered by the same winds (maximum, over 100 in.) than the western slopes. Farther north the reverse holds true; the Pacific coast north of latitude 40° has an abundant rainfall (maximum over 100 in.), and its mountains are clothed with dense forests; but there are large areas of deficient rainfall (less than 20 in.) in the interior where the intermont and piedmont plains of the Cordilleras in middle latitudes are dry and treeless. Regions of heavy snowfall are chiefly in the far north-western Cordilleras: over the northern interior and in Greenland the snowfall is less heavy, but the persistence of winter cold preserves much of the small amount that is received.

The extension of the continent across the belts of the wind system tends to turn branches from the westerlies to the trades along the mountainous Pacific coast, and from the trades to the westerlies over the open interior and on the Atlantic coast; it is partly because of this deflection of general circulation up the Mississippi valley, aided by cyclonic indrafts, that the eastern interior of the continent receives, especially in summer, so beneficial a rainfall (over 40 in.) over its forests and prairies. In winter when inflowing winds from the south are replaced by outflowing winds from the north, little rain or snow would fall there, but for the repeated passage of cyclonic storms across the continent, by which the outflow appropriate to the cold season is temporarily reversed. The free play of cyclonic winds north and south over the great medial plains permits indrafts from torrid and frigid sources, often succeeding each other rapidly, and producing, especially in winter, great and rapid changes of temperature. Similar but less extreme contrasts are produced by winds drawn in on the eastern coast from over the warm waters of the Gulf stream and from the cold waters of the Labrador current. The equatorward flow of the branching winds along the Pacific coast gives them a drying power; hence the arid region of the United States and north-western Mexico broadens toward the Pacific, and is strongly unlike the rainy and heavily forested coastal slopes of the north-western United States and western Canada. The belt of passage between the dry and the rainy areas migrates southward in the winter, carrying wet weather with it as the stormy westerly winds reach lower latitudes; a reverse migration takes place in summer, carrying fair weather northward. The extremity of the peninsula of Lower California, in Mexico, receives a small measure of convectional summer rains, as does south-eastern Florida.

Fauna and Flora.—The fauna of North America (Nearctic) is more closely related to that of Europe-Asia (Palaearctic) than

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NORTH AMERICAN INDIAN TYPES: STOCKS AND TRIBES

1. Stock: Salish. Tribe: Salish or Flathead
2 & 3. Stock: Athabasca. Tribe: Apache
4. Stock: Eskimo. Tribe: Kiñugumiut
5. Stock: Algonkin. Tribe: Sauk and Fox
6. Stock: Sioux, Yankton Group. Tribe: Yankton
7. Stock: Shahaptl. Tribe: Nez Percé
8. Stock: Kiowa and Tribe: Kiowa

NORTH AMERICA



BY COURTESY OF (2-8) THE SMITHSONIAN INSTITUTION; PHOTOGRAPH, (1) THOMAS LEE

NORTH AMERICAN INDIAN TYPES: STOCKS AND TRIBES

1. Guatemala. A Maya-Quiché Indian Woman
2. Stock: Shoshone. Tribe: Ute
3. Stock: Tuni and Tribe: Tuni
4. Stock: Caddo. Tribe: Pawnee
5. Stock: Yuma and Tribe: Yuma
6. Stock: Shoshone. Tribe: Comanche
7. Stock: Sioux. Dhigiha group. Tribe: Osage
8. Stock: Sioux. Chiwere group. Tribe: Oto

to that of any other zoögeographical province; the two areas are united by many writers in one province (Holarctic). The reindeer (caribou), beaver and polar bear are found in both; the moose, wapiti, bison and grizzly bear of North America are closely related to the elk, red deer or stag, bison, and brown bear of Eurasia; and the following groups are well represented in both provinces: cats, lynxes, weasels, bears, wolves, foxes, seals, hares, squirrels, marmots, lemming, sheep and deer. The following forms are characteristic of North America: (rodents) pouched rats or gophers, musk-rat, prairie dog, Canadian porcupine; (carnivora) raccoon and skunk; (ungulates) musk ox, big-horn, Rocky mountain goat, prong-horn; (marsupial) opossum. Among birds, there is a close resemblance to those of Eurasia, with some admixture of South American forms, such as humming birds. Characteristic forms are the Baltimore oriole, bobolink, cowbird, flycatchers, wood-warblers, Californian quail, tree grouse, sage grouse, wild turkey and turkey buzzard. Turtles are especially numerous; salamanders are varied and large; rattlesnakes are among the reptiles.

The floral area of North America, defined by form and climate, may be divided into five belts; the eastern forested area, the western forested area, the interior unforested area, the northern barren lands and the torrid coasts. The eastern forested area extends from the Laurentian highland in Canada southward to the Gulf and Atlantic coast east of the Mississippi; in the north and southward along the mountains the trees are largely conifers with a mixture of birches, poplars and maples; southward, especially in the interior and at low levels, the conifers almost disappear and oaks, hickories, plane-trees, tulip-trees, walnuts and other valuable deciduous trees are in abundance; the long-leaf pine characterizes the low coastal margin. The western forested area begins in the Rocky mountains and extends to the Pacific, but does not descend below the lower timber line into the dry intermont basins of middle latitudes; northward in Canada, the forest is continuous from the upper timber line down into the valleys; it attains a luxurious and dense development along the rainy coast, where the redwood (Sequoia) of northern California and Oregon reaches a height of from 300 to 400 feet. The unforested area of the interior includes two dissimilar regions. On the east are the fertile prairies, spreading between the middle Ohio and the upper Great Lakes and extending beyond the Mississippi; here the native grasses and herbaceous vegetation are now largely replaced by agricultural crops. On the west under a drier climate vegetation is more scanty; but far north a wooded belt connects the eastern and western forests across the medial plains. Aridity and barrenness increase south-westward into California and southward into Mexico; on this broad desert few trees are found, although piñons grow on cliffs and ledges and cottonwoods are found along watercourses; and the mountains that rise above the desert carry forests. The desert vegetation consists of cactus, agaves, sage-brush (*Artemisia*) and other dry-climate plants in large variety. In the far north are the "barren lands," with their permanently frozen subsoil: the growing season here is short and trees cannot develop, although birches, poplars, willows and some other genera which attain good size southward are here present as dwarfed shrubs. The torrid coasts support a tropical vegetation; it is somewhat developed in Florida and becomes dominant in Mexico and Central America. (W. M. D.)

POPULATION

In the accompanying table are given the best available data regarding the numbers of people in the major political divisions of North America and the islands in the Caribbean sea generally classed as belonging to this continent. Unfortunately, there are no actual census counts available for some of the smaller countries. The data in column B tell whether the figures given in column C are census figures or estimates and the date on which they were presumably gathered. The data in column D are estimates as the column heading indicates and were made by the author on the basis of the available information.

In the case of Mexico, because of the unsettled condition of affairs during the period 1910–20, which apparently resulted in a loss of population and because there is no means of telling whether the quieter period since about 1920 has brought about an increase, or if it has, whether this increase has largely migrated to the United States, no estimate of reasonable accuracy seemed possible.

In column E is given the density per square mile of the population in the different countries. It will be seen from these data that some of the smaller islands among the West Indies are very densely populated, indeed they are among the most densely peopled parts of the world. Jamaica, Porto Rico and Haiti are also quite thickly settled, their density being comparable to that of France.

In column F are given the populations of the same areas in 1881 or thereabouts—40 years earlier. It will be seen that the population of the continent has almost doubled during this time.

Urban and Rural.—In Canada 49·52% of the population was urban in 1921 and 50·48% rural. In this case rural includes all unincorporated towns and the open country, and consequently is not exactly comparable with the same classification in the United States. In the latter country all places having a population of 2,500 or more are considered urban and constituted 51·4% of the total population in 1920 and the rural population was, therefore, only 48·6%. In Mexico, Central America and the West Indies similar classifications are not made, but a large part of the people in this area live in rural territory. Commerce and manufacturing are not highly developed in any of these countries, hence they cannot support very large city populations. Mexico City and Havana are the only cities which could be called large. This part of North America is essentially agricultural.

Racial Composition.—The base of the population in Mexico and Central America is Indian. In Mexico, for example, the census of 1921 reported (in round numbers) 1,400,000 whites, 4,200,000 Indians and 8,500,000 of mixed blood (almost wholly white and Indian). Thus, less than 10% of the population is considered white, locally, and the percentage of pure white stock is certainly much smaller. What is true of Mexico is true also of the Central American republics. Furthermore in these, the Indians and mixed stocks are being still further mixed by a considerable immigration of West Indian negroes.

In the West Indies there are great differences between islands, but the predominant stock in the tropic isles is negro, very generally mixed with white stock and in some cases with Indian stock. The amount of pure white stock is nowhere very large. This statement holds in spite of the fact that Porto Rico reports about 72% of its 1,299,000 inhabitants as white.

In the United States certain racial lines are closely drawn. Of the total population in 1920 there were 10,463,131 or 9·9% classed as negro, 244,437 or 0·2% as Indian and 182,137 or 0·2% are other coloured. The white stock constituted 89·7% of the total. In Canada the number of negroes was only 18,291 (1921) or 0·21%, the Indians constituted only 1·26%, and the Asiatic people only 0·75%. The important distinction in Canada, however, is that between British and French, the former constituting 55·4% of the total population in 1921, while the latter constituted 27·9%. Thus Canada, unlike most other countries in North America, has no real "colour problem" but only a "language problem."

The total population in North America in 1920 was approximately 143,000,000, or about one-third that of Europe. This population was scattered over an area 2·25 times as great so that its density was only about one-sixth that of Europe. (W. S. T.)

ETHNOLOGY

The Indians of North, as of South, America are believed to have had their origin in the eastern hemisphere. In the New World there are no unquestioned fossils of human ancestors or extinct human races, such as Europe, Africa, Asia and Oceania contain. Then, many regions of the Old World are studded with sites containing implements and refuse of *pure* Palaeolithic type, whose geological formation and associated animal bones leave no doubt that they were occupied during the Pleistocene or glacial era; but in America there are no such sites, implements of Paleolithic type being normally found in association with Neolithic ones.

There is no reason to believe that the entry of man into

Population and Density of the Countries of North America at the Last Censuses

A	Date*	Population	Estimated population 1927	Density 1920	Population (ca. 1880–82†)
	B	C	D	E	F
United States	C. 1—1—20	105,710,620	118,628,000	35·56	50,411,910
Outlying possessions:					
Alaska	C. 1—1—20	55,036	51,500	0·09	33,426
Virgin islands	C. 1—1—20	26,051	25,500	197·36	..
Panama Canal Zone	C. 1—1—20	22,858	28,200	43·37	..
Porto Rico	C. 1—1—20	1,299,809	1,407,000	378·40	731,648**
British possessions:					
Canada	C. 1—6—21	8,788,483	9,644,200	2·36	4,324,810
Newfoundland	C. 1—6—21	259,259	271,000	1·64	179,509
Labrador	C. 1—6—21	3,774	4,000		
British Honduras	C. 1—6—21	45,317	49,100	5·27	27,452
Bermudas	C. 1—6—21	20,127	20,900	1,059·32	14,888
British West Indies:					
Windward islands:					
Barbados	C. 1—6—21	156,312	147,000	941·63	171,860
Granada	C. 1—6—21	66,302	66,000		42,403
St. Vincent	C. 1—6—21	44,447	46,000	314·45	40,548
St. Lucia	C. 1—6—21	51,505	53,300		38,551
Leeward islands	C. 1—6—21	122,242	129,000	177·64	119,546
Bahamas	C. 1—6—21	53,031	51,300	12·04	43,521
Jamaica	C. 1—6—21	858,188	874,000	203·99	580,804
Cayman islands	C. 1—6—21	5,253	5,500	59·02	4,700
Turks and Caicos islands	C. 1—6—21	5,612	5,600	33·81	4,732
French possessions:					
Guadeloupe	C. 1—7—21	229,839	240,000	432·03	200,329
Martinique	C. 1—7—21	244,439	280,500	634·91	167,679
St. Pierre and Miquelon	C. 1—7—21	3,918	4,000	42·13	5,534
Danish possessions:					
Greenland	C. 1—10—21	14,355	14,900	0·31	10,000
Mexico and Central American Republics:					
Costa Rica	E. 1920	468,373	534,200	20·36	203,780
Guatemala	C. 28—8—21	2,004,900	2,142,900	41·52	1,224,606
Honduras	C. 1923	773,408	845,400	17·47	350,000
Mexico	C. 30—11—21	14,234,799	14,234,799	20·13	10,447,974
Nicaragua	C. 1—1—21	638,119	708,000	12·35	275,815
Panama	C. 1920	446,098	475,000	13·12	285,000
Salvador	E. 1920	1,495,000	1,700,000	113·46	613,273
West Indian Republics:					
Cuba	C. 15—9—19	2,889,004	3,400,000	65·42	1,521,684
Haiti	E. 1918/19	1,631,260	1,860,000	159·86	872,000
Dominican Republic	C. 24—12—20	894,665	1,062,000	46·28	300,000
Total		143,562,403	159,008,799	..	73,247,982

*C = Census E = Estimate
†From Emile Levasseur, *Statistique de la Superficie et de la Population des Contrées de la Terre* (pp. 154–169, 1887).
**Includes Virgin islands.

America occurred as a single migration which was discontinued and never resumed. If one body of immigrants was able to find the way, it is almost certain that others would find it. The great speech diversification of America may have begun while the original speakers were still in the Old World.

THE PEOPLING

It is practically certain that the peopling took place from Siberia via Bering Strait, other land bridges to America being geologically too ancient to have served man. Bering Strait is shallow, frozen over part of each year, less than 50 miles wide, with the Diomede islands near the middle. While probably never an insuperable obstacle even to primitive peoples, it never has been and is not now an easy means of communication; and the lands on both sides of it are inhospitable and capable of sustaining only a thin population. The Strait thus served much like a kinked tube. Man managed to filter through, and culture elements succeeded in being transmitted, but the flow of both was impeded.

There is no evidence that until the Russian occupation any advanced people ever occupied north-eastern Asia. Consequently, whatever relatively late accessions of inventions or other cultural materials reached the American Indians, were of a type normally occurring among peoples of a relatively low level. Both in America and Asia the higher attainments of civilization occur in latitudes not far from or below the Tropic of Cancer.

That the intercontinental connections occurred as just outlined, is strongly suggested by recent ethnic conditions about Bering Strait. The Eskimos on both sides of the strait are almost identical in physique, speech and customs; and farther back live Palaeo-Asiatic tribes (Chukchee, Koryak, Yukaghir) and American tribes (Dene, Tlingit, Haida) which resemble each other so conspicuously that some authorities have included the Palaeo-Asiatic ones with the Indians.

Race.—It follows that the racial origin of the American Indian has to be sought in Asia. The findings of anthropometry bear out the inference. The Indian belongs obviously to the Mongoloid division of the human species. He is brown skinned, with straight, stiff, black head hair, a minimum of beard and body hair, a definitely broad face (in popular parlance, high cheek bones), and moderate prognathism. These traits are constant among Indians, as among East Asiatics. Minor peculiarities, such as shovel-shaped incisor teeth, and bluish pigment spots in the sacral region during infancy, occur equally among the two populations.

The relations of the American Indian are, however, to the Mongoloid stock as a whole rather than to any specific Mongolian people. They are probably closest to the East Siberians.

Although often called "red," the American Indians are so only when they paint themselves. Their general colour is a brown, little if any darker than that of the Japanese. The tallest people are found in the centre of the continent in the Mississippi valley, and for some distance north and east. Along the Pacific coast and in Mexico, body heights are less. The Aztecs and Mayas were short peoples. Head form is about as variable as in the Old World. In general, the cranial index is 79 or above (cephalic

index 81+), except in six areas where it is less (longer heads): 1, the Eskimos of the Arctic coast; 2, 3, 4, in the east, from Cape Hatteras to St. Lawrence river; from the St. Lawrence north of the Great Lakes almost to the Rockies; an irregular tract in the Ohio and middle Mississippi valleys; 5, 6, on or near the Pacific coast, two intermittent tracts or chains of separated groups, between northern California and the tip of Baja California; from southern Arizona to central Mexico. In South America the long heads are almost all found in the eastern half of the continent, in or adjacent to Brazil.

The Eskimos (*q.v.*) are a well-marked sub-race. They are short, thick set, unusually long headed and broad faced, powerful jawed, narrow nosed, and with some tendency to the Mongolian eye. The remainder of the American race is difficult to sub-classify satisfactorily. Hrdlička distinguishes three types, of which he considers all existing populations in North and South America to be either representatives or mixtures. These are: 1, tall and broad headed (Athabascan); 2, long headed, mostly tall; 3, broad headed, stature moderate to short. The more advanced peoples from Mexico to Peru are assigned to this third type.

There are some interesting but as yet insufficient indications of Australian or Melanesian Negroid influence on the physique of the American Indians of certain localities. The very long and low skulls of the south end of Baja California may represent a colony or infusion of such immigrants. Similár conjectures have been advanced about the long headed peoples of the Atlantic sides of both North and South America.

Language.—The outstanding characteristic of native American speech is its diversity. According to the usual reckoning there are more stocks of languages in either North or South America than in the entire eastern hemisphere—about 75 on each continent. Recent researches have moved in the direction of uncovering remote similarities between some of these stocks, thereby reducing their number. There is little indication of borrowing between languages, except in South America.

The older view that American languages are overwhelmingly agglutinating, incorporating or polysynthetic, can no longer be maintained. There are languages as genuinely inflectional (Penutian) and isolating (Otomi, Zapotec) as in the Old World. It is, however, true that the Indian languages tend to describe concretely and visually. Elements expressing the instrument or manner of action, the shape or position, and space relations, although by no means universal, are frequently well developed in the grammatical structure. It is also true that many of the idioms do not shrink from piling up structural elements into long words.

The most important linguistic stocks north of Costa Rica, in point of number of speakers or territory, are Eskimo, Athabascan, Algonkin, Iroquoian, Siouan, Muskogi, Caddoan, Uto-Aztecan, Salish, Sahaptin, Penutian, Hokan, Tarascan, Otomi, Totonac, Zapotecan, Mixe-Zoque, Maya, all of which are separately described. Of secondary rank, and also treated separately, are Tlingit and Haida (with Athabascan = Na-Dene?), Tsimshian, Wakashan (Kwakiutl and Nutka), Chinook, Kootenay, three Pueblo stocks (Tanoan, Keres, Zuñi), Kiowa (with Tanoan?), Tonkawa, Natchez (probably with Muskogi), Yuchi, Beothuk. The remaining small stocks are in Washington, Chimakum; in Oregon, Wailatpu and Lutuami (with Sahaptin?); Kalapuya; Yakonan; Kus and Takelma (Penutian?); in California, Yurok and Wiyot (Algonkin?), and Yuki; in Texas, Coahuiltecan and Karankawa (Hokan?); in Louisiana, Tunica, Chitimacha, Atakapa (probably related); in Florida, Timucua, Calusa, perhaps Arawak and Carib colonies; in north-eastern Mexico, Tamaulipan, Xanambre, Olive, Lagunero; in Baja California, Waicuri and Pericu (perhaps distinct); in Guerrero and Nicaragua, Subtiaba; in Oaxaca, Huave (Mixe-Zoque?); in Chiapas and Nicaragua, Chiapanec (Chorotec, Chinantec); and, in Honduras and Nicaragua, Xinca, Lenca, Matagalpa, Xicaque, Paya, Mosquito, Ulva, Chibchan.

Culture.—The culture of the American Indians, like that of any large group, is so complex that a descriptive review is inadequate in proportion as it is compact. This culture is therefore perhaps best considered from the point of view of how its constituents classify as to origin—elements common to America and the Old World, peculiar to America, important in the Old World but lacking in the New, etc.

1. A series of simple culture traits are literally (or practically) universal among American tribes and of equally common occurrence in the Old World, and may be assumed to have formed part of the culture stock with which the first immigrants came into the hemisphere. These traits include the use of fire and the ability to make fire with the drill; the dog as a domesticated or semi-domesticated animal; stone implements for piercing, cutting, scraping, chopping; the spear, the spear-thrower, and probably the harpoon and bow; cordage, netting, and basketry; adolescence rites for boys and girls; shamanistic beliefs and practices. These elements survive in the more remote and backward portions of the eastern hemisphere, and for the most part have their relative antiquity attested directly by archaeology, carrying back to the end of the Palaeolithic or beginning of the Neolithic period.

2. Equally well defined is a class of culture traits which are widespread in the eastern hemisphere, in fact practically universal in all parts possessing a sufficient development, but are totally lacking in both North and South America. These elements evidently originated in the Old World subsequent to the movement which mainly populated America; they were not for some reason, perhaps chiefly because of the inhospitable conditions and backwardness of culture in the region of Bering Sea, diffused into America. This class of traits includes all the important domesticated animals and plants excepting the dog, viz., cattle, sheep, the goat, pig, horse, ass, camel and even reindeer; wheat, barley, rice, etc.; the plough and the wheel; iron; stringed instruments. Environment may be held responsible for the absence of some of these from the western hemisphere; it cannot account for the non-existence of iron-working, the plough and the wheel.

3. The higher civilizations of America were reared on an economic and technological foundation of their own, evidently evolved in and largely remaining confined to the region of "Middle America," namely the area from Mexico to Peru. The basis of this civilization was a form of agriculture limited to a series of indigenous plants. Fundamental among these plants was maize, seemingly altered by domestication from a wild species native to the highlands of Mexico and Guatemala. Closely associated with maize were beans (*Phascolus*) and pumpkins and squashes. These plants were cultivated by all the Indians of both Americas as far as agriculture was practised by them, from the St. Lawrence to the La Plata. In the tropical region there were cultivated in addition other important plants—the potato, sweet potato, manioc, tomato, pineapple, chili pepper, tobacco, chocolate, etc. All this agriculture was practised without implements more complicated than a hoe or simple planting stick; it was strictly a hand culture. Domesticated animals were lacking, except for the llama and alpaca in Peru and the turkey in Mexico. Copper, gold, silver, platinum, tin and lead were smelted, cast, plated and alloyed in middle America; in other words, the metallurgical arts of the Old World prior to the iron age were known. Cotton, of another species than the cotton of the Old World, had been domesticated in middle America and was the basis of an elaborate textile art, operating however with simple apparatus; and clothing was of types based upon true fabrics instead of skins or bast fibres. Pottery shows a wide distribution almost identical with that of agriculture; archaeologically, it is generally associated with agricultural remains; and it may therefore be assumed to have originated in middle America at about the same time as agriculture. Masonry had spread somewhat beyond middle America as far as north-western Argentina and south-western United States.

Middle America was the region of cities, therefore of higher political organization, and in Mexico and Peru of considerable empires. In the same regions ritualistic religion, including altars, permanent edifices, sacrifices and symbolism, reached its most complex development. This development was evidently dependent upon the existence of a priesthood persisting through successive generations under stable social and political conditions. Finally, the intellectual achievements, probably also in large part due to priests, culminated in the mathematical and calendrical systems

of the Maya, and in an incipient system of writing employed by them and the neighbouring Mexican nations. Attempts have been made to derive these products of learning from the Old World; but analysis shows their principles, especially those of the calendar, to be unique. The Maya, for instance, had devised position numerals and a sign for zero; but their system of numeration was vigesimal. Also, they were using this system by the beginning of the Christian era, centuries before any people in the Old World had invented a sign for zero.

4. Other culture traits in America, not specially characteristic of higher civilization, do not occur regularly distributed in or around the Mexican-Peruvian area. Some of these traits may be presumed as due to local inventions independent of the middle American stimulus. Others may have originated earlier than the middle American agriculture-metal-town-priesthood growth and have diffused irregularly, or perpetuated themselves only in certain tracts. Most elements peculiar to one or two culture areas (*see* below) fall into the present class; for instance, the carpentering, wood-carving and frame houses of the North Pacific coast; the special war customs of the eastern United States; the acorn food technique of California. Clan systems or exogamic institutions, usually with totemic manifestations, occur in North America in several areas: the south-east and north-east, the North Pacific coast, in a limited area in the plains, and somewhat doubtfully in certain parts of Mexico.

5. A certain number of traits restricted to the north-western half of North America show modern or recent analogues in the Old World, usually in northern Asia and Europe, but do not appear to possess prehistoric antiquity. They may therefore be assumed as importations into America, mainly by diffusion rather than by migration, in the last few thousand years. For the most part these traits are distinguishable without difficulty from the universal and supposedly very ancient ones of class 1. Into the present group there may fall the sinew-backed bow (the supposed American equivalent of the composite bow of Asia), the tepee or skin tent on poles, the snow-shoe and toboggan (equivalent of Old World snow-shoe of ski type), birch bark canoes and vessels, the half-underground house roofed with earth, tailored or fitted clothing of sewn skins, perhaps coiled basketry, and several myth episodes such as "Earth Diving" and the "Magic Flight." The distribution of most of these traits in America stops before it reaches the south-west and south-east United States. None of them had reached the advanced portions of Mexico.

Culture Types.—An attempt has been made by Americanists to organize the complex and irregular manifestations of native culture by classifying them into certain types characteristic of regions known as culture areas. These are to a certain degree environmental; the natural environment is thought to have acted as a stabilizing and perpetuating factor, once a certain type of culture had been achieved in an area. Essentially, however, this classification is one of culture types, and the concordant geographical areas largely represent empirical determinations of distribution. In this respect the culture area classification, as first formulated by Wissler and accepted with only minor modifications by practically all American students, differs from older attempts which proceeded from environment as the supposed determinative factor (*see* O. T. Mason's article "Environment," in the *Handbook of American Indians*). The more important types of culture in these areas are outlined in separate articles. The areas are: 1, Mexican, north about as far as the Tropic of Cancer (*see* AZTEC, TOLTEC, MAYA, ZAPOTEC); 2, South-west (*i.e.*, of the United States, but including northern Mexico; *see* PUEBLO); 3, 4, South-east and North-east, perhaps to be joined and called Eastern woodland (*see* MUSKOGIAN, MOUND BUILDER, IROQUOIS); 5, Plains (*q.v.*), in the untimbered centre of the continent; 6, Plateau, in the western inter-mountain region, an area relatively undifferentiated in culture, with actively entering influences from the adjacent areas (the Great Basin is sometimes separated from the upper Columbia and Frazer region and united with California); 7, California; 8, North Pacific Coast (*q.v.*), from northern California to southern Alaska inclusive; 9, Mackenzie-Yukon (*see* ATHABASCAN); 10, Arctic (*see* ESKIMO). The West Indies seem to belong culturally with South rather than with North America. The southern frontier of the Mexican area may be placed in Nicaragua, Costa Rica and Panama forming part of the Chibcha or Colombian area of South America. In this continent there may be recognized: 1, Chibcha or Colombian; 2, Andean (southern Ecuador, Peru, highlands of Bolivia, north-west Argentine, northern Chile); 3, Patagonian, a hunting area dependent largely on the guanaco; 4, Orinoco-Amazonian, where manioc disputed the supremacy with maize; 5, Antillean or West Indian.

Temperament.—This is notoriously difficult to dissociate from culture habits, but there appears to be a fairly general agreement as to a characteristic American type of mind and personality, though it might be arguable how far this is innate. Almost universally the American Indian is reserved, stoic, enduring and unresponsive, the antithesis of the negro, and more similar to the Mongolian in behaviour than to the Caucasian. He is not without humour, but holds expressions of it in rigorous check, so that it becomes manifest chiefly in intimacy. He is patient but not quick; tough in adversity but unenterprising; stable but unimaginative; cruel when his inhibitions have been removed, but not given to brutality ordinarily. He prizes control as the highest virtue, and restraint and decorum as the essentials of manners, and therefore almost always impresses as imbued with unusual sense of respect of personality.

Population.—The original numbers of the American Indians are imperfectly known. The most complete and careful count, that by Mooney (*Smithsonian Misc. Coll.*, lxxx., 1928) arrives at a total of 1,150,000 souls north of Mexico at the time of first contact with Europeans. Inasmuch as several specialists have set a somewhat lower figure for the regions with which they were most familiar, Mooney's total is probably too large rather than too small, and one million in the United States and Canada is, perhaps, not far from the true number. In Mexico and in Central America population was much denser relatively and absolutely; it cannot well be put at less than three to four million. Similar conditions prevailed in South America: there may have been nearly as many natives in Peru as in the remainder of the continent.

In general, the race has declined after contact with Europeans. Some North American tribes have become completely extinct. Many others have shrunk to such an extent as to have lost their identity and merged with other tribes. Some have partly held their own, others wholly so, and a few, like the Navaho, have indubitably increased. The conditions to which each tribe was subjected must be known in detail before the reasons for this variety of fortune are intelligible. In most tribes there has been a heavy infusion of white and sometimes of negro blood. Except in the south-west, it may be said that even those tribes that remain as numerous as originally, are so only through the inclusion of alien blood. Socially the mixed bloods generally are Indians. Of this population of pure and mixed blood, there remains not quite half a million in the United States and Canada. Mexico is estimated to be about one-third pure Indian, and more than another third, part Indian.

History.—There is no native documented history of the American Indian, except for the Aztec and Maya. The great bulk of the tribes possessed neither time systems nor writing, and left only legendary traditions. These usually possess a certain authenticity. In the main the history of the tribes is a history of their contacts with Caucasians. Often more can be gathered as to the movements or other fortunes of a stock, from its recent distribution and from the relations of its component languages, than from any directly historical source. (*See* for instance ATHABASCAN, UTO-AZTECAN, ALGONKIN, SIOUAN, MUSKOGIAN, IROQUOIS.)

Native history resting on a documentary basis has been preserved only in the Mexican region. The Maya left both monuments with dated inscriptions and post-Spanish chronicles. The calendar (*q.v.*) in which the inscriptions are expressed is extremely accurate and is well known. Its conversion into our chronology is not quite so certain, the evidence bearing on this point being somewhat conflicting as well as incomplete. According to the correlation accepted by most specialists, the Maya cities of the

Old Great period, which have left the principal dated inscriptions, flourished from the first to the end of the 6th century after Christ. The earliest date found converts to 96 B.C. This calendar system involves long observation, some historical knowledge, considerable facility in computing, and is accompanied by hieroglyphic writing, fine sculpture, and advanced architecture. In short, Maya civilization had already taken shape by the beginning of the Christian era. Beyond this was most likely a formative period as yet unknown, and back of this an Archaic period of which the first traces are apparently beginning to be discovered. The principal other system of chronological conversion interprets all Maya dates as about 270 years earlier.

An Archaic period is well known from remains in the valley of Mexico. This, however, was a culture already emerged from primitiveness, since it possessed agriculture and pottery. There is nothing to fix its period, except that its freedom from Maya influence argues its being anterior to the development of the characteristic Maya civilization. It was succeeded by the more advanced culture of the Toltecs (Teotihuacan), and on this legendary data were preserved by the still later Aztecs. Some of the Aztec accounts are chronological and carry Toltec history back to about A.D. 600, with a period of florescence around A.D. 900–1000. The Toltec-Aztec calendar, however, while absolutely accurate within its cycles of 52 years, did not with certainty distinguish successive cycles, so that all Toltec dates must be accepted as being only approximations.

In the south-western United States, Pueblo and pre-Pueblo culture have been unravelled by intensive archaeological work, until a series of seven stages is now known, the first being one without pottery and with an estimated age of about 3,500 years. None of the Pueblo periods, however, are as yet really datable.

BIBLIOGRAPHY.—The most important general work of reference is the *Handbook of American Indians*, published by the Bureau of American Ethnology as Bulletin 30 in two parts (1907 and 1910). The basic work on linguistic classification is by Powell, *7th Report of the Bureau of American Ethnology* (1891). As regards culture, the points of view here adhered to were first outlined by Boas in a brief article, "The History of the American Race" (*N.Y. Acad. Sci.*, xxi., 1912); supplemented in the *Intern. Congr. Americanists*, xxi. (Göteborg, 1925); and are most fully developed, with special emphasis on the culture areas and with attention also to racial and linguistic factors, in Wissler, *The American Indian* (1917; 2nd ed., 1922). Supplementary considerations will be found in Wissler, *Man and Culture* (1923), and *The Relation of Nature to Man in Aboriginal America* (1926). Farrand, *The Basis of American History*, gives the natural setting. Brief comprehensive works on special areas are Goddard, *Indians of the South-west, Indians of the North-west;* Wissler, *Indians of the Plains;* Spinden, *Ancient Civilizations of Mexico* (these four are *Handbooks* of the American Museum of Natural History) Kroeber, "Handbook of the Indians of California," *Bur. Amer. Ethn. Bull. 78;* Kidder, *South-western Archaeology* (1924). Numerous monographs and special articles are cited in the bibliographies included in these general works. (A. L. K.)

ARCHAEOLOGY

In recent years various remains attributed to early man within the area of the United States have been discovered, notable among which was the finding of the so-called "Lansing skeleton" in 1902 at Lansing, Kansas, at the base of the Missouri river bluffs, 20 feet below the surface and 60 and 70 feet from the mouth of a tunnel excavated for storage use. The place was visited and studied by several geologists and archaeologists, the geologists varying in opinion as to the age of the deposits and consequently the antiquity of the skeleton.

In Florida have been found various human remains to which extreme age has been ascribed, sometimes accompanied with objects of human handiwork. Some of these remains are more or less mineralized bones found near Osprey, Manatee county, on the west coast, from 1871 to 1887, and this fossilization has generally been regarded as an important indication of antiquity. The features of the crania, as well as of the other bones, show no material differences from those of recent Florida Indians.

In 1894 and 1906 were discovered remains of what became known as the "Nebraska Loess Man" in the Gilder Mound on a ridge above the Missouri river, 10 miles north of Omaha. These remains, some of them accompanied with crude flint implements and chips, were found at varying depths, those below 4½ feet, to a depth of 11½ feet below the surface (the lowermost 5 feet, however, containing only scattered fragments of bone), being regarded by the explorers as contemporaneous with the loess formation and antedating the hill itself. Subsequent investigation of the site and of the skeletal materials therefrom seemed convincing that, regardless of their depth and the apparently undisturbed condition of the loess in which most of the remains were found, there is no substantial ground for belief in any considerable difference in the age of the upper and the lower bones; that the appearance of knife-marks on bones from both the superficial and the deeper layers suggest a custom such as post-mortem cleaning of the bones of the dead for secondary burial that could hardly have occurred at such remote periods as claimed, and that the many fragments of bones found deepest in the loess might well have been the result of the burrowing of rodents, evidences of which were present.

From an asphalt pit on Rancho La Brea, near Los Angeles, California, have been taken a vast number of bones of animals of the Quaternary period, and in 1914 widespread interest was aroused by the recovery therefrom of considerable parts of a human female skeleton. Although in such close association with the extinct animal remains, the human skull bears no features that mark it as other than that of an ordinary California Indian.

In 1913–1916 there were found at Vero, Florida, various vertebrate, invertebrate and plant fossils of Pleistocene age, together with fossilized human remains accompanied with implements and chipped flints, all in such association as to establish the basis of a claim of incontestable evidence of contemporaneity. Thus did the "Fossil Man of Vero" become widely exploited. The primary observations were made entirely from a geological point of view; subsequently other geologists, as well as anthropologists, investigated the site, and a thorough study of the skeletal remains for the first time was later made by Hrdlička, who, after examining the conditions under which they were deposited, was convinced that the burials were intentionally made in the fossil-bearing deposits long after the extinction of the animal species whose bones were found in association.

In 1924 remains of several human skeletons were found within an area of 12 square feet and at a depth of 19 to 23 feet, in excavation for an outfall sewer near Los Angeles, California. Fortunately it was possible to make scientific observations on the spot immediately, and by study of the local geological conditions it became evident that the presence of the osseous material, rather than being washed in, was due to miring under bog conditions, presumably prior to the accumulation of the greater portion of the deposits that overlay the human remains. No indication



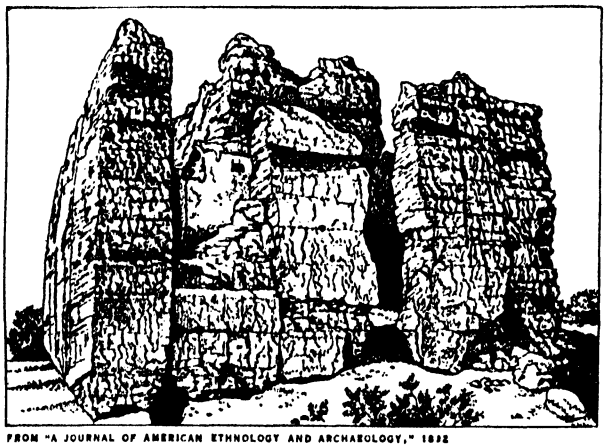
FROM "PAPERS" OF THE PEABODY MUSEUM

CAHOKIA MOUND, IN ILLINOIS, LOOKING WEST; THE LARGEST PREHISTORIC EARTH-WORK IN AMERICA

of Pleistocene or of recent mammals was found in association. The conclusions reached by Professor Stock were that the evidence did not point unequivocally to Pleistocene age of the deposits containing the human material, but that they might well be measured in terms of thousands of years, but not necessarily tens of thousands.

In 1923–1924 the nearly complete and articulated skeleton of a Pleistocene bison was found on Lone Wolf creek, near Colorado, Mitchell county, Texas, embedded in an indurated matrix of cemented sands, gravels and clays, beneath which were two thin,

well-chipped, flint projectile points and part of another. In 1925 an almost identical discovery was made in the bank of an arroyo near Folsom, New Mexico, the two implements there found in direct association with fossil bison being even finer examples of chipping than those which came from Texas. The excavations at Folsom are still in progress. These two interesting discoveries are quite comparable, so far as the circumstances are



FROM "A JOURNAL OF AMERICAN ETHNOLOGY AND ARCHAEOLOGY," 1892

RUINS OF AN EARLY ABORIGINAL DWELLING "THE BIG HOUSE," AT CASAS GRANDES, MEXICO

The building probably reached a height of six or seven storeys, and is constructed of sun-dried blocks of mud and gravel. Its age has not been determined beyond the fact that it was already in ruins at the time of the Spanish conquest

yet known, to the finding of a somewhat cruder spear-point, likewise found in connection with a fossil bison, at Russell Springs, Logan county, Kansas, in 1895. Again, in 1926, near Frederick, Tillman county, Oklahoma, there were reported to have been found, near the base of a great hilltop gravel and sand deposit, 10 to 25 feet in thickness, in a stratum containing fossil vertebrates and beneath a layer of sandstone, a chipped flint spear-point, together with two stones described as "pestles or grinding instruments," which were not regarded as of sufficient importance to preserve. Above the sandstone, in partially cemented sand, gravel, and pebbles, 9 to 15 feet thick and likewise containing fossils, a flint drill-point was found. In the same stratum, 8 feet beneath mammoth remains, were unearthed five specimens of what were identified as metates, or mealing slabs, of sandstone. No human skeletal remains were anywhere present. Mr. Harold J. Cook regards these artifacts as earlier representatives of Pleistocene man than those found in Texas and New Mexico, which follow in order in point of age; he believes that the Frederick deposits are of early Pleistocene age, probably Aftonian.

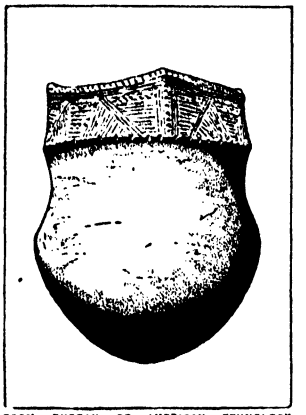
DISTRIBUTION OF CULTURES

Archaeological research has been widely conducted north of Mexico; but the territory is so vast, the tribes and bands were so numerous and their shiftings so many, that knowledge of the archaeology of many areas is still almost a blank. Enough has been gleaned, however, to enable a fair classification of the character and distribution of the cultures in prehistoric times, and in many instances it has been possible, by analogy with the arts and customs of existing tribes or through historical research, to identify the peoples whose remains were under investigation.

There is general agreement with respect to the limits of the various archaeological culture areas north of Mexico, such differences as are due to more or less marginal influence not materially affecting the general classification. Furthermore, a close correlation is shown in the archaeological culture areas and those of the historic tribes. Within the limited area of this treatment the Indians had no records beyond arbitrary, and for the greater part undecipherable picture-writings, hence archaeology at best can hardly be relied on to present a vivid picture of the life of the northern Indians before the coming of white men. In a comparatively few instances Indians occupied dry caves and rock-shelters in which have been found examples of almost everything they made, of their foods, as well indeed as the bones of the occupants, thus enabling determination of at least the approximate relationship of the crania, affording an opportunity to reconstruct much of the life of the people, and of estimating the relative periods of occupancy through study of the stratigraphy of the deposits. While archaeology has revealed a relatively high degree of culture in certain areas north of Mexico, notably in those of the mound-building tribes and of the Pueblos of the Southwest, yet in no instance did it equal that of Mexico and Central America, where the ancient cultures were characterized by stupendous buildings of elaborate architecture, by glyphic writing, and by works of art in stone, wood, mural and other painting, and ceramics, in many respects equal to the highest art of early times in the Old World.

Culture Areas.—Based on the more clearly manifested phases of their culture content, the following eleven general archaeological areas north of Mexico as set forth by Holmes, have been recognized, the classification varying in no great degree from that based on ethnological observations as mapped by Wissler: (I.) North Atlantic area; (II.) Georgia-Florida area; (III.) Middle and Lower Mississippi Valley area; (IV.) Upper Mississippi and Great Lakes area; (V.) Plains and Rocky Mountains; (VI.) Arid region; (VII.) California area; (VIII.) Columbia-Fraser area; (IX.) Northwest Coast area; (X.) Arctic Coastal area; (XI.) Northern Interior area. This general classification well serves the present purpose.

I. **North Atlantic Area:** This culture area, sometimes divided into two at the Delaware valley and sometimes into still lesser areas, may be regarded as extending from Newfoundland and the St. Lawrence valley in the north to southern Georgia in the south, and as including the Maritime Provinces of Canada, New England, New York, Pennsylvania, Maryland and large portions of Virginia, West Virginia, the Carolinas and Georgia, the northern part of the territory extending inland indefinitely to the north and west, and its southern part extending westward to the Appalachian mountains. The tribes were chiefly those of the Algonkin, Iroquoian and (in the south) Siouan stocks of historic times, and save for certain shiftings of boundaries and the extinction especially of most of the Algonkin and Siouan members, the archaeological and known linguistic areas may be regarded as practically coëxtensive. The forests and highlands afforded excellent hunting; the many rivers and bays, and the sea itself, offered an abundance of fish and shellfish, and while agriculture was practised, it was subordinate to fishing and the chase. Shellfish (oysters, clams, mussels, scallops, whelks, cockles) formed an important part of the diet, as shown by the almost numberless heaps of shell refuse along the coast and the tidewater bays, rivers and inlets. One heap at Pope's creek on the Potomac in Maryland, consisting of oyster-shells, covered about 30 acres and reached a depth of 15 feet. The Peninsular shell-mound, one of five principal deposits of oyster-shells on the west bank of Damariscotta river, Maine, is about 400 feet long and attains a maximum height of 22 feet.



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

AN IROQUOIS VASE, 13 IN. IN HEIGHT, FOUND IN A GRAVE IN NORTHERN PENNSYLVANIA

The dwellings of the ancient Indians of the North Atlantic area probably varied in no respect from those of early historic times. Stone as a building material was almost unknown, construction being of wattlework, bark, and mats, and the Iroquois villages were often protected with stockades. Cache pits for storage were used in the central part of the area, centring in New Jersey. Some of the houses, as those of the Iroquois, the

Mohican, and of Virginia and North Carolina tribes, were of the community type, those of the Iroquois (the well-known "long-houses") being 50 to 100 feet long and 16 to 18 feet wide.

Burial customs varied more or less with locality, but interment was the usual practice; sometimes the corpse, fully clothed, was placed in the grave in a sitting posture. The custom of the Algonkin and Iroquois tribes from the St. Lawrence to the Delaware was to wrap the corpse and to bind the legs against the trunk, and sometimes, except among the early Algonkins who rarely practised the custom, the implements, utensils, and ornaments of the departed were buried with his remains. Interment of dogs, sometimes with the human dead, was common. In the Iroquois area especially the bones of the dead were periodically gathered from their graves and deposited in ossuaries lined with furs and covered with brush and earth, but this was not an Algonkin custom. Among the Powhatan tribes of Virginia two methods of disposal were practised in prehistoric times as well as at the beginning of the Colonial period—the bodies of important men were wrapped and placed on platforms in the "temples," and probably afterward gathered and buried while those of ordinary people were at once inhumed.

In the lower Penobscot valley, in Maine, it was an ancient custom to place quantities of red hematite paint in the graves and to deposit with the dead certain exceptional stone objects only—long slender celts, gouge-adzes, and slate points of bayonet shape, resembling those of the Eskimo and even those of northern Europe and Asia. In the abundant shell-heaps of the region such slate points are unknown, and the other implements are either scarce or entirely lacking, whereas bone and shell objects so common to the shell-heaps are not found in the graves. These conditions have given rise to the designation "Red-paint people" to distinguish the earlier from the later inhabitants, not alone because the graves of the ancients contain the hematite deposits, for a similar custom was practised elsewhere in New England as late as Colonial times. There are certain indications that point to relationship with the extinct Beothuk of Newfoundland, as well as with the Algonkin culture of New York.

The ceramic art of the North Atlantic area was somewhat rudimentary in comparison with that of other cultures, yet the cooking utensils and the trumpet-like smoking pipes of the Iroquois display considerable taste, and the pipes especially were often elaborately decorated with modelled life forms or miniature jars. The typical Virginian pipe with long stem and upturned bowl, taken to England by early colonists along with the first tobacco, gave form to the common clay pipe of the present time. The chief distinguishing features of the ancient earthenware vessels of the Iroquois of New York and Pennsylvania are a conical base, constricted neck, and flaring squarish collar usually embellished with an incised rectilinear pattern and sometimes with modelled heads and figures in relief. In the marginal regions, —New York bay, Long Island, the lower Hudson valley, Connecticut, and Rhode Island,—the Algonkin pottery, otherwise usually plain in form and simply decorated by incising or with fabric- or cord-marked impressions, often shows Iroquois influence.

Stone objects consisted of the pecked and polished celt-hatchet, grooved axe, chisel, pick, gouge-adze, mortar, long cylindrical pestle, knife and spearhead of slate, and hammer-stone; of these the gouge-adze is of exceptional excellence. Chipped stone implements of all the ordinary types (knives, projectile points, drills, etc.) were plentiful; objects of the same material used as ornaments or in ceremony were banner-stones, bird-shape stones, "plummets," tubes, pierced gorgets, etc. Not all of these objects are found throughout the area, their distribution depending on the varying sub-cultures of the former tribes and their chronological sequence. Human effigies of stone are rare. Soapstone (steatite) abounds, and owing to its suitability and the ease with which it may by fashioned, it was extensively quarried with stone pickaxes and chisels for manufacturing cooking-pots, smoking pipes and ornaments. Objects of bone, especially in the Iroquois area, are rich in form and variety. Mica was mined in Virginia and North Carolina for use especially in making ornaments and mirrors, and it became an important medium of trade over a wide area, great quantities having been recovered from Ohio mounds. Argillite, jasper, and rhyolite were quarried in New Jersey, Pennsylvania, and New York, and quartz and quartzite boulder deposits in the District of Columbia and elsewhere for chipping into prodigious numbers of implements and weapons, especially arrow-points and celt-hatchets (tomahawks). Engraved conch-shell gorgets of Virginia and the Carolinas suggest culture intrusion from the west. Water transportation was by dugout and bark canoes. Petroglyphs, or rock-writings, are rather common, the most noted being Dighton Rock in Taunton river, Mass.

II. **Georgia-Florida Area.**—The southern part of Georgia and northern Florida were occupied by tribes of the Muskogin family, and the peninsula by the extinct Timucua and Calusa, with evidences on the west coast of early Arawakan intrusion from the West Indies, all of which have left their impress on the archaeology of the region. The antiquities are somewhat distinct from those of the North Atlantic area, but grade imperceptibly into those of the Gulf states to the west and the Mississippi valley area to the northwest. Agriculture was practised in suitable localities, but the waters of the extensive coast and of the streams afforded the principal food supply, and the refuse of feasts over long periods is still seen in the hundreds of shell-mounds along the coast and on some of the river banks.

Burial mounds of earth and sand are numerous, and have yielded many relics, especially in the peninsula, where it was the custom to place with the dead many crude objects of fired clay, vessels of fanciful shapes, and rude effigies of creatures or things real and fanciful, as mortuary offerings. Especially in west Florida large deposits of earthenware utensils are found with the dead, the forms sometimes suggesting a distinct type of mortuary vessel, and like those of the peninsula, they were often perforated in the bottom, or "killed." Methods of burial varied: the body was (1) extended, or (2) flexed; (3) it was exposed until the flesh decayed, when the bones were gathered and interred; (4) the remains were cremated. Urn burial, of cremated or non-cremated remains, common in Georgia, was rare on the peninsula.

The houses were built of poles and thatch, often in circular village groups and surrounded by palisades as a means of defence; but only traces of these have been found. Along the Gulf coast pile-dwellings also were once used. Pottery, sometimes of pleasing forms, but not painted, was extensively manufactured, and in the western part of the area life forms were skilfully modelled,



AFTER HOLMES

GENERAL VIEW SHOWING PROGRESS IN REMOVING SHELLS AND LODGE-SITE REMNANTS AT POPE'S CREEK SHELL-HEAP

and engraved and indented designs were used. Elsewhere the surfaces of vessels were embellished with the figured stamp or paddle, some of which are so closely analogous in motive, grouping, and execution to certain designs on wooden objects from the West Indies as to create the belief that they could have arisen only through identity or by intimate relationship of the peoples employing them. Traces of distinctive Caribbean treatment and motive are found almost as far north as the boundary of Virginia and South Carolina, in the valley of the Tennessee near Knoxville, and westward on the Gulf coast in southeastern

Alabama. Earthenware pipes are usually of angular trumpet shapes with bowls expanded into human or animal heads, but in west Florida they were more clumsily made.

Finely carved stone bowls and strange plates with ornamented rims have been found; but stone sculptures are exceptional, hence earthenware forms the chief basis of study of the culture status of the early inhabitants of the region. By the recovery of various remarkable masks, figurines, dishes, stools, and other carved and painted wooden objects from the canal muck on Key Marco, on the southwest Florida coast, in a region occupied by the Calusa in late prehistoric and early historic time, a degree of art was attained that is not suggested by the stone and pottery articles of the area, making it probable that the culture represented by these objects and by those of shell and bone found in association, was exotic. Cutting and incising tools of shell and of sharks' teeth appear to have been the main reliance of the craftsmen of the Florida keys, some of whose products bear patterns identical in motive with designs found in the West Indies.



BY COURTESY OF MUSEUM OF THE AMERICAN INDIAN

EARTHENWARE EFFIGY PIPE FROM THE NACOOCHEE MOUND, IN GEORGIA

In the northern part of the culture area flint was utilized for the manufacture of the usual kinds of chipped implements, a phenomenal abundance of which is found in Georgia. Only in limited areas are found the varieties of stone usually employed in manufacturing the pecked-ground implements, hence tools of this kind are comparatively rare, with the exception of the celt. The grooved axe also is of rare occurrence, although abundant in the northern sections of most of the Gulf states, where it is closely associated with the celt. Comparison has been made with the occurrence of great numbers of celts and the rarity of the grooved axe in the West Indies, the celts from those islands and from Florida bearing closer resemblance than those from any of the more northerly districts, hence suggesting insular influence as in the case of the pottery. A further suggestion of intrusion of culture is the occurrence in Florida, and in other Gulf states, of a perforated hoe-shape stone implement which corresponds closely with a type of axe prevalent in South America, and pile-dwellings in the south and suggestions of the practice of cannibalism on St. Johns river point in the same direction. Wood commonly took the place of stone in fashioning mortars and pestles. Ornaments of gold and silver have been found in the peninsula, and while some of the more elaborate pieces may have been derived from Mexico or Central America, the skill of the Florida metal-workers is shown by objects of wood and bone overlaid with sheet-copper, and by certain plates of sheet-copper with symbolic devices executed in repoussé fashion with much precision. As in the ceramic art, the metal-work of the South Atlantic area indicates a higher degree of culture than that of the northern area.



FROM "12TH ANNUAL REPORT" OF THE BUREAU OF AMERICAN ETHNOLOGY

PLAN OF THE SERPENT MOUND IN ADAMS COUNTY, OHIO

III. **Middle and Lower Mississippi Valley Area.**—This interior area, with much outlying territory, is characterized by remains which in many respects represent the highest culture attained by any of the aboriginal peoples north of central Mexico. This is what is commonly known as the mound-builder culture, exemplified by many earthworks of varying forms and magnitude, and designed by their sedentary builders for domiciliary, religious, civic, defensive, and mortuary uses, and in some instances no doubt as places of refuge in times of flood. Effigy mounds, numerous in the Upper Mississippi and Great Lakes area, are uncommon; the Serpent Mound is notable. The builders of the mounds were long regarded as a race distinct from the Indians, but archaeological investigation has proved that these tumuli are solely the product of the Indians: that indeed many of them south of the Ohio valley were in use and even in process of erection after the coming of Europeans, as attested by the finding of articles of civilization as original inclusions. Tribes of this region known to have occupied the mound area and to have been builders of earthworks belonged to the Siouan, Algonkin, Iroquoian, Muskogin, Tunican, Chitimachan and Caddoan linguistic families, and these may have been preceded by other Indian groups in prehistoric times.

The culture of this area cannot be said to be confined strictly to the region designated, for in certain of its typical aspects it extends to the Georgia coast, blending with that of the Florida area, and to the coast of other Gulf states. The culture likewise has much in common with that of the Upper Mississippi and Great Lakes area, and grades somewhat abruptly into that of the adjacent region of the west. Although presenting more or less homogeneity throughout, the Lower Mississippi area is not a simple culture unit, for there are a number of localized centres of development and differentiation, no one of which can yet be selected as the type for the entire area. Aside from the more typical forms of culture, there are limited areas in which very primitive conditions seemed to have prevailed down to the advent of Europeans; and there are some indications, in various parts of this area, of culture relations with Mexico.



BY COURTESY OF OHIO STATE ARCHAEOLOGICAL AND HISTORICAL SOCIETY

EFFIGY PIPE FROM AN INDIAN VILLAGE SITE IN OHIO

Of the character of the domiciles and temples of the mound-building Indians little is known, for, unlike the earthworks, being of a more or less temporary character, practically nothing of them has survived. It is known however from early descriptions that buildings of the Natchez of Mississippi and of other tribes were of wattlework faced with clay, and with roofs of bark and thatch—materials that soon decayed. Of similar materials probably were the buildings associated with the great earthworks—Cahokia in Illinois, Etowah in Georgia and Marietta, Newark, and Fort Ancient in Ohio. Remains of stockades that supplemented the embankments in defensive works and served to protect the villages from attack have been found. Modes of burial within the mound area were extremely varied, and vast numbers of artifacts were deposited as offerings with the dead in ordinary cemeteries, in stone graves, and in mounds of earth and stone.

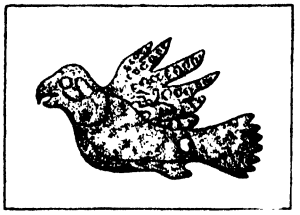


FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

VASE WITH INCISED DESIGN FROM THE LOWER MISSISSIPPI VALLEY

Art in stone was well developed, although sculpture of the human form had made but slight advance, except in the case of the smoking pipes, where exceptional skill is shown both in this respect and in the production of animal effigies. Stone was employed in a limited way in the building of walls and fortifications and in the construction of graves, and desirable varieties were quarried on a large scale for the manufacture of implements, utensils, and ornaments, and also objects pertaining to religion and ceremony. Chert was quarried almost throughout the area; hematite ore for implements and ochre for paint were procured in Missouri; granitic and other durable rocks were distributed over the northern borders by ice-sheets of the glacial period and were utilized by the inhabitants for implement-making. Copper from the Lake Superior region found an important place in the native arts and remarkable skill was shown in its manipulation by the malleating processes. Among examples of copper work found in the

Hopewell mounds in Ohio, are a head-dress consisting of a high frontal piece made of sheets of copper covered with indented figures out of which rise a pair of wooden antlers neatly plated with sheet copper; certain spool-like objects, probably ear-ornaments, each skilfully formed of thin sheets of copper over a wooden base; and artificial copper noses on two skeletons and a necklace of 320 pearls. At the Mound City group, a few miles eastward, three sets of copper antlers belonging to head-dresses were unearthed. Personal ornaments of the same material from the mounds are of great variety, including beads, pendants, pins, ear-ornaments, bracelets, gorgets, etc.; but none of the copper objects are more remarkable than the repoussé figures in sheet-copper, some of which suggest Mexican influence.



BY COURTESY OF OHIO STATE ARCHAEOLOGICAL AND HISTORICAL SOCIETY

FLYING EAGLE, 12½ IN. LONG, MODELLED IN COPPER, FROM THE MOUND CITY GROUP OF OHIO

The presence of quantities of mica in the mounds of the middle region show that the inhabitants procured that desirable and readily worked material from North Carolina. By reason of the abundance and variety of these materials, "the range of lithic artifacts," says Holmes, "is greater than in any other region north of the valley of Mexico. The sword-like blades of Tennessee approach the highest place among American chipped products, and the agricultural implements of the Illinois region constitute a unique and remarkable class without parallel in any country." Thus there are numberless implements for cutting, scraping, boring, piercing, digging and hammering; axes, celts, adzes, chisels, discoidal "chunkey-stones" used in gaming, banner-stones, ornaments and tobacco pipes, in great variety and excellence of form, design and finish. As mortuary offerings hoards of stone implements have been found, one of the most noteworthy of which was a deposit, in an Ohio mound, of many hundreds of beautifully chipped obsidian implements, transported from unknown sources at least a thousand miles away. Another interesting mortuary deposit in one of the Hopewell mounds of Ohio consisted of more than 8,000 large flint discs. Pigment palettes from Alabama, and engraved shells and sculptured utensils of the middle districts are among many other art products of the mound-building Indians. Perhaps in pottery alone did these people fall short of the ancient Pueblos of the Southwest, yet the elaborately engraved and painted vases and effigy vessels, particularly those representing the human head, of the middle Mississippi region, and the scroll-decorated receptacles of the lower Mississippi and the Gulf coast, display both excellent taste and skill. Bottle-shape vases were a favourite form of receptacle. The stamp-decorated ware of the southern Appalachian region on the border of this and the southern Atlantic culture areas, is of great interest. For some of the more noteworthy earthworks *see* CAHOKIA MOUND; ETOWAH MOUND; GRAVE CREEK MOUND; FORT ANCIENT; NEWARK WORKS; ELEPHANT MOUND.



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

EARTHEN VESSEL OF THE MID-MISSISSIPPI VALLEY, FINISHED IN COLOUR

IV. **Upper Mississippi and Great Lakes Area.**—This archaeological culture area is less sharply differentiated from those adjacent than are the others from their neighbouring cultures. The tribes inhabiting the region when first explored belonged to the Algonkin and Siouan stocks, and many Indians of the former still dwell within the domain, the ancestors of the Chippewa having forced the Sioux westward at the beginning of the 18th century. In a general way the ancient culture, as revealed by artifacts and other remains, is almost equal to that of the territory to the eastward, but is inferior on the whole to that of the Middle and Lower Mississippi area. Agriculture was practised in favourable localities, and the so-called garden beds of Michigan, ridged or furrowed tracts, are among the most novel and mysterious features of the archaeology of the area. But hunting, fishing and seed-gathering, especially of wild rice, were the chief means of livelihood. Burial mounds of ordinary forms are widely distributed, and monumental features of unique type, including groups and chains of earthworks in formal and puzzling arrangements, and animal-shape mounds confined largely to Wisconsin, are abundant, such as the so-called Elephant Mound (*q.v.*).



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

EARTHEN VESSEL OF THE MID-MISSISSIPPI VALLEY MODELLED AFTER THE HUMAN HEAD

This area was the source of two kinds of highly valuable raw materials that were extensively quarried or mined, and distributed far and wide—catlinite or red claystone in Pipestone county, Minnesota, and copper of the Lake Superior region. Excavations for obtaining the catlinite, which was readily made into pipes, ceremonial objects and ornaments, extended along a narrow outcrop for nearly a mile. The quarrying was done with fragments of quartzite from the strata between which the seam of catlinite lay, and which were roughly shaped for the purpose. The sites of the copper mines are marked by extensive pittings in exposing the copper-bearing rocks and breaking them up to release the masses of native copper by means of heavy boulders from the lake shore. Thousands of these rude hammers are found about the pits, and occasional specimens are grooved for hafting. The copper at first was worked to produce forms resembling those of the stone implements, but sooner or later the celts, hatchets, awls, knives, drills, spearheads and similar simple tools took on new forms and other varieties were evolved. The metal was too soft wholly to supersede stone as a material for the manufacture of implements, but its pleasing colour and other properties led to its use for personal ornaments, and by the time the whites arrived it had spread over the greater part of the country. Doubtless the material of most if not all of the remarkable objects of sheet-copper with repoussé designs, found in mounds and graves from Illinois to Florida, had its source in the Lake Superior workings.

The stone implements and utensils of the area include rude mortars and cylindrical pestles, grooved axes, celts, adzes, tobacco pipes, tubes and the usual range of ceremonial and talismanic objects, noteworthy among which are certain saddle-shape stones which, together with other problematical forms, are characteristic of the ancient Algonkin area. The fluted axe and the faceted celt are peculiar to this region. Deposits of flint were worked in many places and chipped implements of usual types are exceedingly plentiful. Quartz veins were worked at an early period about the Little Falls of the Mississippi, and crudely chipped implements thereof found in flood-plain deposits of the vicinity have led some geologists to attribute to them geological age. Pottery receptacles are of distinctive types and generally are more primitive in make than is the ware in the Lower Mississippi area; but in some localities the vessels were carefully finished and decorated with incised and indented figures, though painted examples are rare.

V. **Great Plains and Rocky Mountain Area.**—The cultures of the territories surrounding the Great Plains—the sedentary mound and Pueblo cultures, and the cultures of the California and Columbia-Fraser areas—gradually fade out; for excepting limited areas in the larger eastern valleys of the area, agriculture was not practicable, but the teeming herds of bison and antelope, and an abundance of other game animals, afforded an adequate food supply, and even the tribes that practised agriculture to any extent seem to have depended more on hunting than on the

product of tillage. The Great Plains therefore were occupied largely by Indians who dwelt in *tipis* and were largely nomadic.

The time of the advent of the various tribes of this region is not known, but the semi-sedentary Caddoan peoples—the Pawnee of Nebraska, the Wichita of Kansas and other Caddoan tribes of Arkansas, Oklahoma and Texas—occupied their historically known seats from much earlier times. While Apache bands were met on the western Texas plains when the Spaniards first explored the country in the 16th century, they probably did not pass westward into New Mexico and Arizona until later; and the Comanche did not appear in the southern plains until the beginning of the 18th century. The only houses of the entire region that approached permanency were the earth-lodges, 30 to 60 feet in diameter, of the Pawnee and Omaha of Nebraska, the Ponca of Nebraska and South Dakota, the Osage of Missouri-Arkansas, and the Arikara, Mandan and Hidatsa of the upper Missouri river in North Dakota. Remains of these are still traceable at old undisturbed village-sites, in the form of rings, for the floor of the earth-lodge was sunk two to four feet below the surface.

Quarries of flint with associated sites of manufacture of chipped implements are found in Oklahoma, Kansas and Texas, and of quartzite and soapstone in Wyoming, the diggings for the quartzite being very extensive. Two remarkable deposits, or caches, of flint implements have been found within the region, one consisting of a thousand specimens in a sulphur spring at Afton, Oklahoma, the other a cache of thousands of flint arrow-points in Delaware county of the same state. Obsidian, a favoured material for projectile points and knives, is abundant in Yellowstone Park and the upper valleys of Snake river, Wyoming and was not only used locally, but found its way by channels of aboriginal barter hundreds of miles from its place of origin. The stone implements of the general Plains region reflect the hunting tendencies of the Indians that inhabited it—arrow- and spear-points, knives, scrapers, hammers, club-heads. The heavy grooved hammer used in early as well as in historic times for cracking the bones of the larger mammals for extracting the marrow, for driving stakes, and for pounding seeds, etc., is regarded as probably the most typical and characteristic of the stone tools of this culture area. The hafted stone hammer, used as a club, is thought to have been of somewhat recent introduction. The metate and mano, used for grinding corn by the agricultural Pueblos of the arid region, found their way to a slight extent into the mountains and plains to the north and east, and other evidences of a lowly Pueblo culture have been traced to western Texas. In the upper Missouri valley have been found indications of an overflow of such stone objects as tubular tobacco pipes and paddle-shaped clubs, more characteristic of the middle Pacific slope region of Oregon and Washington. In the great central reaches of the area are found circles and lines of boulders, with an occasional effigy in outline. The so-called "Medicine Wheel" in the Big Horn mountains of Wyoming, with a circumference of 245 feet, is notable. Some of the lines of stones doubtless mark the sites of buffalo pounds, while the small circles may indicate the sites of *tipis*. Pictographs are not uncommon. Pottery is rare throughout the area, excepting in its eastern fringe, where the western limits of mound-building Indians were reached.

Perhaps no more ancient remains have been found in the area than those recovered from certain dry rock-shelters in the Ozark mountains of western Missouri-Arkansas, which were conducive to the preservation of practically everything their inhabitants used —basketry, cradle-boards of cane, woven bags, fish-nets, overshoes and sandals of grass, moccasins of deerskin, feather robes, pendants and beads of shell, and stone spears which were hurled with an *atlatl*, or throwing-stick, for they hunted buffalo, elk, deer and turkey. These Bluff-dwellers were agriculturists as well as hunters, raising corn, beans and squashes, and using also for food many wild vegetable products. Little pottery was used. Adjacent caves revealed a later but still prehistoric culture, shown by the presence of the bow instead of the *atlatl*, and of a superior class of pottery, which may be attributable to the ancestors of the Osage or the Kansa.

In the southernmost part of the Plains area, in Texas, little intensive research has been conducted. Throughout the limestone region are found numerous and extensive kitchen-middens which give evidence of a hunter culture only; but along the streams of the central part of the state are many old camp-sites which reveal evidences of a superior culture. In the timber region of eastern Texas are evidences of an early mound-builder culture and of the relatively settled village culture of the historic period; and in the trans-Pecos and Panhandle regions a low form of Pueblo culture has been revealed, with some evidence of Basket-maker life.

VI. **The Arid Region.**—This area may be said to comprise the present Arizona, New Mexico, Nevada, southern Colorado and Utah, a part of western Texas, and northern Chihuahua. It is largely a region of desert plains, plateaux, cañons, mesas and lofty forested mountains, with here and there perennially or intermittently watered valleys of remarkable fertility when brought under irrigation. In its physiographic features as a whole the territory is quite unlike any other in North America, and therefore the culture of its ancient inhabitants stands alone.

The basic element of the culture growth, maize agriculture, was derived from the south and was taken up, fifteen to twenty centuries before Christ, by a previously resident long-headed, nomadic or semi-nomadic people of a culture perhaps not unlike that of the present desert Shoshoneans of Nevada, who did not practise skull deformation, and made excellent coiled basketry, sandals and twined woven bags, and used the *atlatl* or throwing-stick in lieu of the bow, but whose dwellings were of an unsubstantial character. This postulated stage has been termed *Basket-maker I.*, or *Early Basket-maker*.

The newly-acquired art of agriculture led to a more settled life and to the development of more permanent houses; but as yet pottery-making was unknown. This stage, *Basket-maker II.*, is exemplified by remains found especially in south-central and south-eastern Utah and in north-eastern Arizona.

At a later date pottery was introduced or possibly independently invented; houses of the pit type, "slab-houses" with pole-and-brush roof, were perfected and became grouped into villages, and bow and arrow began to supplant the throwing-stick; but the long-headed people still persisted. This was *Basket-maker III.*, or *Late Basket-maker*, remains of which are found throughout the San Juan drainage of Utah, Colorado, Arizona and New Mexico, and in parts of the Little Colorado watershed in Arizona.

At a still later period skull-deformation was initiated (some believe that a new broad-headed strain superseded the ancient long heads); cotton was introduced; dwellings emerged from the ground, rooms became rectangular and were grouped more closely; structural coils were left unobliterated on cooking vessels and thus corrugated pottery originated. This stage, *Pueblo I.*, or *Proto-Pueblo*, is represented by sites throughout the San Juan drainage and in parts of the Rio Grande, Little Colorado and upper Gila valleys. Black-on-white and neck-coiled pottery is characteristic of the period, and the *kiva*, or ceremonial chamber, had its beginning.



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

VASE FROM PUEBLO VIEJO, GILA VALLEY, ARIZONA

The development of culture was rapid. A period of wide geographical extension marked by small-village life; corrugated pottery, often of elaborate technique, extended over the whole surface of cooking vessels. This culture stage was *Pueblo II.*

There was perhaps a decrease in the extent of territory occupied, and certainly a concentration of population in certain areas, together with greater architectural and ceramic achievement and strong regional specialization. This was *Pueblo III.*, the *Great Period.*

Subsequently large areas were abandoned, there appears to have been a considerable shrinkage of population, and there was a defi-

nite cultural degeneration. Corrugated pottery gradually disappeared. This period, *Pueblo IV.*, or *Proto-Historic*, was brought to a close by the colonization of the south-west by the Spaniards at the beginning of the 17th century.

The *Historic* or *Pueblo V.* stage is the period commencing with the Spanish settlement and continuing to the present time.

Thus were gradually evolved, over long periods, thousands of small houses built of masonry, associated with the ruins of which is black-on-white pottery that evidently originated in the San Juan drainage, spread in almost every direction until the culture represented by it extended roughly from Great Salt Lake and southern Colorado almost to the Texas border and southern New Mexico, eastward to the limits of New Mexico, and westward to the California boundary. Then concentration commenced, seemingly by the result of hostile pressure, resulting in large many-storeyed community pueblos, such as Pueblo Bonito and others in the Chaco cañon in New Mexico. Regardless of the sites, these pueblo clusters were built with a view of defense—on mesa-tops which were well-nigh impregnable, or in valleys convenient to tillage, where the character of the buildings, often terraced one above another with a well protected court and with outer walls having only a single opening, bespoke their defensive character. Many such villages were large enough to house a population of several hundred. To this day the Hopi villages and Acoma retain their mesa-top situations, and only within the last few decades have ground-floor openings been provided in place of ladders and hatchways. Some of the mesa-top pueblos were further protected by low masonry walls at vulnerable points of the cliff.



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

PITCHER WITH CHARACTERISTIC INDIAN DESIGN FROM FOUR-MILE RUIN, ARIZONA

In addition to the use of stone as building material in the mesa and valley pueblos and in the cliff-dwellings, a form of concrete was used in constructing certain massive buildings in the southern area, such as the well-known Casa Grande in Arizona (the principal building of a large compound of circumvallated structures), the main walls of which, three to five feet thick, rise to a height of 20 to 25 feet, equivalent to two stories; but in 1699 it was four storeys high. The dimensions are 43 by 59 feet. Such edifices were erected by planting two rows of posts as far apart as the width of the walls was to be, wattling the posts with osiers, and filling this form, *pisé*-fashion, with mud made of the calcareous soil, which when dry became very hard. Moulded adobe bricks were not used in prehistoric times, but mud mixed with sage was rolled into the form of loaves and used for wall-building. "Wattle-and-daub" was occasionally employed for unexposed walls. The *kiva*, or ceremonial chamber, usually circular and wholly or partly subterranean, was a common feature of ancient as of modern pueblos, and their large number compared with the rectangular domiciles in cliff-dwellings, notably those of the Mesa Verde in Colorado, recalls early Spanish reference to their occupancy in the pueblos by the male inhabitants in addition to their use for religious rites. Especially in southern Arizona, the inhabitants of the villages composed of many large community clusters built of concrete like Casa Grande, cultivated extensively by means of irrigation, their canals sometimes extending for many miles and their storage reservoirs being of great capacity.

Sacrificial caves, pueblos, cliff-dwellings, and graves have yielded vast numbers of artifacts illustrating the ancient life and culture of the early peoples and have been of prime importance in determining chronological sequence. Taken as a whole the pottery (made without the wheel, of course) exceeds that of any other area north of central Mexico in grace of form, variety, range and execution of decoration, and, of the later periods, in colour. There were two periods during which the decoration was in glaze. On early vessels from the Mimbres valley, New Mexico, are well executed representations of zoömorphic and other forms, and the pottery of the later polychrome period is often beautifully embellished with realistic as well as conventionalized figures of birds, feathers, and other motives in great variety. Effigy vessels are common to many localities and to various periods. The excellent basketry of the earliest stages of culture gave way largely to earthenware after the adoption of corn-raising and sedentary life became firmly established. The throwing-stick, or *atlatl*, early superseded by bow and arrow, has been mentioned. Netted and woven articles of wild vegetable fibres, and fabrics of remarkable beauty sometimes interwoven with feathers after the early introduction and cultivation of cotton, exhibit the facility of the ancient inhabitants in the textile art. Stone slabs and vessels for preparing or containing paints and medicines are sometimes well finished and embellished in relief with effigies of birds, animals, serpents, and frogs; but sculpture generally was inferior to that of the Mississippi Valley tribes, the Pueblo hunting fetishes representing prey animals not equalling the remarkable effigy pipes from Ohio mounds. The most ambitious effort of Pueblo sculptors of old is shown in the partly destroyed crouching mountain-lions carved life-size in rock-in-place near Cochiti pueblo in the Rio Grande valley. Petroglyphs are abundant, but nowhere do they exhibit any degree of aesthetic advancement or any approach to a glyphic system. Obsidian, jasper, and chalcedony are among the native substances used for chipping arrow- and spear-points, knives, scrapers, and drill-points. Turquoise mined in the Cerrillos near Santa Fe and in other localities in New Mexico, Arizona, and Nevada, was made into various ornaments, including mosaic brooches, pendants, ear-ornaments, hair-combs, and rings, and into beads so finely drilled with the pump-drill that the process of perforating them is a mystery. Axes and hammers both singly and doubly grooved are common throughout the area; arrowshaft straighteners and smoothers are often excellently made; metates and manos of varying degrees of coarseness for grinding corn, and mortars and slabs for pounding and grinding foods and paint are found among the remains of many households. The stone gouge, celt, and chisel, usual to other localities, are absent; but gouges, chisels, awls, punches, spatulas, knives, flakers, weaving implements, and various other tools of bone or of antler are common. Slightly tapering tobacco pipes, usually quite plain, are characteristically Pueblo; others, used as "cloud-blowers," are sometimes perfectly cylindrical. Cane cigarettes have been found in sacrificial caves by thousands. There is no evidence that the people of the arid region possessed any knowledge of metal-working, the copper bells found there being doubtless of Mexican origin.

Burial customs varied more or less with the locality. In some places the remains were deposited in talus, in others cemeteries were provided, and often interment was made beneath the floors of dwellings. In the Gila drainage of Arizona both house burial and cremation were practised, and cremation found its way at least as far as ancient Zuñi. Very frequently the personal belongings of the departed were deposited with his remains, and rich indeed have been the mortuary objects found in some graves.

As in prehistoric times the Pueblo tribes have been reduced in number of villages and in population since they first became known to the Spaniards in 1540; but the linguistic families seem to be the same today as then—Zuñi, Hopi, Tanoan (Tigua, Tewa, Jemez), Keres—and there is no reason to suppose that there was any notable linguistic change for a long time before the beginning of the historic period. In addition to the Pueblos other sedentary Indians still inhabit the arid region—Pima, Papago, Maricopa, and several tribes of the Yuman family within the drainage area of the Colorado river—but these are in no way comparable with the Pueblos. The non-village Indians are the Ute, Paiute, Navaho, and several Apache bands, but there is reason to believe that the Athapascan Navaho and Apache did not enter New Mexico and Arizona until after the Spanish advent.

VII. **The California Area.**—Despite its diversified physiography and its remarkable number of unrelated languages, ancient California exhibits a uniformly primitive aboriginal culture as indicated by its antiquities, with a few marked exceptions. In most of its eastern and southern desert areas the Indian

inhabitants were doubtless as lowly, on the whole, as were the historic occupants of the region, if we except a wave of very early Pueblo culture, characterized especially by decorated pottery, recently found to have extended across Nevada practically to the California line, and being especially well advanced in southeastern Nevada. Also in western Nevada cave explorations have yielded prehistoric remains of Indians whose chief subsistence was gained from wild plants, rabbits and other small mammals, fish, and ducks, and possibly from a very limited agriculture. They made basketry, textiles, feather head-dresses, simple implements of wood, stone, and bone, as well as cordage, fish-hooks, fish-nets, rabbit-snares, and decoy ducks on a tule foundation. The abundance of baskets made of coiled osiers and elaborately decorated, the presence of the atlatl and the absence of pottery, all suggest an extension of the Basket-maker culture of the Pueblo region. There are parts of California which give indication of specific localized sub-cultures, as in the Humboldt Bay district, where an animal-shape stone club having affiliations in Oregon and on Columbia river is found. In lower San Joaquin valley have been unearthed narrow cylindrical vases of steatite, plain and incised earthenware balls, small crescentic obsidian blades such as are known to have been used by the Miwok in dances to represent bear's claws, and thin effigy ornaments of haliotis and mussel shell. Near Buena Vista lake at the head of San Joaquin valley, in the historic Yokuts territory, associated with prehistoric burials were recovered (*a*) an eagle's skull with eyes of haliotis, indicating Yokuts origin in connection with an eagle-mourning ceremony and therefore suggesting connection with an eagle-killing ceremony of the Luiseño and Diegueño of southern California; (*b*) a similar connection with southern California and the Southwest afforded by a club of the potato-masher type; (*c*) the hair preserved with some of the Buena Vista Lake skulls pertaining to an individual of the region is plastered in long masses typical of the historic Colorado river tribes and the Pima and Maricopa of Arizona; (*d*) and of even greater interest as suggesting intrusion is a cotton blanket which unquestionably came from one of the settled Pueblo tribes of New Mexico or Arizona. The sub-culture of the Santa Barbara islands and mainland is characterized by the greatest number of unique forms and specialized types found in California. They are mortuary and probably Chumashan, of unknown age.

California offered every means for agriculture, but its wild vegetal products, especially acorns, berries and seeds, were sufficiently abundant to afford sustenance to the interior tribes without recourse to tillage, consequently it is the only sedentary culture area in the United States where corn was not cultivated. Pottery, sometimes with rudimentary decoration, was made in the southern half of California for domestic and for mortuary uses, but it is in nowise comparable with that of the Pueblos. Movable mortars (found under ancient conditions only in the northern half of the state), bowls and globular cooking vessels, especially of steatite obtained chiefly from Santa Catalina island, together with a great variety of basketry, some of which has not been excelled anywhere, took the place of pottery to a large extent; these with the pestle, the heavy globular, conical and cylindrical mortars, the later metate slabs with their flattish hand-stones, and the pounding slab used by the coast tribes from San Francisco bay northward, were the only utensils suitable for gathering, preparing, containing and storing the native vegetal products. In the northern part the large mortars consist of excavations in bedrock. Many of the stone vessels are exceptionally well made, and some are ornamented with shell incrusted with bitumen. Rectangular and ovoid cooking plates and tobacco pipes of steatite, and polished bowls and cups of serpentine, are among the stone objects of the higher class from the historic Chumash territory about Santa Barbara. In the central and northern parts, especially in the Hupa country, black and mahogany obsidian is abundant, hence chipped implements of this material are found in great numbers. The large ceremonial knives, or batons, of obsidian, some of which are two feet or more in length, are marvels of the flaking art, and barring the flaked obsidian objects of Mexico are second in this respect only to the slender flint blades of ancient Tennessee. There are also superb flint blades in some localities, and arrow-points and spear-heads of exceptional beauty. Unusual stone artifacts are circular digging-stick weights, hook-shape carvings, killerwhale images, boat-shape amulets of steatite found in the Santa Barbara region, and the plummet-like stones and imperforate banner-stones of middle California. The grooved stone axe, the celt and the gouge, implements of such high importance in other areas, do not occur or are of great rarity on the Pacific slope, the small adze-blades, and perhaps implements of shell taking their place to some extent. The occurrence of stone artifacts in the auriferous gravels of California has been mentioned in referring to the antiquity of man in America.

Sea-food was abundant and formed the chief diet of the inhabitants of the coast and adjacent islands, as is attested by the abundant shell-heaps, the shells being chiefly mussels, clams and oysters. The heaps about San Francisco bay, some of which, estimated to be at least 3,000 years old and which were still occupied after the coming of the Spaniards, reach enormous proportions, the Ellis Landing heap having a million and a quarter cubic feet of material. The principal artifacts from these mounds are obsidian implements, mortars and pestles, bone awls and plummet-like "charm stones," all substantially with the same frequency throughout. The ease with which shells of all kinds were procured (haliotis, clam and dentalium especially) profoundly influenced the native arts, for some of the shells were used not only as lesser utensils, but afforded the means for incrusting both ornaments and objects of utility, and in the north were made into wampum for trade and for embellishing garments, baskets, etc.

There is no reason to suppose that the dwellings of the California Indians in early times differed materially from those known to history. They were all of a temporary character, being built of thatch, brush or bark, sometimes of poles covered with earth, and in the northern forest country slabs of wood were employed. Stone was not used as building material. The floor of the dwelling was usually excavated lower than the surrounding surface. The absence of ruins and earthworks has made the discovery of inhabited sites largely a matter of accident, yet it is known that the prehistoric sedentary population of California was large. Prehistoric sites rarely reveal anything of moment that is not apparent in the life of the recent natives of the same locality, hence archaeology has added little to the determinations of ethnology.

Notwithstanding the excellence of their basketry, their well-made utensils of stone, their chipped obsidian and flint implements, and their work in shell and bone, the California Indians were far from attaining the degree of material culture reached by the Pueblos of the arid region. From central California northward the status of culture represented by art works rises gradually as we pass to the north through Oregon, Washington and British Columbia, the culmination being reached by the tribes of the north-west coast.

VIII. **Columbia-Fraser Area.**—This culture region extends from California in the south to the Columbia and Fraser drainage area in the north, including all the area occupied by the historic Shahaptian tribes of Washington, Oregon and Idaho, but excluding the strip of coast north of the Columbia. While its culture phenomena are diversified, owing to the differences between the moist, forested environment of the coast and the semi-arid interior, yet in large measure it is uniform. The inland sub-culture grades into that of the plateau and mountain region on the east, due in part to the presence of the bison, a closer proximity to the tribes of the plains, and remoteness from the tribes of British Columbia. The culture of the entire area merges gradually with that of California, but it presents strong contrasts with the culture of the north-west coast.

The historically known tribes of the area belong to a number of distinct linguistic groups who subsisted and to a large extent still subsist by fishing and hunting, and by the natural supply of seeds, nuts, fruits and roots, in the southern part acorns and fish being the principal food, while all along the Columbia river especially salmon was the staple. Their better houses in the coastal region, some of them very large, were of planks with shed or gable roofs, now traceable chiefly by the depressions of their shallow floor excavations; in the interior stone-capped earth rings, 30

feet or more in diameter, mark the sites of pit-houses. In the Nez Percé country, on Snake and Clearwater rivers, village-sites are marked by circular and elongate house-rings varying from 25 feet in diameter to 18 by 60 to 85 feet, represented by a depression a foot to three feet deep, with elevated rims—the remains of ordinary dwellings and of communal lodges. As in California, along the shores are numerous shell-heaps, artifacts from which virtually agree with those of the general region. In Willamette valley and in southwestern Oregon, as well as in Washington, burial mounds have yielded a wide range of ordinary local articles, associated in some cases with objects of civilized origin. Earthworks and simple fortifications are mentioned, but little is known of them. Petroglyphs are distributed throughout the region, those opposite The Dalles, in Washington, showing correlation in technique and design with certain pictographic animal figures in Idaho, Utah and Nevada. Stone artifacts seem to vary little from those known to the historic Indians. Certain forms of implements and other stone objects characteristic of California extend northward throughout the length of the Columbia-Fraser area, while other forms characteristic of the north-west coast extend far to the south. Deep globular mortars prevail in some parts, and metates are found in others. The pestles in certain localities are of the oblong-club shape, many well finished and tastefully carved; in others they are ovoid or flattish, many being merely adapted boulders; and all were occasionally used as hammers. Tobacco pipes, straight in the south and bent in the north, are known; the grooved axe is absent, but adzes, celts and chisels of jadeite have been found on the middle Columbia. Among the other abundant stone objects are dishes, knives, net-sinkers, abraders, scrapers, reamers, drills, etching tools, weaving implements; spindle-whorls, plain and grooved hammers and mauls, bowls, paint cups, arrow-shaft smoothers, clubs, and projectile points; and antler wedges and bone clubs and fishing implements are likewise found.

Exceptional stone objects are large obsidian blades like those of northern California, batons of stone and bone carved in representation of animals, looped weight-like stones, and certain strange carved heads of simian aspect, unlike any other carvings in North America.

Lewis H. Morgan and others regarded the Columbia as having a very important place in the ethnic history of North America: that it was a kind of hothouse, the multiplying peoples of which spread out over the south and east; but no linguistic or other evidence has been adduced in support of this contention.

IX. **North-west Coast Area.**—As defined by Holmes, this archaeological culture classification area comprises a rather narrow strip of the mainland and the contiguous coastwise islands in British Columbia and Alaska, and extends from Puget Sound northward to Mount St. Elias, a distance of twelve or thirteen hundred miles. The tribes occupying this region as known to history belong to several linguistic stocks. Their material culture embodies many noteworthy features which cause it to stand well apart from all other cultures of the continent, yet it resembles in some respects the material culture of the coast on the south and of the inland to the east. Hunting and especially fishing have always been the chief sources of food, agriculture being unknown. Their territory abounding in splendid forests, the inhabitants developed great skill in woodworking with stone implements, which of course were superseded by tools of metal on the advent of the whites in the 18th century. The dugout canoes, made from trunks of the giant cedar and sometimes nearly a hundred feet long, are marvels of beauty and grace of line, and are probably the world's highest achievement in this direction. Their houses were often built of immense hewn timbers, and their carved and painted totem poles, house and grave posts, storage chests, human and animal effigies, and many and varied feast and other vessels, utensils, masks, etc., are worthy of the art of any people. While the sculptures of these people have doubtless been accelerated by the acquirement of steel tools, their innate aesthetic ability is shown by their minor works of art in stone, shell, ivory, antler, bone, horn and copper, many of which exceed the more massive productions in beauty and refinement. The smaller objects of stone include hammers and mauls of the highest known types, adzes, mortars, pestles, knives, chisels, clubs, batons, pipes, amulets and ornaments, jade being greatly sought and often laboriously fashioned to suit individual needs. Chipped stone objects are rare; pottery is unknown, vessels of wood, bone and horn serving instead. Ornaments and utilitarian articles of bone, ivory, wood and stone were attractively inlaid with iridescent shell. The ancient character of the graphic art of the north-west coast people is suggested by the petroglyphs, numerous in some parts, which display the same peculiar characteristics as the painting, engraving and weaving of the historic peoples. Copper has long been worked, and with considerable skill, especially into masks, rattles, whistles, knives and other utensils, ornaments and certain shield-like objects which are highly esteemed as symbols of wealth; but it is not known whether the copper art was an activity of prehistoric times, although the native metal occurs in surface deposits in the region. Altogether features of the arts of the north-west coast are thought to suggest inspiration from the Pacific islands; but this has not been shown to be the case, although it has been pointed out that if any such influence existed, it may have been exerted exclusively during the long period since modern seagoing vessels began to ply back and forth on the Pacific. Traces of advanced Asiatic art occasionally encountered along the coast are attributable to the stranding of vessels carried oversea by the Japan current rather than to purposeful voyagings in early times.

The peculiar geography of the country, in conjunction with its exceptional vegetable and animal resources, doubtless served to develop the unusual culture of this people. Archaeological research in the region has not been carried far enough to show that the forms of native artifacts are distinct from those that appear to have been in use in historic times, but so far as observation has been possible the culture is a homogeneous one, with only slight trace of antecedent forms of art either lower or higher than the historic. Nothing has been observed in the culture of the people suggesting migrations from the north by way of Bering strait, and no characteristic features that might have arisen within the local environment or from possible intrusions within a few centuries.

X. **Arctic Coast Area.**—As its name indicates, this culture area extends from Greenland on the east to farthest Alaska and even to northeastern Siberia on the west, and from the tortuous shores of the continent somewhat indefinitely into the interior to the range of the northern Algonkin and Athabascan tribes, into whose culture that of the Arctic Eskimo merges. Where not affected by the culture of these bordering Indians, that of the Arctic Coast area is essentially Eskimoan in both its prehistoric and its historic phases, and the uniformity of the environment and of the physical character of the inhabitants has resulted in marked uniformity in arts and customs. Archaeological research has been conducted at only a few sites on the Atlantic and Pacific coasts, but these have revealed little in the way of domiciliary and mortuary remains or of artifacts that are not practically identical with the types still in use where the natives remain free from the influences of civilization. Yet in some instances the archaeological remains, palpably Eskimoan, are regarded by the natives of today as relics of mythological beings.

In the frigid Eskimo habitat shelter was ever a necessity. The dwellings were built in such manner as was most convenient, and of such materials as were available. Driftwood, whalebones, stone, earth, sod and snow were utilized as occasion demanded, and the sunken floors and extended passages of the more permanent houses helped to afford a degree of comfort during the long and rigorous winters. Traces of such houses, and of storehouses and cairns, have been noted by explorers for thousands of miles along the frozen shores. Fire for cooking and for bodily comfort within the houses was obtained by the use of a flat earthenware or stone (usually steatite) lamp, with oil or fat for fuel—the only device of its kind known to aboriginal America. Food was obtained solely by hunting and fishing, and the implements and other devices used in these activities are not only highly ingenious, but many of them, especially those of ivory and bone, are beautifully carved and engraved, although such ornamentation is believed to be of relatively modern origin. In the western part of the Eskimo range, jade, pectolite, and other hard varieties of stone were

fashioned into mortars, pestles, dishes and other receptacles, hammers, adzes, chisels, picks, knives, whetstones, sinkers and various other necessary appliances, and hard and brittle stones, such as slate and flint, suitable for fracturing, were wrought into knives, scrapers, drills and projectile points; yet, although the Arctic dwellers were skilled in the flaking and chipping processes, their spear and harpoon points, knives, and especially the woman's knife, or *ulu*, were often shaped and sharpened by grinding, a process probably suggested by its employment in working ivory and bone. The grooved axe, celt and gouge are absent, evidently because there was relatively little occasion for fashioning wood of considerable size. Stones of many varieties were used also for manufacturing articles of personal adornment,—labrets, ear-plugs, beads, pendants,—some of these being unsurpassed for beauty of material and finish. Figurines, toys, fetishes, charms, talismans and a multitude of other small objects were likewise carved with great skill and of all available materials. Rather heavy pottery vessels have been found especially along the coast as far east as Franklin bay; they are of good form, of medium or large size, and are ornamented with incised and impressed decoration. The age of these vessels is not known, but evidently the potter's art has long been obsolete except for the manufacture of lamps where stone was not available. The shell-heaps of the Alaska coast are numerous, but are chiefly remarkable as representing three successive periods of occupancy—the littoral period, characterized by the absence of artifacts; the fishing period, in which there are traits of very primitive forms of stone implements; and the hunting period with evidences of culture approaching that of the historic Alaskan tribes—estimated altogether to represent an approximate period of 3,000 years, or about equal in age to the larger shell-heaps of California.

As known to ethnology, the Eskimo (and there is no reason to suppose that the ancient remains found on the Arctic shores of America are not assignable to Eskimo culture), considering their harsh environment, the ever-present difficulties involved in the food quest, and the limited range of materials available for their purposes, achieved a high degree of culture, as attested by the ingenuity of the appliances necessary to their daily life as hunters and fishermen which often involved long journeys by canoe, the facility with which they could build comfortable houses with what little their country afforded, and the expression which they gave to their aesthetic sense in almost everything they manufactured.

XI. **The Northern Interior Area.**—Since known to history this vast region has been occupied by Athabascan and Algonkin tribes who subsisted almost entirely by the chase, moose and caribou being the larger quarry, while a host of mammals of lesser species were also pursued or trapped for food or to provide skins for clothing and shelter. With few exceptions their material culture was poor, hence the archaeologist may hardly expect to find more than such commonplace articles as projectile points, knives, scrapers, abrading stones, hammerstones, etc., used by a hunter people, or to add to the meagre information that on the southern border the cultures are marginal to those of the adjoining area. Archaeologically the area is practically a terra incognita, yet it may hold much of interest in the elucidation of the questions of migration of the ancestors of the Indians from northeastern Asia, and of the separation of Athabascan bands in this far northern land and their gradual movement into northern California and to the arid southwest. Attention has been called by Holmes to the probability that all traces of very early occupancy, if such there were, must have been wiped out by the ice sheets which, one after another, must have swept southward over the country, "the latest invasion in the central region continuing down to the period which witnessed the building of the Egyptian pyramids." Limited areas in the west and north-west were not thus invaded by the ice, but as yet these have not yielded anything of particular archaeological value. (F. W. H.)

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NORTHAMPTON, EARLS AND MARQUESSES OF.

The Northampton title has been held in various English families. About 1080 Simon de Senlis (d. 1109), a Norman noble, and the builder of Northampton castle, was created earl of Northampton as well as earl of Huntingdon by William the Conqueror; his son Simon (d. 1153) was also recognized in the title about 1141, though his stepfather, David, king of Scotland (1084–1153), had meanwhile obtained the earldom in right of his wife. The second Simon died childless. In 1337 William de Bohun (*c.* 1310–60), a son of Humphrey de Bohun, 4th earl of Hereford and 3rd earl of Essex, was created earl of Northampton; and his son Humphrey, who succeeded, fell heir in 1361 to the earldoms of Hereford and Essex, which thus became united under that of Hereford. The titles, however, became extinct at his death in 1372.

In 1547 William Parr (1513–71), son of Sir Thomas Parr and brother of Catherine Parr, queen of Henry VIII., was created marquess of Northampton, and though attainted in 1553 was re-created marquess in 1559. He favoured the claim of Lady Jane Grey to the English throne. Although sentenced to death he was pardoned and released from prison at the end of 1553. North-

ampton died at Warwick on Oct. 28, 1571. He left no children and his marquessate became extinct. In 1604 Henry Howard (*see* below) was created earl of Northampton, his title dying with him. It next passed into the Compton family, where it has since remained. The 1st earl of Northampton in this line, William Compton (d. 1630), who received the title in 1618, was a great-grandson of the Sir William Compton (1482–1528) who was with Henry VIII. at the Field of the Cloth of Gold, and his son the 2nd earl is noticed below. The 9th earl, Charles Compton (1760–1828), was created a marquess in 1812, receiving at the same time the titles of Earl Compton and Baron Wilmington.

HENRY HOWARD, earl of Northampton (1540–1614), was the second son of Henry Howard, earl of Surrey, the poet, and of Lady Frances Vere, daughter of the 15th earl of Oxford, and younger brother of Thomas Howard, 4th duke of Norfolk. After discovery of his brother's plot to marry Mary, Queen of Scots, and of his own correspondence with her, he was arrested more than once on suspicion of harbouring treasonable designs. In 1583 he published a work entitled *A Defensative against the Poyson of supposed Prophecies*, an ostensible attack upon astrology, which, being declared to contain heresies and treason, led to his imprisonment for a short time. After the accession of James I. he received many honours, and became Lord Privy Seal (1604) and a commissioner of the treasury (1612). He was one of the judges at the trials of Raleigh and Lord Cobham in 1603, of Guy Fawkes in 1605, and of Garnet in 1606, in each case pressing for a conviction. In 1604 he was one of the commissioners who composed the treaty of peace with Spain, and from that date he received from the Spanish Court a pension of £1,000. Northampton died on June 15, 1614. His title died with him. Northampton built Northumberland house in London and superintended the construction of the fine house of Audley End. He founded and planned several hospitals. Bacon included three of his sayings in his "Apophthegms," and chose him as "the learnedest councillor" in the kingdom to present to the king his *Advancement of Learning*.

Northampton's works are: a *Treatise of Natural and Moral Philosophy* (1569; ms. in the Bodleian library); a pamphlet supporting the union between Elizabeth and the duke of Anjou (1580; Harleian mss 180); *A Defensative against the Poyson of supposed Prophecies* (1581); a reply to a pamphlet denouncing female government (1589; Harleian ms. 7021); *Duello Foiled*, printed in T. Hearne's *Collection of Curious Discourses* (1775), and ascribed there to Sir Edward Coke; *Translation of Charles V.'s Last Advice to Philip II.*, dedicated with a long epistle to the queen (Harl. 836, 1506 and elsewhere in Stowe 95, King's mss. 106); devotional writings (Arundel mss. 300); speeches at the trials of Guy Fawkes and Garnet in *State Trials*, vol. i. In Somers Tracts (ed. 1809), ii. 136, his opinions on the union between England and Scotland are recorded.

See the life in *Surrey's and Wyatt's Poems*, ed. by G. F. Nott (1815), and Sidney Lee's article in the *Dict. Nat. Biog.*

SPENCER COMPTON, 2nd earl of Northampton in the Compton line (1601–43), was the son of William, 1st earl, lord president of the marches. On the outbreak of the Civil War he was entrusted with the execution of the commission of array in Warwickshire. After varying success and failure in the Midlands he fought at Edgehill, and after the king's return to Oxford was given, in November 1642, the military supervision of Banbury and the neighbouring country. He was attacked in Banbury by the parliamentary forces on Dec. 22, but relieved by Prince Rupert the next day. In March 1643 he marched from Banbury to relieve Lichfield, and having failed there proceeded to Stafford, which he occupied. Thence on March 19, accompanied by three of his sons, he marched out with his troops and engaged Sir John Gell and Sir William Brereton at Hopton Heath. In the moment of victory he was surrounded by the enemy, and, refusing quarter, was slain.

See the article in the *Dict. of Nat. Biog.* by C. H. Firth; E. B. G. Warburton, *Life of Prince Rupert;* S. R. Gardiner, *Hist. of England and of the Civil War; Thomason* Tracts, E 99 (18) (Hopton Heath and Northampton's death), E 103 (11) (elegy), E 111 (11), E 110 (8) 1642 (Proceedings at Banbury), E 83 (47) (speech).

NORTHAMPTON, county town of Northamptonshire, England, 66 m. N.W. by N. from London by L.M.S.R. Pop. (1921) 90,895.

British and Roman remains have been discovered near Northampton and it became the chief settlement of the Angle tribes early in the 6th century. It was occupied by the Danes in the reign of Edward the Elder. The mayor was the chief officer in the 13th century, and Henry VI. granted the incorporation charter in 1460. Tanning was an industry in the time of Edward I. and in 1675 a law was made forbidding strangers to purchase hides in the town except on fair-days. Boots and shoes were made here in the reigns of John and Edward I., and by the 17th century Northampton was one of the most noted places in England for their manufacture.

Northampton has been the meeting-place of several important councils and parliaments. In the wars between John and his barons the castle withstood a siege by the latter, but in 1264 it was occupied by the barons under the earl of Leicester. In the Wars of the Roses it was the scene of the battle in which Henry VI. was defeated and taken prisoner in 1460. During the Civil Wars of the 17th century it was held for the parliament by Lord Brooke. In 1675, 600 houses were destroyed by fire.

The town is situated on the river Nene. The main roads converging upon the town meet near the centre in a market-place. All Saints church was rebuilt after the fire of 1675, but retains its Decorated embattled tower. The church of St. Giles, a cruciform structure in the 12th century, has been greatly changed, and besides a Norman doorway contains Early English, Decorated and Perpendicular work. St. Peter's is supposed to be of the same date and its interior is Norman. St. Sepulchre's, one of the four round churches remaining in England, may have been built by the Knights Templars at the close of the 11th century.

Northampton is the seat of a Roman Catholic bishop, and there is a pro-cathedral. Near the town there were a Cluniac priory of St. Andrew, a house (Delapré) for nuns of the same order, and one for Augustinian canons; but the first has disappeared, the site of the second is occupied by a modern mansion, and of the third there are only slight fragments. Some portions of the castle were re-erected on a new site after their destruction when the Castle station was built by the L.M.S. Company. In Hardingstone, south of the town, is one of the original Eleanor crosses. The free grammar school was founded in 1552. The charitable foundations include St. John's hospital (12th century) and St. Thomas's hospital, founded in 1450 in honour of Thomas à Becket. There is a race-course north of the town. The staple trade is the manufacture of boots and shoes. There are also currying, tanning and textile works, breweries, iron foundries and brick works. The cattle market is extensive.

NORTHAMPTON, a city of Massachusetts, U.S.A., the county seat of Hampshire county; on the Connecticut river and Federal highway 5, 16 m. N. of Springfield. It is served by the Boston and Maine and the New York, New Haven and Hartford railways. Pop. (1920) 21,951 (23% foreign-born white). Venerable trees, an irregular plan, and the grounds of the several institutions make the city very attractive. It is the seat of Smith college (*q.v.*), two preparatory schools for girls, a State hospital for the insane, the Clarke School for the Deaf (1867), and Smith's Agricultural school, founded by bequest of Oliver Smith (1766–1845), but opened only in 1908. Mt. Holyoke (954 ft.) is 2 m. S.E. Within the city (on the Mill river) are the villages of Florence and Leeds, important manufacturing centres. The city's factory output (largely sewing silk, silks and satins, silk hosiery, cutlery and brushes) was valued in 1925 at $16,056,674. Northampton was settled in 1654, became a separate town in 1656, and was incorporated as a city in 1883. It was the birthplace of Caleb Strong, Joseph Hawley, Timothy Dwight, William D. Whitney and Arthur, Benjamin and Lewis Tappan. Jonathan Edwards was pastor here from 1727 to 1750.

NORTHAMPTON, a borough of Northampton county, Pennsylvania, U.S.A., on the Lehigh river, 6 m. N.W. of Allentown; served by the Central railroad of New Jersey. Pop. 9,349 in 1920 (29% foreign-born white); estimated locally at 10,000 in 1928. It is a cement-manufacturing centre, and there are silk mills and iron works in the vicinity. The borough was settled about 1740 and incorporated in 1901.

NORTHAMPTON, ASSIZE OF, a short code of English laws issued in 1176, drawn up in the form of instructions to six committees of three judges each, who were to visit the six circuits into which England was divided for the purpose. Though purporting to be a reissue of the Assize of Clarendon (1166), it contains in fact many new provisions. As compared with the earlier assize it prescribes greater severity of punishment for criminal offences; arson and forgery were henceforth to be crimes about which the jurors were to enquire, and those who failed at the ordeal were to lose a hand as well as a foot. In what is perhaps the most important section we may probably see the origin of the possessory action of *mort d'ancestor*, an innovation scarcely less striking than the institution of the *novel disseisin* in the winter of 1166. The justices were also ordered to try proprietary actions commenced by the king's writ for the recovery of land held by the service of half a knight's fee or less. In their fiscal capacity they were to enquire into escheats, churches, lands, and women in the king's gift. The royal bailiffs were to answer at the exchequer for rents of assize and all the perquisites which they made in their offices, and apparently the duty of enforcing this provision was entrusted to the justices. As a result of the rebellion of 1173–74 it was provided that an oath of fealty should be taken by all, "to wit, barons, knights, freeholders, and even villeins (*rustici*)," and that any one who refused should be arrested as the king's enemy, and the justices were to see that the castles, the demolition of which had been ordered, were razed.

See Pollock and Maitland, *History of English Law* (1898); Stubbs, *Constitutional History of England* (1895). The text occurs in *Cronica Rogeri de Howden* (Rolls Series), ii. 89, and *Gesta Henrici Regis Secundi* (Rolls Series), i. 108. It has been reprinted from the latter by Stubbs in *Select Charters* (1913). (G. J. T.)

NORTHAMPTONSHIRE, an east midland county of England, bounded north by Lincolnshire, north-west by Rutland and Leicestershire, west by Warwickshire, south-west and south by Oxfordshire, south-east by Buckinghamshire, and east by Bedfordshire, Huntingdonshire and Cambridgeshire. The area is 1,003·1 sq.miles.

Geology and Physical Features.—The underlying structure of the county is very simple. It forms part of the Jurassic escarpment, here known as the Northampton uplands. All the rocks are of Jurassic age, the dip being in a general way to the south-east, and the strike from south-west to north-east. The oldest, and most westerly belt consists of Lias formations which cover a large surface in the south-west and centre, around Banbury, Daventry and Market Harborough, and they are also exposed along the rivers near Towcester, Northampton, Wellingborough and Kettering. The marlstones of the Middle Lias were formerly much used for building material; the Upper Lias is worked for bricks at Easton Neston (Towcester), Blisworth, Gayton, Heyford, Northampton, Wellingborough, Rushden, Irthlingborough, Kettering and Corby. Through the middle of the county, north-east to Northampton, Rockingham and Peterborough, is an elevated tract of Oolitic rocks, which formerly supplied stone, of which many of the villages are built, as well as lime and marl. The New Duston quarries have several varieties of good stone, the district around Northampton a limestone known as Pendle, and Weldon (Lincolnshire Oolite) a noted freestone; Barnack Rag (near Stamford) is no longer worked. The great Oolite limestone, though unsuitable for building material, owing to the ease with which it weathers, was largely used in the past, Culworth, Blisworth and Cosgrove quarries being famous. At the base of the Inferior Oolite, Northampton sands yield iron ore, which is worked at Duston, Culworth, Towcester and at numerous localities north-east of Northampton. Certain hard shelly beds in the Oolite rocks have been polished and used as marble.

On the south-east border of the county, a belt of Oxford clay occupies the surface, good exposures occurring in the brick fields about Peterborough. Boulder clay is widely distributed over the uplands and in the east of the county, and glacial and river gravels are also plentiful. The south-west portion of the county forms the principal watershed of the Midlands; the Cherwell, the Avon, the Leam, the Welland, the Nene have their sources in this region, and all form sections of county boundaries. The position of Daventry as a wireless station and a meeting place of roads is also related to this fact of centrality and elevation. The longitudinal river Nene flows in a north-easterly direction along the foot of the uplands, draining them to the Wash.

History and Early Settlement.—In primitive times the waters of the North sea reached almost to the foot of the Northamptonshire uplands. The immigrants of the end of the Stone age seem to have penetrated up from the coast, and Peterborough has yielded important finds of early pottery. Some Beaker pottery occurs, chiefly on the uplands. There are a few material objects of the La Tène I. culture and the La Tène III. culture. During the Iron age, the uplands offered defensible sites, and many hill camps were made, Hunsbury (1½ m. S.W. of Northampton), being one of the most famous. In Roman times, iron, stone and clay were worked, and Towcester was an important station on the Watling street route to the north-west. At some time in the 7th century the district suffered a simultaneous invasion (West Saxons from the south, Anglian tribes from the north), finds show a mingling of races, but West Saxon influence never spread farther north than a line from Daventry to Warwick, and with the extension of the Mercian kingdom under Penda and the conversion of the midland districts, ceased altogether. The abbey at Medehamstede (now Peterborough) was begun by Penda's son, Peada, in 655, and about the same time foundations were established at Peakirk, Weedon Beck, Castor and Oundle. In 870 the district was overrun by the Danes, and Northampton was one of the five Danish boroughs, until in 921 it was recovered by Edward the Elder, who fortified Towcester in that year.

In the 11th century Northamptonshire was included in Tostig's northern earldom; but in 1065, together with Huntingdonshire, it was detached from Northumbria and bestowed on Waltheof. The monastic foundation of Peterborough survived the Conquest. Norman castles existed at Rockingham, Barnwell, Lilbourne and Northampton. The shire is probably of Danish origin, representing in the 10th century the area which owed allegiance to Northampton as a political and administrative centre. In 921 this area extended to the Welland, and at the time of the Domesday survey the boundaries were approximately those of the present day. Northamptonshire is first mentioned by name in the *Historia Eliensis*, in connection with events which occurred at the close of the 10th century.

The Geld roll (William I.) and Domesday (1086) mention 28 hundreds in Northamptonshire, and part of Rutland is assessed under this county. By 1316 the divisions were changed, re-named and reduced to 20, and have remained practically unaltered. The names of the hundreds point to primitive meeting-places gradually superseded by villages and towns, and the court for Fawsley hundred met under a large beech tree in Fawsley park until the beginning of the 18th century, when it was transferred to Everdon. The shire-court originally met at Northampton.

Northamptonshire was originally included in the diocese of Lincoln. The archdeaconry of Northampton is mentioned in the 12th century, and in 1291 included the deaneries of Peterborough, Northampton, Brackley, Oundle, Higham, Daventry, Preston, Weldon, Rothwell and Haddon. The diocese of Peterborough was created in 1541, and in 1875 the archdeaconry of Oakham was formed and included in this county the first and second deaneries of Peterborough and the deaneries of Oundle, Weldon and Higham Ferrers.

At the time of the Domesday survey the chief lay-tenant in Northamptonshire was Robert, earl of Mortain, whose fief escheated to the Crown in 1106. The estates of William Peverel, founder of the abbey of St. James at Northampton, also escheated to the Crown in the 12th century. Holdenby House was built by Sir Christopher Hatton, privy councillor to Queen Elizabeth, and Yardley Hastings was named from the Hastings, formerly earls of Pembroke. Higham Ferrers was the seat of the Ferrers family; Braybrook Castle was built by Robert de Braybrook, a favourite of King John; and Burghley House gave the title of baron to William Cecil. During the middle ages the Nene was a busy artery of trade, and many moated homesteads were built on its banks.

Northampton was a favourite meeting-place of the councils and parliaments of the Norman and Plantagenet kings. In 1215 John was besieged in Northampton Castle by the barons, and in 1264 Henry III. captured the castle from the younger Simon de Montfort. During the Wars of the Roses Henry VI. was defeated at Northampton in 1460. In the Civil War of the 17th century the county declared almost unanimously for the parliament. A royalist garrison was placed at Towcester by Prince Rupert in 1644, but almost immediately withdrawn.

In 1547 Brackley and Peterborough returned each two members, and in 1557 Higham Ferrers returned one member. Under the act of 1832 the county returned four members in two divisions, the above boroughs being merged in the county divisions. There are now four divisions with one member each, in addition to a member for the county division.

Architecture.—Of monastic foundations, the abbey-church of Peterborough, afterwards the cathedral, is the only remaining one of importance. At Geddington, and also at Hardingstone, near Northampton, there is an Eleanor cross, erected by Edward I. The county is famous for its churches with beautiful broached spires. To the Saxon period belong the tower of Earls Barton church, on what is probably the mound of an old English strong-house; the tower, etc., at Brigstock; the ground plan, etc., at Wittering; the remarkable tower at Barnack; and Brixworth church, by some believed to include part of a Roman basilica. Of Norman work, excluding Peterborough cathedral, the finest examples are St. Peter's and St. Sepulchre's, Northampton, and the tower of Castor church. St. Mary's church, Higham Ferrers, formerly collegiate, Early English and Decorated, is one of the finest churches in the county; the churches at Irthlingborough and Lowick, with their lantern towers, Warmington, fine Early English work, Rushden, Finedon, Raunds and Fotheringhay should be mentioned.

A gateway at Rockingham, and earth-works at Higham Ferrers and Brackley are worthy of mention. Some castellated ruins remain of the castle at Fotheringhay, famous as the scene of the imprisonment, trial and execution of Mary, Queen of Scots. Barnwell castle, founded by William the Conqueror, is still a fine ruin, which includes four of the round towers and an imposing gateway. Holdenby manor house, where Sir Christopher Hatton (1540–1591) was born, and whence Charles I. was carried away by Cornet Joyce, is largely restored. Among ancient mansions are Castle Ashby, the seat of the Comptons; Althorp, the seat of the Spencers; Drayton House; Burghley House, Stamford, founded by Lord Burleigh (1553); and Kirby Hall, a beautiful Elizabethan building once the residence of Sir Christopher Hatton.

Climate and Agriculture.—The climate of Northamptonshire is mild, and it is drier than many other inland districts owing to its low elevation (rarely more than 700 ft.). The mean annual rainfall at Wellingborough is 27·2 inches. The soil is fertile, nearly nine-tenths of the surface being under cultivation. The Lias clay belt gives rise to good grazing, and 360,134 ac.—nearly three-fifths (1926)—were under permanent pasture. Large numbers of cattle (139,507 in 1926) are fattened, droves from Scotland, Ireland, Wales, Hereford being sent for that purpose. The selling of fat cattle for Christmas markets, sets the population free in winter for hunting, giving rise in the 18th century to the making of whips at Daventry, while the long winter evenings encouraged the use of the tobacco-pipe, made almost exclusively from Northampton clays. Easy access to hides and to bark for tanning in the forests originated an industry in leather, which flourished in Norman times, and, in the middle of the 17th century Northampton began to specialize in the manufacture of boots and shoes, for which it has become famous. The difference in bulk between imported raw hides and exported finished boots and shoes creates an economic problem in connection with this trade. Good wheat can be grown on the boulder clay, but no less than one-sixth of the county is under grain. Beans form an important crop; root-crops are also grown; sugar-beet is a fast developing industry (1,077 ac. in 1926, as against 141 ac. in 1925).

Sheep are kept in large numbers on the rich pastures, improved Leicesters for wool and Southdown for mutton. Wool was important in Norman times; in the 17th century the centre of weaving changed from Northampton to Kettering. Charcoal-burning was an early industry in the forests (Rockingham, etc.), mast from the oaks also feeding large numbers of pigs; these are still important. Paper-making, dependent on pure water, was introduced in the 18th century; early in the 19th, silk-weaving spread from Coventry.

Communications.—Two main lines of the L.M. and S. railway cross the county, linking London with the industrial north-west. The first is the Wolverton (Bucks) Blisworth, Rugby (Warwick) line, with an alternative route to Northampton, and branches north-east to Peterborough and north to Market Harborough (Leics.); with it are connected at Blisworth junction, branch lines through Towcester, west to Stratford-on-Avon (Warwick) and south-west to Banbury (Oxon). The second is the Wellingborough, Kettering, Market Harborough line with a branch to Oakham (Rutland). There are other branch lines. A main line of the L. and N.E. railway passing through the south of the county, connects with the G.W. railway at Banbury through Woodford. The Grand Junction canal, which is connected with the Oxford canal, enters the county at Braunston on the borders of Warwickshire, and passes by Daventry and Blisworth into Buckinghamshire, a branch connecting it with Northampton. The Grand Union canal unites with the Grand Junction near Daventry, and runs north until it joins the Leicester canal at Foxton, branches passing to Welford and Market Harborough.

Population and Administration.—The area of the whole county is 638,612 ac.; this total includes the soke of Peterborough, which is itself an administrative county, area 53,464 ac. Pop. (1921) 349,363, or without the soke 302,404. In Domesday the county is mentioned as containing 30 hundreds, but it then included a considerable part of Rutland. These divisions were first reduced to 28, and in the Reign of Henry II. to 20, their present number. The administrative counties include four municipal boroughs, namely, Brackley, Daventry, Higham Ferrers and Peterborough, together with the municipal and county borough of Northampton (87,021). There are one court of quarter sessions and nine petty sessional divisions. The borough of Northampton and the liberty of the soke of Peterborough have each a separate court of quarter sessions and a separate commission of the peace. The total number of civil parishes is 346, of which 33 are in the soke of Peterborough. The ancient county contains 297 entire ecclesiastical parishes or districts, wholly or in part, most of them being in the diocese of Peterborough; but small parts of the county fall within the dioceses of Oxford, Ely and Worcester. For parliamentary purposes the county is divided into four divisions, Daventry, Kettering, Peterborough and Wellingborough. The parliamentary borough of Northampton returns one member.

See *Victoria County History, Northamptonshire;* John Norden, *Speculi Britanniae, pars altera,* or *A Delineation of Northamptonshire* (1720); John Bridges, *History and Antiquities of Northamptonshire,* compiled by Rev. Peter Whalley (2 vols., Oxford, 1791); Francis Whellan, *History, Topography and Directory of Northamptonshire* (2nd ed., London, 1874).

NORTH ANDOVER, a manufacturing town of Essex county, Massachusetts, U.S.A., on the Merrimack river, 2 m. E. of Lawrence; served by the Boston and Maine railroad. Pop. 6,265 in 1920 (30% foreign-born white); 1928 local estimate 7,400. The town was settled about 1643, and a house built in 1667 by Simon Bradstreet, one of the founders, is still standing. His wife, Anne Dudley Bradstreet (1612–72), was the first woman in America to make a reputation as a poet. North Andover was set off from Andover and incorporated as a town in 1855.

NORTH BAY, a lumber, mining and railway town on the north-east shore of Lake Nipissing, northern Ontario, Canada, 227 m. N. of Toronto, on the Canadian Pacific, Canadian National, and Temiskaming and Northern railways. It is the base of supply for the mining districts of Cobalt, Gowganda and Porcupine, and is also noted as a tourist centre and summer resort. Pop. (1921), 10,692.

NORTH BERWICK, royal burgh, parish, East Lothian, Scotland. Pop. (1921) 4,524. It is situated on the south shore of the entrance to the Firth of Forth, 22½ m. E.N.E of Edinburgh by the L.N.E. railway, being the terminus of a branch line

from Drem Junction. It was created a royal burgh by Robert III. (d. 1406), and though once a port of some importance it dwindled to a fishing hamlet. It is now, however, a fashionable watering-place, frequented for bathing and golf. Near the station are the ruins of the abbey of Cistercian nuns founded by David I. Immediately to the south rises the fine cone of North Berwick Law.

NORTH BRADDOCK, a borough of Allegheny county, Pennsylvania, U.S.A., 10 m. S.E. of Pittsburgh, on the hills back of Braddock and Rankin. Pop. 14,928 in 1920 (27% foreign-born white); estimated locally at 17,000 in 1928. The three boroughs form one community and industrial centre, with large steel works and other important manufactures. North Braddock is chiefly a residential section, but one of the largest steel plants is within its limits. Its assessed valuation for 1927 was $16,951,535, and the total for the three boroughs was $42,316,765. The first white man's cabin west of the Alleghenies was built here in 1742 by John Frazier. On the ground now occupied by Braddock and North Braddock was fought (July 9, 1755) the battle in which Braddock was defeated.

NORTHBRIDGE, a town of Worcester county, Massachusetts, U.S.A., on the Blackstone river, 13 m. S.E. of Worcester; served by the New York, New Haven and Hartford railroad. Pop. (1920) 10,174 (36% foreign-born white). It is a manufacturing town, making principally textile machinery, silk and cotton goods and embossed paper. Part of Uxbridge was established as the district of Northbridge in 1772, and in 1775 the district was made a town.

NORTHBROOK, THOMAS GEORGE BARING, 1ST EARL OF (1826–1904), English statesman, eldest son of the first baron (long known as Sir Francis Baring; *see* BARING), was born on Jan. 22, 1826, and educated at Christ Church, Oxford, where he graduated with honours in 1846. He was successively private secretary to Mr. Labouchere (Lord Taunton), Sir George Grey, and Sir Charles Wood (Viscount Halifax). He was member of parliament for Penryn and Falmouth (1857–66). He was a lord of the admiralty in 1857–8; under-secretary for war, 1861; for India, 1861–4; for the home department, 1864–6; and secretary to the admiralty, 1866. In the Gladstone ministry of 1868 Northbrook was under-secretary for war (1868–72). He was then governor-general of India, but resigned in 1876, because his policy of coming to an arrangement with Shere Ali, which might have prevented the Afghan War, was overruled by the duke of Argyll, then secretary of state. From 1880 to 1885 Northbrook, who had received an earldom, was first lord of the admiralty in Mr. Gladstone's second government. In Sept. 1884 Northbrook was sent to Egypt as special commissioner to enquire into its finances. He died on Nov. 15, 1904.

See B. Mallet, *Thomas George, Earl of Northbrook* (1908).

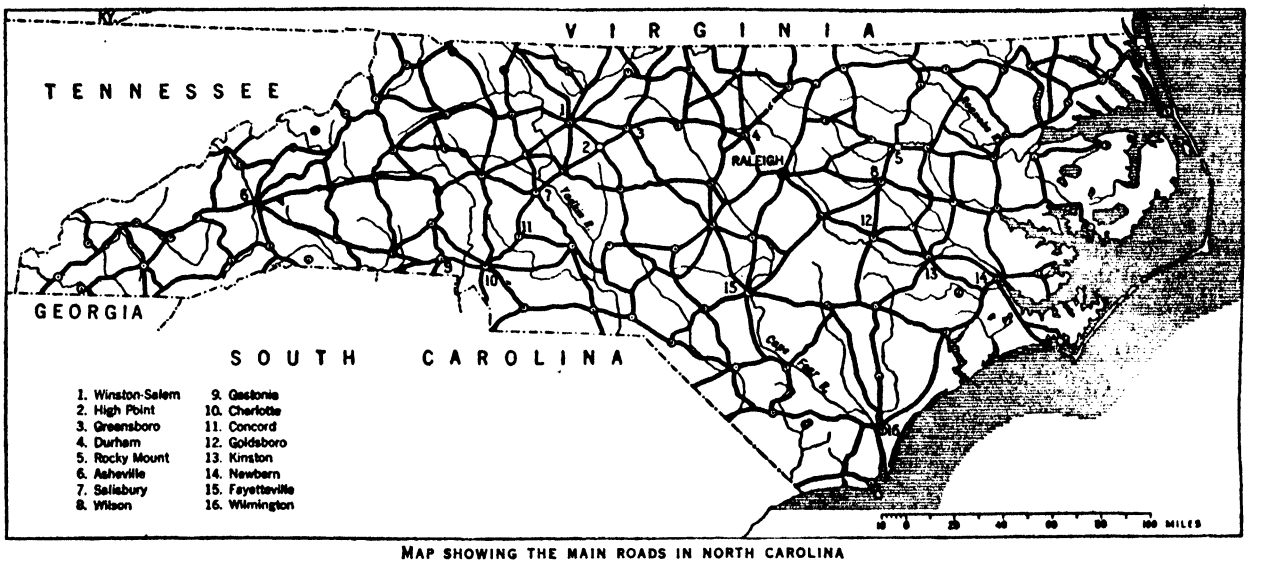
NORTH CAPE, a promontory on the island Magerö off the north coast of Norway in 70° 10′ 20″ N., 25° 45′ E., 78 m. north-east of Hammerfest. Knivskjaerodden, an island a little to the west, is actually a little farther north than the North Cape, and Nordkyn, 45 m. farther east, is the northern extremity of the mainland (71° 7′ N.). The desolate cape, rising abruptly over 1,000 ft. from the sea, is frequently visited during the summer period of the "midnight sun."

NORTH CAROLINA, popularly known as the "Tar Heel State," is one of the Atlantic coast States of the United States of America, situated between 33° 51′ 37″ and 36° 34′ 25·5″ N., and between 75° 27′ and 84° 20′ W. It is bounded north by Virginia, east and south-east by the Atlantic ocean, south and south-west by South Carolina, south also by Georgia, and west and north-west by Tennessee. North Carolina has an extreme length from east to west of 503¼ m., which is greater than that of any other State east of the Mississippi river. Its total area is 52,426 sq.m. of which 3,686 sq.m. are water surface.

Physical Features.—The State lies wholly within the three leading topographical regions of the eastern portion of the United States: the Coastal Plain region, which occupies approximately the eastern half, the Piedmont Plateau region, which occupies about 20,000 sq.m. in the middle, and the Appalachian region, which occupies about 6,000 sq.m. in the west. At the eastern extremity of the Coastal Plain region an outer coast line is formed by a chain of long narrow barrier beaches from which project capes Hatteras, Lookout and Fear, whose outlying shoals are known for their dangers to navigation. Between Hatteras and Lookout is Raleigh bay and between Lookout and Fear is Onslow bay; and between the chain of islands and the deeply indented mainland Currituck, Albemarle, Pamlico and other sounds form an extensive area, especially to the northward, of shallow, brackish and almost tideless water. Projecting into these sounds and between the estuaries of rivers flowing into them are extensive tracts of swamp land—the best known of these is Dismal Swamp, which lies mostly in Virginia and is about 30 m. long and 10 m. wide. Through most of the Coastal Plain region, which extends inland from 80 to 150 m. the country continues very level or only slightly undulating, and rises to the westward at the rate of little more than one foot to the mile. The "Fall Line," the boundary between the Coastal Plain and the Piedmont Plateau, has a very irregular course across North Carolina, but lies in a general south-west direction from the Falls of Roanoke between Halifax and Northampton counties to Anson county on the South Carolina border and marks a rapid increase in elevation of about 200 feet. The Piedmont Plateau region extends from this line to the Blue Ridge Escarpment, toward which its mean elevation increases at the rate of about 3½ ft. to the mile. The south-east face of the Blue Ridge Escarpment, which rises precipitously 1,200–1,500 ft. or more above the Piedmont Plateau, forms the south-east border of North Carolina's Appalachian mountain region, which includes the high Unaka mountain range, segments of which are known by such local names as Iron mountains, Bald mountains and Great Smoky mountains. These ranges reach their culmination in this State, and with a series of more or less interrupted cross ranges constitute the greatest masses of mountains in the east half of the United States. Four peaks along the Blue Ridge have an elevation exceeding 5,000 ft., and about 30 peaks in the Unakas and in the several cross ranges exceed 6,000 ft., the highest being Mt. Mitchell or Mitchell Dome (6,711 ft.), of the Black mountains, a short cross range extending north from the Blue Ridge through Yancey county. Other noteworthy peaks are Black Brother (6,690 ft.) and Hairy Bear (6,681 ft.), the next highest mountains. The valleys are usually narrow and deep, though few descend to less than 2,000 ft. above the sea.

From the Black mountains, the streams flow as from a ridge pole, some to the Atlantic, others to the Mississippi and finally to the Gulf of Mexico. West of Blue Ridge the Hiwassee, the Little Tennessee and the French Broad rivers flow west or north-west into Tennessee. Farther north are the headwaters of the New river, which finds its way to the Ohio. On the south-east slope of the Blue Ridge rise the Broad, the Catawba and the Yadkin, which first flow north-east, then finding a passage across one of the ridges of the Piedmont Plateau, turn to the south-south-east and across the boundary line into South Carolina, in which State their waters reach the Atlantic. In the north-west part of the Piedmont Plateau region rises the Dan, which in its north-east course crosses the boundary into Virginia, where it becomes a tributary of the Roanoke, in which its waters are returned to North Carolina near the "Fall Line." The other principal rivers—the Cape Fear, the Neuse and the Tar—rise in the north-east part of the Piedmont Plateau region, have their south-east courses wholly within the State, and, with the Roanoke, drain the Coastal Plain region. In the Mountain region and in the Piedmont Plateau region the rivers have numerous falls and rapids which afford a total water power unequalled perhaps in any other States than New York and Georgia east of the Mississippi river, the largest being on the Yadkin, Roanoke and Catawba; and in crossing some of the mountains, especially the Unakas, the streams have carved deep narrow gorges that are much admired for their scenery. In contrast with the rivers of these regions those of the Coastal Plain are sluggish, and toward their mouths expand into wide estuaries.

Climate and Soil.—North Carolina has a climate which varies from that of the south-east corner, which approaches the sub-tropical, to that of the Mountain region, which is like the medium



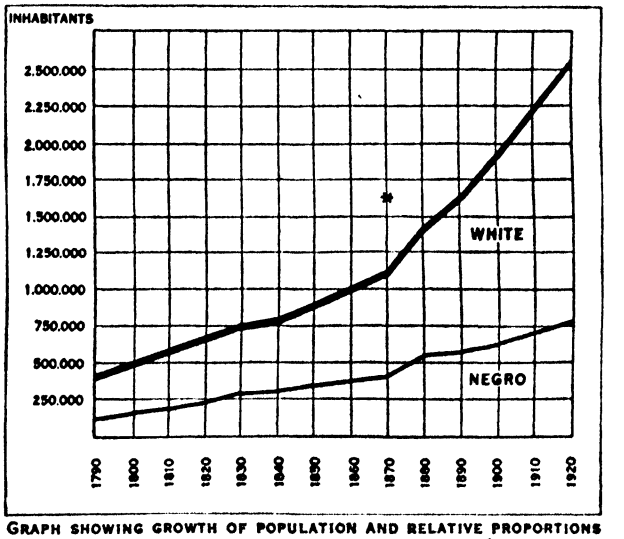
MAP SHOWING THE MAIN ROADS IN NORTH CAROLINA

continental type, except that the summers are cooler and the rainfall is greater. The mean annual temperature for the State (below an elevation of 4,000 ft.) is about 59° F. For the Coastal Plain region it is 61° F; for the Piedmont Plateau region, 60° F; for the the Mountain region, 56° F; for Southport, in the south-east corner of the State, 64° F; and for Highlands, at an elevation of 3,817 ft. in the south-west corner, 50° F. Extremes have ranged from −19° F at Highlands to 107° F at Chapel Hill, Orange county, in 1900 and again in 1902. The average precipitation for the State is about 52 in. a year, nearly all of it in the form of rain. For the Coastal Plain region it is 54 in.; for the Piedmont Plateau region, 48 in.; and for the Mountain region 53 inches. On the east slope of some of the mountains the rainfall is exceedingly heavy. The winds are variable and seldom violent, except along the coast during the sub-tropical storms of late summer and early autumn.

On the Coastal Plain the soil is generally sandy, but in nearly all parts of this region more or less marl abounds; south of the Neuse river the soil is mostly a loose sand, north of it there is more loam on the uplands, and in the lowlands the soil is usually compact with clay, silt or peat; toward the western border of the region the sand becomes coarser and some gravel is mixed with it. The entire Piedmont region is underlain by crystalline rocks, such as granite and schists. The soils are, for the most part, red sandy loams and clay loams, gravelly and sandy in spots.

Population.—The estimated population in 1928 was 2,938,000 as compared with 2,559,123 in 1920, a gain of 378,877, or 14·8%. North Carolina in 1920 ranked, in population, 14th among the States of the Union. The population of the State at certain other censuses was as follows: 393,751 in 1790; 478,103 in 1800; 992,-622 in 1860; 1,071,361 in 1870; 1,617,949 in 1890; 1,893,810 in 1900; and 2,206,287 in 1910. Of the total in 1920 only 7,099, or slightly over one-fourth of 1% were foreign-born, a smaller foreign admixture than that of any other State. According to race distribution 1,783,779 were whites, 763,407 negroes, 11,824 Indians and 112 Japanese and Chinese. Until nearly a century after the founding of the Carolinas there was not a town in North Carolina that had a population of 1,000, and the urban population of the State was exceptionally small at the beginning of the rapid rise of the manufacturing industries about 1880. In 1920 the urban population (in places having 2,500 inhabitants or more) was 490,370, or 19·2% of the total as compared with 14·4% in 1910. The density of population in 1920 was 52·5 persons per square mile. The chief cities in 1928 and their population were Winston-Salem, 80,000; Charlotte, 82,100; Greensboro, 51,900; Durham, 47,600; and Wilmington, 39,100. According to the U.S. Census estimate in 1926, Asheville had a population of 31,474 and Raleigh, the State capital, 30,371.

Government.—North Carolina has been governed under the charters of 1663 and 1665 (1663–1729), under commissions and instructions from the crown (1729–76), and under the State Constitutions of Dec. 1776 and of April 1868, with numerous amendments. The present Constitution, as amended, prescribes that no convention of the people of the State may be called by the legislature unless by the concurrence of two-thirds of all the members of each house followed by an affirmative vote of a majority of the electors voting on the question; and that an amendment to the Constitution may be adopted only by a three-fifths vote of each house followed by an affirmative vote of the majority of electors voting on the question. The suffrage provisions containing the famous "grandfather clause" (in Art. vi. section 4), were adopted in the form of a constitutional amend-



GRAPH SHOWING GROWTH OF POPULATION AND RELATIVE PROPORTIONS OF WHITES AND NEGROES IN NORTH CAROLINA, 1790–1820

ment, ratified in Aug. 1900, and in effect July 1, 1902. Since Dec. 1, 1908, all new applicants otherwise qualified may place their names on the voting register, provided they can read and write any section of the Constitution in the English language.

Perhaps the most notable feature about the administration is the weakness of the governor's position. He is elected by popular vote for four years, and cannot succeed himself in office. His power is limited by a council of State, a relic of colonial days. This body is not, however, a special board, as in Maine, New Hampshire and Massachusetts, but a kind of administrative

cabinet consisting of the secretary of State, the auditor, the treasurer and the superintendent of public instruction, advising the governor in the administration of his office. Judges, heads of departments, and executive boards are elected, and in most instances in which the governor appoints to office the confirmation of the senate is necessary. Furthermore, in North Carolina the governor has no veto power. In addition to the executive officials mentioned above there are a lieutenant governor, and attorney-general, a commissioner of agriculture, a commissioner of labour and printing, a commissioner of insurance and a commissioner of revenue, all elected for a term of four years.

Sessions of the general assembly are held biennially, beginning on the Wednesday after the first Monday in January, in odd-numbered years. The senate is composed of 50 members elected biennially from 33 senatorial districts, and the house of representatives of 120, elected biennially and chosen by counties according to their population, each county having at least one representative, no matter how small its population. The pay for both senators and representatives is four dollars per day for a period not exceeding 60 days, and mileage; should the session be prolonged the extra service is without compensation.

There is a supreme court consisting of a chief justice and four associates, elected by popular vote for eight years, and a superior or circuit court, composed of 20 judges elected by the people in each of 20 districts for a term of eight years. Minor civil and criminal cases are tried before a justice of the peace or municipal judge. The county officials are the sheriff, a coroner, a treasurer, a register of deeds, a surveyor and three or five commissioners, elected for two years; a clerk of the court elected for four years; a county board of education, elected or appointed for two years; and a superintendent of schools and a superintendent of public welfare, appointed for a term of two years.

Finances.—North Carolina was one of the few States in the Union in 1926, that had no State tax on property. The total of the State's general fund revenues for the fiscal year ending June 30, 1926, was $13,878,552; the principal sources being income ($6,111,037), insurance ($1,236,593), inheritance ($886,376), franchise ($1,649,268), utilities ($1,285,685), corporation ($270,-313), and bus ($145,058) taxes. The average rate of county taxation in 1925 was $1.28 per $1,000 of valuation on assessed property values of $2,706,032,819. The chief sources of the special fund revenues were automobile licences ($7,213,854), a gasolene tax ($7,166,008) and the departments and institutions funds ($2,611,203). General fund disbursements for the fiscal year 1926 were $13,459,815. Of this amount, the chief disbursements were for State educational institutions ($3,882,256), administrative departments, boards and commissions ($3,073,552), maintenance of charitable and correctional institutions ($2,498,658), interest sinking funds and debt payments ($1,954,412) and pensions ($1,004,252). Of the special fund disbursements the greater were for road construction and maintenance ($23,833,350), institution buildings ($2,800,273) and interest ($3,395,110). The total indebtedness of the State on June 30, 1926, was $123,788,000 in bonds and $20,300,000 in loans. Of the bonded debt, $69,-999,600 were for highway construction, $22,519,000 for educational and charitable institution improvement, $10,000,000 for public school building bonds, and the remainder for funding and miscellaneous improvements.

Education.—The public school system of North Carolina has made remarkable and well rounded progress since 1900. The public school funds increased from approximately $3,000,000 in 1910 to $35,000,000 in 1925. The total school expenditures increased from $1,248,157 in 1901 to $32,443,426 in 1926, or from a per caput of $2.87 to $39.63. The per caput cost for rural school education in 1926 was $34.11 as compared with $57.25 for city schools. In 1901 there were 8,320 teachers and 435,184 enrolled pupils as compared with 23,128 teachers and 818,793 pupils in 1926. Of the 1926 enrolment, 623,760 were in rural schools and 195,033 in city schools. The high school enrolment increased from 63,499 in 1923–24 to 81,605 in 1925–26. Of the 1925–26 total 45,440 were enrolled in rural high schools and 36,165 in city high schools; 8,237 were coloured and 73,368 were whites. The number of consolidated schools increased from 228 in 1921–22 to 657 in 1925–26. In the latter year, transportation was furnished for 87,283 pupils. A programme of vocational education as a part of the State's policy of public education was inaugurated in 1917–18 after the passage of the Smith-Hughes vocational education act made available Federal funds. There were in 1926, 111 schools giving instruction in agriculture and 147 giving courses in home economics. The average annual salary for white teachers was $853 and for negro teachers $467.

Chief among the State institutions of higher learning is the University of North Carolina at Chapel Hill, chartered in 1789 and opened in 1795, one of the oldest State universities in the country and one of the oldest universities in the South. In 1925–26 it had a total enrolment of 7,061 students, of which 2,505 were resident students during the main term. Other schools maintained by the State are the North Carolina College of Agriculture and Engineering at Raleigh, the North Carolina college for women at Greensboro, the East Carolina Teachers college at Greenville, the Cullowhee State normal school at Cullowhee and the Appalachian State normal school at Boone. State-supported negro institutions include the Negro Agricultural and Technical college of North Carolina at Greensboro, the Winston-Salem Teachers college at Winston-Salem, North Carolina college for negroes at Durham, and normal schools at Fayetteville and Elizabeth City. A school for the Cherokee Indians of Robeson county is located at Pembroke. Among the non-State supported institutions of higher education Duke university, formerly Trinity college, at Durham, is the greatest. It received from the late James B. Duke the sum of $6,000,000 for building and an endowment fund estimated to amount to anywhere from $80,000,000 to $100,000,000, one of the largest foundations for education and hospitalization in the world. Well known sectarian schools are Wake Forest college at Wake Forest; Davidson college at Davidson; Greensboro college for women at Greensboro; Guilford college for women near Greensboro; Lenoir-Rhyne college at Hickory; Catawba college at Salisbury; Meredith college at Raleigh; Belmont Abbey college at Belmont; Elon college at Elon; and Atlantic Christian college at Wilson. Institutions for negroes include Shaw university at Raleigh, Johnson C. Smith university at Charlotte, Livingston university at Salisbury and St. Augustine's school at Raleigh.

Charities and Corrections.—The chief State-supported institutions in 1927 consisted of hospitals for the white insane at Raleigh and Morganton and a hospital for negro insane at Goldsboro, the Caswell Training school for mental defectives at Kingston, the North Carolina Orthopaedic hospital for crippled children at Gastonia; the Stonewall Jackson Training school for delinquent white boys at Concord, the Eastern Carolina Industrial Training school for delinquent white boys at Rocky Mount, the Morrison Industrial school for delinquent negro boys at Hoffman, the Samarcand Manor for delinquent white girls at Samarcand and the State prison at Raleigh.

Agriculture.—North Carolina, in 1926, ranked sixth among the States in the value of its agricultural products, the total crop values being estimated at $327,700,000. In that year, the State ranked first in the production of tobacco and of peanuts and third to Georgia and Texas in the production of sweet potatoes. The principal crops in 1926, their acreage, yields and values are as follows: tobacco 574,000 ac., 393,190,000 lb., $103,802,000; cotton, 2,023,000 ac., 1,250,000 bales, $71,875,000; Indian corn, 2,376,000 ac., 52,272,000 bu., $45,999,000; hay 816,000 ac., 738,-000 tons, $14,552,000; potatoes 74,000 ac., 7,400,000 bu., $11,-840,000; wheat 447,000 ac., 6,303,000 bu., $9,013,000; peanuts 194,000 ac., 190,120,000 lb., $7,985,000; sweet potatoes 84,000 ac., 7,560,000 bu., $7,560,000; oats 310,000 ac., 6,820,000 bu., $4,706,000; rye 104,000 ac., 1,352,000 bu., $1,690,000.

In the production of vegetables and fruits the State ranks high. In 1926 the orchards yielded 5,986,000 bu. of apples, 2,100,000 bu. of peaches and 270,000 bu. of pears. The vineyards of the State produced 6,840 tons of grapes. The 5,040 ac. devoted to strawberries produced 10,821,000 quarts valued at $1,731,360. Of the total strawberry crop 1,252 carloads were shipped out of

the State.

The live stock on the farms of North Carolina in 1927 consisted of 513,000 cattle, of which 303,000 were kept for dairy purposes; 849,000 swine; 279,000 mules; 114,000 horses and 77,000 sheep; their total value was estimated at $69,120,000. The value of the dairy products in 1924 was $14,095,407; and of the eggs and chickens produced, $18,120,881.

The tendency noted in 1910 and 1920 toward smaller holdings was also evident in 1925; in the last mentioned year, the average size farm was 65·6 acres. In 1925 the farm acreage was 18,593,670 as compared with 20,021,736 in 1920. During the same period the number of farms increased from 269,763 to 283,482. Of the total number of farmers, 202,516 were whites and 80,966 coloured. The greater part of the coloured farmers (58,865) were tenants. The total number of tenants was 128,254, or 45·2% of the farmers as compared with 43·5% in 1920. The total farm population in 1925 was 1,446,881 as compared with 1,501,227 in 1920.

Forests and Fisheries.—North Carolina had in 1925, 1,047 active saw mills which produced 1,040,735,000 bd.ft. of sawed lumber as compared with 1,286,638,000 bd.ft. in 1899 and 2,177,715,000 bd.ft. in 1909. Of the 1925 production, 843,755,000 bd.ft. were classified as softwood, chiefly, yellow pine (750,475,000 bd.ft.), spruce (38,463,000 bd.ft.), cypress (24,446,000 bd.ft.) and hemlock (21,650,000 bd.ft.); and 196,980,000 bd.ft. as hardwood, principally, oak (82,334,000 bd.ft.) chestnut (41,164,000 bd.ft.), red gum (21,681,000 bd.ft.) and yellow poplar (21,140,000 bd.ft.). Other species of some importance were hickory, cedar and ash. The early and continued production of rosin, turpentine and tar from the long-leaf pine forests of the coastal plain has caused North Carolina to be popularly called the "Tar Heel State." The value of the lumber and timber products in 1925 was $38,080,932.

In the sounds along the coast, in the lower courses of the rivers that flow into them, and along the outer shores, fishing is an important industry. In 1923, there were 141 vessels and 9,308

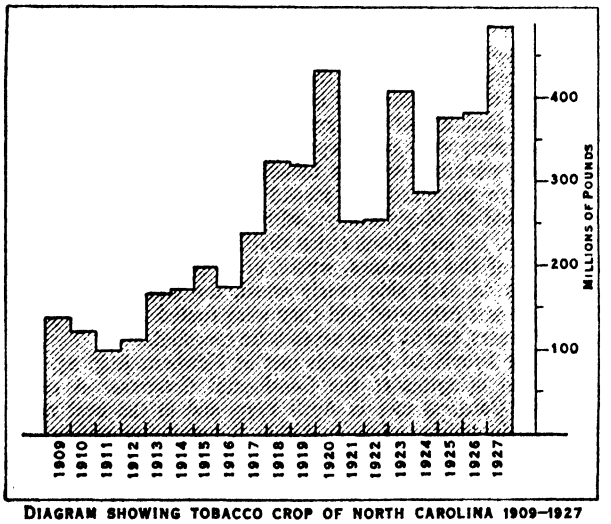
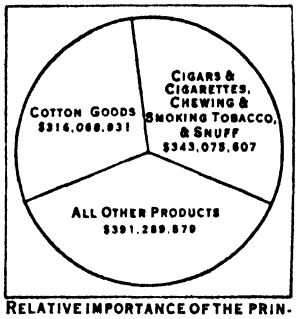


DIAGRAM SHOWING TOBACCO CROP OF NORTH CAROLINA 1909–1927

persons engaged in the industry; the product was 95,192,343 lb. valued at $2,414,499.

Minerals.—During the first half of the 19th century North Carolina was a mining State of the first importance, but in 1925 it ranked 38th among the States of the Union. The total value of the mineral products of the State, in the latter year, was $9,504,063, or ·19% of tile total for the United States. The principal minerals produced, ranked according to value, were clay products ($3,868,962), stone ($3,478,855), sand and gravel ($886,351), crude feldspar ($496,563), coal ($283,000), mica ($180,194) iron ore ($49,511), gold ($18,540) and silica ($10,692). In 1924, North Carolina's output of crude feldspar constituted 47% of the total quantity and 42% of the total value of that mineral produced in the United States. Feldspar was produced chiefly in Mitchell, Yancy and Avery counties. North Carolina also ranked first in the production of mica, which is found in the north-eastern portion of the mountain region. Granite, suitable for building stones and paving blocks, is found in most parts of the State west of the "Fall Line." Talc also is widely distributed in the State.

Manufactures.—North Carolina in 1925 ranked second to Texas among the Southern States and 15th among the States of the Union in the value of her manufactured products. This industrial pre-eminence has been gained since 1880. Industrial leadership in the manufacture of cotton goods and tobacco products has been achieved principally by an abundant supply of raw materials, favourable climatic conditions, a reliable supply of native labour and cheap hydro-electric power. The State department of conservation and development estimated in 1925 that over 50% of North Carolina's knitting mills, 50% of her furniture factories, 90% of her tobacco manufacturing industries and over 90% of her textile spindles were electrically driven. In 1925, 597,000 h.p. was developed by water-power in North Carolina. In the same year it was estimated by the U.S. Geological Survey that the State had undeveloped water-power resources equal to 540,000 horse-power. The total value of the manufactured products of the State in 1880 was $20,095,037; in 1914 it was $289,412,000.



RELATIVE IMPORTANCE OF THE PRINCIPAL MANUFACTURES OF NORTH CAROLINA, 1925

A comparison of the value of the manufactured products in 1914 with that of 1925 shows an increase of $761,022,000, or approximately 263%. In the latter year, the State's 2,614 industrial establishments, with a product exceeding $5,000, employed 182,234 wage-earners and had an output valued at $1,050,434,117. The following table shows the principal industries in 1925, the number of establishments, the average number of wage-earners and the value of the product:

Industry	Number of establishments	Wage-earners	Value
			$
Cotton goods	364	84,139	316,068,431
Cigars and cigarettes	12	13,133	312,736,113
Furniture	127	13,567	51,208,238
Knit goods	111	13,727	44,300,819
Lumber and other timber products	515	17,787	38,080,932
Chewing and smoking tobacco and snuff	9	2,582	30,339,494
Fertilizers	65	1,796	20,068,546
Flour and grain-mill products	115	484	18,201,542
Cotton seed oil, cake and meal	51	1,426	17,484,244
Planing mills	154	2,982	15,981,683

Gaston county, with the industry centred chiefly at Gastonia and Belmont, was the leading textile producing county in the United States in 1925. Other important textile producing counties of North Carolina were Alamance, Cleveland and Mecklenburg. Nearly 50% of the tobacco factories were situated in the city of Winston-Salem and over 80% of the total value of the yearly output was reported from that city. Others in which the industry flourished were Durham, Greensboro, Reidsville and Statesville. The chief centre of the furniture industry was High Point in Guilford county. Other centres of importance were Winston-Salem, Thomasville, Hickory, Lexington, Mount Airy, Salisbury and Lenoir.

Transportation.—Railway building was begun in the State in 1836 with the Raleigh and Gaston line, opened from Raleigh to Gaston in 1844 and extended to Weldon in 1852. The steam railway mileage in 1925 was 5,347 as compared with 5,565 in 1915. The eight electric railway companies in the State in 1925

had a total of 355 m. of track, of which about 200 m. were main line. Since 1920 great progress has been made in developing a great system of highways. The State highway system on Jan. 1, 1927, had a mileage of 6,218; of this total 5,464 m. were surfaced. During 1926, 696 m. of new surfacing were placed. The total highway expenditures made by or under the direction of the State department amount to over $30,000,000 annually. There were, in Aug. 1927, according to the State corporation commission, 97 passenger bus lines operating on 4,500 m. of road and 17 motor freight and express lines over 1,756 m. of road. The total motor vehicle registration for 1926 was estimated at 389,586. Wilmington, the deep-water port, had in 1926 a water-borne trade of 196,285 tons of imports and 23,699 tons of exports.

History.—The history of North Carolina may be divided into four main periods: the period of discovery and early colonization (1520–1663); the period of proprietary rule (1663–1729); the period of royal rule (1729–76); and the period of Statehood (from 1776).

It is possible that some of the early French and Spanish explorers visited the coast of North Carolina, but no serious attempt was made by Europeans to establish a settlement until near the close of the 16th century. After receiving from Queen Elizabeth a patent for colonization in the New World, Sir Walter Raleigh, in April 1584, sent Philip Amadas, or Amidas (1550–1618), and Arthur Barlowe (*c.* 1550–*c.* 1620) to discover in the region bordering on Florida a suitable site for a colony. They returned in September with a glowing account of what is now the coast of North Carolina, and on April 9, 1585, a colony of about 108 men under Ralph Lane (*c.* 1530–1603) sailed from Plymouth in a fleet of seven small vessels commanded by Sir Richard Grenville. The colony was established at the north end of Roanoke island on Aug. 17 and about a week later Grenville returned to England. Threatened with famine and with destruction from hostile Indians, the entire colony left for England June 19, 1586, on Sir Francis Drake's fleet. Only a few days after their departure Sir Richard Grenville arrived with supplies and more colonists, 15 of whom remained when he sailed away. Although greatly disappointed at the return of the first colony, Raleigh despatched another company, consisting of 121 persons under John White, with instructions to remove the plantation to the shore of Chesapeake bay. They arrived at Roanoke island July 22, 1587, and were forced to remain there by the refusal of the sailors to carry them farther. Of the 15 persons left by Grenville not one was found alive. White's granddaughter, Virginia Dare (b. Aug. 18, 1587), was the first English child born in America. White soon returned to England for supplies, and having been detained there until 1591 he found upon his return no trace of the colony except the word "Croatan" carved on a tree; hence the colony was thought to have gone away with friendly Indians.

In 1663 Charles II. granted the territory between the 31st and 36th parallel and extending from sea to sea, to the earl of Clarendon (1609–74), the duke of Albemarle (1608–70), and six other favourites. By a second charter issued in 1665 the limits were extended to 25° and 36° 31′. The first permanent English colony in North Carolina was established at Albemarle on the Chowan river about 1660 by people from Virginia. Other settlers, chiefly Scotch, Scotch-Irish and Germans, followed down the valleys from Pennsylvania. The colony grew rapidly, and at the close of the colonial period (1776) the population numbered approximately 300,000, including about 40,000 negroes. Economic advantages seem to have been the chief motives of colonization. The proprietary period (1663–1729) was a turbulent one. Six out of 16 governors or deputy governors were driven from office between 1674 and 1712, and there were two uprisings which have been deemed worthy of the term rebellion. A war with the Tuscarora Indians, in 1711–13, resulted in the defeat of the Indians and the removal of the greater part of the tribe to New York, where they became the sixth nation of the Iroquois confederacy.

In 1729 an act was passed by parliament establishing an agreement with seven of the proprietors for the surrender of their claims to both provinces. They were allowed £17,500 for their rights and £5,000 for arrears of quit rents. Lord Carteret, the eighth proprietor, refused to sell, but in 1744 he gave up his claim in return for a strip of land in North Carolina lying between lat. 35° 34′ and the Virginia line (36° 30′). The political history during the royal period is, like that of other colonies, the story of a constant struggle between representatives of the people and the representatives of the Crown. There were disputes



BY COURTESY OF THE NEW BERN CHAMBER OF COMMERCE

CHRIST CHURCH, OF THE EPISCOPAL DENOMINATION, NEW BERN, N.C.

over questions of Government, of commerce, of finance and of religion. In the "back country" extortionate fees, excessive taxes, and the oppressive manner of collecting them brought about a popular uprising, known as the Regulation. Violence followed the refusal to pay taxes, and in Sept. 1768 Governor Tyron was forced to lead a military expedition against the Regulators. They, however, were not prepared to withstand the governor's forces and submitted without bloodshed. New outbreaks in the fall of 1770 provoked the second military expedition of the governor, and on May 16, 1771, with a force of about 1,000 men and officers, he met about twice that number of Regulators on the banks of the Alamance, where, after two hours of fighting, with losses on each side nearly equal, the ammunition of the Regulators was exhausted and they were routed. About 15 were taken prisoners, and of these seven were executed.

The first Provincial Congress met at Newbern Aug. 25, 1774 and elected delegates to the Continental Congress. A second Provincial Congress met in April 1775, and in the next month Gov. Martin sought safety in flight. A committee representing the militia companies of Mecklenburg county, on May 31, 1775, passed a series of resolutions which declared that the royal commissions in the several colonies were null and void, that the Constitution of each colony was wholly suspended, and that the legislative and executive powers of each colony were vested in its Provincial Congress subject to the direction of the Continental Congress; and the resolutions requested the inhabitants of the county to form a military and civil organization independent of the Crown of Great Britain which should operate until the Provincial Congress should otherwise provide or the British Parliament should "resign its unjust and arbitrary pretensions with respect to America." The Mecklenburg Declaration of Independence, which it is alleged was passed on May 20 by the same committee, abounds in phrases which closely resemble phrases in the great Declaration of July 4, 1776.

The first sanction of independence by any body representing the whole province was given by the fourth Provincial Congress on April 12, 1776, and the same body immediately proceeded to the

consideration of a new and permanent form of government. Their labours ended, however, in another provincial Government by a council of safety, and the drafting of North Carolina's first State Constitution was left to a Constitutional convention which assembled on Nov. 12, at Halifax.

North Carolinians fought under Washington at Brandywine and Monmouth and played a still more important part in the Southern campaigns of 1778–81. The State was twice invaded, in 1776 and in 1780–81, and two battles were fought upon her soil, Moore's Creek Feb. 27, 1776 and Guilford Court House March 15, 1781.

North Carolina sent delegates to the Philadelphia Constitutional convention of 1787, but the State convention, at Hillsboro, called to ratify the Constitution for North Carolina, did not meet until July 21, 1788, when ten States had already ratified. The document was most strongly opposed because it contained no bill of rights and on the ground that it would provide for such a strong central Government that the State Governments would ultimately be sacrificed. At the conclusion of the debate the convention by a vote of 184 to 84 declared itself unwilling to ratify the Constitution until a bill of rights had been added and it had been amended in several other particulars so as to guarantee certain powers to the States. But a second convention met at Fayetteville in Nov. 1789 and the Constitution was speedily ratified (on the 13th) by a vote of 195 to 77.

The period from 1790 to 1835 was marked by a prolonged contest between the eastern and the western counties. In 1790 the West began to urge a new division of the State into representative districts according to population and taxation. This was stubbornly resisted, and the West assumed a threatening attitude as the East opposed its projects for internal improvements for which the West had the greater need. In 1823 the West called an extra-legal convention to meet at Raleigh, and delegates from 24 of the 28 western counties responded, but a lack of agreement over the counting of slaves as well as whites as a basis of representation caused little to be accomplished. Finally in Jan. 1835 the legislature passed a bill for submitting the question of calling a Constitutional convention legally to all the voters of the State. When the popular vote was taken, in the following April, every eastern county gave a majority against the convention, but the West voted strongly for it and carried the election with a total majority in the State of 5,856 votes. In the convention, the East made some concessions: such as the popular election of the governor, the disfranchisement of free negroes, the choosing of senators from districts according to public taxes and the apportioning of commoners to districts according to population based on the Federal ratio. The electorate gave its approval to the revision by a vote of 26,771 to 21,606, and with this the agitation over representation ceased.

The fundamental points of difference between North Carolina and South Carolina were exemplified in the slavery conflict. South Carolina led the extreme radical element in the South and was the first State to secede. North Carolina held back, worked for a compromise, sent delegates to the Washington Peace convention in Feb. 1861, and did not secede until May 20, 1861, after President Lincoln's call for troops to preserve the Union. Liberal support was given to the Confederacy, both in men and supplies, but Gov. Vance, one of the ablest of the Southern war governors, engaged in acrimonious controversies with President Jefferson Davis, contending that the general Government of the Confederacy was encroaching upon the prerogatives of the separate States. Owing to its distance from the border, the State escaped serious invasion until near the close of the war. Wilmington was captured by the Federals in Feb. 1865; Gen. Sherman's army crossed the southern boundary in March; a battle was fought at Bentonville, March 19–21; Raleigh was entered on April 13; and the Confederates under Gen. Joseph E. Johnston surrendered near Durham station, in Durham county, on the 26th.

Reconstruction was a costly experience here as in other Southern States. Jonathan Worth (1802–69), elected governor under the presidential plan in 1865, was an honest and capable official, but the Government established in accordance with the views of Congress in 1868 was corrupt, inefficient and tyrannical. Carpet-baggers, negroes and unscrupulous native whites, known as scalawags, were in control of affairs, while the people of wealth, refinement and education were disfranchised. Gov. William Woods Holden (1818–92; governor 1868–70) was so weak and tyrannical that he was impeached by the legislature in Dec. 1870. Under his successor, Tod R. Caldwell (1818–74), there was some improvement in the condition of affairs, and in 1875 a Constitutional Convention, in session at Raleigh, with the Democrats slightly in the majority, amended the Constitution, their work being ratified by the people at the State election in 1875. The native white element completely regained possession of the Government in the following year, when the Democrats came into office under Gov. Zebulon B. Vance. Since that time the most interesting feature in the political history has been the rise and fall of the People's Party. The hard times which followed the financial panic of 1893 made it possible for them, in alliance with the Republicans, to carry the State in the election of 1894. The race question was the chief issue in the election of 1898, the Democrats were successful, and what amounted to a negro-disfranchising amendment to the Constitution was adopted in Aug. 1900. In the presidential election of 1928, the Republican candidate carried North Carolina by 62,000 votes.

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NORTH CHICAGO, a manufacturing city of Lake county, Illinois, U.S.A., on Lake Michigan, 35 m. N. by W. of Chicago, between Waukegan (on the north) and the Great Lakes Naval

Training station. It is served by the Chicago and North Western, the Chicago, North Shore and Milwaukee, and the Elgin, Joliet and Eastern railways. Pop. 5,839 in 1920 (33% foreign-born white).

NORTHCLIFFE, ALFRED CHARLES WILLIAM HARMSWORTH (1865–1922), VISCOUNT, British newspaper proprietor, was born on July 15, 1865 at Chapelizod, Dublin, the eldest of a family of fourteen. His father, Alfred Harmsworth (1837–1889), descended from an old Hampshire family, was a barrister-at-law of the Middle Temple. His mother, Geraldine Mary, who died Aug. 29, 1925, a woman of remarkable intellect and strong character, was a daughter of William Maffett.

Of the seven sons, the two eldest, Alfred and Harold, became members of the House of Lords as Lord Northcliffe and Lord Rothermere respectively; the third, Cecil Bisshopp (b. 1869), became in 1915 under-secretary for home affairs and in 1919 under-secretary for foreign affairs, having entered the House of Commons as Liberal M.P. for Droitwich (1906–10) and subsequently sitting for S. Beds; while the fourth, Robert Leicester (b. 1870), who was created a baronet in 1918, entered the House of Commons in 1900 as Liberal M.P. for Caithness, a seat which he retained till 1922. The other three sons were Hildebrand Aubrey (b. 1872), from 1901 to 1904 editor of *The New Liberal Review;* St. John (b. 1876), the creator of the Perrier mineral water business; and Vyvyan George (b. 1881).

Early Journalism.—The Harmsworths moved to London in the year 1867, and at Henley House school, West Hampstead, the boy Harmsworth started in 1878 the first of his journalistic adventures, a school magazine. This was originally issued in ms. but was afterwards printed and sometimes set up by himself in his spare time. At 15 he did some work for Mr. Jealous, then editor of *The Hampstead and Highgate Express.* As secretary and companion to one of Lord Lilford's sons, he travelled extensively in Europe. On his return to London he became assistant editor of *Youth* and contributed articles to *The Morning Post,* and to the *St. James's Gazette.*

But his health temporarily broke down in 1884. Ordered to live out of London, he went to Coventry in 1885 and worked for the firm of Iliffe and Sons, owners of many publications. With them he remained till 1886, and he then went back to London and joined a general publishing business. Among other ventures he started on June 16, 1888 *Answers to Correspondents,* a weekly periodical intended to be a more popular form of *Notes and Queries.* As *Answers* it laid the foundation of what eventually became the largest periodical publishing business in the world, the Amalgamated Press. Alfred Harmsworth had already been joined by his second brother, Harold (*see* ROTHERMERE, VISCOUNT). The two brothers revolutionized the current methods of periodical journalism. The profits of the accumulated publications soon soared to £50,000 a year. In the next few years Alfred Harmsworth travelled much in Europe, India, Africa, Canada and the United States. On April 11, 1888 he had married Mary Elizabeth, daughter of Robert Milner, a West Indian merchant.

On Aug. 31, 1894 he and his brother Harold acquired the London *Evening News,* in which the Conservative party had sunk some £300,000. It was then losing money heavily, but it was at once reorganized with such effect that the first working week yielded a profit of £7, and the first year one of £14,000. In the same year he fitted out an Arctic expedition under Mr. F. G. Jackson, which explored Franz Josef Land. In the general election of 1895 he stood unsuccessfully as a Conservative candidate for Parliament at Portsmouth.

The Daily Mail.—On May 4, 1896 a new halfpenny morning paper, *The Daily Mail,* was launched, "the busy man's newspaper," as he called it. It embodied many innovations, a very full service of cables, the employment of numerous famous writers, condensation of unimportant topics, and costly and daring enterprises of various kinds. A comparison of past files of the London Press shows how it revolutionized daily journalism. One of the three leading articles in the first number dealt with the then almost unknown motor-car, in the future of which Alfred Harmsworth had a firm belief, being himself already a qualified driver. *The Daily Mail* attained a sale of 600,000 copies a day in the Boer War, and acquired sound influence on national policy at home and abroad.

In 1903 he founded *The Daily Mirror;* it was at first a complete failure, losing £1,500 a week but after being transformed from a penny paper for women into a halfpenny illustrated morning journal, became as signal a success. In 1905 a Continental edition of *The Daily Mail* was established, with headquarters in France. In 1904 Alfred Harmsworth was created a baronet, and in 1905 he was raised to the peerage as Baron Northcliffe. In 1906 he and his brothers acquired for their companies about 3,000 sq.m. of forest land in Newfoundland, with lakes, rivers and water transport, for the manufacture of paper and wood pulp, the result being the formation of the Anglo-Newfoundland Development Co., a gigantic enterprise with its works at Grand Falls, and two lines of railway, a port and Atlantic and other steamers.

In 1908 Lord Northcliffe obtained control of *The Times,* to own which had always been one of the aims of his life. New machinery was installed, and the size of the paper greatly increased; in March, 1914, he reduced the price to one penny, with the result of a large increase in circulation, though the enormous rise of 600% in the cost of paper during the World War forced a subsequent increase in price. Meanwhile Lord Northcliffe had acquired *The Weekly Dispatch;* disposed of the Sunday *Observer,* which he for some time owned; and sold *The Daily Mirror* to his brother, Lord Rothermere. Among the reforms which Lord Northcliffe introduced into newspaper management were the five-day week for editors, sub-editors and reporters, a more generous payment of journalists and a system of profit-sharing by the chief members of his staffs.

From 1900 onwards, through his newspapers, he had exercised an ever-increasing influence on politics. He had at one time been anxious, like Edward VII. and Cecil Rhodes, to obtain a friendly understanding between England and Germany, but the Boer War caused him to abandon that idea as impracticable. His newspapers consistently pleaded the cause of a strong navy, and as consistently warned the nation for 20 years of the peril from Germany. From 1902 he sought to effect an entente with France, and also to promote agreements with Russia and the United States, whose sentiments and prejudices he had learnt in many visits. Through *The Daily Mail* he gave large prizes for airmanship, in which, from 1906 onwards, he took the warmest interest. His maiden speech in the House of Lords was devoted to the pressing claims of aircraft. He was a strong believer in the future of flying and a daily advocate of the value of aircraft in war. He was also interested from the first in submarines, in one of which craft he made an early and hazardous descent.

The World War.—In the World War he aimed at the vigorous conduct of the struggle, and was from the first of opinion that the War would be long and desperately contested. The chief newspaper campaigns which he carried out, always with the aims of victory and close union between the Allies, were: (1) for the organization of the munition supply and provision of high-explosive shells in April and May 1915, when he did not hesitate to lay the responsibility for the shortage of ammunition on Lord Kitchener in leading articles written by himself in *The Daily Mail* of May 19 and 21, the second of which was publicly burned on the London and other stock exchanges; (2) this campaign was one of the causes of the formation of the Coalition Ministry by Mr. Asquith; (3) throughout 1915 and early 1916, in the teeth of storms of abuse, he urged the necessity of introducing compulsory service; (4) he protested continuously against the excessive optimism of the Asquith Government and against official secretiveness; (5) he called for the strict enforcement of the blockade; (6) so far as the censorship would allow, he resisted the Dardanelles and Salonika campaigns, which absorbed so large a part of the national forces; (7) he continued his pre-War demand for the construction of aircraft—and "the right kind of aircraft"—on the largest possible scale; (8) he urged the necessity of creating a strong naval war staff and taking offensive measures against the enemy submarines; (9) he insisted on the need of compulsory food rationing. While always active with his pen and through

his Press, he went repeatedly to the various battle-fronts, British, French, Belgian, Italian and American, and kept in close touch with the various staffs. In Dec. 1916 he gave his support to Mr. Lloyd George in the political crisis which led to the fall of Mr. Asquith's Government, and dealt the final thrust which brought that Government down, though after the Armistice, by reason of his objection to the long-drawn-out after-war negotiations with the Germans, he became Mr. Lloyd George's most persistent critic. He was offered office but declined.

Work in New York.—Before the United States entered the War he was offered and declined the post of British ambassador at Washington. But he went to New York (June 2, 1917) as chairman of the much-needed British War Mission returning to London on Nov. 12, 1917, when he was created a viscount, as Viscount Northcliffe of St. Peter-in-Thanet, for his services. On Feb. 13, 1918, he became director of propaganda in enemy countries. To pave the way for operations among the nationalities subject to the Habsburgs, he secured an agreement between the Yugoslavs and the Italian Government, which played a big part in the defeat of the Austrian Army and was subsequently embodied, in substance, in the peace terms. An account of his work was given in Sir Campbell Stuart's *Secrets of Crewe House* (1920); Crewe House being the London headquarters of the organization.

Last Days.—During the Peace Conference Lord Northcliffe's Press and the *Continental Daily Mail* especially exerted a powerful influence on the British Government, extracting from Lloyd George a promise to fulfil election pledges and striving to maintain the closest and most cordial relations with France. In July 1921 he went for a prolonged tour of the world, as he was medically advised to take a rest cure. A complete breakdown followed, and after a long illness he died on Aug. 14, 1922 of ulcerative endocarditis. (H. W. W.)

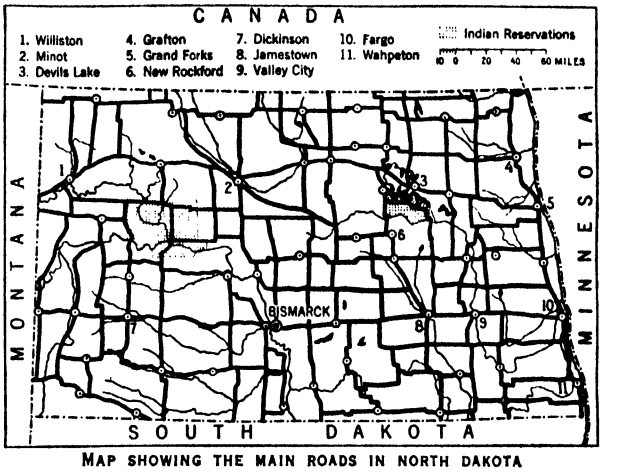
See his *My Journey Round the World* (1923); L. Owen, *The Real Lord Northcliffe* (1922); M. Pemberton, *Lord Northcliffe* (1922).

NORTHCOTE, JAMES (1746–1831), English painter, was born at Plymouth on Oct. 22, 1746. He was apprenticed to his father, a poor watchmaker, but in 1769 left his father and set up as a portrait-painter. In 1773 he went to London and was admitted as a pupil into the studio and house of Reynolds. At the same time he attended the Academy schools. In 1775 he left Reynolds, and, about two years later went to study in Italy. On his return to England he settled in London, where Opie and Fuseli were his rivals. He was elected associate of the Academy in 1786, and full academician in the following spring. Northcote's works are said to number two thousand, and he made a fortune of £40.000. Apart from his painting he wrote lives of Reynolds (1813), and of Titian (1830), and two series of *Fables*. He died on July 13, 1831.

NORTHCOTE, STAFFORD HENRY, 1ST BARON (1846–1911), was educated at Eton and at Merton college, Oxford. He became a clerk in the foreign office in 1868, acted as private secretary to Lord Salisbury, and was attached to the embassy at Constantinople from 1876 to 1877. From 1877 to 1880 he was secretary to the chancellor of the exchequer, was financial secretary to the war office from 1885 to 1886, surveyor-general of ordnance, 1886 to 1887, and charity commissioner, 1891 to 1892. In 1887 he was created a baronet. In 1880 he was elected M.P. for Exeter as a Conservative, and retained the seat until 1899, when he was appointed governor of Bombay (1899–1903), being created a peer in 1900. Northcote was appointed governor-general of the Commonwealth of Australia in 1903, and held this post till 1908. He died on Sept. 29, 1911.

NORTH DAKOTA, the "Flickertail State," is one of the North-central group of the United States, and lies between 45° 55′ and 49° N. and 96° 25′ and 104° 3′ West. It is bounded north by the provinces of Saskatchewan and Manitoba in Canada, east by Minnesota, from which it is separated by the Red river, south by South Dakota and west by Montana. Its extreme length east and west is 360 m., its extreme width north and south is 210 miles. Its total area is 70,837 sq.m. of which 654 sq m. are water surface. The original territory of Dakota was so called because of its being the home of the Dakota Indians, the word "Dakota" meaning "allied" in the language of these tribes.

Physical Features.—In crossing North Dakota from east to west three distinct plains are encountered, rising one above the other. The most easterly of these from 790 to 965 ft. in elevation, is the remarkably level valley floor of the Red river extending from the left river bank 30 to 40 m. westward into the State. This valley was once the bed of a great glacial lake (Lake Agassiz),



MAP SHOWING THE MAIN ROADS IN NORTH DAKOTA

formed by the retreating ice sheet damming the natural northern outlet. Its floor is covered by the rich, silty lake deposits, coloured black by decayed vegetation, which make it one of the most fertile tracts on the continent. Being free from rocks, trees and hills, its wide areas were quickly brought under cultivation by the pioneer, and the valley has continued one of the famous grain-producing regions of the United States.

West of this valley, and between it and the Missouri plateau, is an intermediate plain, ranging from 1,300 to 1,650 ft. in elevation, so covered everywhere with glacial drift that it is usually known as the drift plain. Its east and west width varies from about 70 m. at the south to over 200 m. along the Canadian boundary. The surface of this plain, varying from gently undulating to rolling and hilly, was largely determined by the irregular drift deposit which covers the pre-glacial surface to a depth of 150 to 300 feet. Across the plain from north-west to south-east, a number of irregular ridges or glacial moraines mark successive haltings of the retreating ice sheet. Especially in these moraines, but generally characteristic also of the entire drift area, are the little lakes, varying in diameter from a few yards to a few miles, which occupy the numerous sags and swales. Many of these have no outlet and are strong with salt and alkali. The largest of this character is Devils lake, an irregular body of water about 40 m. in length and 400 sq.m. in area, which forms a natural reservoir for a large area in the north-eastern part of the drift plain which has no other drainage. The drift plain has few rivers, and those of importance, the Mouse, James and Sheyenne have narrow valleys with sharp, deep banks. The lack of well-developed river valleys and the undisturbed surface of the glacial drift indicate a youthful land, little affected as yet by erosion. The soil of its rolling slopes is excellent for most grain crops and this region holds the major portion of the farming population in the State.

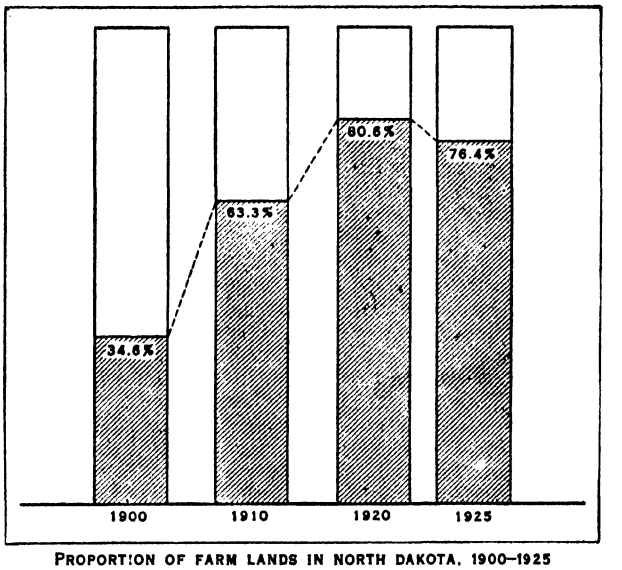
The drift plain is bounded on the west by an escarpment beyond which lies the third and highest plain, the so-called Missouri plateau. The escarpment itself extends from north-west to south-east in a great bow approximately parallel to, but 50 to 60 m. east of the Missouri river. In the north it forms the water-parting between the streams that run into the Missouri river and thus to the Gulf of Mexico and those that flow into the Mouse or Souris river and are carried to Hudson bay. For a long period this escarpment marked the division between farming lands of the east and grazing lands to the west, but dry-land farming methods have created many farming communities west of the ridge wherever the surface of the land is favourable.

As the Missouri river marks approximately the lower edge of the ice sheet and west of this stream the region is almost free from glacial deposits, a marked contrast in the nature of the country is presented. The sands and clays west of the river are fine and soft, and as there is scant vegetation to protect the hillsides they are easily eroded by the rains and winds. Much of the region is so cut by deep coulees and sharp embankments and travelling is so difficult that the early French explorers called the region *les terres mauvaises*, and in its English equivalent, "the bad lands," this appellation still remains. The picturesque effect of the sculpturing by wind and rain is enhanced by the brilliant colours along the faces of the hills and ravines—grey, yellow, black and every shade of red and brown. Here and there black seams of lignite coal protrude. Here too are found petrified forests, and other fossilized evidences of a vegetation and animal growth which long ago disappeared. While the lands are not inviting to the farmer, the ranchman finds deep grassy valleys which provide good winter shelter for his cattle. The "bad lands" are best developed along the principal tributary of the Missouri in this region, the Little Missouri river, together with its numerous branches, but they are by no means confined to that drainage basin. Other important tributaries of the Missouri from the west are the Knife, Heart and Cannonball rivers. A feature of this south-western portion of the State is the large number of buttes rising 400 to 700 ft. above the general level so as to form prominent landmarks, those best known being Black Butte, Sentinel Butte, Camel's Hump and Killdeer mountain.

In North Dakota, except where they have been planted by the farmers, trees are found only in the Turtle mountains, a group of high hills near the Canadian border, in the region about Devil's lake, in the vicinity of streams, and in a few other places sheltered from the wind and sun. The woodland area of the State is estimated at but 600 sq.m., or less than 1% of its entire surface. The prairies of the more humid regions are covered with valuable grasses, and with masses of showy native flowers which bloom from spring to autumn. Cottonwoods flourish along the Little Missouri, and stunted cedars and junipers grow in the sheltered ravines of the "bad lands." Cactus and sage brush in this region are also common.

Climate.—Since there are no mountains, forests or large bodies of water to have a moderating effect, the climate is strikingly uniform over various portions of the State. Great extremes of temperature are likely to be encountered in any part of the State, but the dryness of the atmosphere makes them easier to bear. The seasons are sharply demarked; both winter and summer come rapidly. The summers are short, but long hours of sunlight make the vegetation grow rapidly. Killing frosts sometimes occur in May and return again in September. High winds are frequent and prairie houses are protected by rows of trees planted as "wind breaks." Tornadoes are not unknown, and hail storms are frequent in summer. During the growing season the winds are usually light; but in the late summer occasional dry, hot winds from the south prove very destructive to crops. The average rainfall for the State is 18 in. and is well distributed, but generally decreases east to west from 22 in. in the Red river valley to about 14 in. along the western boundary. While below normal for humid regions, the greater part of the rain comes in the spring and summer so that the crops receive full benefit. The snows are light, and the prairies are often swept bare by high winds so that cattle may graze throughout the winter.

Government.—The State is governed under its Constitution of 1889, as subsequently amended. Previous to 1918 the Constitution required that a proposed amendment pass two successive legislatures before it could be submitted to the people for ratification, but in that year the 28th amendment made it necessary that it pass but one. This amendment also gave the voters of the State the power of proposing amendments by an initiative petition which must be signed by 20,000 voters before the amendment can be voted upon. Another amendment in 1918 gave the voters power to initiate legislation (the initiative petition to require the signature of 10,000 voters), and the power of referendum (the referendum petition to require the signature of 7,000 voters). The veto power of the governor does not extend to measures initiated or referred to the electors and thereupon passed. Amendment 33 gave the electors the power of recalling any elective congressional, State, county, judicial or legislative official, the recall petition to contain the signatures of at least 30% of the voters voting at the preceding election. The legislative assembly of the State is composed of a senate and a house of representatives with a member-



PROPORTION OF FARM LANDS IN NORTH DAKOTA, 1900–1925

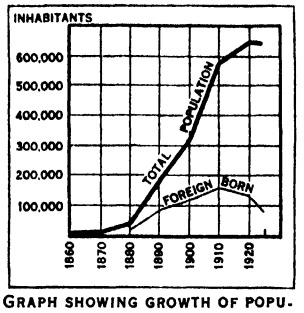
ship respectively in 1927, of 49 and 113 members. Senators are elected for four years and representatives for two years. The assembly meets the first Tuesday after the first Monday in January in odd-numbered years.

The executive officers who are elected are the governor, lieutenant governor, secretary of State, auditor, treasurer, attorney general, commissioner of insurance, commissioner of agriculture and labour, superintendent of public instruction and three railroad commissioners, all serving a two-year term. The executive department includes some 50 boards or commissions whose members are partly elected officials, whose service on these boards is part of their *ex-officio* duties, and partly officials appointed by the governor. The governor appoints a tax commissioner, adjutant general, State engineer, State mine inspector, State examiner, three members of the board of administration (into which the board of control, board of regents and board of education were merged in 1921) and members of many professional examining boards. Since 1919 when the industrial programme of the Non-partisan League was put into operation, one of the most important boards, composed of the governor, commissioner of agriculture and labour and the secretary of State, has been the industrial commission, which has the management of State industries and enterprises, including the Bank of North Dakota and the North Dakota Mill and Elevator, in its hands.

The supreme court of the State, having appellate jurisdiction only, is composed of five justices elected for six years each. A term is held on the first Tuesday of every month in the year, except July and August. There are six judicial districts in the State. The 1st, 2nd and 6th have three justices each, while the others have but two each, all elected for a term of four years. There are probate courts in each county, and justices of the peace in each township and village. Some cities are provided with police courts.

Population.—With homesteaders spreading over the prairies, the population increased from 36,909 in 1880 to 190,983 in 1890, 319,146 in 1900, 577,056 in 1910 and 646,872 in 1920. The influx then halted, the 1925 census showing but 641,192 inhabitants. The density per square mile was 9·2 in 1920. Of the total population in 1920, 98·9% was white. Indians numbered 6,254 or almost 1%, while negroes numbered 467 or 0·1%. The Indians belong

mainly to five tribes, the Chippewa living in the Turtle mountains, the Mandan, Gros Ventre or Hidatsa, the Arikara tribes at the Ft. Berthold agency, and the Sioux, or Dakota, at Devils lake and Standing Rock agencies. Of the white population in 1920 131,503 or 20·5% were foreign-born. The most important countries of origin represented were Norway, 38,190; Russia, 29,617; Canada, 15,550; Germany, 11,960; Sweden, 10,543 and Denmark, 4,552. Of the 79·5% native-born, 31·9% are of foreign parentage and 15·1% of mixed parentage—percentages greater than in any other State of the Union.



GRAPH SHOWING GROWTH OF POPULATION IN NORTH DAKOTA, 1860–1925

Of the total population but 88,239 were inhabitants of cities of 2,500 or over. This urban percentage of 13·6 is lower than in any other State except Mississippi, and shows how pre-eminent are the agricultural interests of the State. Bismarck, the capital city, had a population in 1925 of 9,150, an increase of 2,038 over 1920. Fargo, the chief city, numbered 24,921 inhabitants in 1925 while the other cities of importance and their population in the same year were: Grand Forks, 15,168; Minot, 12,245; Jamestown, 7,230; Devils Lake, 5,409; and Mandan 5,068.

Finance.—The gross wealth of North Dakota was estimated by the Federal Census Bureau at $2,467,300,300 in 1922. In its per caput wealth of $3,692 the State ranked seventh among the States. The assessed valuation of property in 1928 amounted to $1,323,038,508. Real estate composed 72·52%, live stock 3·55%, farm implements and machinery 2·09%, manufacturing machinery and tools ·09% of the assessment valuation. All structures and improvements on farms are exempt from taxation but, nevertheless, farm property paid approximately 62% of all taxes levied in 1927. On the 1926 valuation a total of $29,165,310 in direct taxes was levied, 14·49% by the State, 22·95% by counties, 8·13% by townships, 46·21% by school districts and 8·22% by cities and villages. Besides the general property tax an increasing amount is collected by special taxes. An inheritance tax law was enacted in 1913, a motor vehicle licence tax in 1917, income, gasolene taxes and a gross earnings tax on car companies in 1919 and a cigarette tax in 1925. The income from special taxes in 1928 was $4,372,218. The total tax burden in 1925 amounted to $49.63 per caput, a decrease from $54.17 per caput in 1921.

Receipts of the State Government in the fiscal year 1927–28 amounted to $35,134,694, while expenditures were $21,719,565. On June 30, 1928, the total outstanding State debt was $34,857,500. Approximately $28,000,000 of this was in the form of rural credit bonds, the proceeds of which were loaned in turn to the farmers. These bonds are secured in all cases by first mortgages and the State only stands as surety for their payment. Aside from the rural credit bonds the State has bonds for $6,500,000 used to construct and finance its various industrial enterprises, notably the Bank of North Dakota and the State Mill and Terminal Elevator. If these enterprises become a financial success they will retire their own bonds and taxes for the purpose will not be necessary.

There were, Oct. 30, 1928, 134 national banks, 348 State banks and 3 trust companies. Their total resources and liabilities amounted to $175,883,104; loans and discounts to $92,543,647; capital, surplus and undivided profits to $17,414,707. Of the $147,106,336 deposits $45,152,920 were in savings accounts.

Education.—Public schools of secondary rank are under the control of the State department of public instruction, while the State institutions of higher learning are supervised by the State board of administration.

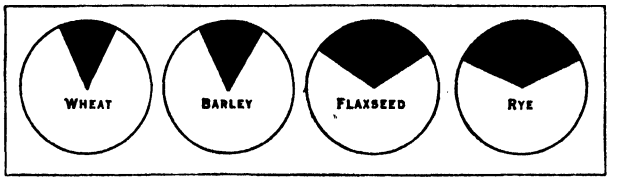
In the secondary school system of North Dakota there were, in 1928 4,357 one-roomed schools, 199 consolidated rural schools of more than one room and 533 graded schools in towns or cities. In the school year ending in June, 1928, there were 172,539 pupils enrolled, of which 69,526 were in rural one-roomed schools, 9,911 in rural schools of more than one room and 93,102 in city and town schools. The number of teachers in the public schools was 8,380, of whom 4,808 were employed in country schools. The average monthly wage paid to those in rural one-roomed schools was $86.76 and to those in city and town schools, $133.40. The high school enrolment was 26,820 in 1927. The total revenue for the public school system amounted to $23,278,408 in the year ending in June, 1928, of which $12,152,072 or 52% was raised by local district taxes. The educational cost per pupil averaged $9.41 a month for the school year.

The University of North Dakota, with 2,608 students and 160 teachers in 1928, is situated at Grand Forks and composed of a college of liberal arts, schools of education, law, engineering, medicine and commerce, a graduate division and an extension division. The State Agricultural college at Fargo had, in 1927–28, 2,057 students regularly enrolled. There are State teachers' colleges at Valley City, Mayville and Minot, all giving four years of college work, with an enrolment in 1927–28 of 2,047, 1,015 and 1,832 students respectively. A State normal school at Dickenson had an enrolment in 1927–28 of 751 while the State normal and industrial school at Ellendale registered 644 students. At Wahpeton is a State school of science, which operates as a trade school and junior college, giving instruction in the electrical trades, plumbing, bricklaying, printing, auto mechanics, dressmaking and business courses. The State school of forestry is at Bottineau and gives work of a junior college grade.

There were but two private institutions of higher learning in 1926–27, Jamestown college at Jamestown, and Wesley college at Grand Forks. All institutions of higher learning, both public and private, in North Dakota are co-educational.

Charities and Corrections.—The State board of administration has general control over a State penitentiary situated at Bismarck, a hospital for the insane at Jamestown, an institution for the feeble-minded at Grafton, a State training school at Mandan, a school for the deaf at Devils Lake, a school for the blind at Bathgate and a State tuberculosis sanatorium at Sun Haven, Dunseith. There is a soldiers' home at Lisbon which is not under the control of the board. There is a State children's bureau which licenses and regulates hospitals and lying-in-places which receive maternal cases and institutions which receive children for temporary or permanent care. The bureau investigates homes into which children are placed for care or adoption, and co-operates with the juvenile courts in investigation of delinquents, with the county commissioners in administering the mother's pension law, and in general works to enforce the child labour and all other laws relating to abuse or neglect of children.

Agriculture and Live Stock.—Probably no other State in the Union depends so exclusively upon agriculture as a means of livelihood as does North Dakota. Of its total area 76·4%, or 34,327,410 ac. is classified as farm land. Of its population 58·2% (exceeded only in Mississippi) actually live on farms, and the



PROPORTION OF TOTAL UNITED STATES CROPS OF CERTAIN GRAINS RAISED IN NORTH DAKOTA, 1927

population of the small towns is almost entirely dependent upon farm trade for its support. The value of all crops was estimated in 1919 at $286,249,403, in 1924 at $358,200,000 and in 1927 at $274,700,000, 1924 representing an unusually good year and 1927 an average one. The value of live stock upon farms amounted to $157,034,635 in 1920 and $94,302,899 in 1925. All farm property was valued in 1925 at $1,191,036,966, a decrease of about $570,000,000 from the inflated valuation of 1920. The decrease was due mainly to the decrease in value of land from an average of $35.33 per acre in 1920 to $23.70 in 1925. The hardships suffered

during the period of agricultural depression were represented in a decrease of farm population from 394,500 in 1920 to 372,886 in 1925 and a decrease in the number of farms operated by owners from 56,917 to 49,513. Of the latter 63·8% in 1925 were reported mortgaged, the average debt being $5,284.

North Dakota is divided into three very distinct farming belts. The black-earth belt occupies nearly half the State covering all east of a line drawn from the southern boundary at Dickey county north-westward to Rolette county on the Canadian border, and also including a small area in Divide and Burke counties in the north-west. In this zone the soils are dark, moisture conditions are favourable, production is the highest for the leading crops and the size of farms (averaging 480 ac.) is generally smaller than in other parts of the State. West of the black-earth belt, extending a short distance west of the Missouri river and including also the greater part of McHenry and Bottineau counties to the north is the farming-grazing belt. This is, in general, rougher in topography with soils somewhat lighter and production about 20% lower than in the black-earth belt. The average size of farms in this division is 640 acres. In the south-western quarter of the State is the grazing-forage crop belt. The region is hilly, the soils are residual in origin and the rainfall is less than in other parts of the State. The size of farms in this section averages 800 ac. and less than 30% of the farm land is devoted to crop production.

The main crop of North Dakota is wheat in the production of which the State ranked first among the States in 1925 and second in 1927 with 112,387,000 and 94,268,205 bu. respectively. Its value for 1925 and 1927 was $147,215,000 and $125,973,000. Slightly less than 50% of the crop area of the State was devoted to this crop, varying from 35 to 42% of the acreage in the east to 60% in the west. North Dakota wheat has a high protein and gluten content and commands a premium in the market. Oats in 1927 occupied about 9% of the crop area, being somewhat more important in the northern than in the southern part of the State. The value of the crop was $34,408,000 in 1926 and $16,990,000 in 1927. About 8% of the crop area in 1926 was devoted to barley, in the production of which the State ranked first in 1925 and third in 1926. Its value in 1927 was $25,020,000. In the growing of rye North Dakota leads all States with a production in 1925 nearly triple, and in 1926 almost double, that of its nearest competitor. In 1927 14,047,000 bu. with a value of $18,450,000 were harvested. North Dakota also led in the production of flax in 1927 with a crop valued at $18,379,000. Indian corn showed marked increase in acreage from 1920 to 1924 but decreased slightly in 1926 and 1927. In the latter year 959,000 ac. produced 23,975,000 bu. valued at $14,864,000. It is relatively more important in the south-eastern portion of the State together with an area in Burleigh and Morton counties. Tame hay occupied about 5% of the crop area and was relatively more important in the western and south-western parts of the State. A great amount of wild hay is also harvested, the value of the latter in 1927 being $8,670,000 and the former $15,155,000. Potatoes are generally of excellent quality. In 1927 7,045,993 bu., valued at $5,763,000, were raised. The average yield per acre for the leading grains during a period extending from 1909 to 1928 was approximately as follows: Indian corn 25 bu., wheat 17 bu., oats 26 bu., barley 20 bu., rye 13 bushels. Deficient moisture is the most important cause of damage to grain, especially in central and south-western North Dakota, while in the south-east wheat is subject to rust.

The raising of grain is supplemented on most farms by the raising of live stock. This becomes the major industry in the grazing-forage belt south-west of the Missouri. Beef cattle, sheep and horses are found in increasing numbers from east to west across the State. Swine are found mainly in the south-east where a large proportion of the corn is raised. They numbered 652,000 in 1928 valued at $26,064,000. Dairying showed a vigorous growth between 1916 and 1927, the number of dairy cows increasing from 221,016 to 365,038. The amount of butter made in creameries increased from 3,210,767 lb. to 33,034,625 lb. and the amount of butterfat marketed through cream stations from 5,777,687 lb. to 31,668,990 pounds. The beef cattle business was slow in recovering from the depression following the World War but there was a notable improvement in 1927. Sheep showed a quicker recovery than any other branch of the live stock business, the number increasing from 203,000 in 1922 to 399,000 in 1925 and their value from $945,000 to $4,074,000. Wool production in 1926 amounted to 2,772,000 lb., or 8·3 lb. per fleece.

Mining.—North Dakota is not a metal-producing State, but it possesses extensive coal and clay deposits which are sure to become more widely developed and prove of great economic value.

Lignite coal deposits of varying thickness underlie no less than 32,000 sq.m. of surface in the western half of the State. The U.S. Geological Survey estimates that of total lignite deposits of 965,902 million tons in the United States 633,329 million are in North Dakota, and about 500,000 million are capable of being mined. Beds 6 to 8 ft. thick are common. In places they lie so close to the surface that the overlying soil can be stripped and the coal mined in open cuts; in other places the room and pillar method is used. In 1927 there were 231 mines in operation of which 146 were underground. The coal output amounted to 1,529,154 tons valued at $2,762,000. The increase in production is shown by comparison with 416,580 tons in 1910 and 878,969 tons in 1920. An economically practicable briquetting process has been perfected which doubles the heat value of the coal, makes it less liable to deterioration and more convenient to handle.

Clay is found in a large number of varieties ranging from common brick through tile to high grade art pottery clay. Deposits are large especially in the western part of the State where they are found near lignite beds, a proximity which enhances the value of both. Clay products in 1927 were valued at $150,000. The great gravel deposits of the State, found mainly in the ridges of glacial moraines, are becoming increasingly important with the construction of modern highways.

Manufactures.—Though in 1925 North Dakota had less manufacturing than any other State except New Mexico and Nevada, this branch of industry was showing a rapid growth. There were then 320 establishments employing 3,261 wage-earners and producing products valued at $44,631,516. The most important products were those closely connected with agriculture, namely, butter, cheese, condensed and evaporated milk products to the value of $14,786,842 and flour, feed and other grain products to the value of $16,052,922.

Transportation.—The State is crossed east and west its entire length by two transcontinental railways, the Great Northern and the Northern Pacific. Another transcontinental line, the Chicago, Milwaukee and St. Paul cuts across the south-western corner, while the St. Paul and Sault Ste. Marie runs from the south-west corner diagonally north-westward to make a transcontinental connection with the Canadian Pacific at the Canadian border. Branches of these main lines intersect the wheat-raising areas in every direction. The railroad mileage increased from 4,201 in 1910 to 5,311 in 1920 but fell to 5,284 in 1927.

There were in 1928 106,498 m. of rural roads and 7,500 m. in the State highway system. Of the latter about one-half was earth graded and provided with drainage and 1,980 m. were surfaced with gravel. Motor vehicles registered increased from 24,908 in 1915 to 90,840 in 1920 and 160,978 in 1927.

History.—Frenchmen of an expedition led by Pierre de la Verendrye crossed from the Assiniboine river in Canada to the Missouri river in 1738 searching for a "river to the west" and were probably the first Europeans in North Dakota. Two of Verendrye's sons returned in 1842 on the same mission but after months of wandering in the region south-west of the Missouri they also were forced to give up their quest and return. After 1790 this journey overland from the Assiniboine to the Missouri became common, parties of traders making the visit nearly every year to trade with the Indians for furs. Also after 1790 penetration of the Red river valley in eastern North Dakota was commenced by North-west and Hudson bay traders. Charles Chaboillez in 1797 established the first North Dakota trading post on the Pembina river near its junction with Red river, but it was soon abandoned. Alexander Henry, Jr. built a post in 1800 near the mouth of Park river which he occupied until 1808, and shortly after John Cameron built a post on the site of the present East

Grand Forks.

After North Dakota, as a part of Louisiana territory, was acquired by the United States in 1803, exploration by that country commenced. The first Government expedition was that by Lewis and Clark which ascended the Missouri in 1804 and spent the winter at the Five Villages of the Mandan and Hidatsa tribes, pressing onward into Montana in the spring of 1805. Their return in 1806 stimulated the interest of St. Louis fur traders in the region, one of whom, Manuel Lisa, ascended the river in 1807 and opened trade relations with the Missouri Indians. His traders or those of his rivals thereafter ascended the river annually.

All of the tribes of Dakota were now in touch with the white man and the next 50 years, 1820–70, is largely a story of the fur trade, and of the attempts of various companies to secure themselves against the encroachments of their rivals. Despite the Treaty of Paris in 1818 which established the international boundary at the 49th parallel, the British long maintained their influence among the Indians of lower Red river valley, the Mouse river and Turtle mountain regions. On the Missouri the trade, after 1828, was monopolized by the American Fur company which built Ft. Clark at the mouth of Knife river, Ft. Union near the mouth of the Yellowstone and in 1831 introduced the steamboat on Missouri waters. The Columbia Fur Company also established a number of posts from the Red river to the Missouri but was forced to sell out to the American Fur Company in 1827.

The first genuine settlement of home-seekers in North Dakota in this period was made by a band of settlers from Lord Selkirk's colony of Scottish Highlanders in Manitoba who migrated south of the boundary line and settled at Pembina in 1819. When Maj. Stephen H. Long, leading the first United States exploring expedition into the Red River valley in 1823, visited the place, the population numbered 600. Communication was soon established and trade opened between this colony and American settlements at Ft. Snelling and Prairie du Chien on the upper Mississippi river. Cattle and seeds were brought in, and cartloads of furs were yearly sent out. Year by year commerce over this Red river trail increased in importance. Ft. Abercrombie was built in 1858 and became a rendezvous for commercial and military operations in the north-west, as well as a rallying point for settlers.

Between 1850 and 1870 there was considerable difficulty with the Dakota Indians, whose lands in Minnesota had been largely appropriated by the whites, and whose buffalo herds on the Dakota prairies were fast being depleted by the hunting activities of traders and half-breeds. The Minnesota outbreak of 1862 was followed by campaigns by Gens. Sibley and Sully in 1863 and 1864 which finally drove the hostile Dakotas to the "Bad lands" west of the Missouri river. All eastern North Dakota was now open for occupation and the completion of the first railroad to the eastern border in 1871 inaugurated the settlement period in earnest.

The following decade was a period of intensive development in the Red River valley, and by 1880 settlement was spreading out over the area of the drift plain, especially along the line of the Northern Pacific railway which in 1873 had reached the Missouri river at Bismarck. West of the Missouri the country was made safe for cattle-raising by the Indian campaign of 1876–91 which finally broke the power of the Dakota tribes. The completion of the Great Northern railway across the northern part of the State in 1887 opened that region to eager settlers. The region forming North and South Dakota, which since 1861 had been known merely as Dakota Territory was divided in 1889 into a northern and southern half. A convention met in North Dakota in July and framed a Constitution which was accepted by the people in an election held on Oct. 1. President Harrison declared the State's admission to the Union on Nov. 2, 1889.

The years 1890–1915 were years of constant growth in population and intensive railroad development. Competing railway lines strove to forestall each other in tapping promising grain territory. Once there they did their best to bring settlers into the newly opened region by conducting land excursions. Nearly 18,000 immigrants annually for this span of years made new homes in the State. Settlement of the drift plain was practically completed and homesteaders invaded the good land beyond the Missouri river. The inrush continued with little abatement until the World War, after which, because of the general depression in agriculture, it practically ceased.

In politics North Dakota is normally Republican but its farmers have shown a tendency to desert the party in times of agricultural depression for third parties which usually promise more direct and radical remedies. In 1912 North Dakota, holding the first presidential primary election in the United States, showed its preference for La Follette. Resentment which had been gathering for a number of years against constant and wholesale abuses in grading and marketing grain resulted in 1915 in the formation of the Nonpartisan League (*q.v.*), a farmer political organization. This organization was so successful that by 1918 it had elected the governor and a majority of both houses of the legislature and so could carry its programme into operation. An industrial commission was created to manage, operate and control all State-owned industries and business projects created by law, and three major enterprises were established, namely: a Bank of North Dakota, a State-owned and State-operated Mill and Elevator, and a Home Builders' Association. The conservative element was able, in an election in 1921, to muster strength enough to recall the members of the industrial commission; but constitutional amendments and initiated laws, proposed at this election with the intention of overturning the league programme, were defeated, and in 1928 all league enterprises, excepting the Home Builders' Association, were still in operation.

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NORTH DWINA PROVINCE, a unit of the North Eastern region of European Russia, bordered on the west and north by Archangel, on the east and north by the autonomous Komi (Zirian) area, on the south-east by Vyatka, on the south by Nizhniy-Novgorod, on the south-west by Kostroma and on the west by Vologda. It has an area of 106,115 sq.km. and a population (1926) of 678,255, of whom 80% are Great Russians and 18% Zirians. Over 80% of the province is clad with coniferous forest, the cleared areas being mainly along the river banks.

The Dwina and its tributaries, the Sukhona, Yug, Vychegda and Luza, drain the province; the Sukhona is most used for navigation, since it connects via the Württemberg canal both with Leningrad and with the Volga river. There are no bridges except the railway bridge over the Luza river.

Cultivation is most dense in the south, and along the river banks, but, apart from the 80% forest, there is 12·8% of marsh land, so that less than 10% is available for the production of the winter rye, oats, barley, flax and potatoes grown here. There is some meadow and pasture land, and horses, cattle, dairy cattle and pigs are bred, the latter in large numbers. The income from hunting and fishing is small, though the salmon and sterlet of the Dwina river are noted for their quality. Linen is the most important industry and exceeds pre-1914 level, as does production of hemp and jute rope.

In addition to river communications, the railway from Vyatka

reaches Kotlas (*q.v.*), which has wharves and grain elevators, and from which the railway is to be continued to Soroka on the Gulf of Onega, thus providing a further outlet for Siberian grain. From Ustyug-Velikiy (*q.v.*), the administrative centre, at the junction of the Sukhona and Yug, post roads, impassable in spring and autumn, go to Vologda and Nizhniy-Novgorod, and the town has telegraphic links with the south and also as far north as Krasnoborsk. Electrification proceeds rather slowly, though the few town centres have production plants. The peat reserves in the region should prove an asset in the future. The province needs much more intensive colonisation for its full development.

See M. I. Ivanovskiy, *The North Eastern Area* (1926) (in Russian).

NORTHERN AUSTRALIA, a term indefinite but applied generally to that portion of the continent which lies north of the Tropic of Capricorn (*c.* 1,150,000 sq. miles = 0·386 or about $\frac{5}{13}$ of the whole territory), comprises the northern portions of Western Australia (364,000 sq. miles = 0·373 of the State), of the (former) Northern Territory (426,320 sq. miles = 0·814) and of Queensland (359,000 sq. miles = 0·535). Except for a practically continuous belt of coastal lowlands—broader along and up the river valleys of the north-west and north and around the Gulf of Carpentaria (*q.v.*), narrow to the point of disappearance along the north-east—almost the whole of this area consists of tablelands of 500–1,500 ft. general elevation with but few small and isolated higher areas in the west, north-west, north-east and central south. (*See* AUSTRALIA: *Geomorphology.*) Climate is thus the dominant factor and characteristic in this respect are prevailingly high temperature levels, 85°–70° F (*c.* 60° in the central interior) and summer (monsoonal) rainfall: *c.* 60 in. along the north, sinking to 20 in. at about 18° lat. and to 10 in. and less farther inland. Thus, apart from the mineral wealth, of which a probably small part has so far been exploited, the chief economic possibilities would appear to be pastoral development in the drier and more invigorating interior, tropical agriculture in the more humid lowlands and fishing—including pearl-oyster, etc., fishing (*see* BARRIER REEF)—around the coasts. The ultimate commercial and strategic importance of certain parts of the coasts are probably also considerable.

The regional differentiation inherent in so vast an area will increasingly invalidate generalisations about it and the tropical portions of Queensland and Western Australia are best dealt with under those States (*qq.v.*). The area which was till recently called the Northern Territory is on a somewhat different basis, and as it also offers a fair average "cross-section" of northern Australia, a brief account of it is given here.

The area in question extends from the Western Australian to the Queensland border (Longs. 129°–138° E.) and from the north coast—including adjacent islands, *e.g.*, Melville, Bathurst, Groote Eylandt—to the South Australian border (26° S. lat.) and covers 523,620 square miles in all. After a chequered history it was handed over by South Australia to the Commonwealth in 1911, and, as a result of further and on the whole unsuccessful experience, it was subdivided—in March, 1927, under the "Northern Australia Act" of 1926—into North Australia and Central Australia, lying respectively north and south of lat. 20° S., to be administered, from Newcastle Waters and Alice Springs (*q.v.*) respectively, as Commonwealth territories, each by a Government Resident assisted by an Advisory Council of four.

North Australia (287,056 sq. miles) consists mainly of rolling country which rises from the coastal lowlands and valleys to a general level of 500–1,000 ft. inland. In the north is the rather higher (sandstone) tableland of Arnhem Land and on the east and west the land rises gradually to the Barkly Tableland and the Kimberley plateau respectively. In the south the swell of the land forms (17°–20° S. lat.) an almost imperceptible watershed between the coastwards and inwards-flowing drainage. The coast is mostly low, sand-beaches and mangrove mud-swamps alternating with cliffy bluffs, but some fine natural harbours ("drowned" river-mouths) exist (*cf.* Port Darwin). There are two seasons, the wet (Nov.–May) and the dry, and the average ann. rainfall ranges from *c.* 40 in. in the north (Darwin: 62 in.) to 14 in. in the south. Temperatures are high, but the range is greater, the heat is drier and more bearable, and the winters are cooler towards the south (Darwin, av. ann. temp., 85·7°–77·2° F; Daly Waters [300 miles inland], 88·2°–68·6° F [*cf.* Alice Springs *inf.*]). In the wet season the streams are mostly swollen, swift and liable to flood and wide areas in the valley bottoms are then under water while inland are lagoons and swamps (Lakes Woods, de Burgh, etc.). The Victoria, Daly, Roper and McArthur are considerable streams but are normally navigable only in the dry season for small craft (4 ft. 6 in. draught; cargo capacity 35 tons). The valleys are often timbered and open forests occur in parts, but the prevailing vegetation is of the savanna type—grass with scattered trees—merging inland into poorer scrub with soft spinifex in the sandy south-western corner. From Camooweal (Queensland) to Newcastle Waters, in the upper Victoria River basin, and also southwestwards towards Hall's Creek (Western Australia) are broad belts and patches ("many thousands of square miles") of open black-soil (limestone and volcanic) plains bearing first-class fodder grasses (Mitchell, Flinders, etc.) and edible scrubs and here are the principal cattle stations (*e.g.*, Alexandra, Anthony's Lagoon, etc., on the Barkly Tableland; Wave Hill, etc., on the Victoria River). Surrounding these and occupying the bulk of the central belt are great expanses of more mixed country, fairly well grassed and watered and containing good patches. The sandy plateaux of the north and of the coastal margins have many well-grassed valleys and the swampy flats mentioned above. Lateritic and travertine incrustations, products of climatic and soil conditions, render considerable areas unproductive. Water is, generally speaking, available on the surface or in underground supplies and minerals are known to be widely distributed. The chief economic potentialities have been indicated. Efforts towards development have not hitherto been conspicuously successful and a summary of the present (1927) economic and social position will suffice.

Population: Europeans, *c.* 2,300; non-Europeans (mainly Asiatics) 1,050; aboriginals, 20,000. *Land Tenure:* Of the total area *c.* 750 sq. miles have been alienated, *c.* 8,000 sq. miles have been reserved for aboriginals and 1,025 for mission stations, while 160,850 sq. miles are leased for pastoral purposes, nearly one-half (or *c.* ½ of the whole of North Australia) of which is held by six lessees. *Stock* (including Central Australia): cattle, 778,000; horses, 27,800; goats, 12,500; and sheep, donkeys, mules, camels, etc. (Cattle and horses do well; sheep do best on the Barkly Tableland.)

Products:—*Minerals:* output, £16,900 (tin concentrates—mainly Marranboy field—98 tons: £15,800), besides gold, silver-lead, etc. *Fisheries:* Pearl-shell (63 tons): £11,500, besides small quantities of other products. *Nuts and Grains:* ground-nuts (peanuts), cotton, and millet are grown. Coconuts are being cultivated. *Trade:* Exports: cattle and cattle products, £103,500 (Darwin exports £29,800, mainly cattle to Manila; this trade in cattle has since been discontinued). Imports £36,800. *Communications: Railways* (3 ft. 6 in. gauge), from Darwin to Emungalan (199 miles), now being extended to Daly Waters (360 miles). *Bush tracks: c.* 3,500 miles. *Telegraph and Cables:* Darwin overland line southwards (to Adelaide), also cables (3 lines) to Java, Singapore, etc. *Wireless:* Darwin and various cattle stations. *Steamer:* Darwin to eastern (Australian) States, monthly; to Western Australia, every two months. *Inland mail services:* 6-weekly (pack horse).

General Social and Economic Conditions.—Isolation, lack of communications, pioneering conditions, climatic influences have contributed to social and political unrest, lack of balance, and of continuity and stability. Wages have been high, labour scarce and exacting, much effort and expenditure has produced small results. The total cost of the Northern Territory to the Commonwealth (1911–1926) was nearly £9,000,000, including deficits taken over from South Australia (*c.* £4,000,000). Climatic difficulties, though serious, do not appear insuperable, but more attention must be devoted to hygiene (housing, ventilation, diet, etc.) and to economic adjustments and adaptations (*e.g.*, morning and evening hours of work).

Darwin (pop. *c.* 1,400), the temporary seat of the administration, is well built and well laid-out with wide streets, has stone

buildings and amenities (Botanic Gardens, etc.) and a natural harbour capable of improvement. The recently appointed Northern Australian Commission, as a result of careful and dispassionate investigation, report (Dec. 1927): "The reason that North Australia is not more developed than it is to-day is . . . certainly not attributable to a lack of natural resources. . . . Portions of the other States . . . which are now thriving centres, had not, as a foundation, country of as good a class. . . . It is regrettable that people, many of whom are not competent to express an opinion, . . . should decry (it)." There is now hope that a policy of sober, scientific, and consistent development is being inaugurated. It is significant that the first recommendations of the Commission should be directed towards the improvement of communications—railways—particularly the linking of the Darwin-Daly Waters line with the Queensland system via Camooweal—motor roads, stock-routes, ports—notably a port on the Gulf coast at the Sir Edward Pellew Islands to serve the Barkly Tableland and farther interior—besides increased telegraphic, wireless, aerial, and coastal shipping services; towards improved water supply, and hygienic and social facilities (*e.g.*, broadcasting), and towards the initiation of organised scientific research. (*See* CARPENTARIA, GULF OF.)

Central Australia (236,400 sq. miles) is an oblong area lying between latitudes 20° S. and 26° S. and longitudes 129° E. and 138° E. The flat-lying sediments (sandstones, etc.) which were the floor of an ancient (Mesozoic) sea were subsequently elevated and denuded and now form a plateau, highest (*c.* 2,000 ft.) in the centre and sloping down gently eastwards and south-eastwards to the Eyre-Diamantina basin in Queensland and South Australia. In the north an extension of the West Australian "platform" stretches eastwards. (*Cf.* Murchison and Davenport "ranges," *c.* 1,000 ft.) Across the centre lie the Macdonnell Ranges (Mount Heughlin, 4,800 ft.), a series of parallel ridges and troughs composed partly of hard folded (Palaeozoic) rocks, the uptilted edges of the above-mentioned plateau. The main drainage lines originate amidst, and north of, the Macdonnell Range and run south-east (Finke, Todd, etc.) towards Lake Eyre. These streams, during a former rainier epoch, incised their courses to keep pace with the uplift (*v. sup.*) and have sawn through the hard ridges remarkable transverse gorges valuable because of the facilities they offer for routeways and for the impounding of water. To-day the beds contain streams only after rains, the lower courses being normally long tree-lined tracks of water-bearing sand and gravel. The climate is transitional between that of northern and southern Australia and shows continental extremes (Alice Springs [alt. 2,000 ft.]: av. ann. temps. 84°–52·5° F with cool and bracing winters; rainfall occurs throughout the year with summer maximum and variations from 28·5 in. to 5 in.). Mainly steppe country with sparse scrub (mulga, etc.), low scattered growths, and grass in good seasons, the earth lies bare and dust-swept in times of drought except where stream-courses, soaks, and water-holes afford a little moisture. Clay and stone desert patches occur and in the little-known north-west and south-west, and again in the east, are areas of sandridge, spinifex, saline flats (Lake Amadeus), and some scrub. In the more humid north-west are areas of seasonal swamp. (*Cf.* North Australia.) After rains the country is transformed as by magic; flowery grasslands spread like seas to the horizon, streams and pools sparkle, life awakens and flourishes for a space. Apart from a little agriculture for home needs—some of it possibly by irrigation—the economic future seems to lie mostly in the direction of pastoralism and mining. Minerals—gold (*e.g.*, Arltunga), mica, nitrates—a recent discovery—exist, the mica deposits being particularly valuable. Erratic rainfall, rabbits and dingoes are the bane of the pastoralist and little stability can be obtained until water-resources—superficial and underground—have been tested and supplies assured. Some 76,000 sq. miles have been let under pastoral leases or grazing licences but as in North Australia the conditions of land tenure seem to need revision. Given water—horses, sheep, cattle, and live stock generally thrive, as do also human beings, in the climate. (Live stock: *c.* 117,000 head—including 85,000 cattle, 15,000 horses.) But costs of all necessities—including fencing and mining machinery—have been prohibitive. Transport has been by camel, horse or mule train, but motor traction is possible and is increasing. The overland telegraph line traverses the heart of the area and along it—with its Government wells—lies the chief route for stock and men. Apart, too, from a few mining, cattle, and mission stations and blacks' encampments, practically all the population (Whites: *c.* 410; aboriginals: *c.* 4,000) lives in telegraph stations along this route. The railway line (3 ft. 6 in. gauge) from Oodnadatta (South Australia) is under construction and this will bring Alice Springs (*q.v.*) within 60 hours (*c.* 1,000 miles) of Adelaide. Another line may ultimately be built from Alice Springs to the proposed port at the Sir Edward Pellew Islands (Carpentaria, Gulf of, *q.v.*) thus giving the area a northern outlet as well. Central Australia should not be regarded as a desert. With improved conditions of water-supply, transport, fencing (against dingoes, etc.), and land tenure its stock-holding capacity, though it will never be high, will probably be very considerable in the aggregate. In particular new sheep areas await development here and facilities for movement (railways, stock-routes, etc.) will help to combat drought. The mineral wealth is a further asset and when social amenities improve, Central Australia will prove a far from negligible national possession.

NORTHERN PACIFIC RAILWAY. The main line of the Northern Pacific Railway extends from Ashland, Wis., United States, through the States of Minnesota, North Dakota, Montana, Idaho, Washington and Oregon, to Seattle and Tacoma in Washington and to Portland, Oregon. Its main terminals in the east are St. Paul, Minneapolis, Duluth and Superior; in the west, Seattle, Portland and Tacoma. It was constructed under an Act of Congress approved by President Lincoln on July 2, 1864. With its completion in 1883 the vast territory adjacent to it was first made accessible to settlers, and the Government's long-cherished aim of opening to the North Pacific coast a route following, roughly, that taken by the explorers Lewis and Clark in their expedition of 1804–06, was at length realized.

The Northern Pacific system consisted in 1928 of about 6,750 m. of operated railroad. It owned also nearly one-half of the stock of the Chicago, Burlington and Quincy Railroad company, and exactly one-half of the stock and bonds of the Spokane, Portland and Seattle Railway company, operating together 11,000 m. additional. A large part of the tonnage which it carries consists of the products of agriculture and of the forest; but its traffic is well diversified and its earnings, under normal conditions, are comparatively stable. It has outstanding 2,480,000 shares of stock of a par value of $100 each. Its bonded indebtedness in 1927 was $318,000,000. (C. DON.)

NORTHFIELD, a city of Rice county, Minnesota, U.S.A., on the Cannon river 35 m. S. of St. Paul. It is on Federal highway 65, and is served by the Chicago Great Western, the Chicago, Milwaukee, St. Paul and Pacific, the Minneapolis, Northfield and Southern, and the Rock Island railways, and by motor-bus lines. Pop. (1920) 4,023. It is the seat of St. Olaf college (Norwegian Lutheran, 1874) and of Carleton college (Congregational, 1866). The Goodsell Observatory of the latter gives the time to the railroads over a wide area, through signals sent out daily by the radio broadcasting station of the department of physics. Northfield is surrounded by a rich farming and dairying region, where the breeding of Holstein cattle is an important specialty. It was settled in about 1851; named after John W. North, who planned it and several other towns; and chartered as a city in 1875.

NORTHFIELD, a village of Washington county, Vermont, U.S.A., in the Green mountain region, 10 m. S.S.W. of Montpelier; served by the Central Vermont railway. Pop. (1920) 1,916. It is the seat of Norwich University, founded in 1819 at Norwich (Vermont) by Capt. Alden Partridge (1785–1854), who had been a professor in the U.S. Military academy at West Point and its acting superintendent, and who became the first president of the new institution, serving until 1843. In 1866, after a fire had destroyed its buildings at Norwich, the university moved to Northfield. The charter requires "a course of military instruction, both theoretical and practical," and the discipline is military in

form and principle. The enrolment in 1926–27 was 331. This was the pioneer engineering school in the country.

NORTHFLEET, an urban district of Kent, England, on the Thames, 22 m. E. by S. of London by the S.R. Pop. (1921) 15,720. The church of St. Botolph is of Norman foundation, but the nave is Decorated and the chancel Perpendicular, and the tower, having fallen down, was rebuilt in 1628. The church contains a brass of the 14th century. The nave and chancel have undergone modern restoration. Besides chemical manufactures, there are paper mills, iron foundries, rubber works, chalk, lime, cement and brick works, docks and a shipbuilding yard. Swanscombe almost adjoins Northfleet on the south-west. Its name is said to be derived from a camp formed here by the Danish king, Sweyn, and tradition fixes at this spot the meeting between William the Conqueror and the men of Kent, to whom was confirmed the possession of all their ancient privileges.

NORTH HOLLAND, a Netherlands province, lying between the North sea and the Zuider Zee, and bounded southward by the provinces of South Holland and Utrecht. Three of the great new polders (*see* NETHERLANDS: *Impoldering*) will extend into the Zuider Zee from its eastern shore. The present area, including the islands of Texel, Vlieland and Terschelling, in the West Frisian group, as well as Wieringen, Marken and Urk in the Zuider Zee, is 1,065 sq.m. with pop. (1926) 1,420,098, showing an increase during the 20th century from 905 per sq.m. to 1,334 per sq. mile. Three natural divisions can be recognized: (1) foreshore and sand-dunes, (2) inner dunes and the *geest* grounds, (3) low fens and clay lands. (*See* NETHERLANDS: *Coast.*) The dunes form a long, smooth, unbroken protection for the other regions, and the absence of deep inlets explains the absence of commercial towns. Ijmuiden is a small town and its recent creation was solely dependent on its position at the exit of the artificial North sea canal from Amsterdam. Nevertheless, the broad, gently-sloping, sandy beach is admirable for sea-bathing, and permits the beaching of the characteristic flat-bottomed fishing boats used at Zandvoort and at smaller fishing villages. Bergen aan Zee, Egmond aan Zee and Wijk aan Zee are gay little unconventional resorts, the growing coastal children of the aged parent villages further inland. In the second zone, behind recently planted woods, especially along the margin of the *geest* grounds, from about 5 m. N. of Haarlem to 10 m. S., hyacinths, tulips, narcissi and crocuses, in exact squares of brilliant and varied colours, attract numerous tourists each spring-time, while market gardens provide valuable and continuous products for home and foreign trade.

This part of North Holland was early inhabited and contains many old towns and villages. Some of the most interesting are Haarlem (pop. 89,500), the seat of government of the old counts of Holland, and the scene of the great resistance of 1573—one of the most glorious failures in history. Near to Haarlem are the extensive red brick ruins of Brederode castle, the seat of an old and illustrious family. Nearer to the south border is Bennebroek, the site of a 10th century nunnery. Alkmaar (*i.e.*, all water), (pop. 27,300), though originally belonging to the lowland zone, also has important historical associations, including its personal success against the Spaniards in the Eighty Years' War. Near Alkmaar are Schoorl—a village in the 9th century—Bergen, also of considerable antiquity, Heiloo, stated to be the site of a church built by St. Willibrord in the 8th century, and the villages of Beverwijk and Velsen. Other possessions of the same apostle still remain, while Egmond, near by, was famed for its great abbey. Nearer Helder (pop. 30,000) is Schagen, a flourishing village in the 12th century, a lordship in the 15th, but of no special importance to-day.

The third division comprises much the largest area, that lying at or below sea-level. Considerable land reclamation has been effected. To the north of the former Y (or Ij) the famous Purmer and Beemster lakes were drained in the beginning of the 17th century; but several sea-polders to the north of these were added to the mainland only in the first half of the 19th century. This region is traversed by the 46 m. North Holland canal (1819–25), between Amsterdam and Helder. The Y, formerly an inlet of the Zuider Zee, was drained, and the direct east to west 15 m. North sea ship canal was cut in its stead (1865–76); in the south, Haarlem lake (72 sq.m.) was drained between 1840 and 1853. The landscape in this lowland division is more typically Dutch than elsewhere. The province is very poor in minerals, consequently cattle-rearing and cheese manufacture (chiefly Edam) are the main industries, but agriculture and even market-gardening are also practised in the heavier clay lands of the polders. Purmerend, the natural focus of the Purmer, Wormer and Beemster polders, with street and canals too narrow to contain the present market-day produce, Alkmaar, the great cheese town with a famous weigh-house, and Enkhuizen, one of the "dead cities" of the Zuider Zee, are the chief market centres. The security offered by the Zuider Zee for trade and fishing was the prime factor in the commercial development of North Holland, and the cities of Medemblik, Enkhuizen, Hoorn, Edam and Monnikendam, though now of little more than local importance, possessed a large foreign commerce in the 16th and 17th centuries. This prosperity later concentrated itself upon the Y (that is, upon Amsterdam, *q.v.*) and upon the series of industrial settlements situated on its offshoot, the Zaan, of which Zaandam (pop. 30,000, with oil, saw, corn, cement and paper mills) is the most important.

Of the islands: Marken is rapidly learning how to commercialize its own quaintness, though it is not yet entirely spoiled; microscopic Urk has a population (about 3,000) largely dependent on the North sea fishery. Texel is noted for sheep and their products: wool and green cheese, and also for sea-birds' eggs, which are exported to Amsterdam. Vlieland and Terschelling are but slightly populated and relatively unimportant.

NORTHINGTON, ROBERT HENLEY, 1ST EARL OF (*c.* 1708–1772), lord chancellor of England, was the second son of Anthony Henley, a Whig member of parliament, and a well-known wit and writer. Robert was educated at Westminster school and St. John's college, Oxford; and was called to the bar in 1732. In 1747 he was elected member of parliament for Bath, of which he became recorder in 1751. He acquired a lucrative practice at the bar, and in 1756 was appointed attorney-general. In the following year he was promoted to the office of lord keeper of the great seal, being the last person so designated. For three years he presided over the House of Lords as a commoner, having incurred the hostility of George II. He was given the title of Baron Henley in 1760 so that he could preside at the trial of Earl Ferrers for murder. On the accession of George III. the office of lord chancellor was conferred on Henley, and in 1764 he was created earl of Northington. In 1765 he presided at the trial of Lord Byron for killing William Chaworth in a duel. Northington, who was a member of the group known as "the king's friends," was instrumental in procuring the dismissal of the marquess of Rockingham and the recall of Pitt to office in 1766, and he himself joined the government as lord president of the council, Lord Camden becoming chancellor. He resigned office in 1767, and died at his residence in Hampshire on Jan. 14, 1772.

See Lord Henley, *Memoir of Robert Henley, Earl of Northington* (1831); Campbell's *Lives of the Chancellors;* Foss's *Judges of England;* Horace Walpole's *Memoirs.*

NORTH LITTLE ROCK, a city of Pulaski county, Arkansas, U.S.A., on the Arkansas river, opposite Little Rock; served by the Missouri Pacific, the Rock Island and the St. Louis Southwestern railways. Pop. 14,048 in 1920, 35% negroes. It is practically an industrial district of Little Rock, with extensive railroad shops, hardwood lumber mills and other manufacturing industries. The factory output in 1925 was valued at $8,609,157.

NORTH PACIFIC COAST INDIANS. The Indians of the coast of southern Alaska, British Columbia, Washington, Oregon and northern California form a unit which has been recognized as distinct from other natives of North America. The principal tribes and stocks comprised are the Tlingit, Haida, Tsimshian, Kwakiutl, Nutka, Bella Coola and other Coast Salish, Chimakun, Makah, Chinook, Yakonan, Kus, Takelma, Yurok, Wiyot, Karok and the Hupa and other Athabascan groups. There is linguistic diversity, but the area lacks the usual Mexican features: agriculture, pottery, metallurgy, axes, shields, drums, sweat-houses, political organization, religious structures and altars,

group fetiches. Cultural stimulus has been derived from the backward tribes of north-east Asia, rather than from China and Japan. The culture is vigorously local and therefore complex. It is characterized by the following generic traits: dependence primarily on fish, especially salmon; coastal maritime navigation; development of wood working, including the carver's art; wealth accumulation, with an elaborate system of economic exchange and property law; the organization of society on the basis of hereditary rank dependent on economic status; religious cults heavily influenced by proprietary rights. Particular traits exemplifying these trends are: deep-sea fishing; whale hunting; large dug-out canoes with plank lashings for higher freeboard; mat sails; clothing largely of mats, with basketry hats; twined basketry with overlay decoration; villages of large, all-frame houses facing the beach or a river; totem poles and wooden grave monuments; boxes for cooking, storage, etc.; clubs, spoons, and most utensils, also rattles, masks, etc., elaborately carved or painted in a peculiar totemic-symbolic art style; dentalium shells, plates of native copper, boxes, etc., serving as standardized media of exchange, often with high fictitious credit values; potlatches or competitive socio-religious festivals with wealth distribution for prestige; loans with high rate of interest; division of society into rich nobles with titles, crests and privileges, commoners and slaves; marriage by purchase; secret religious societies with elaborate ranks and masks. The secret societies extend south to Juan de Fuca, the potlatch to Columbia river; the basic elements of the culture—canoes, frame houses, dentalia, wealth display and ranking, slavery—persist as far as northern California.

See P. E. Goddard, "Indians of the Northwest" (*Amer. Mus. Nat. Hist.*, 1924); also *Monographs* by F. Boas, G. M. Dawson, M. Eells, G. T. Emmonds, G. Gibbs, P. E. Goddard, E. Gunther, C. Hill-Tout, G. Hunt, A. Krause, A. L. Kroeber, A. B. Lewis, T. F. McIlwraith, C. F. Newcombe, A. P. Niblack, E. Sapir, G. M. Sproat, J. G. Swan, J. R. Swanton, G. Vancouver and T. T. Waterman. (A. L. K.)

NORTH PLATTE, a city of Nebraska, U.S.A., 280 m. W. of Omaha. It is on the Lincoln highway, the main transcontinental airway, and the main line of the Union Pacific railroad. The population was 10,466 in 1920, 85% native white, and was estimated at 13,300 in 1928. The city has one of the largest icing plants in the country. The irrigated region raises sugar beet and hay. There is a station of the U.S. Weather Bureau and a State agricultural experiment station 4 m. S. "Scouts Rest," the ranch of Colonel W. F. Cody ("Buffalo Bill") is 3 m. N.W. North Platte was incorporated in 1871.

NORTH SEA, a sea bounded east by the continent of Europe and west by Great Britain. Its area was given by Murray (1888) as 162,600 sq.m., and by Kossinna (1921) as 575,000 sq.km., or 222,000 sq. statute miles. Murray estimated the volume of the North sea at 11,200 cu.m., and Kossinna at 54,000 cu.km., or 12,960 cu.m., giving mean depths of: 61 fathoms (112 metres) and 51·4 fathoms (94 metres) respectively. The North sea is thus shallow; its bed is part of the continental shelf on which the British Isles stand, and it slopes upwards with fair regularity, from north to south. In the south and east there is a broad coastal strip, over which the depth nowhere exceeds 40 metres. In about its middle latitude the Dogger Bank crosses the North sea from east to west, extending for about one-third of the whole distance; near the English coast the depth here is under 20 metres and it increases eastwards to about 40 metres. In one part of the Dogger, where the depth is not more than 13 metres, surf is observed in stormy weather as well as dirty water owing to the bottom deposits being stirred up. South of the Dogger there are local depressions, mostly of small area, in which the depth is as much as 45 fathoms, as in the "Silver pit." A bottom configuration strange to the bed of the North sea is known as "Norwegian channel." This is a gully broad and more than 250 metres deep, closely following the Scandinavian coast, and extending into the Skagerrack, in which the depth increases to as much as 660 metres.

History.—According to Jukes-Browne, the North sea, in its present form, first took shape as a result of the tectonic movements indicated by the break between the older and newer Pliocene deposits. The southern end of the North sea was probably little affected by the general subsidence which occurred during the Glacial period; its boundary in this direction was apparently within the present land area of France and Belgium, while a narrow inlet may have run westwards between France and England in the present position of the Strait of Dover. Meanwhile immense quantities of ice detritus from Scotland and Scandinavia were deposited in the North sea, to a thickness of perhaps 200 metres, and the whole region was subsequently raised above sea-level, constituting the "structural surface" upon which the present river system was developed as a series of tributaries to a great river which formed a continuation of the Rhine. Finally the land subsided again, the plain of the North sea was again submerged.

Coasts.—The coasts of the southern part of the North sea are of no great height. In England they consist of low cliffs with sandy beaches, while on the continental side are immense flats and marshes, with parts below sea-level protected by sand-dunes and artificial dykes. It is not certain whether the rapid changes of coast-line now taking place in many parts are wholly due to the action of the sea or whether a secular sinking of the shores produces this effect. The erosion of the North sea coasts has been made a subject of minute study (in England especially by the British Association and a committee of the Royal Geographical Society), and Harmer has obtained interesting results by comparing the British and continental coasts as characteristic "weather" and "lee" shores.

Temperature and Salinity.—The physical conditions of the waters of the North sea have been extensively studied—since 1902 by expeditions sent out by the Swedish, Norwegian, Danish, German and British governments—under the supervision of the International Council for the study of the Sea (Copenhagen). The waters found in the North sea are classified as follows: (1) oceanic water of 35 *pro mille* salinity or more; (2) water of salinity 34 to 35 *pro mille*, called "North sea" water; (3) water of salinity 32 to 34 *pro mille*, found along the coasts of Holland, Germany, Denmark and Norway, and called "bank-water"; (4) water of 32 *pro mille* salinity or less, belonging to the stream flowing out from the Baltic. The Atlantic water enters the North sea by the passage between the Orkney and Shetland islands, in which way the whole volume of water in the North sea could be recruited in two years. Oceanic or Atlantic water also enters through the Strait of Dover; this inflow is, however, much smaller, and it would take some 20 years to fill the North sea.

Tides.—The tides of the North sea are of great complexity; their nature has been widely investigated during the last 20 years. On the north-east coast of Great Britain the tide runs southward, so that the co-tidal lines, or the lines of equal time of high water, go from north to south; *e.g.*, high water is at 12 o'clock in the Moray firth, it is high water in the Humber five hours, and at Lowestoft nine hours, later. A second tide comes through the Strait of Dover into the southern part of the North sea, and moves to the right side, *i.e.*, the Dutch-German coast, towards the north and the east. A third weak tide flows south-east towards the Norwegian coast. The three systems—the Scottish, the Channel and the Norwegian—meet to the east of the Dogger, so that there the co-tidal lines radiate from this centre. The range of the tides on the Scottish coast is mostly 4 metres and over, on the Dutch-German coast from 2 to 3 metres, and on the Norwegian coast less than 1 metre. (*See* also maps in the article TIDES.)

Fisheries.—The North sea is particularly rich in organisms of all kinds, and the abundance of food attracts fish in such quantities that the North sea fisheries are some of the most productive in the world. Flat fishes, and those feeding at the bottom on smooth ground, are chiefly caught by means of the trawl. The favourite trawling-grounds are the Dogger Bank in winter, and the shallow waters off the Continental coasts in summer. In rough ground, where the trawl cannot be used, hook-and-line fishing is carried on most successfully, and "mid-water" fish are also taken in this way, although the trawl and line fishing overlap considerably. Herring and mackerel are caught by means of drift-nets; herring are also caught by trawling, and in greater quantities than by drifting. The herring fishing off the British coasts exhibits a remarkable variation during summer and autumn, beginning in Shetland in June, and becoming progressively later southwards,

until it ends off the Norfolk coast in November.

The approximate landings of the North sea fisheries amounted in 1924 to 1,069,000,000 kg., consisting of herrings 683,500,000 kg., or 64% of the total catch. Then came haddock 10%, cod 6%, plaice 4%, whiting 3%, mackerel 1%, turbot, sole, halibut, etc. As regards the value of the catch, the North sea herring also came first, but only with 37% of the total value. One of the chief objects of the International Council for the Study of the Sea is to discover the true connection between the varying results of the high seas fishing in the North sea and the changing physio-chemical nature and movements of the waters of the North sea.

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NORTH SEA FISHERIES CONVENTION: *see* FISHERIES, LAW OF.

NORTH SHIELDS, seaport, Northumberland, England, within the municipal and parliamentary borough of Tynemouth (*q.v.*, for history, etc.). The town of that name adjoins it on the east. It lies immediately above the mouth of the Tyne, opposite to South Shields, 7½ m. E. of Newcastle by a branch of the L.N.E. railway. It is a town of modern growth, and in the harbour, there is, between piers, a depth of 29 ft. at spring-tides besides the quays. Coal and coke are largely exported, and corn, timber and esparto grass are imported. There is an extensive fish quay. There are marine engineering (engines, chain-cables, anchors), salt, rope, earthenware and stained glass works and some shipbuilding is carried on.

NORTH TONAWANDA, a city and a port of entry of Niagara county, New York, U.S.A., on the Niagara river, at the western terminus of the State Barge canal (opposite Tonawanda) 14 m. N. of Buffalo. It is on the boulevards connecting Buffalo and Niagara Falls, and is served by the Erie, the Lehigh Valley, the New York Central, the West Shore, electric railways and motor-bus lines. Pop. (1920) 15,482 (26% foreign-born white); 1928 local estimate 18,500. Though separately incorporated, the two Tonawandas are practically one community. They have a fine harbour, with 7 m. of docks and traffic in 1925 amounting to 504,752 tons by lake and 249,139 tons by canal. Electric power from Niagara falls is used. The cities have a large trade in white pine lumber, and manufacture stained shingles, paper, iron, petroleum products, musical instruments, radiators and various other commodities. The output of the factories within the limits of North Tonawanda was valued at $27,620,581 in 1925. North Tonawanda was settled in 1809, incorporated as a village in 1865 and chartered as a city in 1897.

NORTHUMBERLAND, EARLS AND DUKES OF. The earldom, and later the dukedom, of Northumberland, are famous in English history by their connection with the house of Percy (*q.v.*).

In the year 1377 Henry de Percy, 4th Baron Percy, officiated as marshal of England at the coronation of Richard II. and was created earl of Northumberland. With his son Sir Henry Percy, the celebrated "Hotspur," the earl played a leading part in the history of the period, especially in bringing about the deposition of Richard II. and the accession of Henry IV. The quarrel of Northumberland and his son with King Henry over the ransom of their Scottish prisoners taken at Homildon Hill on Sept. 14, 1402 has been immortalized by Shakespeare; and in consequence of their rebellion all the earl's honours were forfeited in 1406. He was not himself present at the battle of Shrewsbury in July 1403, when Hotspur was killed, but he was slain, heading a fresh rebellion, at Bramham Moor on Feb. 19, 1408.

The 1st earl of Northumberland was succeeded by his grandson, Hotspur's son, HENRY (*c.* 1394–1455), who was restored to the earldom and the estates of the Percies in 1414 and was killed at the battle of St. Albans in May 1455. The title then descended in the male line till the death of the 6th earl in 1537. During the Wars of the Roses the Percies took the Lancastrian side, which led to the attainder of Henry the 3rd earl (1421–1461) during the time of the Yorkist triumph, his forfeited title being conferred in 1464 by Edward IV. on John Neville, Lord Montagu (*see* the separate article, p. 538), by a patent which was cancelled a few years later. The earldom, together with the barony of Poynings which his father had obtained by marriage, was restored in 1473 to Henry Percy, son of the 3rd earl, who attached himself to Edward IV., acquiesced in the accession of Richard III., and submitted to Henry VII., by whom he was received into favour. His grandson Henry, the 6th earl (*c.* 1502–1537), left no direct heir, and the latter's nephew, Thomas Percy, was debarred from the succession by an attainder passed on his father for his participation in the Pilgrimage of Grace. In 1549, however, Thomas was restored in blood, and in 1557 he became by a new creation earl of Northumberland, 7th of his line. Meantime, in 1551, John Dudley, earl of Warwick, was created duke of Northumberland (*see* the separate article, p. 537), his title being, however, forfeited by attainder in 1553.

The earldom restored to the house of Percy by the creation of 1557 continued without interruption in the male line till 1670. The 7th earl was beheaded in 1572 for sharing in a conspiracy in which he was joined by the earl of Westmorland with the object of securing the release of Mary Queen of Scots and the free exercise of the Catholic religion. By the earl's attainder the baronies of Percy and of Poynings and the earldom of Northumberland of the older creation were forfeited, but owing to a clause in the patent the newer earldom of Northumberland and the other honours conferred in 1557 passed to his brother Henry (*c.* 1532–1585), who is usually known as the 8th and not the 2nd earl.

Henry's grandson, ALGERNON PERCY, 10th earl of Northumberland (1602–1668), son of Henry the 9th earl (1564–1632), became a peer in his father's lifetime as Baron Percy in 1626. Northumberland played a distinguished part in the Civil War. He was a friend of Strafford, and gave evidence at his trial which, though favourable on the important point of bringing the Irish army to England, was on the whole damaging; and he afterwards leaned more and more towards the popular party, of which he soon became leader in the House of Lords. He was a member of the committee of safety, and later of the committee of both kingdoms; and he took an active part in the attempts to come to terms with the king, whom he visited at Oxford for that purpose in 1643 and at Uxbridge two years later. Northumberland helped to organize the new model army; and in 1646 he was entrusted by parliament with the charge of the king's younger children. He led the opposition in the House of Lords to the proposal to bring Charles I. to trial, and during the Commonwealth he took no part in public affairs. At the Restoration he was called to the privy council by Charles II., and with his habitual moderation deprecated harsh proceedings against the regicides. His second wife, Elizabeth (d. 1705) daughter of Theophilus Howard, 2nd earl of Suffolk, brought him Northumberland House in the Strand, London, which was demolished in 1874 to make room for Northumberland avenue. On the death of his son Joceline, the 11th earl, in 1670, the male line became extinct.

George Fitzroy (1665–1716), third son of Barbara, duchess of Cleveland, the wife of Roger Palmer, earl of Castlemaine, by King Charles II., was created by his father earl of Northumberland in 1674, and duke in 1683. This second dukedom of Northumberland became extinct on his death at Epsom on July 3, 1716.

Meanwhile Elizabeth Percy, daughter of Joceline, the 11th earl, had married Charles Seymour, 6th duke of Somerset; and her son Algernon, the 7th duke, was in 1749 created Baron Warkworth and earl of Northumberland, with remainder to

his son-in-law, Sir Hugh Smithson, Bart., son of Langdale Smithson of Langdale, Yorkshire. Sir Hugh Smithson (*c.* 1714–1786) took the name and arms of Percy on inheriting the earldom in 1750; in 1766 he was created Earl Percy and duke of Northumberland; and in 1784 he was further created Baron Lovaine of Alnwick, with special remainder to his second son, Lord Algernon Percy. He took a prominent part in politics as a follower of Lord Bute, and was one of George III.'s confidential advisers, holding the office of lord-lieutenant of Ireland from 1763 to 1765, and that of master of the horse from 1778 to 1780. He was a man of cultivated tastes, and spent much money in repairing and improving Alnwick castle and his other residences. His wife, Elizabeth (1716–1776), inherited in her own right her father's barony of Percy. The duke was succeeded by his eldest son Hugh; and his second son Algernon, Lord Lovaine, was created earl of Beverley in 1790.

Hugh, 2nd duke of this line (1742–1817), first inherited his mother's barony of Percy. He was present at the battle of Minden, and although in parliament, where he was member for Westminster from 1763 to 1776, he had opposed the policy that led to the American war, he proceeded to Boston in 1774 as colonel commanding the 5th Fusiliers, a regiment that has since then been known as the Northumberland Fusiliers. He succeeded to the dukedom in 1786, and became general in 1793. His son Hugh, 3rd duke (1785–1847), was lord-lieutenant of Ireland in 1829–1830, when the Catholic Emancipation Act was passed, and was pronounced by Sir Robert Peel "the best chief governor that ever presided over the affairs of Ireland." Both he and his brother Algernon, 4th duke (1792–1865), who was created Baron Prudhoe in 1816, died without issue; the barony of Percy devolved on their great-nephew, the duke of Atholl, and the dukedom passed to George (1778–1867), eldest son of Algernon, 1st earl of Beverley, and so to his son, the 6th duke (1810–1899), and grandson, the 7th duke (b. 1846).

See Edward Barrington de Fonblanque, *The House of Percy* (2 vols., 1887); G. E. C(okayne), *Complete Peerage,* vol. vi. (1895).

NORTHUMBERLAND, ALAN IAN PERCY, 8TH DUKE OF (1880–), was born on April 17, 1880, a son of the 7th duke. He succeeded to the title in 1918. As one of the largest coal-owners in the north of England, he was summoned to appear as a witness before the Sankey Coal Commission (1919) and came much into public notice owing to his prolonged controversy with Robert Smillie, the leader of the miners, and subsequently to his anti-Communist campaign. In 1924 the duke acquired an interest in *The Morning Post* newspaper, sold by Lady Bathurst.

NORTHUMBERLAND, JOHN DUDLEY, VISCOUNT LISLE, EARL OF WARWICK, and DUKE OF (*c.* 1502–1553), was the eldest son of Henry VII.'s minister, Edmund Dudley (*q.v.*), by his second wife Elizabeth, daughter of Edward Grey, Viscount Lisle, and co-heiress of her brother John, Viscount Lisle. He was probably descended from the old baronial house of Sutton *alias* Dudley; but his father's attainder and execution in 1509 clouded his prospects. His mother, however, married as her second husband in 1511 Arthur Plantagenet, the illegitimate son of Edward IV., who in 1523 was created Viscount Lisle in his wife's right; and Lisle's rise in Henry VIII.'s favour brought young Dudley into prominence. In 1512 he was restored in blood, and in 1538 he was made deputy to his step-father, who was governor of Calais, and he does not appear to have suffered by Lisle's temporary disgrace and imprisonment in the Tower. Lisle died early in 1542, and Dudley was created Viscount Lisle on March 12 and was made warden of the Scottish marches in November, and lord high admiral of England in 1543 in succession to his future rival, Edward Seymour, earl of Hertford. He was also created a knight of the garter and sworn of the privy council. In 1544 he accompanied Hertford to the capture and burning of Edinburgh. On the capture of Boulogne in September Lisle was given command of the town and of the Boulonnais; in 1545 he directed the operations of the fleet in the Solent which foiled the French attack on Portsmouth and the Isle of Wight; and he was sent to Paris to ratify the peace concluded in 1546.

Lisle had thrown in his lot with the reforming party, and he took an active share in the struggle at Henry VIII.'s court for control of affairs when Henry should die. Hertford and he were described by the Spanish ambassador as holding the highest places in Henry VIII.'s affections and as being the only noblemen of fit age and ability to carry on the government. The Howards were infuriated by the prospect, and Surrey's hasty temper ruined their prospects. Lisle quarrelled bitterly with Bishop Gardiner, served as commissioner at Surrey's trial, and was nominated one of the body of executors to Henry's will from which Norfolk and Gardiner were excluded. On Henry's death Lisle was raised to the earldom of Warwick and promoted to be lord great chamberlain of England, again in succession to Hertford, who became duke of Somerset and Protector. He accompanied Somerset on his Pinkie campaign, and materially contributed to the winning of that victory. Nor did he exhibit any sympathy with the intrigues of the Protector's brother, Thomas Seymour, the lord high admiral; his subtler policy was to exasperate the brothers and thus weaken the influence of the house of Seymour. He helped to bring the admiral to the block in March 1549; and then used the Protector's social policy to bring about his deposition. Warwick detested Somerset's ideas of liberty and his championship of the peasantry against the inclosure movement; one of his own parks was ploughed up as a result of a commission of enquiry which Somerset appointed; and when the peasants rebelled under Kett, Warwick gladly took the command against them. His victory at Dussindale made him the hero of the landed gentry, and as soon as he had returned to London in Sept. 1549, he organized the general discontent with the Protector's policy into a conspiracy. He played upon the prejudices of Protestants and Catholics alike, holding out to one the prospect of more vigorous reform and to the other hopes of a Catholic restoration, and to all gentry the promise of revenge upon the peasants.

The coalition thus created effected Somerset's deposition and imprisonment in Oct. 1549; and the parliament which met in November carried measures of political coercion and social reaction. But the coalition split upon the religious question. Warwick threw over the Catholics and expelled them from office and from the privy council, and the hopes they entertained were rudely dashed to the ground. But it was difficult to combine coercion of the Catholics with the proscription of Somerset; the duke was therefore released early in 1550 and restored to the privy council; and his daughter was married to Warwick's son. Warwick himself assumed no position of superiority over his colleagues, and he was never made protector. But he gradually packed the council with his supporters, and excluded his enemies from office and from access to the king. His plan was to dominate Edward's mind, and then release him from the trammels of royal minority. He abandoned the Tudor designs on Scotland, and made a peace with France in 1550 by which it recovered Boulogne and was left free to pursue its advantage in Scotland. Nor did the betrothal of Edward to Henry's daughter Elizabeth prevent the French king from intriguing to undermine English influence in Ireland. In domestic affairs Warwick pushed on the Reformation with none of the moderation shown by Somerset; and the difference between the two policies is illustrated by the change effected between the first and second Books of Common Prayer. Warwick, however, was widely distrusted; and the more arbitrary his government grew, the more dangerous became Somerset's rivalry. A parliamentary movement had early been started for Somerset's restoration. Warwick therefore kept parliament from meeting, and the consequent lack of supplies drove him into the seizure of church plate, sale of chantry lands, and other violent financial expedients. At length he resolved to get rid of his opponent; his opposition was magnified into conspiracy, and in Oct. 1551, after Warwick had made himself duke of Northumberland and his ally Dorset, duke of Suffolk, and had scattered other rewards among his humbler followers, Somerset was arrested, condemned by the peers on a charge of felony, and executed (Jan. 22, 1552).

Parliament was permitted to meet on the following day, but for the next 18 months Northumberland grew more and more unpopular. He saw that his life was safe only so long as he con-

trolled the Government and prevented the administration of justice. But Edward VI. was slowly dying, and Northumberland's plot to alter the succession was his last desperate bid for life and power. Its folly was almost delirious. Edward had no legal authority to exclude Mary, and the nation was at least nine-tenths in her favour. Northumberland bullied the council and overawed London for a few days; but the rest of England was in an uproar, and as he rode out to take the field against Mary, not a soul cried "God speed." A few days later he returned as Mary's prisoner. He was tried for treason, professed himself a Catholic in the delusive hope of pardon, and was executed on Aug. 22. He was a competent soldier and one of the subtlest intriguers in English history; but he had no principles. The violence of his pretended Protestantism was largely responsible for the reaction of Mary's reign. His best-known son was Robert Dudley, earl of Leicester, Queen Elizabeth's favourite.

See *Letters and Papers of Henry VIII.; State Papers, Domestic and Foreign, Edward VI. and Mary;* ms. 15,888, *Bibliothèque Nationale de France;* G. E. C(okayne), *Complete Peerage;* A. F. Pollard, *England under Somerset* (1900), *Life of Cranmer* (1904) and vol. vi. of the *Political History of England* (1910).

NORTHUMBERLAND, JOHN NEVILLE, EARL OF (*c.* 1430–1471), English soldier, was the third son of Richard Neville, earl of Salisbury, and a brother of Richard Neville, earl of Warwick, the "king-maker." In 1459–61 he was twice a prisoner of the Lancastrians and in 1463 as warden of the east marches towards Scotland, he was responsible for the Yorkist victories at Hedgeley Moor and at Hexham in April and May 1464. In this year (1464) he was created earl of Northumberland, the Percies being now crushed, and their head, Henry Percy, being in prison. Northumberland did not at first join his brother Warwick and the other Nevilles when they revolted against Edward IV., but neither did he help the king. Edward, doubtless suspecting him, restored the earldom of Northumberland and its vast estates to Henry Percy, while John Neville's only recompense was the barren title of marquess of Montagu. At Pontefract in 1470 he and his men declared for Henry VI., a proceeding which compelled Edward IV. to fly from England, and under the restored king he regained his position as warden, but not the earldom of Northumberland. He did not attempt to resist Edward IV. when this king landed in Yorkshire in March 1471, but he fought under Warwick at Barnet, where he was slain on April 14, 1471.

NORTHUMBERLAND, the northernmost county of England. The area, included in the North of England basin, is 2,018 square miles. The higher land, including the north Pennines and the Cheviots, lies in the west and north. The Cheviot hills, rising to 2,676 ft., are formed by the intrusion of an igneous dome in Tertiary times, and between them and the northern Pennines we have the lower line of the Tyne Gap, giving an important way for routes from west to east. The larger rivers generally flow eastward, the chief exception being the Till which flows northward, to join the Tweed, along a bed of shales less resistant than the remainder of the region.

The number of weapons of Neolithic age which have been found in the county show that it was occupied by man in those times. Most implements have been found along a broad band of country north-eastward from Hexham to Alnwick, that is, along the lower levels of the limestone lands. In later times, the evidence of beaker-pottery shows that Northumberland was probably invaded from across the North sea at the dawn of the Metal age. The evidence for the pre-Roman Iron age is not great and the Bronze age may have continued far longer than in the south of England. The county was occupied by the Romans some time after A.D. 80 and about 124. Hadrian built his wall from the Tyne to the Solway to defend his northern frontier, but the region as a whole was not thoroughly Romanized like the south-eastern parts of Britain. Hadrian's wall marked the frontier south of which the Romans never retreated until they finally left Britain, but they often advanced farther north which northern region was crossed by military roads. The wall ran across the county a few miles north of the Tyne from near Haltwhistle to Wallsend. On the wall there was the fort of Magnae, near Haltwhistle, where the road from Kirkby Thore along the south Tyne abutted on the wall. There was a settlement at Corbridge where the main road from the south crossed the Tyne and a fort near Halton where the road met the wall. At the eastern end of the wall there was a fort and another at Newcastle guarding a route across the Tyne. Within the wall, from Halton to Magnae through the Tyne Gap, ran another road.

History.—The first English settlement in the kingdom of Bernicia, which included what is now Northumberland, was effected in 547 by Ida, who pushed through the narrow strip of territory between the Cheviots and the sea, and set up a fortress at Bamburgh, which became the royal seat of the Saxon kings. About the end of the 6th century Bernicia was first united with the rival kingdom of Deira under the rule of Aethelfrith, and the district between the Humber and the Forth became known as the kingdom of Northumbria. In 634 Cadwalla was defeated at Hefenfeld (the site of which lies in the modern parish of St. John Lee) by Oswald, under whom Christianity was definitely established in Northumbria, and the bishop's see fixed at Hexham, where Bishop Wilfrid erected the famous Saxon church. Oswald also erected a church of stone at Tynemouth, which was destroyed in 865 in an incursion of the Danes. The Danes later overran the region, but in Northumberland, the English princes continued to reign at Bamburgh as vassals of the Danes, and not a single place-name with the Danish suffix "by" or "thorpe" is found north of the Tyne. The English names are, however, often associated with those of Gaelic or Cymric origin. In 938 Aethelstan annexed Northumberland to his dominions, and the Danish authority was annulled until its re-establishment by Canute in 1013. The vigorous resistance of Northumbria to the Conqueror was punished by ruthless harrying. The Normans rebuilt the Saxon monasteries of Lindisfarne, Hexham and Tynemouth; Eustace Fitz John founded Alnwick abbey, and other Norman abbeys were Brinkburn, Hulne, the first Carmelite monastery in England, Blanchland and Newminster. Castles were set up at Alnwick, Warkworth, Prudhoe, Dunstanborough, Morpeth, Ford, Chillingham, Langley, Newcastle, Bamburgh, Wark and Norham, a stronghold of the palatine bishops of Durham.

The term Northumberland is first used in its contracted modern sense in 1065 in an entry in the Saxon Chronicle relating to the northern rebellion. The county is not mentioned in the Domesday Survey, but the account of the issues of the county is entered in the Great Roll of the Exchequer for 1131. In the reign of Edward I. the county of Northumberland comprised the whole district between the Tees and the Tweed, and included liberties belonging to the bishop of Durham, archbishop of York, the king of Scotland, the earl of Lancaster and the earl of Angus. These franchises were all held exempt from the ordinary jurisdiction of the shire. By statute of 1495–96 the lordship of Tynedale was annexed to Northumberland on account of flagrant abuses of the liberties of the franchise; that of Hexham in 1572; Norhamshire, Islandshire and Bedlingtonshire continued to form detached portions of Durham until 1844, when they were incorporated with Northumberland. The division into wards existed at least as early as 1295, the Hundred Roll of that year giving the wards of Coquetdale, Bamburgh, Glendale and Tynedale.

The shire-court of Northumberland was held at different times at Newcastle, Alnwick and Morpeth, until by statute of 1549 it was ordered that the court should thenceforth be held in the town and castle of Alnwick. The assizes were held at Newcastle, and the itinerant justices, on their approach to the county, were met by the king of Scotland, the archbishop of York, the bishop of Durham and the prior of Tynemouth, who pleaded their liberties either at a well called Chille near Gateshead, if the justices were proceeding from York, or, if from Cumberland, at Fourstanes. In these franchises the king's writ did not run, and their owners performed the office of sheriff and coroner. The burgesses of Newcastle claimed return of writs in their borough and the town was made a county by itself by Henry IV. in 1400, and has jurisdiction in admiralty cases. The county was in the diocese of Durham. But in 1882 Northumberland was formed into a separate diocese with its see at Newcastle. Northumberland has been the scene of perpetual inroads by the Scots and the churches were

often so built as to form refuges against the invaders. Norham, Alnwick and Wark were captured by David of Scotland in the wars of Stephen's reign, and in 1290 it was at Norham castle that Edward I. decided the Scottish succession in favour of John Baliol.

In 1295 Robert de Ros and the earls of Athol and Menteith ravaged Redesdale, Coquetdale and Tynedale. In 1314 the county was ravaged by Robert Bruce, and in 1382 by special enactment the earl of Northumberland was ordered to remain on his estates in order to protect the county from the Scots. In 1388 Henry Percy was taken prisoner and 1,500 of his men slain at the battle of Otterburn. Alnwick, Bamburgh and Dunstanborough were garrisoned for the Lancastrian cause in 1462, but after the Yorkist victories of Hexham and Hedgley Moor in 1464, Alnwick and Dunstanborough surrendered, and Bamburgh was taken by storm. In 1513 the king of Scotland was slain in the battle of Flodden Field on Branxton moor. During the Civil War of the 17th century Newcastle was garrisoned for the king by the earl of Newcastle, but in 1644 it was captured by the Scots under the earl of Leven, and in 1646 Charles was led there a captive under the charge of David Leslie. The county of Northumberland was represented by two members in the parliament in 1290, and in 1295 Bamburgh, Corbridge and Newcastle-upon-Tyne each returned two members. Today, the parliamentary divisions of the county are Berwick-upon-Tweed, Hexham and Wansbeck, each returning one member; while the parliamentary borough of Newcastle-upon-Tyne returns four members, and Morpeth, Wallsend and Tynemouth one each.

Industries and Agriculture.—The early industrial development of Northumberland was much impeded by the constant ravages of internal and border warfare. Again Aeneas Sylvius Piccolomini (Pope Pius II.) who passed through the county disguised as a merchant in 1436, leaves a picture of its barbarous and desolate condition, and as late as the 17th century, Camden, the antiquary, describes the lands as rough and unfit for cultivation. The mineral resources, however, appear to have been exploited to some extent from remote times. It is certain that coal was used by the Romans in Northumberland. In a 13th-century grant to Newminster abbey a road for the conveyance of seacoal from the shore about Blyth is mentioned, and the Blyth coal-field was worked throughout the 14th and 15th centuries. The coal trade on the Tyne did not exist to any extent before the 13th century, but from that period it developed rapidly, and Newcastle acquired the monopoly of the river shipping and coal trade. The building of ships to carry the coal laid the foundations of the great modern shipbuilding industries. Lead was exported from Newcastle in the 12th century, probably from Hexhamshire, the lead mines of which were very prosperous throughout the 16th and 17th centuries. In a charter from Richard I. to Bishop Pudsey creating him earl of Northumberland, mines of silver and iron are mentioned, and in 1240 the monks of Newminster had an iron forge at Stretton. A saltpan is mentioned at Warkworth in the 12th century; in the 13th century the salt industry flourished at the mouth of the river Blyth, and in the 15th century formed the principal occupation of North and South Shields.

In the reign of Elizabeth glasshouses were set up at Newcastle by foreign refugees, and the industry spread rapidly along the Tyne. Tanning, both of leather and of nets, was largely practised in the 13th century, and the salmon fisheries in the Tyne were famous in the reign of Henry I. The height of the land and the composition of the soil together prevent the county from being rich agriculturally. In 1926 the total acreage under crops and grass was 656,936 of which 166,316 ac. were arable land. As would be expected in a northern county, the chief grain crops are oats and barley while the crop next in acreage is turnips and swedes. Potatoes covered nearly 5,000 ac., and the acreage of clovers and rotation grasses for hay was 40,099. The number of cattle in the county is fairly large, but the large acreage of hill-land makes it pre-eminently a sheep country, these animals numbering over a million in 1926. Manufactories centre on the Tyne, which is a region of ironworks, blast-furnaces, shipbuilding yards, ropeworks, coke-ovens, chemical works and manufactories of glass, electrical apparatus, pottery and fire-bricks, from above Newcastle to the sea. Machines, appliances, conveyances and tools are the principal articles of manufacture in metal.

Communications are provided almost wholly by the L.N.E. railway.

The area of the administrative county is 1,291,515 ac., with a population (1921) of 746,096. Population is densest in the south-east, where the mining district and the Tyneside industrial area are situated. The county is in the north-eastern circuit, and assizes are held at Newcastle-upon-Tyne.

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NORTHUMBERLAND, a manufacturing borough of Northumberland county, Pennsylvania, U.S.A., immediately north of Sunbury, at the confluence of the east and west branches of the Susquehanna river. It is served by the Lackawanna, the Pennsylvania and the Reading railways. Pop. (1920) 4,061 (95% native white); estimated locally (1928) at 5,750. Northumberland was the home of Joseph Priestley, the English chemist, from 1794 until his death (1804), and his dwelling has been preserved as a memorial by the chemists of America.

NORTHUMBRIA, one of the most important of the Anglo-Saxon kingdoms, extended from the Humber to the Forth (*regnum Northanhymbrorum*). Originally it comprised two independent kingdoms, Bernicia and Deira (*q.v.*), each of which had a dynasty of its own. The first known king of the former was Ida, who, according to tradition, acquired the throne in 547 and reigned twelve years. To him the foundation of Bamburgh is attributed. Four of Ida's sons successively occupied his throne: Glappa 559–560, Adda 560–568, Aethelric 568–572 and Theodoric 572–579. Of the first three nothing is known, but Theodoric is said (*Historia Brittonum*) to have been besieged by the Welsh under Urien in Lindisfarne. Theodoric was succeeded by Frithuwald 579–585/6 and Hussa 586–592/3. Then Aethelfrith (*q.v.*), son of Aethelric, came to the throne. He greatly extended his territories at the expense of the Welsh, and eventually provoked an invasion of Aidan, king of the Scots, whom he defeated at a place called Daegsastan (603). The first king of Deira of whom we know was Ella, or Aelle, who, according to Bede, was still reigning when Augustine arrived in 597. Aethelfrith eventually acquired possession of Deira, expelling Aelle's son Edwin (*q.v.*). Thenceforward, with rare intervals, the two kingdoms remained united.

Aethelfrith became involved in war with the Welsh towards the end of his reign and captured Chester, probably about 613. Shortly afterwards, in 616, he was slain in battle on the river Idle by Edwin, who was assisted by the East Anglian king Raedwald. Edwin now became king over both Northumbrian provinces. By his time the kingdom must have reached the west coast, as he is said to have conquered the islands of Anglesea and Man. Under Edwin the Northumbrian kingdom became the chief power in the country. At his death in 633 the kingdom was again divided, Deira falling to his nephew Osric, while Bernicia was occupied by Eanfrith son of Aethelfrith. Both these kings were slain by Cadwallon in the following year, but shortly afterwards the Welsh king was overthrown by Oswald (*q.v.*), brother of Eanfrith, who reunited the whole of Northumbria under his sway and acquired a supremacy analogous to that previously held by Edwin. After Oswald's defeat and death at the hands of Penda in 642 Bernicia fell to his brother Oswio, while Oswine son of Osric became king in Deira, though probably subject to Oswio. Oswine's death was compassed by Oswio in 651, and the throne of Deira was then obtained by Aethelwald son of Oswald. He is not mentioned, however, after

655, so it is probable that Deira was incorporated in the Bernician kingdom not long afterwards. After Oswio's victory over Penda in 654–655 he acquired a supremacy over the rest of England similar to that held by his predecessors. The Mercians, however, recovered their independence in 658, and from this time onward Northumbria played little part in the history of southern England. But Oswio and his son Ecgfrith greatly extended their territories towards the north and north-west, making themselves masters of the kingdoms of Strathclyde and Dalriada, as well as of a large part of the Pictish kingdom. Ecgfrith (*q.v.*), who succeeded on Oswio's death in 671, expelled the Mercians from Lindsey early in his reign, but was in turn defeated by them in 679, his brother Aelfwine being slain. From this time onwards the Humber formed the boundary between the two kingdoms. In 684 we hear of the first English invasion of Ireland, but in the following year Ecgfrith was slain, and his army totally destroyed by the Picts at a place called Nechtansmere (probably Dunnichen Moss in Forfarshire). The Picts and Britons now recovered their independence; for Aldfrith, apparently an illegitimate son of Oswio, who succeeded, made no attempt to reconquer them. He was a learned man, and during his reign the Northumbrian kingdom partially recovered its prosperity. He was succeeded in 705 by his son Osred, and under him and his successors Northumbria began rapidly to decline through the vices of its kings. Osred was slain in 716. He was succeeded by Coenred 716–718, and Coenred by Osric 718–729. The next king was Ceolwulf, to whom Bede dedicated his *Historia Ecclesiastica* in 731. In the same year he was deposed and forced to become a monk, but was soon restored to the throne. In 737 he voluntarily retired to a monastery and left the kingdom to his cousin Eadberht. The latter appears to have been a vigorous ruler; in the year 740 we hear of his being involved in war with the Picts. Aethelbald of Mercia seems to have taken advantage of this campaign to ravage Northumbria. In 750 Eadberht is said to have annexed a large part of Ayrshire to his kingdom. Finally in 756, having now allied himself with Oengus king of the Picts, he successfully attacked Dumbarton (Alcluith), the chief town of the Britons of Strathclyde. Eadberht showed considerable independence in his dealings with the church, and his brother Ecgberht was from 734 to 766 archbishop of York. In 758 Eadberht resigned the kingdom to his son Oswulf, and became a monk.

Oswulf was slain by his household at a place called Mechil Wongtun in 759. Moll Aethelwald, who may have been a brother of Eadberht, succeeded, and after a victory over a certain Oswine, who fell in the battle, abdicated and became a monk probably under compulsion in 765. His successor Alchred sent an embassy to Charlemagne in 768 and was deposed in 774, whereupon he fled to Bamburgh and afterwards to the Picts. His deposition has been ascribed to a formal act of the Witan, but this seems an antedating of constitutional methods and the circumstances point to a palace revolution. The successor of Alchred was Aethelred son of Moll Aethelwald. In 778 three high-reeves were slain at the instigation of the king. Aethelred was expelled during the next year, perhaps in consequence of this event, and Aelfwald son of Oswulf became king. Aelfwald was murdered by Sicga in 789, whereupon Osred his nephew the son of Alchred succeeded. In 790 the banished Aethelred returned to the throne and drove out Osred, whom he put to death in 792. Aethelred, who had married Aelflaed the daughter of Offa, also killed Aelf and Aelfwine, the sons of Aelfwald and was murdered himself at Corbridge in 796. Oswald, who is called *patricius* by Simeon of Durham, succeeded, but reigned only twenty-seven days, when he was expelled and eventually became a monk. Eardwulf *dux*, who had apparently fled abroad to escape the wrath of Aethelred, was now recalled and held the crown until 807 or 808. Aelfwald then became king but Eardwulf was restored in 808 or 809 after appealing to the emperor and the pope. Eanred, son of Eardwulf, probably came to the throne in 809 and reigned until 841. It was during his reign in 827 that Northumbria acknowledged the supremacy of Ecgberht, king of Wessex. Eanred was succeeded by his son Aethelred, who was slain in 850, when Osberht came to the throne and reigned until 863. On the expulsion of Osberht, Ella or Aelle, succeeded. The chroniclers emphasize the fact that this king was not of royal descent. He is said to have slain Ragnarr Loðbrok. In the year 866 Loðbrok's sons Ingwaere (Ivarr, *q.v.*), Healfdene, Ubba and others brought a vast army to England to avenge the death of their father. In the following year they obtained possession of York. Ella seems now to have made peace with the exiled king Osberht, and their united forces succeeded in recovering the city. In the great battle which ensued the Northumbrian army was annihilated and both kings were slain (the death of Ella, according to Irish tradition, being due to the treachery of one of his followers). The southern part of Northumbria now passed entirely into the hands of the invaders, but they allowed a certain Ecgberht to reign over the portion of the kingdom north of the Tyne. Ecgberht was expelled in 872 and died in the course of the following year. His successor Ricsig died in 876 and was followed by Ecgberht II., who reigned until 878. He was the last English king who reigned in Northumbria. After him the chief power north of the Tyne came into the hands of a certain Eadulf of Bamburgh, who did not take the kingly title, but accepted the overlordship of Alfred the Great perhaps in 886. In the winter of 874–75 Healfdene returned to Northumbria, which he partitioned next year among his followers. After an interregnum of a few years a certain Guthred became king in 883. He is said to have been a slave and to have been appointed king at the command of St. Cuthbert who appeared to Eadred the abbot of Carlisle in a dream. There is some reason for the conjecture that he belonged to the family of Loðbrok. He died in 894, after which date little is known of Northumbrian history for some years.

About 919 the country was invaded by vikings from Ireland under Ragnall, grandson of Ivarr, who seized York and occupied the lands of St. Cuthbert. Aldred, the son of Eadulf, who now ruled north of the Tyne, appealed to Constantine II., king of the Scots, for help, but the Scottish and Northumbrian armies were defeated at Corbridge. Shortly after this, however, all the northern princes submitted to Edward the Elder. Ragnall was succeeded by Sihtric, who married Aethelstan's sister. He died in 926, and his brother and successor Guthfrith was soon afterwards expelled by Aethelstan and fled to Eugenius, king of Strathclyde. The Welsh and Scottish kings, however, both submitted to Aethelstan, and Guthfrith was again driven into exile. He died in 934, leaving a son Anlaf (Olafr) Godfredsson or Godfreyson. In 934 Aethelstan invaded Scotland as far as the Tay. In 937 a great fleet and army were brought together by Constantine and Anlaf Godfreyson from Ireland. Aethelstan, however, won a complete victory over them at a place called Brunanburh. Anlaf Godfreyson escaped to Ireland but returned to England after Aethelstan's death, occupied York and compelled Edmund to cede to him all Danish Mercia north of Wattling street. He died in 941, and a series of obscure Scandinavian kings of York followed him until 954 when Northumbria was conquered by Edred king of Wessex. Eadred placed Northumbria in the hands of a certain Osulf, who is called high-reeve at Bamburgh. In the reign of Edgar, Oslac was appointed earl of southern Northumbria, but he was banished at the beginning of the following reign. The next earl was Waltheof and after him Uhtred, who defeated Malcolm II., king of the Scots, in 1006. Twelve years later, however, the Northumbrians were completely defeated at Carhan, and Lothian was annexed by the Scots (*see* LOTHIAN). Uhtred was slain by the orders of Canute, who gave the province to Eric (Eirikr) earl of Lade. Shortly afterwards, however, part of it at least came into the hands first of Eadulf and then of Aldred and another Eadulf, the brother and sons respectively of Uhtred. The younger Eadulf was slain by Siward, probably in the reign of Harltacuut. Siward held the earldom till his death in 1055, when it was given to Tostig, son of earl Godwine, and after his banishment to Morkere, son of Aelfgar, earl of Mercia. Tostig's banishment led to the invasion of Harold Hardrada, king of Norway, and the battle of Stamford Bridge, in which both perished.

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NORTH-WEST FRONTIER PROVINCE, the most northerly province of British India, created on Oct. 25, 1901. Roughly it may be defined as the tract of country north of Baluchistan, lying between the Indus and Afghanistan. More exactly it consists of (1) the cis-Indus district of Hazara; (2) the comparatively narrow strip between the Indus and the hills constituting the settled districts of Peshawar, Kohat, Bannu and Dera Ismail Khan; and (3) the rugged mountainous region between these districts and the borders of Afghanistan, which is inhabited by independent tribes. This last region is divided into five agencies: Dir, Swat and Chitral, with headquarters at Malakand; Khyber, Kurram, Tochi and Wana. The province lies between 31° 4′ and 36° 57′ N., and 69° 16′ and 74° 7′ E. The approximate area is 38,665 sq.m., of which 13,419 sq.m. are British territory and the remainder is held by tribes under the political control of the agent to the governor-general.

Rivers and Mountains.—The mountains of the Hindu Kush running from east to west form the northern boundary of the province, and are met at the north-east corner of the Chitral agency by the continuation of an outer chain of the Himalayas after it crosses the Indus above the Kagan valley. From this chain minor ranges run in a south-westerly direction the whole length of Bajour and Swat, till they merge into the Mohmand hills and connect the mid-Himalayas with the Safed Koh. The Suliman system lies south of the Gomal unconnected with the northern hills. To the east the Safed Koh extends its spurs into the Kohat district. The Salt Range crosses the Indus in the Mianwali *tahsil* of the Punjab, and forms the boundary between Bannu and Dera Ismail Khan, merging eventually in the Waziri hills. The chief peaks in the province are Kaisargarh (11,300 ft.) and Pir Ghol (11,580 ft.) in Waziristan; Shekh Budin (4,516 ft.), in the small range; Sikaram (15,621 ft.) in the Safed Koh; Istragh (18,900 ft.), Kachin (22,641 ft.) and Tirach Mir (25,426 ft.), in the Hindu Kush on the northern border of the Chitral agency; while the Kagan peaks run from 10,000 ft. to 16,700 ft.

With the exception of the Kunhar river, which flows down the Kagan valley to the Jhelum, the whole drainage of the province finds its way into the Indus. (*See* INDUS: KABUL RIVER.)

The Pathan Races.—The North-West Frontier Province as now constituted may be described as the country of the Pathans (*q.v.*). The true Pathan is possibly of Indian extraction. But around this nucleus have collected many tribes of foreign origin. The whole have now become blended by the adoption of a common language, but remain tribally distinct; all alike have accepted Islam, and have invented traditions of common descent which express their present association. For centuries these tribes maintained their independence in the rugged hills which flank the present kingdom of Afghanistan. In the 15th century they began to settle in the plains. The 16th century saw the Pathan tribes established in their present homes. The spirit of independence which always characterized them soon brought them into collision with the Mogul empire. In the 17th century, after a long struggle, the settlers in the plains wrested from Aurangzeb terms which left them almost as independent as their brothers in the hills. The invasion in 1738 of Nadir Shah, who traversed the province from Peshawar to Dera Ismail Khan, is a landmark in the history of the frontier. From his death to the rise of Ranjit Singh, the frontier districts remained an appendage of the Durani empire. Little control was exercised by the rulers of Kabul, and the country was administered by local chiefs or Afghan Sirdars very much as they pleased. The Sikh invasions began in 1818, and from that date to the annexation by the British government the Sikhs were steadily making themselves masters of the plain tracts. After the Second Sikh War, by the proclamation of March 29, 1849, the frontier districts were annexed by the British Government. From that time until the creation of the North-West Frontier Province the settled districts formed part of the Punjab, while the independent tribes were controlled at different times by the Punjab government, and the government of India. Their turbulence still continued, and since 1849 they have been the object of over fifty punitive expeditions. The chief tribes, under the political control of the N.W. Frontier agency, besides Chitralis and Bajouris, are the Utman Khel, Yusafzais, Hassanzais, Mohmands, Afridis, Jowakis, Mullagoris, Orakzais, Zaimukhts, Chamkannis, Khattaks, Bangashes, Turis, Mahsuds, Wazirs, Bhitanis and Sheranis, etc.

Creation of the Province.—The North-West Frontier Province differs from the older provinces of India in having been artificially built up out of part of a previous province together with new districts for a definite administrative purpose. The proposal to make the frontier districts into a separate province, administered by an officer of special experience, dates back to the viceroyalty of Lord Lytton, who, in a famous minute of April 22, 1877, said:—

"I believe that our North-West Frontier presents at this moment a spectacle unique in the world; at least I know of no other spot where, after 25 years of peaceful occupation, a great civilized power has obtained so little influence over its semi-savage neighbours, and acquired so little knowledge of them, that the country within a day's ride of its most important garrison is an absolute *terra incognita*, and that there is absolutely no security for British life a mile or two beyond our border."

The result of this minute was that a frontier commissionership, including Sind, was sanctioned by the home Government, and Sir Frederick (afterwards Lord) Roberts had been designated as the first Commissioner when the outbreak of the Second Afghan War caused the project to be postponed. It was afterwards shelved by Lord Ripon. Twenty-three years elapsed before the idea was revived and successfully brought to completion by Lord Curzon, whose scheme was on a more modest scale than Lord Lytton's. It omitted Sind altogether, and confined the new province to the Pathan trans-Indus districts north of the Gomal. The present administration of the province is conducted by a chief commissioner and agent to the governor-general. It has been specially omitted from the scope of the "reforms" in India.

Population.—The census of 1901, omitting the great majority of the frontier tribes, gave a total population of 2,125,480. In 1921, the figure increased to 2,251,340. The province is mainly agricultural. The towns, except Peshawar and Dera Ismail Khan, are either expansions of large agricultural villages or bazaars which have grown up round the many cantonments of the province. The great majority of the population are Pathan by race and Mohammedan by religion. The predominant language is Pushtu (*q.v.*). The conquered strata of the population speak servile Indian dialects, called Hindki in the north and Jatki in the south, while Gujari is spoken by the large Gujar population in Hazara and north of Peshawar.

Crops, Climate, Etc.—The area under cultivation represents an average of 1·3 acres per head of the total, and of nearly 1·5 acres per head of the rural population. The limit of profitable cultivation has almost been reached. The Pathan, however, is a slovenly cultivator and slow to adopt new methods. The principal crops are—in the cold weather, maize and *bajra;* in the spring, wheat, barley and gram. Rice and sugar-cane are largely grown on the irrigated lands of Hazara, Peshawar and Bannu districts, and the well and canal irrigated tracts of Peshawar district produce fine crops of cotton and tobacco. In the trans-border agencies the valleys of the Swat, Kurram and Tochi yield much rice.

The climatic conditions of the province are extremely diversified. Dera Ismail Khan district is one of the hottest areas in the Indian continent, while over the mountain region to the north the weather is temperate in the summer and intensely cold in the winter. The air is generally dry, and hence the daily and annual range of temperature is frequently very large. There are two seasons of rainfall over the province; the monsoon season, when supplies of moisture are brought up by the ocean winds from the Arabian Sea and the Bay of Bengal; and the winter season, when storms advancing eastwards from Persia and the Caspian districts occasion winds, widespread rain and snowfall. Both sources are precarious and instances are not infrequent of the almost entire failure of either the winter or the summer rainfall.

Canals are the main source of irrigation in the province, and fall under three heads: (1) Private canals in the various districts, the property of the people and managed on their behalf; (2) the

Michni Dilazak and Shabkadar branch in Peshawar, constructed by the district board, which receives water rates; and (3) the Swat and Kabul river canals, which were constructed by and are the property of government, and are managed by the irrigation department. About 20% of the cultivated area is irrigated by canals, 2% by wells and 3% by perennial streams. In the year 1925–26 the irrigated area was 368,481 acres.

Railways.—The railways of the province are mostly intended in the first instance for strategic purposes. The main line of the North-Western railway from Rawalpindi to Peshawar after being first extended 9 m., to Jamrud at the entrance to the Khyber Pass, in Nov. 1925 received further extension of 27 m. through the Khyber to the Afghan frontier. From Nowshera a branch runs to Dargai at the foot of the Malakand Pass. From Rawalpindi again another branch crosses the Indus at Kushalgarh (*q.v.*) and runs to Kohat, whence a 2 ft. line runs to Thal at the foot of the Kurram valley.

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NORTH-WEST TERRITORIES, at first a general name given to all the districts of British North America lying north-west of the St. Lawrence basin. In the British North American Act of 1867, provision was made for the admission to Canada of "Ruperts Land and the North West Territory." Manitoba was formed out of this district in 1870, and the remaining area was called the "North-West Territories." In 1881 the limits of Manitoba were enlarged at the expense of the "North-West Territories." In 1905 Saskatchewan and Alberta were formed out of the remaining area. Further delimitation took place in 1912, and in 1928 the North-West Territories consisted of the Canadian mainland east of the Rockies, west of Hudson bay and north of latitude 60° N., together with all the northern archipelago. This area is divided into the provisional districts of Mackenzie, Keewatin and Franklin. The extent of these territories is estimated at 1,242,224 square miles. These northern regions are nearly uninhabited; parts are even unexplored. In 1921 the population amounted to 7,988. Of this number 3,873 were Indians, 3,242 Eskimos, 473 of British stock, 258 French and 142 others. The territories are administered by the North-west Territories' branch of the Department of the Interior. The government is carried on by a commissioner and five councillors.

Fur is an important product: for the season 1924–25, the number of pelts purchased by traders amounted to 148,885 valued at $1,780,666. Agricultural possibilities are limited to the south of the Mackenzie district, where cereals and vegetables have been successfully grown in favourable years. The northern limit to timber growth runs diagonally from the mouth of the Mackenzie in the west to the mouth of the Churchill (in Manitoba) on Hudson bay. Precipitation is everywhere less than 14 in., the winters are long, dry and extremely cold. Heat waves occur in summer and actual maximum temperatures are quite high, yet keen night frosts in the early summer and very early autumn limit the growing season so as to make cereal growth and general agriculture very precarious. But in the short summers the so-called "barren lands" yield a profusion of wild flowers, heaths, mosses, lichens and in places, luxuriant grasses, and support vast herds of caribou. Pelts, hides and reindeer meat are of value.

NORTHWICH, a town in Cheshire, England, 171m. N.W. of London, on the L.M.S. and Cheshire lines railways. Pop. (1921), 18,381. It lies at the junction of the rivers Weaver and Dane. Of the 2,000,000 tons of salt annually produced in the British Isles, three quarters are yielded by this area. In its narrow and irregular streets many of the houses have sunk and are at fantastic angles, being strongly bolted to keep them secure, because of subsidences resulting from the pumping of brine. This latter method of salt production has largely replaced the mining of rock salt. The salt is conveyed to the Mersey ports for export, by the river Weaver, which is connected by a hydraulic lift with the Trent and Mersey canal on higher level.

NORTON, CAROLINE ELIZABETH SARAH (1808–1877), afterwards Lady Stirling-Maxwell, English writer, was born in London in 1808. One of the three beautiful granddaughters of Richard Brinsley Sheridan, daughters of his son Thomas, the "three Graces" of London society in the reign of George IV., she began to write before she was out of her teens. Her two sisters Helen and Georgina became respectively Lady Dufferin and duchess of Somerset. At the age of 17, Caroline published a merry satire, *The Dandies' Rout,* illustrated by herself; this was followed by *The Sorrows of Rosalie* (1829), and *The Undying One* (1830), a version of the legend of the Wandering Jew. She married in 1827 the Hon. George Norton, brother of Lord Grantley. The husband's persecutions culminated in 1836 in an action brought against Lord Melbourne for seduction of his wife, which the jury decided against Norton without leaving the box. The case against Lord Melbourne was so weak that it was suggested that Norton was urged to make the accusation by Melbourne's political enemies, in the hope that the scandal would prevent him from being premier when the princess Victoria should succeed William IV. In 1853 legal proceedings between Mrs. Norton and her husband were again entered on, because he not only failed to pay her allowance, but demanded the proceeds of her books. Mrs. Norton made her own experience a plea for addressing to the queen in 1855 an eloquent letter on the divorce laws, and her writings did much to ripen opinion for changes in the legal status of married women. George Meredith, in *Diana of the Crossways,* used her as the model for his "Diana." Mrs. Norton was not a mere writer of elegant trifles; her *Voice from the Factories* (1836) was a most eloquent and rousing condemnation of child labour. *The Dream, and other Poems* appeared in 1840. *Aunt Carry's Ballads* (1847), dedicated to her nephews and nieces, are written with charming tenderness and grace. Later in life she produced three novels, but perhaps her best work is her last, the half-humorous, half-heroic story of *The Rose of Jericho* in 1870. She died on June 15, 1877. Her husband died in 1875; and Mrs. Norton in the last year of her life married Sir W. Stirling-Maxwell.

See Jane G. Perkins, *The Life of Mrs. Norton* (1909).

NORTON, CHARLES ELIOT (1827–1908), American scholar and man of letters, was born at Cambridge, Mass., on Nov. 16, 1827. The descendant of a long line of clergymen and of Anne Bradstreet, the Puritans' "tenth muse," in his idealism, restraint and dignity he was a member of the New England group already passing into its decline. Yet in him there was, too, an alien strain that made him, after graduation from Harvard in 1846, take employment with an Oriental trading firm, for which as supercargo he travelled out to India. The leisurely trip through Europe on his return and his early contact with the culture of an older civilization made him feel sharply what he had been losing in life—"pleasure, opportunities, happiness, indeed, of a sort that nothing else can supply." He felt himself to be "half starved" in America, yet he knew that in the Old World he would be "half starved for this strange new one." Thenceforth his work was to be largely that of torchbearer and interpreter. As lecturer on and first professor of the history of art at Harvard (from 1874 to 1898 when he became emeritus), he was long considered the "oracle of the humanities." From his first publication of church hymns (1852), he turned to *Notes of Travel and Study in Italy* (1860), and to his later *Historical Studies of Church Building in the Middle Ages* (1880). A translator of *The New Life of Dante Alighieri* as early as 1859, he did what was probably his best literary work in his prose translation of the *Divine Comedy* (1891–92). He helped to develop the creative abilities of his own countrymen in his editorship (1864–68) with Lowell of the *North American Review.* For long years with unfailing grace and tact he edited the literary remains of many of his friends. *The Correspondence of Thomas Carlyle and Ralph Waldo Emerson* (1883), *Letters of John Ruskin to Charles Eliot Norton* (1904)—records of a rare friendship mutually profitable—the *Orations and Addresses of George William Curtis* (1894), *Henry Wadsworth Longfellow; a Sketch of his Life, together with Longfellow's Chief Biographical Poems* (1907), the *Letters of James Russell Lowell* (1894) all bear testimony to the variety of his

friendships in England and America and to his editorial discrimination. In allusion to this phase of his life, he suggested to Lowell as an inscription over his grave, "He had good friends, whom he loved." Yet his was never too exclusive a disposition. A lover of the beautiful in art, he was also a worker for the beautiful in life. Between 1846 and 1849 when he was still in the counting-house, he opened a night school for men and boys in Cambridge; he was a director of the movement for model lodging-houses in Boston; he was a zealous worker for the Union cause, especially through his editorial labours for the New England Loyal Publication Society. When he died (Oct. 21, 1908) at "Shady Hill," the gracious house in which he had been born, he left the memory of a serene and well-ordered life.

The best record of his life is afforded by his *Letters*, which were edited with biographical comment by his daughter Sara Norton and M. A. De Wolfe Howe (1913). Tributes to his work and personality may be found in *The Harvard Graduates' Magazine* (vol. 16, Dec. 1907; vol. 17, Dec. 1908) and in T. W. Higginson, *Carlyle's Laugh* (1909).

NORTON, THOMAS (1532–1584), English lawyer, politician and writer of verse, was born in London in 1532. He was educated at Cambridge, and early became a secretary to the protector Somerset. In 1555 he was admitted a student at the Inner Temple, and married Margery Cranmer, the daughter of the archbishop. From his eighteenth year Norton had begun to compose verse. He contributed sonnets to *Tottel's Miscellany*, and in 1560 he composed, in company with Sackville, the earliest English tragedy, *Gorboduc*, performed before Queen Elizabeth in the Inner Temple on Jan. 18, 1561. In 1562 Norton, who had served in an earlier parliament as the representative of Gatton, became M.P. for Berwick, and entered with great activity into politics, especially religious politics, and was employed on official business in the Channel islands and at Rome. Towards the end of his life he was a fanatical anti-Catholic. His punishment of the Catholics, as their official censor from 1581 onwards, led to his being nicknamed "Rackmaster-General." At last he was deprived of his office and thrown into the Tower. Walsingham presently released him, but he died on March 10, 1584.

For *Gorboduc see* DORSET, THOMAS SACKVILLE, 1ST EARL OF. The best account of Norton, and his place in literary history, is that of Sidney Lee in his *Dictionary of National Biography*. (E. G.)

NORWALK, a city of Fairfield county, Connecticut, U.S.A., 42 m. N.E. of New York city, on Long Island sound at the mouth of the Norwalk river. It is on Federal highway 1, and is served by the New York, New Haven and Hartford railroad and steamboats to New York. Pop. (1920) 27,743 (21% foreign-born white); 1928 local estimate over 32,000. The city's area of 25 sq.m. embraces districts of very diversified character: the port and manufacturing centres, summer resorts along the sound and residential sections old and new. Around the green (shaded by fine elms) are several old churches. The traffic of the harbour amounted to 159,232 tons in 1925, valued at $6,612,634. Foreign commerce was represented by imports of 17,900 tons of ground wood. The city has important oyster fisheries. Its numerous and varied manufactures were valued in 1925 at $36,345,528. The assessed valuation of property for 1926 was $46,216,109. The site of Norwalk was purchased from the Indians in 1640 by Roger Ludlow and Daniel Patrick. The first settlement was made in 1649 by a small company from Hartford, and the town was incorporated in 1651. The city was formed by its consolidation in 1913 with the city of South Norwalk (chartered 1870). It was from Norwalk that Nathan Hale, disguised as a Dutch school teacher, started on his fatal errand to Long Island in Sept. 1776. The village was burned by the British under Governor Tryon on July 12, 1779, and a chair is preserved in which (the story goes) Tryon sat and watched the flames from Grumman's hill.

NORWALK, a city of northern Ohio, U.S.A., on Federal highway 20; the county seat of Huron county. It is served by the New York Central, the Wheeling and Lake Erie and electric railways. Pop. 7,379 in 1920, 92% native white; estimated locally at 8,300 in 1928. Century-old maple trees line most of the streets, and the manufacturing industries include canneries, wood-working plants and a large piano factory. Norwalk was settled in 1817 by colonists from Norwalk, Connecticut. It was incorporated as a town in 1829 and chartered as a city in 1881. It lay within the "Fire Lands" grant made in 1792 by the State of Connecticut to the people of eight Connecticut towns, to indemnify them for losses by fire during the British expeditions under Governor Tryon in 1779 and Benedict Arnold in 1781.

NORWAY (*Norge*), a kingdom of northern Europe, occupying the west and smaller part of the Scandinavian peninsula. Its east frontier marches with that of Sweden, except in the extreme north, where Norway abuts on Finland. On the north, north-west, west, the boundaries are the Arctic ocean, Norwegian sea (Atlantic ocean) and North sea respectively. The Skagerak washes it on the south and south-east. The south extremity of the country is the island of Kraage near Mandal in 57° 57′ N., and the north that of Cape Knivskjerodden (71° 11′ N.), west of the North cape on the island of Magerö. Of the mainland, the promontory northernmost is Nordkyn, in 71° 8′ N., the southernmost, Lindesnes in 57° 59′ N. Hence the south extremity of Norway lies in the same latitude as Dornoch firth (Scotland) and of mid-Kamchatka. The most western island, Steinsö, lies off the mouth of the Sogne fjord (4° 30′ E.), and the easternmost point is Hornö (31° 10′ E.) near Vardö. The direct length of Norway (south-west to north-east) is about 1,100 miles. The extreme breadth (about 61° N.) is 260 m.; the average is about 60 m., but the Swedish frontier approaches within 5 m. of a head-branch of Ofoten fjord, and the Finland frontier within 22 m. of Lyngs fjord. The length of the coast line is difficult to estimate; disregarding indentations it is about 2,110 m., but including the fjords and greater islands it is probably 12,000 miles. The total area was estimated at 124,964 sq. miles (1920).

Physical Features.—The main highland mass of the whole Scandinavian peninsula is a very much eroded plateau which, probably on account of forming, in the main, the watershed between the rapid western rivers and the normally longer and slower eastern rivers of Sweden, has received the name of Kjolen (the Keel). Although the plateau as a structural feature may be considered to extend from south-west Norway to North cape and even beyond into Spitsbergen, yet its ridge-like character is most marked where it coincides most closely with the Swedish boundary, *i.e.*, north of 63° N., and there is a desirable tendency to restrict the name to this portion. The high plateau consists of early Palaeozoic rocks which represent one of the oldest structural elements in Europe. An Archaean zone stretches along the west coast from Bergen to Hammerfest interrupted towards the north by overlying patches of Palaeozoic deposits. Gneiss predominates, but other crystalline rocks occur subordinately. The Lofoten islands consist chiefly of eruptive granite, syenite and gabbro. South of a line drawn from the head of the Hardanger fjord to Lake Mjösen is another great Archaean area.

A line drawn from the Nase to the North cape coincides roughly with a marked change in the character and structure of the Palaeozoic rocks. East of this line even the Cambrian beds are free from overfolding, overthrusting and regional metamorphism. They lie flat upon the Archaean floor, or have been faulted into it in strips, and they are little altered except in the neighbourhood of igneous intrusions. West of the line the rocks have been folded and metamorphosed to such an extent that it is often difficult to distinguish the Palaeozoic rocks from the Archaean. They form in fact a folded mountain chain of ancient date which has subsequently been worn down and then faulted up. No volcanic rocks of recent date are known in Norway. This faulting largely accounts for the almost unique character of the river and coastal topography of Norway. Differential erosion, partly glacial, has caused many of the highland masses to form prominent mountain summits not only on such islands as the Lofoten chain, but on the plateau itself. The average height of Norway is probably about 1,600 ft. and may be compared with approximately 1,000 ft. for Europe as a whole. This high figure for Norway is not dependent so much on the height of individual summits as on the absence of extensive lowlands; south-east Norway is the lowest part and even this is of a hilly nature. In the area north-west of the Norway-Finland boundary a few peaks reach slightly

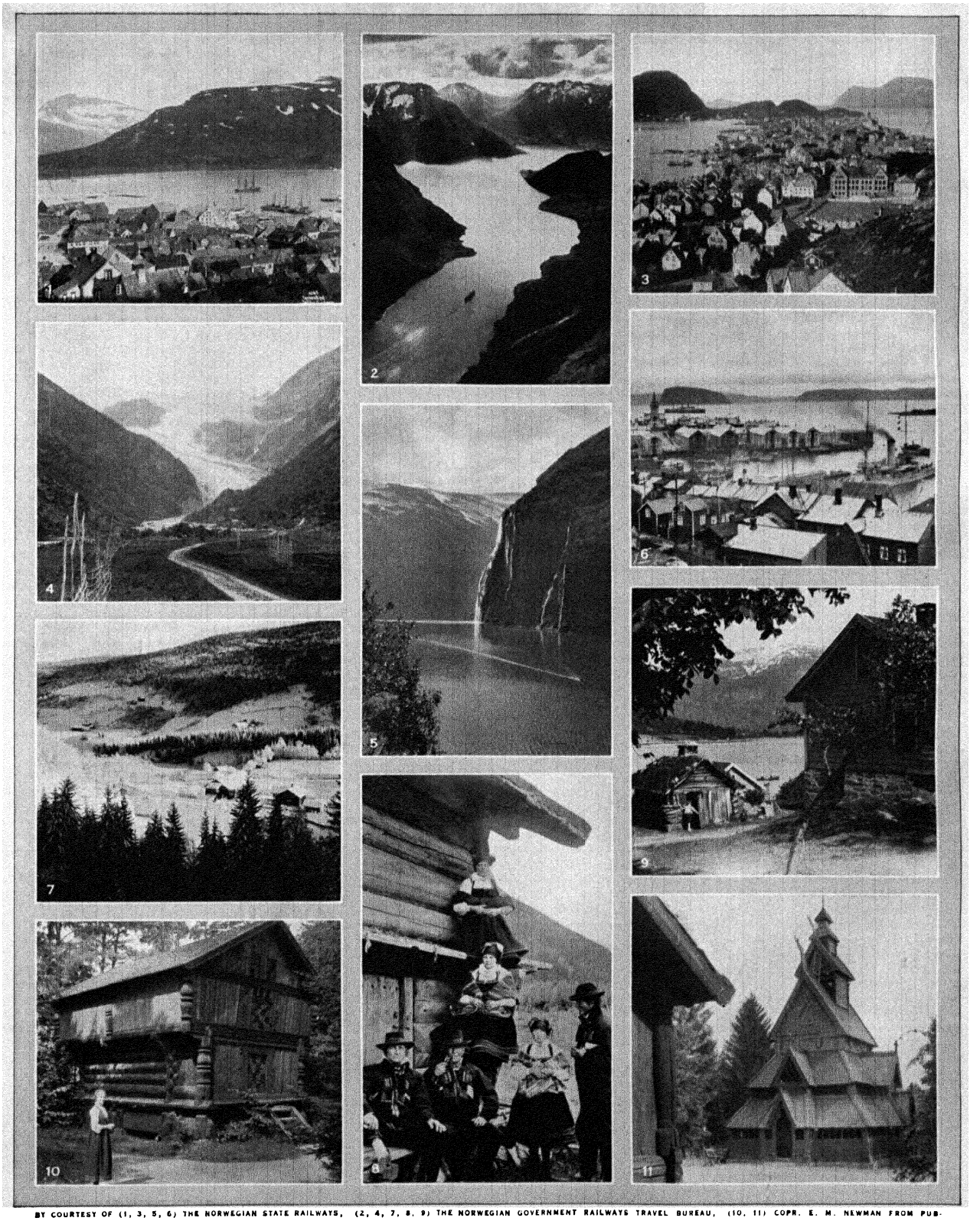
over 4,000 ft., but immediately south of the junction of the three countries the general height increases considerably, though the most lofty summits are entirely Norwegian only in the extreme north of this area. (*See* SWEDEN.) Here Jaeggesvarre (6,283 ft.) lies between Lyngs and Uls fjords, and Kistefjeld (5,653 ft.) provides right bank water for the Barduelv, which runs westward north of Torneträsk. Sulitjälma (6,158 ft.) lies actually on the frontier. Nearer the coast and centred approximately on the Arctic circle is the great icefield of Svartisen (*see* GLACIERS), through which projects Snetind nunatak (5,246 ft.). The only important peaks immediately south of this are Okstinderne (6,273 ft.), and the rather better known Stora Börgefjeld (5,587 ft.). At about Lat. 63½° N. is the southern limit—Trondhjem fjord—of a remarkable depression which runs for upwards of 200 m. south-west to north-east dividing the narrowest part of Norway into almost equal eastern and western strips. Its exit is at Saltfjord (near Bodö) and it is characterized by numerous rivers, some draining north, others south; the depression is of the greatest importance for internal communication and for future railway routes. Due east of Trondhjem fjord the plateau is lowest and narrowest, again offering a relatively easy communication route already utilized by a railway. Also from this fjord southwards is a valley line and a railway route to the Upper Glommen valley and down this to Oslo. South of the Trondhjem "narrowing" the plateau swings westwards, becoming higher, wider and more definitely Norwegian. The Sogne fjord (61° N.) and its branches reach out towards a giant horseshoe of the highest ridges in Norway; northwards are the Jostedalsbrae; the Jotunheim lies north and north-east; the Hardanger fjeld is south-east and the Voss lies south. North-east of the Jotunheim beyond the deep cleft of Gudbrandsdal and its north-west counterpart the Romsdal, is the Dovre fjeld, and south-east of this, the Rondanefjeld. South of the Hardanger fjeld, beyond Hardanger fjord, is the lake-sprinkled Hardanger Vidda, the most expansive tract of open high plateau in Europe; south-eastwards this plateau merges into the lower hummocky Telemark mountains which are drained south and south-east to the Skagerak. The most lofty summits occur in the Jotunheim with Galdhöpiggen (8,097 ft.) as the highest Norwegian mountain, though if the 100 ft. or so of snow on the top of Glitterkind is included, then this reaches to 8,140 ft.; nearly 30 peaks in all exceed 6,500 ft. in the Jotunheim mass. The other mountain areas are lower, though the Dovre fjeld and the Rondanefjeld have Snehaetta (7,550 ft.) and Rundvashögda (6,890 ft.) as their respective summit masses.

Coast.—The Norwegian mountains fall abruptly to the sea, and the coastline almost throughout is cliffbound. The land features are continued as numerous islands, estimated at 150,000, which fringe the mainland. This island fringe, occurring also in a modified form along the Swedish coast, is, in Norway, termed the *Skärgård* (skerry-fence). This fringe and the fjord-coast are most fully developed from Stavanger nearly as far as the North cape, but only between Stavanger and Flekkefjord can the coast be considered smooth and moderately free from islands. Here, particularly north of Egersund, a narrow lowland, abundant in peat bogs, is fringed by a flat, open coast, dangerous to shipping. The channels within the island line are of incalculable value to a people largely dependent on coastwise navigation. In fact, the voyage northward from Stavanger may be made in quiet waters almost throughout. Only at rare intervals, as off the port of Haugesund, or when crossing the mouth of some large fjord, need the open sea be encountered. At some points large steamers follow the carefully marked deep-water channel, between cliff edges which seem to overhang the vessel on either side. Small vessels, fishing or trading between the fjord-side villages, navigate narrow ramifying "leads" (*leder*) where the sole danger is the tidal current, often exceedingly strong. The largest island is Hindö (Lofoten and Vesteraalen group), about 850 sq.m. in area.

Glaciers.—The relatively insignificant Norwegian glaciers of to-day have unimportant effects compared with the glaciation consequent on the presence of the enormous ice-fields in the last Ice age. To these latter glaciers is owed much of the smoothing of islands and the fjord character of the coast. The rounded nakedness of the mountains, the U-shaped valleys, the shelf-like ledges over which the rivers plunge, to produce the "white coal" of Norway, and the pockets of finely divided fertile soils in rock basins are all direct legacies. The level terraces and raised beaches which exist on some of the coasts and prove such desirable sites for settlement are mainly composed of glacial débris once deposited below sea-level but now elevated by land oscillation. To-day Norway still contains the largest European icefield—the Jostedalsbrae. This is some 400–500 sq.m. in extent: from it glaciers run to within 150–200 ft. of sea-level. Jotunheim, though glaciated, has the ice-cap broken by deep valleys, also as it lies further east the precipitation is lower and the summer temperatures higher—two factors seriously affecting the size of ice-caps. Between Hardanger fjord and its branch, Sörfjord, is Folgefond—110 sq.m.—and the most southerly considerable area in Norway. Second in point of size to the Jostedalsbrae, but not inferior in interest, is Svartisen—230 sq.m. in area, from which glaciers descend almost to sea-level. In about lat. 70° a small glacier, the Engabrae, actually enters the sea in Jokulfjord (a branch of Kvenangfjord) and gives birth to miniature icebergs. The Seiland glacier (46 sq.m.), on the island of the same name south of Hammerfest, is the most northerly Norwegian example. The snow line in Norway varies in height with aspect and amount of precipitation, but it is everywhere fairly low—ranging from below 3,000 ft. in Seiland to slightly above 5,000 ft. in south Norway.

Many islands, chiefly northern, are of great elevation; thus the jagged granite peaks characteristic of the Lofotens reach about 4,000 feet. Other interesting islands are Hornelen, near the mouth of Nordfjord, rising nearly sheer for 3,000 ft. above the sea; the well-named Torghatten ("the market hat"), north of Namsos, completely pierced, 400 ft. above the sea, by a vast natural tunnel, which on occasion reaches upwards of 290 ft. in height and 80 ft. in width; the quaintly shaped small Hestmannö ("horseman island"), intersected by the Arctic circle, justly named from its form. Bare rock is the dominant feature of the coast and islands, save where a few green fields surrounding a farmstead occupy a miniature level terrace. The oscillation of the land relative to sea-level is illustrated by marine terraces, 600 ft. above the present sea-level, near Trondhjem, and by the numerous former beach lines of north Norway, which are occasionally in pairs at different heights. Nevertheless, at some points (as on the Jaderen coast) glaciated "giants' kettles" may be observed even below the level of high tide thus indicating the greater level of the land towards the close of the Glacial epoch.

Fjords.—Oslo fjord, opening from the north angle of the Kattegat and Skagerak, differs from the great fjords of the west. Its shores are neither high nor precipitous. It is shallower, wider, and is surrounded by the most extensive lowland in Norway. It is studded with numerous small islands. Thence, past Lindesnes, to Bokn fjord there are many small fjords, 300 fathoms in extreme depth, but even the intermittent inner lead which can be traced to Flekkefjord ceases to exist beyond. Bokn fjord is broad and island-studded, but throws off several inner arms, of which Lyse fjord, due east of Stavanger, is 25 m. long and half a mile wide, with precipitous walls. It is the most beautiful and mysterious fjord in south-west Norway. Hardanger fjord (355 ft. extreme depth) penetrates the land for 70 m. and is frequently visited, for it lies near to shipping routes which converge on Bergen, but its beauty is exceeded by that of Sogne fjord and Nordfjord farther north. Sogne is the largest and deepest fjord of all; its head is over 100 m. from the sea; its maximum width scarcely exceeds 2 m., and the main channel is 500–660 fathoms deep. Some of the northern arms intersect the snow-clad Jostedalsbrae, and their dark blue waters have a surface layer showing a milky tinge imparted by glacier-fed streams. Nordfjord (340 ft. in extreme depth) touches the northern side of the Jostedalsbrae and is popular with tourists. Stor fjord opens inland from Aalesund; it is over 70 m. long and is wild and imposing. Trondhjem fjord (300 ft. in extreme depth), the next great fjord northward, broadens inland from a narrow entrance, but lacks

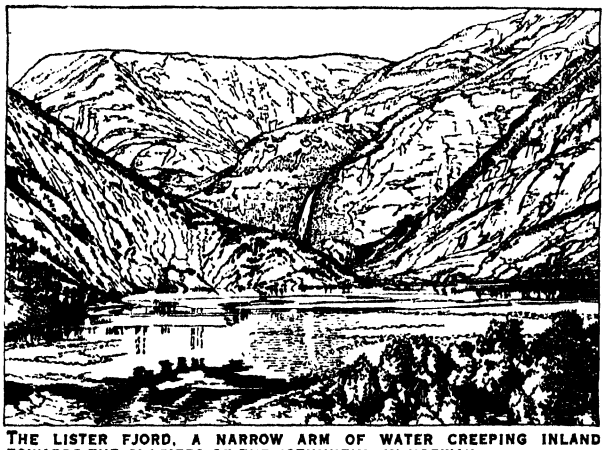


BY COURTESY OF (1, 3, 5, 6) THE NORWEGIAN STATE RAILWAYS, (2, 4, 7, 8, 9) THE NORWEGIAN GOVERNMENT RAILWAYS TRAVEL BUREAU, (10, 11) COPR. E. M. NEWMAN FROM PUBLISHERS PHOTO SERVICE

SCENES IN NORWAY

1. Hammerfest, 70° 35′ north latitude (the midnight sun); a tourist town well within the Arctic Circle. 2. Norangsfjord in the northwest, showing the characteristic ribbon of water and glaciated slopes. 3. Aalesund, port of call on an island near entrance to Storfjord. 4. The Hardanger district, with the Buarbrae Glacier in the background. 5. Geirangerfjord; the vessel in the channel indicates the scale of the view. 6. Trömso, important port and tourist centre more than three degrees north of the Arctic Circle. 7. Roa near Oslo; a typical winter landscape of south Norway. 8. Local costumes of peasant farmers in south Norway. 9. Farm on the Esefjord, Sogne district. 10. 13th century Viking storehouse. 11. 11th century wooden church at Fantoft near Bergen

grandeur as the elevation of the land is reduced at the Trondhjem "narrowing." Immediately north of Trondhjem, the fjords, though long, are not so extensive and the coastline loses its grandeur, but north of Salt fjord, which lies beyond the great Svartisen icefield, the scenery is unsurpassed. Salt fjord is connected with Skjerstad fjord by three narrow channels, where the water, at ebb and flow, forms powerful rapids. The Lofoten islands and Ves-



THE LISTER FJORD, A NARROW ARM OF WATER CREEPING INLAND TOWARDS THE GLACIERS OF THE JOTUNHEIM, IN NORWAY

teraalen are separated from the mainland by the Vest fjord (340 ft. deep), which is continued inland by Ofoten fjord, on which is situated Narvik, the railhead town for the line from Sweden. The main fjords north of Vesteraalen have a general northerly direction; among them is Lyngs fjord near Tromsö, with high flanking cliffs. The softer and looser schists are more prevalent in the north, hence the fjords are wider, branched and interlaced, particularly in Finmark. The Alte fjord (225 ft. extreme depth) is remarkable for the vegetation on its shores. From Lofoten north there is a chain of larger islands: Senjen, Kvalö, Ringvadsö, Sorö, Seiland and Magerö, thus extending to the most northerly point, but hereafter the Skärgård ends abruptly. The coast to the east is of widely different character; flat mountain wastes descend precipitously to a sea destitute of islands, save Vardö, with two low islets at the eastern extremity of Norway. The chief fjords are Porsanger and Tana, opening north, and Varanger opening east. North of the last fjord the land is low and the landscape monotonous; on the south of it a few islands and branch fjords break the smoothness of the coast line.

Hydrography.—Both in respect of rivers and of lakes Norway is well supplied. As a rule, the rivers are short and have a small basin; and the lakes are long, of little area, but of great depth, for many give soundings showing their beds to be well below the present sea-level. In this connection, Mjösen, the largest Norwegian lake, 140 sq.m. in area at an altitude of 397 ft., has a maximum depth of 1,482 ft. (nearly 1,100 ft. below sea-level); Tyrifjord (alt. 207 ft., area 51 sq.m.) has its maximum depth 700 ft. below sea-level; Tinsjön (alt. 605 ft., area 17½ sq.m.) with its bed over 800 ft. below sea-level; but the most remarkable case is Hornindalsvand, 6 m. beyond the head of Nordfjord —20 sq.m. in area, 180 ft. alt.; its maximum depth is 1,414 ft. below sea-level. Many of the high level lakes are also of great depth, *e.g.*, Bydinsjön—area 17½ sq.m., alt. 3,485 ft., greatest depth 705 ft. The total number of lakes, tarns and pools is very high: in all they probably cover nearly 2,950 sq.m. (2½% of entire country). In many cases the low-lying lake near the head of a fjord is separated from sea water by a narrow but steep-sided neck of land which on further land subsidence would resemble the submerged sill which is so characteristic of the underwater topography of the fjords. The majority of the river valley lakes resemble mere expansions of the width of the river, and possess strong currents, hence their value for internal transport is, on the whole, less important as routes for water-borne traffic than for providing through lines for land communication in the difficult mountainous sections of the country. Stora Le on the frontier in the south-east is somewhat exceptional, for it provides a definite water-transport link between a canal system of Norway and one of Sweden. The majority of the rivers run swiftly between steeply sloping valley walls, particularly in their upper and middle courses, and are there of little or no value for any form of navigation though they are extremely useful as gigantic flumes for the gravity carriage of timber. They are utilized as water-heads for hydro-electric schemes by which nearly 1,400,000 horse-power are now being developed and used.

The unexploited sources are still enormous, over 10 million horse-power, and the people are fully aware of this source of natural wealth. Its development becomes easier on account of the numerous rapids and falls which characterize the rivers. As Norway also fully realizes the financial value of her remarkable scenery and of her anglers' haunts, the mode of utilizing this smokeless-power in the industrialization of any area will be given much thought. A limiting factor in the "white coal" schemes is the seasonal character of many Norwegian streams which run low in winter on the freezing of their upper courses and rise rapidly during the period of maximum rainfall—here the lakes are of supreme value as safety-valves controlling spring thaw-water and autumnal rain water. Nevertheless, disastrous floods are not unknown. The lakes themselves in the north and interior freeze for varying periods each year, but in the south, where the majority of the large lakes are situated, it is only during very severe winters that these reservoirs become icebound. In a land where rivers possess so many and so varied interests selection becomes difficult.

The principal river of Norway is the Glommen, about 400 m. long, which rises about 2,300 ft. above sea-level in the highlands south of Trondhjem fjord. It is a swift stream with numerous falls, and even within 8 m. of its mouth, in Oslo fjord, there is a series of seven falls of which Sarpsfos (60 ft. high and 164 ft. wide) is the best known. The river, which runs mainly north to south, drains about 16,000 sq.m., pierces the richest timber area and provides an important railway route from Oslo to Trondhjem. Above Öieren (area 36 sq.m.) the largest lake of the numerous ones in its course, the Glommen makes a remarkable bend (at Kongsvinger). Here, in post-glacial times, the river which formerly ran due south to Väner lake (Sweden) made a sudden swing to the west capturing the upper waters of the Laagen, formerly an independent stream. (The old bed still carries occasional flood water from the Glommen to the lake.) The Laagen, 200 m. long, has, for a Norwegian river, a large upper basin receiving water from the Jotunheim and the Dovre fjeld. Its sources lie near Romsdals fjord, for which it is providing the following railway route direct from Oslo: along its lower course (River Vormen) past the shores of Lake Mjösen up the Gudbrandsdal, over the water parting and down Romsdal—another railway line links Trondhjem with the head of Gudbrandsdal. This last name illustrates a common practice, in Norway, of using different names for a river in its different courses, and different names for a river and for its enclosing valley—the valley name being also frequently employed for surrounding districts. Of the other important streams entering Oslo fjord, the Tistedalelv reaches its eastern seaboard after draining through a series of long, narrow lakes connected by rapids; the Dramselv (Drammen), a large river with a considerable basin extending into Hemsdals fjeld, Valdres and File fjeld, enters on the western sea-board. Its upper tributaries, the Randselv and the Aadalselv (plunging over Hönefos), unite to form the Storelv which expands into the Tyrifjord lake. Below this the real Dramselv begins and receives, on the right bank, the Hallingsdalelv which flows through Lake Kröderen—all these valleyways afford important but not easy routes, and, though the rivers are not navigable for any long stretches yet steamers are employed on the lakes. Numerous streams drain southwards from the plateau and lake district of Hardarger Vidda, one of these, the Numedalslaagen (nearly 200 m.) is noted for its falls, *e.g.*, Hammerfos and Labrofos, and for its wealth in salmon. From the Telemarken district, runs the Skienelv (150 m.) flowing through the very deep Tinsjön and the slightly larger, deep Nordsjön; the former lake receives the river Maane, on which is the famous Rjukanfos (415 ft. high).

The most notable falls occur in the courses of the shorter and more rapid western streams. Some of the most striking, in order from the south, are: Vöringfos (535 ft.) on the Bjoreia and Skjaeggedalsfos (525) on the Tyssaå—these two are in the Hardanger fjord area. Around Sogne fjord are several, of which Vettisfos (850 ft.) on the Morkedöla is probably the most interesting. The famous "Seven Sisters Falls" are in a branch of the Storfjord, while the Namsenelv (85 m.) a popular salmon river entering Namsenfjord has Fiskumfos (105 ft.) and several others. The Arctic ocean rivers have gentle gradients, occasional rapids but no important waterfalls. Two longer ones are the Altenelv (112 m.), which drains into the Alte fjord, but unfortunately its valley affords no route of importance and the Tanaelv (120 m. long—third longest river of Norway) which drains a considerable area in Norway and Finland, but the absence of lakes results in summer floods increased by the presence of ice dams. The lower river is wide (about 2,000 yd.) and tidal for 6 or 7 m., and is ascended by small vessels. River boats are used along certain river stretches below and above the Storfos rapids which occur about 45 m. from the mouth of the river and have a fall that averages 23 ft. in 1,000 yards.

Flora.—The forests of Norway consist chiefly of conifers. The principal forest regions are in the south-east and south. In the Trondhjem area and in Nordland there are extensive forests of pine and spruce with the pine on the drier, higher, and less congenial parts. In south-east Norway the conifer tracts extend from sea-level to 2,500 to 3,000 ft.; in the inland parts of the Trondhjem region the upper limit sinks to 2,000 ft.; while on the coast the upper limit is only from 600 to 1,200 ft.; farther north the spruce disappears and the pine limit falls to 700 ft. about 70° N. Above and north of the conifers is the birch belt; next follow various species of willows, and the dwarf birch, and last of all, before the snow-line, the lichen belt, in which the reindeer "moss" is always conspicuous, but a few flowering plants, shrubs and trees of the willow belt sometimes extend close up to the snow line. Even among the conifers there is a sprinkling of other trees—lowland birches, aspens and rowans in the high north, while in the south and less elevated districts the lowest zone of forests includes the ash, elm, lime, oak, beech and black alder; but the beech is much rarer than in Sweden and, in fact, flourishes only near the Skagerak; here and elsewhere the extreme coast region is destitute of forest. The richest flora is found in the inland fjord valleys, but the Dovre fjeld is the district in which Arctic flora may be studied in great variety and within narrow limits. Marine flora is very finely developed on the coastal banks.

Fauna.—The great forests are still the haunt of the bear, the lynx, and the wolf. Bears are chiefly restricted to the uplands north of Trondhjem, and the cutting of forests has limited their range to the least accessible highlands. The wolves decreased very suddenly in south Norway about the middle of the 19th century, probably owing to disease, and during the last half-century have continued to decrease in the north; but they are still abundant in Finmark, and are the worst enemy of the reindeer. The elk occurs in the eastern forests, and near the coast in the Trondhjem district, but is now becoming rare. The red deer is confined chiefly to the west coast districts; its principal haunt is the island of Hitteren, off the Trondhjem fjord. It is usually regarded as a survival of the oak age. On the high fjelds are found the wild reindeer, glutton, lemming and the fox. The wild reindeer, which occurs in Finmark has decreased, though large tame herds are kept by the Lapps. The lemming is noted for its curious non-periodic migrations; at such times vast numbers of these small animals spread down country, even swimming lakes and fjords. They are pursued by beasts and birds of prey, and even the reindeer kill them for the sake of the vegetable matter they contain. Hares are very common all over Norway up to the snow line. The beaver, formerly widespread, decreased seriously, but strict protection has saved it, and it is fairly plentiful in the south Norway valleys.

Game birds are fairly abundant in most districts. Black grouse are widely distributed in the region of conifers and birches south of Finmark. Hazel grouse are found mainly in the spruce forests of the south-east and east, and fairly generally in the north, as are capercailzie, but the former is lacking in the west, and the latter is found near certain fjords only. Woodcock and snipe are moderately plentiful. The partridge, an immigrant from Sweden, occurs principally in the east and south-east. A severe winter causes a marked scarcity of them. A very large proportion of the Norwegian avifauna consists of migratory geese and ducks, various birds of prey, golden plover, etc. These birds leave in autumn by three well-defined routes—one from Finmark into Finland, one by the Cristiania valley, and one by the west coast, where they congregate in large numbers on the lowlands immediately south of Stavanger; but certain high Arctic birds as the king-eider, Spitzbergen guillemot and the little auk move on to the north Norway coast from higher latitudes at the end of summer. The Arctic type of bunting, the snowy owl, and the rough-legged buzzard are exceedingly numerous. In some localities the puffin and kittiwake form great colonies (*fugleberge*, bird cliffs).

The common seal is very frequent; and Arctic seals visit the northern coasts; among these the harp, or Greenland, seal is believed to be particularly destructive to the fisheries. A large number of the best European food-fisheries occur along the coasts, including cod, herring, mackerel, sprat and flat-fish. Various species of whales visit the coast; the most important is the rorqual, or finner—the largest is the blue whale, which appears off the coast of Finmark from June to August. Other finners are the *true finner* and the smaller fish-whale. The most important of other types of whales are the bottle-nose, the humpback and the caaing whale. Of freshwater fish the *Salmonidae* are by far the most valuable. Next to these, perch, pike, grayling and minnow are most common.

South Norway is richer than west Norway in insects, and north Norway has numerous characteristic Arctic types.

Norway is much frequented by British anglers. The *Salmonidae* have penetrated considerable distances inland, and though the trout is the only one to reach many of the upland lakes yet it is very abundant there. (Most of the owners of water rights have a full appreciation of the value of good fishing to sportsmen, especially when netting rights are given up for the sake of rod-fishing.)

Climate.—The striking and unique feature of the climate of Norway is the presence of the largest positive temperature anomaly on the surface of the globe, which results in such unusual conditions as average temperatures within the Arctic circle which are higher than those of places farther east and 20° of latitude farther south. Again, Hammerfest, a thriving settlement of over 3,000 inhabitants, is actually north of King William's Land, which witnessed the tragedy of the Franklin polar exploration party. This temperature anomaly is consequent on the warm water and air-drift across the Atlantic ocean on to the shores of Norway. February is the coldest month, and south-east Norway then has a mean temperature of below 32° F (Oslo 23·9°), but the coldest parts in this area are the Glommen valley, between Tönset and Röros (near the Swedish border). At the latter place (altitude 2,067 ft.) the February mean is 12·2° and an absolute minimum of approximately 80° F of frost has been recorded. Even this intense cold has been exceeded at stations near the Norway-Sweden boundary in Lapland. A somewhat unusual phenomenon is that lower-lying stations occasionally show lower winter averages than upland stations near to them; *e.g.*, Tönset 11° average against Röros 12·2°. Tromsö, Skudenes (on an island north of Stavanger) and Bergen have averages of 25·0°, 34·5° and 33·6° respectively. The number of days on which frost occurs varies between 60 at Skudenes and 240 in certain parts of Finmark; North Cape has about 190. The fjords are not penetrated by the cold water from the open ocean and are always ice-free except for patches along shallow coastal stretches during unusually severe winters. Summer temperatures range between slightly below 50° in the extreme north (Tromsö 51·8° F July average), and 60·6° at Oslo in July. Röros, with much greater altitude, has 52·2° average in the same month. The south-east of Norway is the warmest part in summer. At Bergen and Sku-

denes the warmest month is August (57·9° average for each). Absolute maxima are high, and the following have been recorded: Skudenes, 84°; Bergen 86°; Oslo 93°; and even Karasjok, in Lapland, has recorded 88°. The annual range increases from west to east generally and from south to north along the coast.

Though the south-west wind is usually prevalent over Norway and very marked in summer yet the winter high pressure area causes outflowing winds. These may be roughly classified thus:—

In Winter	(Skagerak) N.E.	West Coast S. and S.E.	North Coast S.W.

Gales are frequent on the west coast, averaging three to four per month in winter and about one to two per month in summer. In the interior and east gales are comparatively rare. Gales from the south-west bringing rain are the most common; next in frequency are gales from the north-west bringing snow. Calm weather is rare on the west coast but frequent in the interior. December and January are the stormiest months. Hailstones and thunderstorms are not of frequent occurrence in any part of Norway.

The number of days on which rain or snow falls is greatest on the north-west and north coasts, least in the south-east districts and the interior of Finmark. In the former area, precipitation occurs on about 200 days in the year. On Dovre fjeld and the south-east coast the average is about 100 days. Snowfall occurs least frequently in the south (*e.g.*, at Mandal, 25 snowy days out of 116 on which precipitation occurs), increasing to 50 at Oslo, and Dovre fjeld, to 90 at Vardö, and to 100 at the North cape. Hence in the north and in the upland tracts, snow occurs at least as frequently as rain. Snow may fall in any month on the coast as far south as the Lofotens. The amount of precipitation exceeds 100 in. per annum in the mountains a few miles from the coast north and south of Sognefjord. On the outer islands there is a slight decrease; inland the decrease is rapid and great. In the extreme south of the country the average is about 39 in. There is a diminution eastward along the north coast and a further rapid decrease towards the northern interior, where the average is 16 in., but strongly marked local variations are observed.

The amount of cloudiness is great. The coast of Finmark has over three cloudy days to one clear day; in the interior of the country clear and cloudy days are about equally divided. Summer fog is frequent on all coasts but fog is rare in winter, though occasionally experienced in the south-east. Sometimes, in severe winters, a frosty fog ("smoke-frost") appears on the west coast fjords, and is caused by the piercingly cold land wind passing over the relatively warm water.



BY COURTESY OF NORWEGIAN GOVT. RAILWAYS

WOMEN DRESSED IN THE NATIVE COSTUME OF GUDBRANDSDAL AND SETESDAL

The "Midnight Sun."—Part, at least, of the sun's disc is above the horizon at the North cape continuously from May 12 to July 29, and at Bodö, in lat. 67° 17′ N., from July 3 to July 7. Even at Trondhjem there is practically no night from May 23 to July 20, while the long twilight gives the extreme south of Norway no real darkness from the end of April to the middle of August. In winter, on the other hand, the sun does not rise above the horizon at the North cape for over two months and there is only a twilight at midday. In the extreme south mid-winter night is 17½ hours long.

Population.—The resident population of Norway on Jan. 1, 1927, was estimated at 2,788,893. The table below shows the area and population of each of the 18 *Fylker* (counties) and of the two largest towns, according to the decennial census taken in 1920:—

District	Population 1920	Area in English sq.m.
Southern—		
Östfold	160,128	1,614
Akershus	179,962	2,059
Oslo (city)	258,483	6·3
Buskerud	137,249	5,718
Vestfold	124,060	902
Telemark	125,245	5,864
Aust-Agder	74,700	3,608
Vest-Agder	82,807	2,805
South-eastern (inland)—		
Hedmark	149,619	10,636
Opland	129,149	9,752
Western—		
Rogaland	166,423	3,527
Hordaland	156,218	5,991
Bergen (city)	91,443	13·5
Sogn og Fjordane	90,114	7,132
More	159,391	5,811
Sör Tröndelag	166,797	7,212
Northern—		
Nord Tröndelag	89,221	8,653
Nordland	173,826	14,700
Troms	90,750	10,421
Finmark	44,190	18,540
Total	2,649,775	124,965

This gives an average population per square mile of but 21·2, hence, Norway, on average, is the most thinly populated political unit in Europe. The most sparsely populated English county, Westmorland, had 83¼ persons per square mile in 1921. This was exceeded only in the fylker of Vestfold, Östfold and Akershus with 137·6, 99·2 and 87·4 respectively. The next in order was Rogaland with 47·2. The first three are the smallest Norwegian counties and are in the immediate neighbourhood of Oslo. Rogaland is in the extreme south-west of the country. A vast area practically uninhabited, save in the north by nomadic Lapps, reaches from the extreme north as far south as the middle of Hedmark, apart from small local patches of denser population such as those in the outer Lofoten islands and across the Trondhjem depression. The most northerly fylker, Finmark, is the least thickly populated (2·4 per square mile); in many highland regions habitations are hardly less scanty than in the lowland regions of the extreme north. The vast majority of the population dwell by the coast and fjords. In 1920, 1,864,371 were living in rural districts and 785,404 in towns. Of the chief towns of Norway, Oslo, the capital, had a population in 1920 of 258,483, Bergen of 91,443, Trondhjem of 55,030, Stavanger of 43,778, Drammen of 26,204. The towns with populations between 20,000 and 15,000 were the ports of Haugesand, Alësund, Kristiansand, Skien, Fredrikstad and Kristiansünd.

The population of Norway in 1801 was less than one million; the increase was very marked from 1815 to 1835, after which rates of increase gradually diminished. The second half of the century, down to 1890, was the period of heaviest emigration, chiefly to the United States of America. Emigration slackened in the last decade of the 19th century, during which period the movement from rural districts to towns, which had decreased from about the middle of the century, revived. The number of Norwegians abroad is probably about 400,000. In 1926, 9,326 emigrated (6,497 to U.S.A. and 2,570 to Canada). The Lapps, 19,328 in 1920, called Finns by the Norwegians, were confined especially to Finmark, and are estimated at about 1% of the population. There were also 7,309 Finns, whom the Norwegians call Kvoener. Of Lapp-Finns there were 2,814. The excess of births over deaths, about 1·8 to 1 in 1926, is much above the European average; the death-rate is unusually low. The number of marriages is rather low, the average marriage age being high. The percentage of illegitimacy, about 6·7% of total births in 1926, has shown a recent decrease, but is still above that for many European countries. The preponderance of females over males (1,359,306 to 1,290,469 in 1920) is partly accounted for by the number of males who emigrate, whilst the higher mortality of males is traced in part to the dangers of a seafaring life.

Government.—Norway is a constitutional and hereditary monarchy. The Constitution rests on the fundamental law (*Grundlov*) promulgated by the National Assembly at Eidsvold on May 17, 1814, and altered in detail at various times, particularly after the dissolution of the union with Sweden on June 7, 1905. The executive is vested in the king, who comes of age at 18. His authority is exercised through a council of State consisting of a prime minister (*statsminister*) and at least seven other councillors (*statsraader*), who are the heads of finance, church and education, justice, defence, public works, commerce and industry, agriculture and social affairs. The prime minister is normally in charge of foreign affairs. The king has the command of land and sea forces and makes all appointments, but contrary to the custom in most other countries the king has no power to dissolve the parliament (*storting*). The 150 members of this legislative body are elected directly by the people, divided into electoral divisions in such a manner that the towns are represented by one-third of the total members. Elections are direct, proportional, and take place every three years. The franchise is extended to all Norwegian citizens, male and female, who have completed their twenty-third year and have resided five years in the country. There are certain mild legal conditions of citizenship. A parliamentary member (*stortingsmand*) must possess the franchise in his constituency; must have resided ten years in the country; and must not be less than 30 years of age. Women, since 1915, have been entitled to membership of the King's Council, but up to 1928 none have been so appointed. The *storting* meets at Oslo on the first weekday after Jan. 10 each year and remains assembled as long as may be found necessary. After the opening the assembly divides itself into two sections, the upper (*lagting*) consisting of 38 members and the lower (*odelsting*) of the remainder. The inspection of public accounts and revision of the Government belong exclusively to the *odelsting,* which also first receives each new bill; if passed there it is sent to the *lagting,* and if carried there it is sent forward for the royal assent. If the *odelsting* and *lagting* do not agree, a joint session is held and the fate of a measure is decided by a two-thirds majority of the combined sections. The king has a veto, but if a vetoed measure is passed unaltered by three successive parliaments it becomes law *ipso facto*. Members of parliament are now paid 6,000 k. per annum and their travelling expenses. Parliament has both legislative and administrative authority, it also fixes taxation, and has control of the members of the Council of State, who though they may take part in discussions may not vote in the *storting*.

Justice.—An outstanding characteristic of Norwegian legal procedure is that civil cases are usually brought first before the town or district commission of mediation (*forliksraad*) from which an appeal lies to the local inferior courts, which are also tribunals of first instance, and are worked by judges on circuit and by assessors. There are three superior courts of appeal (*overrettene*) at Oslo, Bergen and Trondhjem, and one supreme court (*höiesteret*). Criminal cases are tried either in jury courts (*lagmandsret*) with three judges and 10 jurors or courts of assize (*meddomsret*) with one judge and two assistant judges. The first is for more serious offences; the second deals with minor offences and is a court of first instance. Military crimes are dealt with by a military judicial organization. Finally, there is a High Court of the Realm (*rigsret*) composed of the *lagting* and the ordinary members of the *höiesteret*, before which members of parliament, the Government, etc., are tried for misdemeanours committed in their public capacity.

Local Government.—The country is divided into 20 districts, viz., 18 counties (*fylker*) (see *population*) and the cities of Oslo and Bergen. Other towns are formed into 65 communes, governed by representatives, from whom a council of one quarter of the total representatives is elected by themselves; 672 rural communes (*herreder*) are similarly administered, and their chairmen form a county council (*fylkesting*) for each county. At the head is the *fylkesmann*, the county governor. The electoral system for local councils is the same as the parliamentary system, and has been extended to women under similar conditions.

Religion and Customs.—The endowed State religion, to which the king must conform, is Evangelical Lutheran. In 1920 there were but 71,062 dissenters, though all Christian sects except Jesuits are tolerated. The king nominates the clergy of the Established Church.

Norway is divided into seven bishoprics (*Bispedömmer*), Oslo, Hamar, Khristiansand, Bergen, Trondhjem, Tromsö, and Stavanger; and these into 91 archdeaconries (*prostier*) with subdivisions into 514 clerical districts (*prestegjeld*), parishes, and sub-parishes. The clergy take a leading part in primary education, which, in spite of the difficulties arising in a sparsely populated country, reaches a high standard.

Down to the middle of the 19th century drunkenness was a strongly-marked characteristic of Norwegians. A strict licensing system was then introduced with success. Local boards were given a wide control over the issue of licences, and in 1871 incorporated societies (*samlag*) on the Swedish model were introduced to monopolize and control the retail trade in spirits. Their work practically ceased when the existing prohibition came into force. A plebiscite in 1919 gave 487,999 votes for and 304,297 against prohibition. On account of existing and potential trade treaties with France, Spain and Portugal it was decided that the plebiscite should have an advisory force. At present all production and trade in spirits as beverages is prohibited, and the wine monopoly severely controls the sale of wine and beer even in those districts where the local municipal authorities have issued a licence, without which sale is impossible.

In Norway there is a strongly individual national character, as is shown in the case of modern music and painting, combined with conservatism of ancient rites and practices. Such peculiar customs as those associated with weddings, lighting of the midsummer fires and the attendant celebrations still survive. In coastwise trade and fishing, high-prowed square-sailed boats, the direct descendants of the Viking vessels, are still frequently employed. Examples of the ancient farmstead, composed of a group of single-chambered wooden buildings, are preserved, and mediaeval ornamental woodwork remains important. Wood is the principal building material except in some larger towns. In the rural areas fires have left few really old domestic buildings, but the preservation of ancient wooden houses elsewhere makes several of the Norwegian towns peculiarly picturesque. Norway retains a few of the peculiar richly carved small wooden churches (*stavekirke*) dating from the 11th to the 14th century. They have high-pitched wooden shingle roofs rising in tiers so as to give the building something of the form of a pyramid. The roofs overhang so deeply (to offer weather-protection to the wooden walls) that the lowest often shelters a species of external colonnade. The most famous of these churches is that of Borgund —19 m. from Laerdalsören; another fine example is at Hitterdal on the Kongsberg Telemark road. There are also a few Romanesque and Gothic stone churches. In some of these the influence of English architecture is clear, as in the magnificent metropolitan cathedral of Trondhjem, and the nave of Stavanger cathedral. A good example of the smaller stone church is at Vossevangen, on the Oslo-Bergen railway, and there are several of Late Romanesque character in the Trondhjem district. Remains of pure Early English work are occasionally found, but the later Gothic styles were not developed to any extent in Norway.

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Defence.—The early military history of Norway was one of storm and stress, marked by wars with Scandinavian neighbours and invasion of England up to the 11th century, of union with Denmark and Sweden (1389), separation (1523) and union with Sweden (1814) which endured until October 1905. Stable military conditions were established by a Treaty of Nov. 2, 1917, in agreement with Great Britain, France, Germany, Russia and Norway. From that date the Norwegian independent army on its present footing can be said to derive. Neutrality was maintained in the World War.

Recruiting Service and Organization.—All male Norwegians are liable to compulsory service, in the landsturm (only called up for defence in war) between the ages of 18 and 20, and 44 to 55; in the regular army for 12 years from the age of 20, with 72 to 126 days training in the first year and 24 days in 3 of the subsequent years; and in the territorial army from the ages of 32 to 44. The budget effective for 1928 numbered 4,325 regulars and district strength, 1,424 in the military schools, in addition to the annual contingent of about 15,000 under training.

See also League of Nations *Armaments Year-Book* (Geneva, 1928). (G. G. A.)

Navy.—The principal units are:—4 small coast defence battleships, 3 destroyers, 29 torpedo boats, 8 submarines, 9 miscellaneous vessels.

It is the intention (1928) to organise and modernise the fleet and to replace the older ships by those of a more modern type.

All seafaring men between the ages of 20 and 44 are liable for naval service. The Naval Air Service is gradually to be expanded to 96 hydroplanes. The navy and army are both administered by the Department of Defence. (E. A.)

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ECONOMIC AND FINANCIAL CONDITIONS

The Pre-War Position.—For more than 30 years the economic life of Norway had developed on an increasingly industrial scale when the dissolution of the Union between Norway and Sweden, in 1905, gave it a fresh impetus. Very soon an extraordinary expansion set in, which continued practically undiminished up to the outbreak of the World War. The use of the waterfalls became an urgent question in politics.

Agriculture was, as it had been for centuries, the principal resource of the country by which, roundly, 890,000 persons gained their livelihood out of a population of two and one-third millions. The total number of farmers was 188,000, of which hardly one-tenth were tenants and leaseholders; the remainder freeholders. The chief cereals were oats, barley, rye and wheat, and the principal root crop potatoes. Cattle breeding was also developing on a satisfactory scale, and as an article of export of growing importance, condensed milk appeared in the statistics.

Next to agriculture, forestry is the most important trade of Norway, owing to the mighty industry which has grown up in connection with it. In 1913 about 85% of the forests were owned by private persons or companies, and 12½% by the State, while the remaining 2½% was owned jointly. From the latter half of the 16th to the latter half of the 19th century, sawn and planed timber constituted the chief articles of export derived from the forest industry, but within the last 40 years prior to the war, the development of the mechanical and chemical wood-pulp industries as well as of the paper industry, had increased to an extent which made the timber industry lag far behind.

The mining industry, which in Norway dates from the beginning of the 17th century, experienced a renaissance, especially between 1897 and the outbreak of the war, owing to the increasing number of mines, mostly of iron ore, opened up in north Norway. From an annual output at the turn of the century valued at £260,000–270,000 the output expanded to a value of approximately £1,388,000 in 1913. A fishing fleet of steam vessels, larger sailing vessels supplied with auxiliary engines, and decked motor boats had to a great extent replaced the former old-fashioned fleet, while modern implements and methods had given the fisheries quite a new turn all round. As another important economic conquest within these years, allied to the fisheries, should be mentioned the whaling in the Antarctic, which, initiated in 1906, very soon proved a remarkable success. In 1913 the fisheries and the whaling yielded a profit of approximately £6,861,000 and £2,080,000, respectively. In connection with the fisheries should be mentioned the foundation of the canning industry which within the 30 years prior to the war became one of the most flourishing industries of Norway.

In 1900, the net register of steam and motor vessels was 498,447 tons. In 1914, it amounted to 1,223,009. Simultaneously, the net tonnage of sailing vessels decreased from 930,442 to 561,462; in fact only Great Britain, the United States and Germany had at the time larger mercantile fleets than Norway. About one-tenth of the fleet is engaged in regular trade along the coast of Norway, while another one-tenth is engaged in transport to and from foreign countries; the remainder have to seek employment in trade between foreign countries, which, in practice, means that the great bulk of Norwegian tonnage in pre-war days, as at present, was engaged in ordinary tramp trade all over the world.

Increased use of water-power has developed manufactures, for instance, the saltpetre industry, based on the principle of manufacturing nitrogen from the atmosphere, which was worked out in practice between 1906 and 1914. Owing to this extraordinary development in practically all fields, the trade balance of Norway also improved materially within the period, say from about £32,740,000 in 1906 to £52,994,000 in 1913.

Effects of World War Conditions.—These were, broadly speaking, the conditions of the leading trades of Norway when the outbreak of the World War suddenly upset the economic stability. But the nation soon adapted itself to the new state of things.

During the whole of 1915 the chief trades of the country achieved very considerable revenues. This especially applies to the shipping trade, and some of the leading manufacturing industries, while in other trades, *e.g.,* the wood and the fishing trades, the deficiency as to quantitative returns were amply counter-balanced by the excellent prices obtained. During 1916 this development was even more pronounced. The revenues scored by shipping broke all previous records; the manufacturing industries were working under high pressure, while agriculture and the fisheries, although unsuccessful as to quantities, were remarkably profitable, owing to the unparalleled prices obtained for the products. At the same time the figures of the trade balance went up by leaps and bounds. Generally speaking, the closing months of 1916 mark the culmination of economic expansion during the war, and although extraordinary revenues were scored in the two following years, conditions were fraught with difficulties, owing to the more and more extraordinary character of the war by which Norway was affected, as perhaps no other neutral State, owing to her large mercantile fleet.

One of the first economic consequences of the war was, as already hinted at, the substantial rise in the international freight market in connection with a no less pronounced rise in the prices of all sorts of commodities and raw material, which quite naturally also brought about a constant rise in wages. During the first two years of the war the advantages derived from the enormous revenues more than counterbalanced these drawbacks, and

in a number of fields important results were achieved in the direction of consolidating the economic life on a national basis; on the other hand, the enormous influx of capital created exceedingly easy conditions in the money market, which very soon resulted in excessive speculation, chiefly in shipping and industrial shares, which threatened to become fatal. It should always be borne in mind that the losses inflicted upon Norway, chiefly through the German submarine war, were enormous—say 1,-237,000 gross reg. tons—not to speak of the lives of nearly 2,000 seamen. After the war Norway had to rebuild a mercantile fleet of, roundly, 1·2 million gross reg. tons. This achievement, successfully performed within less than ten years after the war, under exceedingly difficult circumstances, will always rank among the most remarkable feats of Norwegian enterprise.

Post War Reaction.—Owing to a number of circumstances too intricate to be detailed, the economic reaction only became general towards the end of 1920, when the note circulation of the Bank of Norway reached an amount corresponding to £26,-700,000, as compared with £6,000,000 in 1913, while, by an Order in Council of Aug. 1914 the bank had been exempted from redeeming its notes with gold. The increase of the loans of the private joint stock banks from, roundly, £35,555,000 at the outbreak of the war to £172,780,000 at the expiration of 1920, was another evidence of the inflation of the war period, along with the fact that the price index rose to 435 in the autumn of 1920 (1913 being 100). Yet it should not be forgotten that the item of deposits simultaneously rose from £32,900,000 to £172,888,000 while the deposits of the savings banks also increased heavily.

From the beginning of 1921 the reaction revealed itself in a way which makes that year a most gloomy one in the economic history of Norway. The fishing, mining and wood industries, her chief export industries, as well as shipping, suffered by the general collapse in the foreign markets, which led to a widespread cancelling of purchasing contracts. At the same time Norwegian money depreciated substantially, especially in relation to sterling and dollars, while the economic structure was severely shaken by an increasing number of banks being compelled to suspend payments. In addition to this may be mentioned the heavy increase in debts of the State and the municipalities.

Since 1924 an energetic work has been performed by patriotic forces in public and private life to restore the economy of Norway, and remarkable results have been achieved in a number of fields; among the most important should be mentioned that the kroner has again (May 1, 1928) been restored to the gold parity. At the same time the public debt is decidedly on the decline, while the industry is being reorganized by the foundation of an increasing number of new banks. (S. C. H.)

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HISTORY

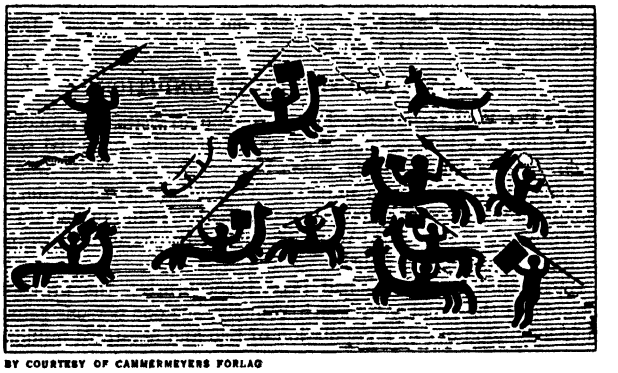
Archaeological and geological researches have revealed a fishing and hunting population in Norway, possibly as far back as *c.* 6000 B.C. Until lately this aboriginal people, which was certainly non-Aryan, was held to be Lappish, but recent investigations seem to show that the Lapps only entered Norway about A.D. 900–1000, and that the original population was probably of Finnish race, though only distantly allied to the Ugro-Finns now inhabiting Finland. To them belong perhaps certain non-Aryan names for features of the country, such as Toten, Vefsen, Bukn.

EARLY HISTORY

Teutonic Immigration.—The time of the immigration of a Teutonic element is uncertain. It did not extend N. beyond the Trondhjem district until about the beginning of our era, but the evidence of archaeology suggests that the Teutonic element entered S. Norway towards the end of the (Scandinavian) later Stone age, *c.* 1700 B.C. (*see* SCANDINAVIAN CIVILIZATION). The language of the older race was superseded by Teutonic, and those aborigines who were not incorporated (probably as slaves) were driven into the mountains or the islands that fringe the coast. In the highlands the "Finns" maintained some independence down to historical times. The old English poem *Beowulf* mentions a "Finnaland" which should perhaps be located in S. Norway in about the 6th century, and later on the ancient laws of this region forbid the practice of visiting the "Finns" to obtain knowledge of the future. But only in Finmark, which even in the 13th century stretched far into Sweden and included the Norwegian district of Tromsö, could the earlier inhabitants live their old life, and here they finally fell into the utmost want. Their existence is mentioned as a thing of the past by a North Trondhjem writer in 1689. The Teutonic element flowed into Norway from two centres; one western, probably from Jutland, the other eastern, from the W. coast of Sweden.

Early Kingship.—When history first sheds a faint light over Norway we find each small district or "fylke" (Old Norse *fylkir*, from *folk*, army) settled under its own king, and about twenty-nine *fylker* in the country. The king always possessed a *hird*, or company of warriors sworn to his service, and indeed royal birth and the possession of such a *hird*, and not land or subjects, were the essential attributes of a king. There was no law of primogeniture, and on the death of a king some of his heirs would take their share of the patrimony in valuables, gather a *hird*, and spend their lives in warlike expeditions (*see* VIKINGS), while one would settle down and become king of the fylke. There are indications that these conditions were fostered by a matriarchal system, and that it would often occur that a wandering king would marry the daughter of a fylkes-king and become his heir. Probably the king's power was only absolute over his own *hird*. He was certainly commander-in-chief and perhaps chief priest of the fylke, but the administrative power was chiefly in the hands of the *herser* and possibly of an earl. The position of earls is vague, but it is noticeable that both those of whom we hear in Harald Haarfager's time take the opposite side to their king.

The eight Trondhjem *fylker* had a common *Thing* or assembly very early, but these districts were remote, while the wealthy western districts were too much cut off from each other to unite effectively, though here also a common Thing was early established. The first successful attempt at unification originated round Vestfold, the modern Jarlsberg and Laurvik Amt on the Christiania fjord, where it is possible that national feeling was fostered by proximity to the Danish and Swedish kingdoms. Tradition made the royal family a branch of the great Yngling dynasty of Uppsala, which claimed descent from the god Frey. Through several generations this family had extended its kingdom by marriage, conquest and inheritance, and by the end of the



BY COURTESY OF CAMMERMEYERS FORLAG

NORWEGIAN HORSEMEN IN THE BRONZE AGE. FROM A ROCK CARVING IN BAAHUSLEN, FORMERLY SOUTHERN NORWAY

reign of Halfdan the Black, it included the greater part of Hamar and Oslo Stift, and the fylke of Sogn, the district round the modern Sognefjord.

Harald Haarfager.—Halfdan's son, Harald Haarfager, having no brothers, succeeded to the whole kingdom. By 866 his power was so well established in S. Norway that he contemplated the conquest of the whole land. There can be no doubt that Harald introduced a feudal view of obligations towards the king, and landowning families, who had regarded their *odel*, or inherited property, as absolutely their own, resented being forced to

pay dues on it. In each district Harald offered the *herser* the opportunity of becoming his vassals, answerable to him for the government of the district but many quitted the lands which were their real title to influence, rather than suffer the new order. Only the little kingdoms made futile attempts at combination, except in the western districts of Agde (comprising the modern Lister and Mandal and Nedenaes), Rogaland and Hordaland. Here was the home of the "western Vikings" who for nearly a century had owed wealth and fame to their raids on the British Isles. Attack by land was impossible, and Harald had to gather men and ships for three years before he could meet the fleet of the allied kings at Hafsfjord. The battle (872) resulted in a victory to him, and with it all opposition in Norway ended. An expedition to Scotland and the Scottish isles (*c.* 891) dispersed enemies who could harry the Norwegian coast, many of them taking refuge in Iceland; and the earldom of the Orkneys and Shetlands became an appanage of the Norwegian Crown. For the moment the whole country was under a single king, but Harald destroyed his work by giving about twenty of his sons the title of king, and dividing the country among them, only qualifying this retrograde step by installing his favourite son Erik Blodöxe as over-king (930). Moreover, Harald had established no common Thing for the whole of his kingdom, and the three natural divisions of the country remained more or less separate for centuries, even having separate laws until the second half of the 13th century.

The Successors of Harald.—Erik Blodöxe (Bloody-axe) only managed to rid himself of two rival over-kings, Olaf and Sigfred, his half-brothers, for on hearing of his father's death (933), another son, Haakon (*q.v.*), called the Good, who had been brought up at Aethelstan's court, came to Norway and succeeded in ejecting Erik (934). After Haakon's death in 961 at the battle of Fitje, where his long struggle against Erik's sons and their Danish allies terminated, these brothers, headed by Harald Graafeld (grey-cloak) became masters of the W. districts, though the ruling spirit appears to have been their mother Gunhild. Earl Sigurd of Lade ruled the N., and the S. was held by vassal kings whom Haakon had left undisturbed. By 969 the brothers had succeeded in ridding themselves of Sigurd and two other rivals, but the following year Harald Graafeld was lured to Denmark and treacherously killed at the instigation of Earl Haakon, son of Sigurd, who had allied himself with the Danish king Harald Gormssön. With the latter's support Earl Haakon won Norway, but threw off his yoke on defeating Ragnfred Erikssön at Tingenes in 972. The S.E. districts were, however, still held by Harald Grenske, whose father had been slain by the sons of Erik. Haakon ruled ably though tyrannically, and his prestige was greatly increased by his victory over the Jomsvikings, a band of pirates inhabiting the island of Wollin at the mouth of the Oder, who had collected a large fleet to attack Norway. The landed proprietors revolted and, in 995, there landed in Norway Olaf, great-grandson of Harald Haarfager and son of the king Tryggve of the Vik whom Gudröd Eriksson had slain, and whose father Olaf had been slain by Erik Blodöxe.

The earl was treacherously killed by his thrall while in hiding, and Olaf entered unopposed upon his short and brilliant reign. His great work was the enforced conversion to Christianity of Norway, Iceland and Greenland. Both Olaf and his successor and namesake looked for help to England, whence they obtained a bishop and priests; hence it comes that the organization of the early church in Norway resembles that of England. The hierarchical party in Norway only rose to power after the establishment of an archiepiscopal see at Trondhjem in 1152.

Relations with Denmark.—In the year 1000 Olaf fell at the battle of Svolder off Rügen, fighting against the combined Danish and Swedish fleets. The allies shared Norway between them, but the real power lay in the hands of Erik and Svein, sons of Earl Haakon, In 1015, when Erik was absent in England, another descendant of Harald Haarfager appeared, Olaf, the son of Harald Grenske, a great-grandson of Harald Haarfager (*see* OLAF II. HARALDSSÖN). He defeated Svein at Nesje in 1016, which left him free to work towards a united and Christian Norway, but he strained the loyalty of his subjects too far, and on the appearance of Knut the Great in 1029 he fled to Russia. His death at the battle of Stiklestad on his return in 1030 was followed by a few years of Danish rule under Svein Knutssön, which rendered Olaf's memory sweet by contrast, and soon the name of St. Olaf came to stand for internal union and freedom from external oppression. In 1035 his young son Magnus, afterwards called the Good, was summoned from Russia, and was readily accepted as king. A treaty was made with Hardeknut which provided that whichever king survived should inherit the other's crown. Hardeknut died in 1042, and Magnus became king of Denmark, but a nephew of Knut the Great, Svein Estridssön, entered into league with Harald Haardraade (*see* HARALD III.), the half-brother of St. Olaf, who had just returned from the East. As soon, however, as overtures were made to him by Magnus, he forsook the cause of Svein, and in 1046 agreed to become joint king of Norway with Magnus. The difficulties arising out of this situation were solved by Magnus's death in 1047.

The End of Harald Haarfager's Line.—Harald's attempts to win Denmark were vain, and in 1066 he set about a yet more formidable task in attacking England, which ended with his death at Stamford Bridge in 1066. His son Olaf Kyrre (the Quiet) shared the kingdom with his brother Magnus until the latter's death in 1069, after which the country enjoyed a period of peace. In 1093 Olaf was succeeded by his turbulent son Magnus Barfod (barefoot) and by Haakon, son of Magnus the Good. The latter died in 1095. Besides engaging in an unsuccessful war against the Swedish king Inge, in which he was defeated at Foxerne in 1101, Magnus undertook three warlike expeditions to the Scottish isles. It was on the last of these expeditions, in 1103, that he met his death. He was succeeded by his three sons, Eystein, Sigurd and Olaf. Olaf died young. Sigurd undertook a pilgrimage, from which he gained the name of Jorsalfar (traveller to Jerusalem). He won much booty from the Moors in Spain, from pirates in the Mediterranean, and finally at Sidon, which he and his ally Baldwin I. of Jerusalem sacked. Eystein died in 1122. Sigurd lived till 1130, and was the last undoubted representative of Harald Haarfager's race, for on his death his son Magnus was ousted by Harald Gille, or Gilchrist, who professed to be a natural son of Magnus Barfod.

Disputed Successions.—Harald Gille was slain in 1136 by another pretender, and anarchy ruled during the reign of his sons Eystein, Inge and Sigurd Mund. At last Inge's party attacked and killed first Sigurd (1155) and then Eystein (1157). Inge fell in a fight against Sigurd's son Haakon Herdebred in 1161, but a powerful baron, Erling, succeeded in getting his son Magnus made king, on the plea that the boy's maternal grandfather was King Sigurd Jorsalfar. In 1164 the archbishop of Trondhjem crowned Magnus, demanding that the crown should be held as a fief of the Norwegian Church. Owing to such concessions the Church was gaining a paramount position, when a new pretender appeared. Sverre (O.N. Sverrir) claimed to be the son of Sigurd Mund, and was adopted as leader by a party known as the Birkebeiner or Birchlegs. In spite of help from Denmark, the support of the Church and of the majority of barons, Magnus was defeated time after time, till he met his death at the battle of Nordnes in 1184. The aristocracy could offer little further opposition. In joining hands with the Church against Sverre, the local chiefs had got out of touch with the small landowners, with whose support Sverre was able to build up a powerful monarchy.

Magnus.—Sverre died in 1202. His son, Haakon III. died two years later, perhaps of poison, but the Birkebeiner party in 1217 succeeded in placing Haakon's son and namesake on the throne (*see* HAAKON IV.). In 1240 the last of the rival claimants fell, and the country began to regain prosperity. The acquisition of Iceland was at length realized. Haakon's death occurred after the battle of Largs in 1263. The war with Scotland was soon terminated by his son Magnus, who surrendered the Hebrides and the Isle of Man at the treaty of Perth in 1268. He gained his title of Law-Mender from the revision of the laws, which until 1274 had remained very much as in heathen days. The new code repealed all the old wergild laws, and provided that the major

part of the fine for manslaughter should be paid to the victim's heir, the remainder to the king. Henceforward the council comes more and more to be composed of the king's court officials, instead of a gathering of the *lendermaend* or barons of the district in which the king happened to be. During Magnus's reign we hear of a larger council, occasionally called *palliment* (parliament), which is summoned at the king's wish. The old landed aristocracy had lost its power so completely that even after Magnus's death in 1280 it did not recover during the minority of his son Erik.

Paralysis of the Aristocracy.—Erik was succeeded in 1299 by his brother Haakon V., who in 1308 felt himself strong enough to abolish the dignity of the *lendermaend*. This paralysis of the aristocracy is no doubt partly to be ascribed to the civil wars, but in part also to the gradual impoverishment of the country, which told especially upon this class. Russia had long eclipsed Norway as the centre of the fur trade, and other industries must have suffered, not only from the civil wars, but also from the supremacy of the Hanseatic towns, which dominated the North, and could dictate their own terms. In earlier times the aristocratic families had owed their wealth to three main sources: commerce, Viking expeditions and slave labour. Trade had been a favourite means of enrichment among the aristocracy up to the middle of the 13th century, but now it was almost monopolized by Germans, and Viking enterprise was a thing of the past. The third source of wealth had also failed, for it is clear from the laws of Magnus that the class of thralls had practically disappeared. This must have greatly contributed to shatter the power of the class which had once been predominant.

Union of Norwegian, Swedish and Danish Thrones.—Haakon's daughter Ingeborg had married Duke Erik of Sweden, and on Haakon's death in 1319 their three-year-old son Magnus succeeded to the Norwegian and Swedish thrones, the two countries entering into a union which was not definitely broken till 1371. In 1343 Magnus handed over the greater part of Norway to his son Haakon VI., who married Margrete, daughter of King Valdemar III. of Denmark. Their young son Olaf V., already king of Denmark, succeeded to his father's throne on Haakon's death in 1380, but died in 1387, leaving the royal line extinct, and the nearest successor to the throne the hostile King Albrecht of Sweden, of the Mecklenburg family. The difficulty was met by filling the throne by election—an innovation in Norway, though it was the custom in Sweden and Denmark. The choice fell on King Haakon's widow Margrete, but a couple of years later, chiefly in order to gain German support in a coming struggle with the Mecklenburgers, the Norwegians elected as king the young Erik of Pomerania, great-nephew of the queen, who henceforth acted as regent. Erik had claims on the Swedish and Danish thrones, and in 1397, at Kalmar, he was solemnly crowned king over the three countries, which entered into a union "never to be dissolved."

Reigns of the Kings of Norway

Harald (I.) Haarfager	872–930	(d. 933)
Erik Blodöxe	930–934	
Haakon (I.) den Gode	935–961	
Harald (II.) Graafeld	961–970	
(Earl Haakon of Lade 970–995)		
Olaf (I.) Tryggvesson	995–1000	
(Earls Erik and Haakon 1000–1016)		
Saint Olaf (II.)	1016–1029	(k. 1030)
Svein, son of Knut the Great	1030–1035	
Magnus (I.) den Gode	1035–1047	
Harald (III.) Haardraade	1047–1066	
Olaf (III.) Kyrre	1066–1093	
Magnus (II.)	1066–1069	
Magnus (III.) Barfod	1093–1103	
Eystein (I.)	1103–1122	
Sigurd (I.) Jorsalfar	1103–1130	
Olaf (IV.)	1103–1116	
Magnus (IV.)	1130–1135	
Harald Gille	1130–1136	
Sigurd (II.) Mund	1136–1155	
Eystein (II.)	1136–1157	
Inge	1136–1161	
Haakon (II.) Herdebred	1161–1162	
Magnus (V.)	1162–1184	
Sverre	1184–1202	
Haakon (III.)	1202–1204	
Haakon (IV.) den gamle	1217–1263	
Magnus (VI.)	1263–1280	
Erik	1280–1299	
Haakon (V.)	1299–1319	
Magnus (VII.)	1319–1343	
Haakon (VI.)	1343–1380	
Olaf (V.)	1381–1387	
Margrete	1387–1389	
Erik of Pomerania	1389–	

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1397–1814

The history of Norway from 1397 down to the union with Sweden in 1814 falls naturally into four divisions. First, in 1450, the triple bond gave place to a union in which Norway became more firmly joined to Denmark. Next, in 1536, as the result of the Reformation, Norway sank almost to the level of a province. After 1660 she gained something in status from the establishment of autocracy in Denmark, and in 1814 she became a constitutional kingdom on a footing of approximate equality with Sweden. But for the convulsions to which some of these changes gave rise, Norway possesses during this period but little history of her own, and she sank from her former position as a considerable and independent nation. The kings dwelt outside her borders, her fleet and army decayed, and her language gradually gave place to Danish. Germans plundered her coasts and monopolized her commerce, and after 1450 Danes began to appropriate the higher posts in her administration. When in 1448 Karl Knutsson was chosen king by the Swedes, and Christian of Oldenburg by the Danes, it was by force that Norway fell to the latter. The Norwegians protested, but the next year the Swedes assented to a separation. Christian I. (1450–81) gave estates and offices in Norway to his Danish subjects and raised money by pawning her ancient possessions, the Orkneys and Shetland islands, to the king of Scotland. His son Hans (1482–1513) purchased the obedience of the Norwegian nobles by concessions to their power. The imposing union continued in name, but the weakness of the nation and its government was strikingly illustrated when the Germans in Bergen besieged a monastery in which a high official had taken refuge.

After the downfall of Christian II. (1513–24) the position of Norway was changed for the worse. She was ruled for a century and a quarter by Danish officials; her churches and monasteries were sacked by Danes, and Danes were installed as pastors under the Lutheran system, which the Norwegians were compelled to accept in 1539. Soon Norway was dragged by Denmark into the

so-called Seven Years' War of the North (1563–70). However, the power of the Hanse League in Bergen was broken. The rule of the Oldenburg dynasty proved neglectful rather than tyrannical, and under it the mass of the peasants was not flagrantly oppressed. Christian IV. (1588–1648), who founded Christiania (Oslo), may almost be said to have discovered Norway anew. He reformed its government and strove to develop its resources, but his policy involved the loss of Jemtland and Herjedalen, which were ceded to the Swedes by the peace of Brömsebro (1645). The Danish war of revenge against Charles X. of Sweden resulted in further loss by Norway. By the peace of Roskilde (1658) she was compelled to renounce Trondhjem and Baahus, and although the former was restored by the peace of Copenhagen, (1660), her population fell below half a million. The Swedes had now acquired the rich provinces in the south and south-west of the Scandinavian peninsula, and their ambition to extend their frontiers to the North sea grew. From the middle of the 17th century, however, the Dutch and English made their influence felt, and the political status of Norway could no longer be regarded as a purely Scandinavian affair. The establishment of hereditary autocracy in Denmark by Frederick III. in 1660 conferred many benefits upon Norway. The Norwegian peasant remained a freeman while his counterpart in Denmark was a serf. Norwegian law was revised and codified under Christian V. (1670–99), who was well served by the Norwegians in his attempt to regain the lost provinces from Charles XI.

Under the sons of these monarchs, Frederick IV. and Charles XII., Norway was once more compelled to pay for Danish aggression. Her shipping was destroyed, and in 1716, when driven from continental Europe, Charles XII. fell upon her. Only his death, in 1718, averted the danger. During this war Peter Tordenskjold, the greatest among a long series of Norwegian heroes who served in the Danish fleet, won undying fame. Before the close of the 18th century something had been done towards dispelling the intellectual darkness. Holberg, though he flourished outside Norway, by stemming the tide of German influence made the future of Norwegian literature possible. At the close of the century Hauge, the Wesley of Norway, appeared, while the growth of the timber trade with England gave rise to a great increase in wealth and population. In a century and a half the number of the Norwegian people was doubled, so that by 1814 the population was 900,000. In 1788 the oppressive law that grain should be imported into Norway only from Denmark was repealed, and thanks to Danish policy, Norway actually drew financial profit from the wars of the French Revolution.

The Norwegian national movement was to render a decade at the beginning of the 19th century more memorable in Norwegian history than any century which had passed since the Calmar Union. In 1800 the Danish Government committed the Norwegians to the second Armed Neutrality, and therefore to a share in the battle of Copenhagen, by which it was broken up. It was not until 1807, however, that Norway was fully involved in the Napoleonic wars. Then, after the bombardment of Copenhagen, she was compelled by Danish policy to embrace the cause of Napoleon against both England and Sweden. Commerce was annihilated, and the supply of food failed. The national distress brought into the forefront of politics national leaders, among whom Count Wedel-Jarlsberg was the most conspicuous. As yet, however, patriotism went no farther than a demand for a national administration and university; concessions which were accorded by Denmark in 1807 and 1811.

UNION WITH SWEDEN

Three years later the nascent nation found itself suddenly transferred to the rule of the king of Sweden. The Swedes, with Bernadotte as the heir-apparent, had fought against Napoleon, while the Danes, under Frederick VI., had espoused his cause. The result was the treaty of Kiel (Jan. 14, 1814), which, as was generally understood, compensated Sweden for her loss of Finland to Russia by giving her Norway. But the Norwegians, who had not been consulted in the matter, declared that, while the Danish king might renounce his right to their crown, it was contrary to international law to dispose of an entire kingdom without the consent of its people. A meeting was convened at Eidsvold, where, on May 17, 1814, a constitution, framed upon the constitutions of America, of France (1791), and of Spain (1812), was adopted. It made the *storting*, or National Assembly, a single-chamber institution, and gave the king no absolute veto, or right of dissolution. The Danish governor of Norway, Prince Christian Frederick, was unanimously elected king. Bernadotte invaded Norway, but after a fortnight opened negotiations. A convention at Moss proposed that the Norwegians should accept the Swedish king as their sovereign, but that the Eidsvold constitution should remain. An extraordinary *storting* at Christiania, on Nov. 4, 1814, declared Norway "a free, independent, and indivisible kingdom, united with Sweden under one king." Prince Christian Frederick had already left the country.

The Act of Union.—The Act of Union, which was accepted by both countries in the following year, stated that the union was accomplished "not by force of arms, but by free conviction," and the Swedish foreign minister declared to the European Powers that the Treaty of Kiel had been abandoned, and that the union was due to the confidence of the Norwegians in the Swedish people. The Eidsvold constitution henceforward formed the *Grundlov*, or fundamental law. The union thus concluded was really an offensive and defensive alliance under a common king, each country retaining its own government, parliament, army, navy and customs. The Swedish people, none the less, believed that they had won Norway by arms. As the national principle grew more powerful, and the Norwegians richer, more numerous and more self-conscious, a tension developed on the question of union which was eased only by severance in 1905.

From 1814 to 1829 the king was represented by a Swedish viceroy, while the government was, of course, composed only of Norwegians. Count Wedel-Jarlsberg was its first head while several of Prince Christian Frederick's councillors of state were retained. Over the first two viceroys Count Wedel exercised considerable influence.

The end of the Napoleonic wars brought to Norway poverty and depression of trade, and her finances were in a deplorable condition. The *storting* therefore cut down the army by one-half and founded a bank of Norway. The paid-up capital was procured by an extraordinary tax, and this, together with the growing discontent among the peasantry, brought about a rising in Hedemarken, designed to dissolve the *storting* and to reduce taxation. The rising, however, soon subsided, and the bountiful harvest of 1819 brought more prosperous times. Meanwhile, however, the financial position had endangered independence. The settlement with Denmark of Norway's share of their joint national debt threatened to provoke the intervention of the Powers. Bernadotte, now Charles XIV. of Sweden (Feb. 5, 1818), accepted England's mediation, and in Sept. 1819 concluded a convention with Denmark, by which Norway was held liable for only 3,000,000 specie dollars (nearly £700,000). The obstinacy of the *storting* in 1821, however, nearly occasioned a fresh interference of the Powers. When at last the Norwegians yielded, the king doubted their sincerity, and in July 1821 assembled 3,000 Swedish and 3,000 Norwegian troops near Christiania (Oslo), ostensibly for manoeuvres. A circular note (June 1) to the Powers complained bitterly of his treatment by the *storting* and courted their sympathy for any attempt to revise the Norwegian constitution. The *storting*s of 1815 and 1818, moreover, had passed a bill for the abolition of nobility, which the king had refused to sanction. The Norwegians maintained that the few remaining counts and barons were all Danish and of very recent origin, while the true nobility of the country were the peasants, descendants of the old jarls and chieftains. According to the constitution, any bill passed by three successive *storting*s, elections being held every third year, became law without the king's sanction, and, though the king did everything to obstruct it, the bill was carried.

In 1822 Count Wedel-Jarlsberg retired. In 1821 he had been impeached before the Rigsret, the supreme court of the realm, for having caused the state considerable losses. Jonas Collett (1772–1851) succeeded as minister of finance. The king,

apparently abandoning his plans for a *coup d'état*, now substituted proposals for removing from the constitution all that was at variance with a monarchical form of government. These changes had been suggested in his circular note to the Powers, and were designed to please his Swedish subjects. In 1824 and subsequently, however, the *storting* unanimously rejected not only the king's proposals, but also others by private members. In 1830 they were discussed for the last time, with the same result. The *storting* thus became regarded as the defender of the constitution against a would-be absolutist king, while the king began to consider the celebration of May 17 (Independence day) as a demonstration against himself, and when Collett was impeached for having made payments without the sanction of the *storting*, he regarded it as an attack upon his royal prerogatives. Although Collett was acquitted, he dissolved the *storting* with every sign of displeasure. The Swedish viceroy tried to convince him that his prejudice against the celebration of May 17 was groundless, but in 1827 it was celebrated in a very marked manner, and was followed by a demonstration against *The Union*, a foolish political play. The king therefore appointed Count Platen, whose first act was a proclamation against celebrating the day of independence. In April 1828 the king, against the advice of his ministers, summoned an extraordinary *storting*, to recover the supremacy lost to the *storting* in 1827. He also intended to prevent the celebration of May 17, and assembled 2,000 Norwegian soldiers near the capital. Though present in person, he did not accomplish any constitutional changes, but the *storting* decided to omit the celebration, and the people quietly acquiesced. In the following year, however, trouble broke out again. Crowds paraded the streets, singing and shouting, and gathered finally in the market-place. A little rioting, and its suppression with sword and musket, became known as the "battle of the market-place," and did much to increase the ill-feeling against Count Platen. He died in Christiania (Oslo), at the end of the year, and his post remained vacant for several years.

Development of the National Movement.—The July revolutions of 1830 stimulated political consciousness in Norway at a time when the peasants in the *storting* were challenging the representatives of the official classes, hitherto supreme. This party was ably led by Ole Ueland, a member of every *storting* from 1833 to 1869. The *storting* of 1833 was the first of the so-called "peasant *stortings*," their numbers rising from 20 or less to 45, nearly half of the total representation. They found a champion in the youthful poet Henrik Wergeland, who soon became one of the leaders of the "Young Norway" party. He was a republican in politics, and the most zealous upholder of the national independence of Norway and of her full equality with Sweden. Another rising poet, J. S. Welhaven, led the upper classes against Wergeland and the peasants, who sought to make the cultural separation from Denmark as complete as possible, and in every way to encourage national feeling among the people. Though zealous for the education of the people and beloved by the poorer classes, Welhaven could form no political party and at his death in 1845 stood almost isolated. His opponents then became the leaders in the field of literature, and carried on the work of national reconstruction with more restraint.

While the violent agitation of 1830 died away, the tension between king and *storting* reached its height during the session of 1836, when all the royal proposals for changes in the constitution were laid aside, without even passing through a committee. The king decided to dissolve; but Lövenskiold, one of the ministers, was impeached for this decision, and eventually fined 10,000 kroner (about £550), though retaining his post. Collett, who had greatly displeased the king, was dismissed; but unity in the government was brought about by the appointment of Count Wedel-Jarlsberg as viceroy. From this time the relations between the king and the Norwegian people began to improve, whereas in Sweden he was, in his later years, not a little disliked.

When the king's anger had subsided, he summoned an extraordinary session, in which the *storting* urged that steps should be taken to place Norway upon an equal footing with Sweden, especially in the conduct of diplomatic affairs. The same address contained a petition for the use of the national or merchant flag in all waters. The constitution gave Norway her own merchant flag, and in 1821 the *storting* had resolved that this should be scarlet, divided into four by a blue cross with white borders. The king gave permission only for its use in waters near home. Beyond Cape Finisterre the naval flag, which was really the Swedish flag, with a white cross on a red ground in the upper square, must be borne. Royal permission in 1838 for all merchant ships to carry the Norwegian flag in all waters was hailed with great rejoicings; but the question of the national flag for general use had yet to be settled, and in 1839 the king appointed a committee of four Norwegians and four Swedes, to consider the question raised about diplomacy and the equality of Norway in the union.

Its powers were extended to consider a comprehensive revision of the Act of Union, with the limitation that fundamental conditions must in no way be interfered with. But before the committee had finished their report the king died (March 8, 1844), and was succeeded by his son Oscar I. According to the constitution the Norwegian kings must be crowned in Trondhjem cathedral, but as the bishop doubted whether the queen, a Roman Catholic, could be crowned, the king decided to forgo coronation. He soon showed his desire to meet the wishes of the Norwegian people, decreeing that in all documents concerning her internal government Norway was to stand first in the royal title; that Norway and Sweden should each carry its own national flag as the naval flag, with the mark of union in the upper corner; and that the merchant flag should bear the same mark of union.

The condition of the country had now considerably improved, and King Oscar's reign was marked by the carrying out of important legislative work and reforms. New roads were made, the first railway built, steamship routes established, lighthouses erected, and trade and shipping developed. During the Schleswig-Holstein rebellion (1848–50) and the Crimean War, Norway and Sweden remained neutral and Norwegian shipping especially benefited. The abolition of the English navigation acts in 1850 opened up a great future for the Norwegian merchant fleet.

In 1826, by the treaty with Russia, the frontier in the Polar region was definitely delimited; but in 1851 Russia demanded for her frontier Lapps the right to fish on the Norwegian coast, and to settle upon a portion of the coast on the Varanger fjord. The Norwegian Government refused, and serious complications might have ensued if the attention of Russia had not been turned in another direction. During the Crimean War the king concluded a treaty with England and France by which these countries guaranteed Norwegian and Swedish territory against Russia. Relations with Russia therefore became strained; but after the peace of Paris in 1856, and the accession of Alexander II., the Russian ambassador at Stockholm restored harmony.

Owing to the king's ill-health his son was appointed regent in 1857, and two years later succeeded as Charles XV. This gifted, genial and noble king desired to inaugurate his reign by proof of his willingness to acknowledge the claims of Norway, but he did not live to see his wishes carried out. According to the constitution, the viceroy might be either a Norwegian or Swede. Since 1829 no Swede had held the post, and since 1859 no appointment had been made. But the paragraph in the constitution still existed, and the Norwegians naturally wished to have this stamp of "provinciality" obliterated. A proposal to abolish the office was passed by the *storting* in 1859. The king had privately promised that he would sanction the proposed change in the constitution; but a violent outcry arose in Sweden. Under pressure the king eventually refused to sanction the resolution; but he added that he shared the views of his Norwegian counsellors, and would, when "convenient," himself propose the abolition.

In the following year the Swedish Government pressed the demands of the Swedish Estates for a common parliament which, according to population, would contain two Swedish members to every Norwegian. The Norwegian Government did not seem at all disposed to entertain the proposal; but some dissensions arose with regard to the form of its reply. The more obstinate members of the ministry resigned, and others, of a more pliable nature, were appointed under the presidency of Fredrik Stang, min-

ister of the interior from 1845 to 1856. Both the new and old governments agreed that no proposal for the revision of the Act of Union could then be entertained. The king, however, advocated a revision based upon full equality. In 1863 the *storting* assented to his appointment of a second Union committee. It was not until 1867 that its report was made public, and it could not be discussed by the *storting* before 1871. Meanwhile, the Danish complications in 1863–64 threatened to draw the two kingdoms into war. The king favoured a defensive alliance with Denmark, but the *storting* would only consent if an alliance could also be effected with at least one of the Western Powers.

In 1869 the *storting* passed a resolution by which its sessions were made annual instead of triennial. The first yearly *storting* in 1871 had once more to consider revision. The Norwegians steadily postulated (1) the full equality of the two kingdoms, and (2) no extension of the bonds of the union. However, the new draft implied the supremacy of Sweden and introduced important extensions of the bonds of the union. Strangely enough, the new Stang ministry accepted it and it was even supported by some of the most influential newspapers under the plausible garb of "Scandinavianism." In these circumstances the "Lawyers' Party," under the leadership of Johan Sverdrup, and the "Peasant Party," led by Sören Jaaboek, allied to defend the constitution of 1814. Thus was founded the great national party of the "Venstre" (the left). The proposed revision in 1871 was rejected by an overwhelming majority.

In 1872 a private bill proposed that ministers should be admitted to the *storting* and take part in its proceedings. After stormy debates, Sverdrup carried the bill by a large majority, but the Government, jealous of the new Liberal Party, advised the king to refuse his sanction. In the preceding half-century the Government Party had several times introduced a similar bill, but the opposition had feared lest the superior skill in debate and political experience of the ministers should turn the scale too readily in favour of Government measures. Now, on the contrary, the opposition had gained more experience and had confidence in its own strength; but the Government saw in the proposed reform the introduction of full parliamentary government, by which they could not remain in office unless supported by a majority. The Liberals carried a vote of censure against the Government but the king declared that the ministers enjoyed his confidence. Three, however, resigned, and enthusiastic public meetings were held all over the country in support of the proposed reform.

In Sept. 1872, Charles XV. was succeeded by his brother, Oscar II. In the following year the king sanctioned the abolition of the office of viceroy, and the president of the ministry was afterwards recognized as the prime minister. Stang was the first to fill this office. In the same year Norway celebrated its millenary with great festivities.

Struggle Between the King and the Storting.—In 1874 the government, in order to show the people their goodwill, laid before the *storting* a royal proposition for the admittance of the ministers to the national assembly. But this was to be accompanied by certain other constitutional changes, such as the royal right of dissolving the *storting*, and providing fixed pensions for ex-ministers, as a guarantee against the majority misusing its new power. The bill was unanimously rejected by the *storting*, who in the same year, and again in 1877, passed a modified version of the bill of 1872. On both occasions the king refused his sanction. The *storting* accordingly resorted to the procedure provided by the constitution to carry out the people's will. In 1880 the bill was passed for the third time, by 93 votes out of 113. To the general surprise, the king again refused his sanction, declaring that his right to the absolute veto was "above all doubt." Sverdrup, the Liberal leader and president of the *storting*, therefore proposed that the bill, which had been passed three times, should be declared to be the law of the land. This was carried by a large majority on June 9, 1880, but the king and his ministers declared the resolution invalid. The faculty of law at the Christiania (Oslo) university with one dissentient upheld the king's right to the absolute veto in questions concerning amendments of the constitution, although they could not find that it was expressly stated in the fundamental law of the country. The ministry also advised the king to claim a veto in questions of supply, which still further increased the ill-feeling in the country against them.

The prime minister, Stang, now resigned, and C. A. Selmer (1816–89) became his successor—an appointment which indicated that the conflict was to be continued. In June 1882 the king came to dissolve the *storting*, and astonished the people by censuring their representatives in a speech from the throne. Sverdrup and Björnstjerne Björnson, the popular poet and dramatist, called upon the people to support the *storting* in upholding the resolution of June 9. In the elections the Liberals won 83 seats to the Conservatives' 31. The ministry, however, showed no sign of yielding, and, when the new *storting* met in Feb. 1883, the Odelsting (the lower division of the national assembly) decided to impeach the whole of the ministry. They were charged with having acted contrary to the interests of the country by advising the king to refuse his sanction—first, to the amendment of the law for admitting the ministers to the *storting;* secondly, to a bill involving supply; and thirdly, to a bill by which the *storting* could appoint additional directors on the state railways.

After ten months' trial, the Rigsret sentenced Selmer and seven of his ministers to be deprived of their offices; while three, who had either recommended the king to sanction the bill for admitting the ministers to the *storting*, or had entered the cabinet at a later date, were heavily fined. The excitement in the country rose to fever-height. It was generally believed that the king would attempt a *coup d'état*. Fortunately, after some hesitation, he issued (March 11, 1884) an order in council announcing that the judgment would be carried into effect. King Oscar, however, in his declaration upheld the constitutional prerogative of the crown, and in April asked Schweigaard, one of the ministers who had been fined, to form a ministry. His "April ministry" sent in its resignation in the following month; a similar nomination failed, and the king was at last compelled to appoint Sverdrup. Thus the first Liberal ministry in Norway came into being (1884). The *storting*, to satisfy the king, passed a new resolution admitting ministers, and this received formal sanction.

During the following years a series of important reforms was carried through. In 1887 the jury system in criminal matters was introduced after violent opposition from the Conservatives. A bill intended to give parishioners greater influence in church matters, however, was eventually rejected, the result being a break-up of the ministry and a disorganization of the Liberal Party. In June 1889 Sverdrup resigned, and a Conservative ministry was formed by Emil Stang. After two fruitful years this was wrecked on the diplomatic question. In 1814 nothing had been settled about the conduct of diplomatic affairs; in 1835 a resolution was issued which in effect gave Norway a right of inspection of business transacted on her behalf by the Swedish foreign minister with the king. The Swedes were willing to grant equal representation in a joint council, but on the assumption that the minister of foreign affairs should continue to be a Swede, and this the Norwegians would not accept. In 1891, after a deadlock, the Stang ministry resigned, and a Liberal ministry under Sverdrup's successor, Steen, was appointed.

A new deadlock was produced by the resolve of the *storting* in 1892 to establish a separate consular service for Norway, which provoked the king's veto and the resignation of the ministry. By a compromise, the ministry returned to office, on the understanding that the question was postponed. In 1893 the *storting* again passed a resolution for the establishment of the proposed consular service, but the king again refused his sanction. Upon this the Liberal ministry resigned (May 1893), and the king appointed a Conservative Government, with Stang as its chief. At the end of 1894, when the triennial elections took place, the majority declared in favour of national independence on the great question then before the country. In 1895, after over four months without a responsible Government, a coalition ministry was formed, with Professor G. F. Hagerup as prime minister. A new committee of Norwegians and Swedes spent over two years in fruitless labour on the question of separate diplomatic representation. At the elections in 1897, 79 Liberals and 35 Conservatives were

returned, and in Feb. 1898 Hagerup was replaced by Steen. Soon afterwards the bill for the general adoption of the national or "pure" flag was carried for the third time, and became law without the king's sanction. In 1898 universal political suffrage for men was passed by a large majority, but the proposal to include women received only 33 votes.

NORWAY INDEPENDENT

The Consular Crisis.—In Jan. 1902, on the initiative of the Swedish foreign minister, another joint committee on the consular question was appointed. It unanimously reported that "it was possible to appoint separate Norwegian consuls exclusively responsible to Norwegian authority and separate Swedish consuls exclusively responsible to Swedish authority." Further negotiations resulted in the so-called *communiqué* of March 24, 1903, which announced an agreement between the two countries for a separate consular service. In due course the Norwegian Government submitted to the Swedish Government their draft of the proposed laws and regulations, but no reply was forthcoming for several months. The friendly Swedish foreign minister, Mr. Lagerheim, resigned, and in Nov. 1904 Boström, the prime minister, suddenly submitted to the Norwegian Government a number of new conditions for the establishment of separate consuls. According to Boström's proposals, the Norwegian consuls were to be placed under the control of the Swedish foreign minister, who was to have the power to remove them. Hagerup proceeded to Stockholm, but no satisfactory agreement could be arrived at. The Norwegians felt that nothing remained but to take matters into their own hands. On March 1, 1905, Hagerup resigned and was succeeded by Christian Michelsen, and a ministry from both political parties. A bill was resolved on for the establishment of a Norwegian consular service not later than April 1, 1906. During the king's illness the crown prince vainly attempted to reopen negotiations. In April Boström resigned, apparently to facilitate negotiations. On May 23 the bill was passed by the *storting* without a dissentient voice, but on May 27, in spite of the earnest entreaties of his Norwegian ministers, the king refused his sanction. The Norwegian Ministry immediately resigned, but the king would not accept their resignation, which they declined to withdraw. On June 7, Michelson informed the *storting* that, as an alternative Government could not be formed, the union with Sweden, based upon a king in common, was dissolved. The resigning ministry was unanimously authorized to exercise the authority vested in the king in accordance with the constitution.

Separation from Sweden.—On receiving this news, the king sent a telegraphic protest to the Norwegian prime minister and to the president of the *storting*, and the Swedish Government summoned an extraordinary session of the Riksdag (parliament) for June 20, when a special committee was appointed to consider the crisis. On July 25 it reported to the Riksdag that Sweden could have no objection to enter into negotiations about the severance of the union, when a vote to the effect had been given by a newly elected *storting* or by way of referendum. The report was unanimously adopted on July 27, and the next day the *storting* decided that a general plebiscite should be taken. On August 13, 368,211 voted for the dissolution and only 184 against it. It was thereupon agreed that representatives of Norway and of Sweden should meet to arrange for the severance of the union. After more than three weeks of difficult negotiation, agreement was reached on Sept. 23. This provided for a neutral zone on both sides of the southern frontier, the Norwegians undertaking to dismantle some fortifications within that zone. The agreement was to remain in force for ten years, and could be renewed for a similar period, unless one of the countries gave notice to the contrary. On Oct. 27, after ratification by *storting* and Riksdag, the king relinquished the crown of Norway. Failing acceptance by a member of the house of Bernadotte, it was conferred upon Prince Charles of Denmark by a second popular vote (259,563 against 69,264) and by the *storting* with no dissentients. On Nov. 25, the king, now Haakon VII., and Queen Maud, the youngest daughter of Edward VII. of England, entered the Norwegian capital.

In 1907 parliamentary suffrage was granted to women with the same limitation as in the municipal suffrage granted to them in 1901, viz., to all unmarried women over 25 years, who pay taxes on an income of 300 kroner (about £16) in the country districts and on 400 kroner (about £22) in the towns, as well as to all married women whose husbands pay taxes on similar incomes. Norway was thus the first sovereign country in Europe where women gained the vote.

1907-1914.—The Michelsen Government, which achieved these results, functioned in a *storting* composed of some 77 Liberals and parties of the Left, 36 Conservatives, and 10 members of the new Labour Party. In Oct. 1907 the premier was succeeded by his minister of foreign affairs, R. J. Läland. Most of the Left then reorganized as the Consolidated Left under Gunnar Knudsen, who became premier in March 1908. Knudsen's administration carried through the "concession laws," making it impossible to buy waterfalls of more than 1,000 h.p., forests, mines and other real property without a concession from the Government.

The Conservative Parties opposed especially the proviso that concessions should not be granted for more than 60 years, and that on their expiration all waterfalls, power stations, etc., should become national property without compensation. In March 1909 a group of the old Liberals reorganized as the Liberal Left. In the general elections of Oct. 1909 the Conservatives and Liberals secured 63 seats, as against 47 Radicals, 11 Socialists and two Independents, and on Feb. 1, 1910, formed a Coalition Government under the old Liberal leader Wollert Konow. In 1911 the Government passed a new taxation law introducing compulsory declaration of income and limiting rights of municipal taxation. Owing to persistent friction on the *landsmål* question (*see* NORWEGIAN LITERATURE), Konow resigned (Feb. 1912), and was succeeded by the Conservative leader Bratlie. But this friction had weakened the coalition; the elections of 1912 returned 76 Radicals against 24 Conservatives and Liberals and 23 Socialists. Knudsen again became premier, with Castberg the leading member of his cabinet. Controversy centred round the so-called "Castberg laws," giving illegitimate children equal rights of inheritance with legitimate, except in the case of peasants' farms, and imposing on the fathers increased obligations to protect their illegitimate children and the mothers of them. The laws were passed in 1915 by the Radical majority, after Castberg had left the cabinet. In 1914 the centenary of the Norwegian constitution was celebrated.

1914-1920.—A controversy with Sweden concerning the suzerainty over a group of submarine skerries, Grisebaaerne, was decided by The Hague Tribunal in 1908. The World War brought the three Scandinavian countries closer together. In Aug. 1914 they proclaimed strict neutrality and signed an agreement to remove any possibility of either country preparing hostile action against the other. On Dec. 18–19 the three Scandinavian kings with their premiers and foreign ministers met in Malmö to discuss joint action regarding questions raised by the war. Similar conferences of the Scandinavian premiers and foreign ministers were held in Copenhagen (March 1916), in Oslo (Sept. 1916), in Stockholm (May 1917), Copenhagen (June 1918), Stockholm (May 1919), Oslo (Feb. 1920) and in Copenhagen (Aug. 1920).

After the first panic at the outbreak of war, both public and private enterprises made vast profits and incurred extravagant expenditure. Wages and salaries rose rapidly; the shipping companies paid huge dividends; all sorts of new financial and industrial enterprises were started; imports reached an enormous height. The elections of 1915 returned the previous Government with an increased majority; 80 Radicals were elected, 20 Conservatives, 19 Socialists and 4 Independents. The Government received extraordinary powers. A victualling commission controlled prices and imports, and a price directorate controlled retail prices. In 1916 grains and cereals, meat, sugar, coffee and tea were rationed. Temporary Prohibition was initiated in Dec. 1916, and extended in June 1917 to all trade in wines of an alcoholic strength of over 12%. In July 1916, as the result of a violent struggle in the labour market, an emergency measure was passed —under protests from both Labourites and Conservatives—prohibiting strikes and lock-outs and enforcing public arbitration in industrial conflicts. In spite of extraordinary revenues, however,

the national debt, thanks to the needs of defence and bonuses to officials, rose from 362,300,000 kroner in 1914 to 736,600,000 kroner in 1917 and 1,008 million at the end of 1918.

The new elections in the autumn of 1918 brought a strong reaction. The Radicals lost 26 seats, the Socialists lost one, the Conservative-Liberals gained 30. These elections threw into relief the unfair electoral system, which had hitherto secured the Left a number of seats out of all proportion to the votes cast for them. The Conservatives, assisted by Labour—where the moderates were losing power in consequence of the impossibility of achieving results by parliamentary methods—were now able to establish proportional representation. The Knudsen cabinet tendered its resignation in Jan. 1919, but as the Conservatives had no working majority it continued to sit till June 1920, when Otto Halvorsen, the Conservative leader, succeeded Knudsen.

1920-1927.—Halvorsen's cabinet was immediately faced with the most formidable labour troubles. After 1906 more Socialists had entered the *storting* and gained rapidly in influence. They collaborated closely with the trade unions which in 1889 had been merged into a national federation under a central committee, elected partly by the trade unions, partly by the Labour Party. The trade unions were similarly represented in the executive committee of the Labour Party. Under the influence of the Russian revolution of 1917, the Radicals gained the upper hand at the party congress and in the executive committee in 1918; in 1919 the Norwegian Labour Party joined the Third International, and sent a member to the executive committee in Moscow. The moderate leaders then left the Labour Party and founded the Social Democratic Party.

A wave of revolutionary feeling spread over Norway, the fruits of which were the "revolutionary" railway strike of Dec. 1920 and the national strike of May 1921. The cabinet met both strikes successfully; the railwaymen (who were State employees) capitulated unconditionally after 17 days, and the national strike proved a fiasco and caused much bitterness against the Radical leaders and Moscow. The Conservative position was strengthened; yet in June 1921 the Government was defeated on the Prohibition question and resigned.

In Oct. 1919 a referendum had sanctioned the temporary prohibitions of 1916 and 1917 by 489,660 votes to 305,241, over 400,000 votes not being cast. But the policy produced a trade war with Spain and Portugal, which cost Norwegian shipowners and the whole fishing population heavy losses. Smuggling, too, increased enormously as did secret home distilling. The Prohibitionists, supported by the Left, Labour and Socialists, replied by greater severity.

The elections of 1921, on the revised basis, gave 57 seats to the Conservative-Liberal coalition, 39 to the Left, 29 to the Labour Party, 8 to the Socialist and 17 to the new Farmers' Party. The Government, although it had lost seats and votes, remained in power, the Left holding the balance between Conservatives and Labour. Otto Blehr, who had succeeded Halvorsen, failed, and a second Halvorsen Government (March 1923) sanctioned the importation of port and sherry. A new treaty was concluded with Portugal, and the commercial war with Spain came to an end. The importation and sale of wines and brandies is now a monopoly under Government control. The shareholders get 6%, the surplus (in 1925 5,000,000 kroner) goes to public funds. The temporary measure enforcing public arbitration in industrial disputes expired in April 1923 and was not renewed. In May 1923 Halvorsen died. His minister of finance, Berge, who succeeded on an insecure majority, endeavoured to replace prohibition by a well-controlled sale of highly-taxed brandies. The Left, Labour and some of the Farmers' Party, however, stood out for another referendum and Berge gave place to J. L. Mowinckel.

In the fall of 1923 the Norwegian Labour Party withdrew from the Third International; whereupon their left wing organized the Communist Party, which remained affiliated with Moscow. At the election of Oct. 1924 the Social Democrats secured 8 seats, the Labour Party 24 and the Communists 6, the Left numbered 36, the Conservative coalition 54, and the Farmers' Party 22. The Conservative Parties thus had a majority of two in the new *storting;* but as the Farmers' Party refused to form an active coalition the Mowinckel Government retained office till March 1926, when they were defeated on the budget and succeeded by a Conservative cabinet under Lykke. The municipal elections of Nov. 1925 also brought victories to the "bourgeois" parties at the expense of Labour, and even more of the Communists.

The Spitzbergen archipelago had from time immemorial been under the suzerainty of Norway, but the discovery of coal caused various international conferences to be held in Oslo. The Versailles Treaty gave this group of islands and Beeren Island to Norway (1925). On March 4, 1920, the *storting* resolved that Norway should join the League of Nations. In the following years there was some friction with Denmark concerning Greenland, which had belonged to Norway until 1814. Norway had always resented its loss, and its east coast had been regarded as the fishing and hunting ground of her west coast population. Denmark's request in 1919 for recognition by the Powers of Danish suzerainty over the whole of Greenland led to a separate agreement between the two countries, both agreeing to regard the east of Greenland as no-man's-land *vis-à-vis* the other. Treaties of unconditional arbitration were concluded with various Powers (Germany, Uruguay, etc.) from 1924 onwards.

Since, despite all progress, Norway remains a relatively small, scattered and isolated nation, its political history still depends largely upon economic and financial conditions. The unrest due to the World War is to some extent perpetuated by the existence of a highly educated class more numerous than are the openings for professional employment within the country. The task of 1926–27 continued to be the restoration of the pre-war equilibrium. The connection of the extreme Socialists with Moscow, indeed, inspired a national attempt to place Dr. Nansen, the explorer, at the head of a non-party government. Failing this, Lykke returned to office early in 1926, with a programme of economic and financial reconstruction. In July, the discovery that during the crisis of 1923–24 Berge had secretly supported the Handelsbank with state funds and a guarantee for 40,000,000 kroner led to the impeachment of himself and his colleagues, though the patriotism of his motives was not in question. A verdict of guilty in any particular would have involved the condemnation of the accused to pay at least 1,000,000 kroner until, during the trial itself, the law was so altered as to give the court a reasonable discretion. All of them however, were acquitted on every count (March 1927). Meanwhile a referendum (Oct. 1926) had shown that although the number of votes cast for Prohibition had increased since 1919, the majority of 184,344 was now replaced by a minority of 108,943. A Government committee therefore recommended that adults should be empowered to buy liquor with an alcoholic strength exceeding 21% and in May 1927, Prohibition ended on these terms. The sale was entrusted to incorporated societies and restricted to the hours bewen 11 A.M. and 5 P.M. At the same time arbitration in industrial disputes was made compulsory, in spite of the strenuous resistance of Labour. In Jan. 1927 a new united Labour Party had been formed. The Moscow-led Communists were excluded, but in June when the Soviet minister at Oslo charged Britain with responsibility for the murder of his colleague in Poland, Madsen, its leader, defended the Soviet reprisals, declaring that the lives of 20,000 Soviet hostages were not equal to that of a single Communist. The *storting* condemned Madsen by nearly four to one, and the police raided the offices of Communist newspapers for seditious propaganda among the British fleet. The autumn elections reduced the Communist deputies to 3, but Labour gained 27 seats and attained a strength of 50. Conservatives and Liberals numbered 32; Farmers' Party, 26; Radicals, 29; and Labour Democrats, 1.

After a prolonged crisis in which both Farmers and Liberals declined office, a Labour Government, under Christopher Harnarud, was formed (Jan. 26, 1928). This declared that the interests of the workers were paramount, and that it would prepare for complete disarmament and the Socialist State. Widespread panic followed, and the Norwegian Credit Bank was for a time in danger. The Labour Government survived, however, for only a

fortnight, yielding place to Mowinckel and the Liberals. On May 1 the gold standard was re-introduced. On March 21, 1929, Crown Prince Olaf of Norway was married at Oslo to Princess Martha of Sweden, the ceremony being performed amid scenes of the greatest public enthusiasm.

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NORWAY, a city of Dickinson county, Michigan, U.S.A., in the southern part of the Upper Peninsula, on the Chicago and North Western railway and Federal highway 2, near the Menominee river. The population was 4,533 in 1920 (36% foreign-born white). Iron-mining and lumbering are the principal interests.

NORWEGIAN LANGUAGE AND LITERATURE. The language used in almost all great newspapers, in commerce and by the best known authors differs in many ways from the spoken language even of people of literary education, still more from that of less educated classes in the towns and of the rural population. "The ordinary literary language," as it is officially styled, or the "Norwego-Danish" as it is scientifically termed, or *"Riksmaal"* in colloquial speech, is the Norwegian variety of the Danish language which came in during the union with Denmark (1380–1814).

Up to the beginning of the 19th century Danish in Norway was chiefly a written language, its oral use being limited to reading, preaching and, towards the end of this period, society purposes. During the 19th century the upper classes, especially of the towns, developed a spoken Norwego-Danish, with Norwegian sounds and intonation, and progressively influenced by the Norwegian popular idiom. Pure Danish was spoken by some actors as late as 1889. In 1887 Norwego-Danish was recognized for standard reading in the secondary schools, and gradually it penetrated even the church, the last stronghold of the Danish tradition. In 1907 some important characteristics of Norwegian pronunciation were adopted into the orthography of the language, and in 1917 orthography took a further step away from modern Danish.

Colloquial Varieties.—The colloquial form varies greatly according to the locality and the social class of the speaker. Locally Norwego-Danish speech may be divided into four principal dialects: the southern dialect, comprising the towns Arendal, Christianssand and Stavanger and others on that part of the coast, with *b-d-g* for Norwegian p-t-k following a vowel; the western dialect (Bergen), with a peculiar accent and great fluency of diction, and with the same (uvular) *r* as the southern dialect; the northern dialect (Bodø Tromsø) with a somewhat monotonous "singing" accent; and the eastern dialect (Oslo-Trondhjem), now the principal form of the spoken Norwego-Danish.

This Norwego-Danish literary language, with its dignified pronunciation especially as heard in the capital, is presented as "Norwegian" in school and reference books written for foreigners. Through different social strata this language is connected with the dialects of the towns and of the factory workers in the country. These town dialects exhibit the same phonetic and inflectional traits as the surrounding country dialects and are thus fundamentally Norwegian; but they are susceptible of modifications in the direction of the Norwego-Danish speech of the upper classes. There are thus three strata in the speech of the towns: upper, middle and lower class dialects, the first originally Danish, the last essentially Norwegian. The town dialects are little represented in literature, being limited to writings of a light and humorous kind; modern authors, however, frequently use the colloquial (middle class) and vulgar forms of speech in dialogues and as a means of characterization, and on the stage. Only exceptionally has it found its way into serious drama.

New Norwegian.—The New Norwegian National Language (*Landsmaal*) is a common standard literary form for the dialects, propounded on a scientific basis by Ivar Aasen (1813–1896) in his grammar of Norwegian speech (1848, 1864) and in his *Dictionary* (1850, 1873), and since 1853 cultivated in literary works. From that time the Landsmaal has been further developed by a series of authors, by newspapers, by periodicals, by scientific and educational works (especially on national philology and history, on pedagogics and theology), and by school books of all kinds.

Landsmaal is supported by the national democratic parties and a strong Young People's Association movement. In 1885 the Storting passed a resolution declaring the equality of the popular language and the Norwego-Danish language. In 1892 the school circuits were allowed to make Landsmaal the principal language of the elementary school; and it has been adopted by more than 2,000 school circuits, mostly in the west and midland districts, and by the great majority of the free adult schools. In the secondary schools and, from 1908, in the university, students may use Landsmaal, but only in three State schools is it the principal language; and in some other secondary schools founded by private individuals or corporations. In some 200 churches the liturgy is in Norwegian, and an increasing number of clergymen preach in Norwegian.

In the districts from Møre to Telemark, statutes have been promulgated in Landsmaal. Two hundred district authorities have asked that the central administration and the Government officials use Landsmaal when writing to them. Since 1894 the Storting has voted a few laws in Norwegian.

The official orthography of the names of towns, districts, estates and other localities is now in course of revision in order to do away with the Danicized forms and establish an orthography corresponding with their national origin and pronunciation.

Dialects.—Dialect differences are not great enough to prevent intercourse between people of different provinces. Some dialects exhibit strongly marked peculiarities, *e.g.*, that of Setesdal with its diphthongization of old long vowels and its characteristic vocabulary. The country dialects are eastern, western and northern, with many transitional forms especially in the coast districts. The vocabulary is not uniform, and some of the dialects have simplified inflection; but the chief differences are due to the varying development of sounds. The eastern groups have cacuminal and supradental sounds; the northern and greater part of the country palatalizes *nn, ll, dd, gg;* eastern and northern dialects and still others have to a great extent assimilated *nd, ld, ng, gn, mb.* In eastern dialects *rd* is mostly pronounced [ɻ] (thick l), in western [*r*]. Other assimilations are still more wide-spread, such as *rn* to [*nn*].

The Character of New Norwegian.—Landsmaal is rooted in old Norse. The principal features of the spoken language are the same; it has kept up the old diphthongs and to a great extent the old West Scandinavian vocal system of the stem syllables, differing in this respect from Swedish and Danish (the chief exceptions being rather important changes in the original short syllables, the weakening of sounds in terminations, especially of adjectives, and a certain number of apocopes).

Vocabulary.—The vocabulary is extremely rich, especially in the midland, western and Trøndelag dialects, but it varies greatly from coast districts to mountain and forest districts. It has many literary words, frequently compounds or words of a wider meaning than that given to them in popular speech; these are sometimes termed neologisms and are used as substitutes for established foreign literary and technical terms. While as a spoken and popular language, Landsmaal is more puristic than Swedish and Danish; a number of loan-words come from Old Norse, being borrowed from and through Old English, Old French, and, in the latter period of the Middle Ages, from Low German (the Hanse), and in later times through Danish, from High German. Many Danish words, especially such as belong to the field of religion, found their way into Norwegian, although their number is smaller than might have been expected.

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(S. K.)

LITERATURE

From a linguistic and artistic aspect the literature of ancient Norway is inextricably bound up with Icelandic; Old Norse literature is, therefore, dealt with under Iceland (*q.v.*); yet it should not be forgotten that the psychological features revealed through the so-called *Older Edda*, as well through the sagas, are so typically Norwegian in all essentials that this literature forms the very basis on which the literary fabric of Norway has been raised in the course of centuries.

The literature of the Old Norse language came to an end in the beginning of the 14th century simultaneously with the decline and fall of Norway as a sovereign State with a culture of her own. The chief characteristic of this literature, formed as it was in "an age of axes, an age of swords," is the remarkable fighting spirit by which it is pervaded, and which quite naturally makes it abound in dramatic scenes and striking personalities; at the same time, in poetry as well as in prose, it is imbued by a serene view of life, which reveals a remarkably high moral standard. Another very distinct feature is its decidedly aristocratic leaning, with a pronounced hero-worshipping tendency, as might be expected in an age when the king generally appeared surrounded by his faithful chieftains, and frequently with a young poet before him, singing his praises in glowing terms.

The Literary Revival.—Meanwhile the political union between Denmark and Norway (concluded in 1380) gradually brought Danish nobles and officials to the front in this country, with the result that the Old Norse language was replaced by Danish. This development which constitutes perhaps the most remarkable event in the cultural history of the nation, may be considered as completed by the middle of the 16th century. Accordingly, when about the same time the literary revival set in, which to some extent is due to the introduction into Norway of the Lutheran Reformation, the new literature came to be composed in the Danish language, which for nearly three centuries was to hold an unchallenged position as the official language of Norway.

The first outcome of the revival of literary interest in Norway was the appearance of the first book ever printed in Norway, an almanac, printed in Christiania in 1643. During the following years Christen Bang (1580–1678) published a number of religious tracts and also a *Description of Christiania* (1651), which at that time had only recently completed the 25th anniversary of its foundation. These curiosities have, however, nothing to do with literature in the true sense of the word, and the first name of importance in Norwegian literature after the spiritual revival in the Reformation century was Peder Claussön (1545–1614), a clergyman by profession and at the same time a highly gifted author who by his translation of Snorre Sturlassön (*q.v.*) as well as by his independent works on Norway, has got a lasting reputation. The next striking personality in Norwegian literature is Petter Dass (1647–1708) whose *Nordlands Trompet* (Clarion) with its lyric-topographical description of the scenery and life of north Norway is still considered one of the gems of Norwegian literature. On the other hand, Dorothea Engelbrechtsdatter (1635–1716), who among her contemporaries enjoyed a great reputation as an author of religious poetry, is now practically forgotten owing to the melancholy tone of her work.

Holberg.—Contrasted with these authors, who all spent their life in Norway, Ludvig Holberg (1684–1754) (*q.v.*) early found his way not only out of Norway, but out of Denmark. Leaving Norway for ever at the age of 21, after having taken his degrees at the University of Copenhagen, he went to England, where he studied for more than 18 months at Oxford, from which he carried with him an indelible impression of England and the English. Later travels brought him to France, Germany and Italy, but wherever he went he lived in the English world of thought and reasoned on the basis of his Oxford experiences. In this way, thanks to his inborn genius and his unbiased mind, he prepared himself for the lifework by which he became the founder of modern Norwegian and modern Danish literature. He revolutionized the conception of life in two kingdoms and paved the way for the intellectual and political liberty of the future. His most famous works next to his *Comedies* (*see* DRAMA: *Norway*) are *Peder Paars* (1719), a heroic poem, the humour and satire of which has stood the test of two centuries; *Niels Klim's Underground Travel* (1741), originally written in Latin, a classic evidence of his mental independence, and finally from the closing years of his life his *Epistles* and *Moral Reflections*, which are the best source of information for Holberg students. Holberg restored the cultural connection between Norway, England and western Europe in general, which had been broken off since the end of the saga period. This fact cannot be emphasized too strongly, for it constitutes the connecting link between the Old Norse literature and the literature of modern Norway, and gives the clue to some of the most outstanding features of the latter, *e.g.*, its independent conception of life and its absolute acceptance of facts, however disagreeable.

English native poets, like James Thomson and Edward Young, had their counterpart in Norway in Christian Tullin (1728–65), a manufacturer and merchant of importance in the business community of Christiania, and a central figure in the extremely sociable life of the city. By his famous poem, *The May-Day* (1758), composed on the occasion of a wedding among "the upper ten" of Christiania, Tullin became the first interpreter in Norwegian literature of the long pent-up love of nature which three-quarters of a century later should find such splendid expression in the poetry of Wergeland.

Det Norske Selskab.—Meanwhile, the importance of Holberg's work, along with a number of other factors, among them a constantly growing awareness of being an individual nation with historical traditions and cultural and economic possibilities, gradually began to prevail. The centre of this movement was Copenhagen, where the Norwegian students, partly graduates staying there in search of employment, felt themselves aliens in the midst of a display of public sympathy which made the name of Norway and the Norwegians resound in a way bearing promise for

the future. In 1772, to mention a particular year of lasting importance in Norwegian literature, the Norwegian poets and other men of letters were so strong in Copenhagen that they formed a society which was to become famous under the name of *Det Norske Selskab* (the Norwegian Society). The two most conspicuous members of this society with whom its name has for ever been associated were Johan Herman Wessel (1742–85) and Johan Nordahl Brun (1745–1816); besides them should be mentioned Claus Fasting (1746–91), Claus Frimann (1746–1829), and his brother Peter Harboe Frimann (1752–1839), as also their younger contemporaries, Jonas Rein (1760–1821) and Jens Zetlitz (1761–1821). No student of Norwegian literature who wants to understand the under-currents in the Norwegian nation in the last 40 years prior to the dissolution (1814), should pass by these poets, among whom Claus Frimann still lives in a few songs of popular reputation. The sovereign talent among them is, however, Wessel (*see* DRAMA: *Norway*), the spiritual inheritor of Holberg, a champion in the fight against pedantry and prejudices, a *gamin* spirit full of irony and good humour in the midst of adversities.

Norwegian literature has no finer display of comic fiction than his three immortal poems, "The Smith and the Baker," "The Dog-murder" and "The Fork," while a number of his pithy and pointed epigrams have long ago become classic. Nordahl Brun's fame with posterity rests less on the poetic value of his works than on the tradition of his striking personality, which in his lifetime made him the very embodiment of the national aspirations of Norway; his famous song "To Norway, giants' country, hail," still sung, bears witness to it.

The Renaissance of 1814.—In literature this renaissance, in its first stage, was represented by three poets, Henrik Anker Bjerregaard (1792–1842), Mauritz Christopher Hansen (1794–1842) and Conrad Nicolai Schwach (1793–1860). Bjerregaard was famous for his *Sönner av Norge* (Sons of Norway), written in 1820, which for half a century was the national anthem of Norway. His merry musical piece, *A Highland Adventure* (1824), is inspired by a genuine love of nature and a sound common sense.

Wergeland and Welhaven.—The commanding genius of this generation is Henrik Arnold Wergeland (1808–45) (*q.v.*), who, as has justly been said, contrived within the limits of a life as short as Byron's to concentrate the labours of a dozen ordinary men of letters. As a poet he is inspired alike by an intense love of nature. Besides larger poems, among which may especially be mentioned *The English Pilot* (1844), he has written in addition a quantity of lyrics with dramas, essays, historical works and journalistic articles—all stamped by his vivid imagination, his sound common sense and his high moral standard.

His contemporary, Johan Sebastian Cammermeyer Welhaven (1807–73), is primarily known for his highly critical nature, with its keen sense of beauty and harmony. His early poems are associated with his literary clash with Wergeland, but notwithstanding the interest attached to them for their polemic character, the memory of Welhaven as a poet chiefly rests upon his beautiful romances. This romantic movement was evident about 1840 and it is the same spirit which led to the discovery of the folk-lore, with its wonderful prose and poetry, in which the soul of the nation and the nature of the country faithfully reflected themselves.

The ideal was that every piece of folk-lore should be rendered in the form given to it by the people in the course of time, and here the Norwegian nation was particularly fortunate. At the right moment the two friends, Peter Christen Asbjörnsen (1812–85) and Jörgen Moe (1813–82), whose names are for ever associated with the Norwegian folk-tales which bid fair to challenge the most famous folk-tales in any European country, made their appearance in literature. Asbjörnsen was a first-rate story-teller with a broad, jovial nature; Moe was a true poet with humour and a rare gift of self-criticism. There was also the Rev. Magnus Brostrup Landstad (1802–80), who in 1853 published his famous collection, *Norwegian Folk-Songs*, the poetical part of the Norwegian folk-lore of which the folk-tales constitute the prose. The former are older than the latter, and accordingly differ from them in several ways; but jointly they constitute what up to the middle of last century was "the missing link" between the eddas and the sagas on one side, and the literature of modern Norway on the other.

The Landsmaal Movement.—Along with this literary revival there also set in a linguistic and historical renaissance of paramount importance to literature as a whole. In 1848 Ivar Aasen (1813–96) published a grammar and in 1850 a dictionary of the Norwegian folk-language, whereby the intimate connection between the peasant dialects of the day and the Old Norse language was revealed in the most convincing way. Some years after Aasen's appearance in literature the famous historian, Peter Andreas Munch (1810–63), published his mighty work, *History of the Norwegian Nation* (8 vols., 1852–63)—an event of paramount importance in the field of literature.

This Romantic movement leading to the foundation of the national stage in Norway, with Björnson and Ibsen as the two pioneers (*see* DRAMA: *Norway*), it is easy to see why both of them turned to the saga period for suitable subjects and characters. At the same time, however, realism had already set in. During the '50s the Rev. Eilert Sundt (1817–75) started his epoch-making investigations of life and manners in the rural districts, which made the Norwegian peasant appear in a light considerably different from that in which he appeared in the flattering illumination of the former "peasant worship." Accordingly, Björnson's famous peasant novels, the first of which was *Synnöve Solbakken* (1857), of a decidedly poetical turn, must be described as imbued by romanticism more than by realism so far as the outward surroundings are concerned.

The Big Four.—In 1855 Madame Camilla Collett (1813–95), Henrik Wergeland's sister, published her famous novel, *The Governor's Daughters*, the first true description in Norwegian literature of ordinary life, while at the same time it dealt a heavy blow to the conventional marriage and education of young girls. In this way Madame Collett became a pioneer in the movement for the emancipation of women in Norway to whom both Björnson and Ibsen felt themselves indebted. Next to Madame Collett, the fame of the realistic novel is chiefly developed through Jonas Lie (1833–1908) and Alexander Kielland (1849–1906), who, together with Ibsen and Björnson, constitute the famous constellation in the golden age of Norwegian literature popularly known as "the big four." Lie is the author of a number of pure, fresh and eminently characteristic novels dealing with various aspects of every-day life within different ranks of society. *The Pilot and his Wife* (1874), *Rutland* (1880) and *Go On!* (1882), should be mentioned in this connection, no less for the spirit of the white sails and foaming sea by which they are imbued, than for their intimate humanity in substance and psychological analysis. The latter qualities are also splendidly displayed in *The Commander's Daughters* (1886) and *Matrimonial Life* (1887), which, together with his beautiful novel, *The Family at Gilje* (1883), a master-piece of historical review and human psychology dealing with life and characters of the '40s, rank among the crowning works of Lie's extensive authorship. Contrasted with Lie, whose highly impressionistic style not infrequently becomes colloquial to a fault, Kielland is a sovereign master of form, and at the same time a keen psychologist with a decided vein of irony and a heart full of compassion for human suffering. His social novels, *Garmann and Worse* (1880) and *Skipper Worse* (1882), have long ago become classic, as have a number of his short stories, which by their delicacy of style represent the highest attainment of modern Norwegian prose.

Among other authors from the same epoch should be mentioned Kristian Elster (1841–81), who showed great talent in his pessimistic novels, *Tora Trondal* (1879) and *Dangerous People* (1881), and Amalie Skram (1847–1905), wife of the Danish novelist, Erik Skram, whose novels, while deficient in literary beauty, are of a considerable crude force and excellent in their local colour, dealing chiefly with Bergen and west coast life. The outstanding feature of all the authors of the '80s, which may broadly be described as an age of entirely prosaic writers, is the "problem setting," to which there is no parallel in Norwegian literature, and to which Björnson himself contributed in his great novel, *Town and Harbour Beflagged* (1884), to mention one of the most

typical "problem" novels of the age.

Vinje and Garborg.—The *landsmaal* literature produced two remarkable authors, Aasmund Olafsen Vinje (1818–70) and Arne Garborg (1851–1925). Vinje was a man of rare gifts, a fine lyric poet, a brilliant essayist and a keen critic, who exercised a great influence on Ibsen in his first period as a dramatist and who, broadly speaking, was one of the most striking literary figures of the '60s. Garborg, who was brought up under sternly pietistic influences in the south-west corner of Norway known as Jaeren, carried with him from these surroundings a gloomy view of life, but being at the same time a revolutionary spirit and an imaginative thinker with a considerable training, principally as a critic, he seemed predestined to make his appearance in literature. His great novel, *Peasant Students* (1883), is of a polemic nature. This novel, like the rest of Garborg's novels through the '80s, is written in the *landsmaal,* which at the time to a certain extent was a drawback to their circulation. In 1891, however, he suddenly turned to the *riksmaal* in his extraordinary novel, *Tired Men,* an exquisite example of Norwegian prose.

Hamsun.—Meanwhile another author had already made his appearance in Knut Hamsun (b. 1859) (*q.v.*), whose powerful romance *Hunger* (1888), marks a new departure in Norwegian literature. He is, in fact, its central figure throughout the '90s in the midst of a number of authors of an entirely different stamp from those of the '80s. The most unmistakable genius was, however, Hans Kinck (1865–1926), to whom we propose to return presently. As a typical feature of the '90s it should especially be mentioned that the art of poetry, which had been practically banished from Norwegian for a number of years, again got its exponents, chiefly in Niels Collett Vogt (b. 1864) and Vilhelm Krag (b. 1871). The sensitive spirit of the age is, however, revealed nowhere more remarkably than in Sigbjörn Obstfelder (1866–1900), whose exquisite poetry, as we can study it in his *Posthumous Works,* is rivalled only by his fascinating prose. In both he gives promise of something new in Norwegian literature which was cut short by his early death. At the same time the *landsmaal* poetry witnessed a revival, chiefly through Per Sivle (1857–1904), an excellent national poet whose poems dealt with the episodes and characters of the saga period.

The most consummate work in the *landsmaal* lyric during the '90s is, however, Garborg's *Haugtussa* (1895), inspired by the strange and impressive scenery of the Jaeren. Thus, at the end of the 19th century, there was a revival both in the *riksmaal* and in the *landsmaal* literature.

The first decade of the 20th century will for ever be memorable for the passing away of the four great classics of the preceding age: Ibsen, Björnson, Lie and Kielland. Thereby the field of fiction was thrown open to a new generation of authors, who found themselves confronted with problems essentially different from those which had taxed the attention of the former generation. Norway was no longer the country of consuls, shipowners, vicars, rectors, chamberlains and estate owners, representing official views and opinions against which persons not "made of that self metal" occasionally revolted, and always with deplorable result to their own social interests; nor was Norway the country of women suffering in silence under slow torture of an apparently correct marriage, or a country of workers imbued by a patriarchal respect for their employers, based on personal connections from generation to generation. She was a community in which democracy had established itself on a broad basis.

Recent Literature.—No dramatic work of lasting influence has appeared since the age of Ibsen and Björnson, but an examination of the history of the Norwegian novel leaves a more satisfactory impression. Hamsun produced works, generally written in an exquisite style and filled with an exuberant vitality, of which *Pan* (1895) ranks particularly high. Compared with this work, the *Growth of the Soil* (1917; Eng. trans. 1920), by which Hamsun has become famous all over the English-speaking world, does not approach it in range of passion and in mystic grandeur.

Kinck, who is by all critics admitted to be an author of rare gifts, has not yet received general recognition either at home or abroad. Yet by his daring metaphors, his exuberant passions, his deep psychology supported by extensive historical studies, he is one of the most intimate guides to the depths of the Norwegian mind. His Hardanger novel, *The Avalanche* (1919–20), is considered his greatest work, but generally speaking he is at his best in the short story. Another classic writer is Trygve Andersen (1867–1920), a self-controlled author with a limited production.

Besides these three poet-artists and classics should be mentioned Johan Bojer (b. 1872), whose novels, notwithstanding their fame in the English-speaking world and elsewhere, are not considered by Norwegian critics as revealing any particular feature typical of the Norwegian mind. A more intimate author is Peter Egge (b. 1869), a conscientious writer with an artistic style which adds to his original gifts as a narrator and psychologist. These qualities are happily displayed in *Hanna Solstad* (1926), one of the finest novels written in recent years.

The most remarkable figure in recent Norwegian literature is, however, Madame Sigrid Undset (b. 1882) (*q.v.*), who holds a position of her own by her mighty cycles of historical novels, of which *Kristin Lavransdattar,* i.–iii., shows a remarkable psychological insight and a rare power of appreciating bygone ages.

One of the chief characteristics of Norwegian literature during the last generation is the ever-increasing number of local authors who, substituting particular districts for the country as a whole, have given rise to local literature, partly written in the literary tongue of the country known as the *riksmaal,* partly in the *landsmaal,* or in a *riksmaal* coloured to a marked degree by local dialects. The most conspicuous of these authors are Oskar Braaten, Hans Aanrud (b. 1863), who scored success as a playwright of broad humour in the '90s, and Johan Falkberget (b. 1879)—all typical East Norway novelists. Braaten's literary domain, not only as a playwright but as a novelist, is the industrial quarters of Oslo and its surrounding districts. Aanrud is a keen observer of life and manners in the midland countries round Lake Mjösen. Falkberget is intimately acquainted with the miners of the mountain districts of the valley of Österdalen.

Gabriel Scott has, in an idyllic novel, *The Source* (1918), found an exquisite expression of the typical Sörland (literally Southerland) nature and Sörland temper as they reveal themselves all through the charming coastland. West Norway country life has been ably sketched by Jens Tvedt (b. 1857), who writes in the *landsmaal.* The particular district of the North Trondhjem country, known as the valley of Namdalen, has in Olav Duun (b. 1876), whose works all deal with life and manners in his native valley, produced the most gifted author of modern times writing in the *landsmaal.* Another significant author in the same language is Kristofer Uppdal (b. 1878), originally a navvy, whose works are imbued by the ideals of the labour movement.

In poetry Niels Collett Vogt has continued to proclaim his emotions in stanzas of vigorous and beautiful metaphors. Olaf Bull (b. 1882) combines to a rare degree a refined versification with silent resignation and lofty enthusiasm. Herman Wildenvey (b. 1885), a genial troubadour talent, sings out his joys, his cares and his whims in easy verses and metaphors, striking for felicity of phrase. Simultaneously with this lyric flourishing in the *riksmaal,* no adequate revival has taken place in the *landsmaal.* The gem of lyric poetry in that tongue is still *Haugtussa,* a lasting tribute to the genius of Arne Garborg, by whose death the *landsmaal* literature lost its first rate lyric poet.

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NORWICH (nŏr'rĭj), **GEORGE GORING,** EARL OF (1583?–1663), English soldier, son of George Goring of Hurstpierpoint and Ovingdean, Sussex. He was knighted in 1608, and became a favourite at court, benefiting largely from monopolies granted by Charles I. He became Baron Goring in 1628, and privy councillor in 1639. When the troubles between Charles and his

parliament became acute Goring devoted his fortune freely to the royal cause; and the king in November 1644 renewed for him the title of earl of Norwich which had become extinct at his uncle's death. He went with the queen to Holland in 1642 to raise money for the king, and in the autumn of the next year he was seeking arms and money from Mazarin in Paris. His proceedings were revealed to the parliament in January 1644 by an intercepted letter to Henrietta Maria. He was consequently impeached of high treason, and prudently remained abroad until 1647 when he received a pass from the parliament under a pretext of seeking reconciliation. Thus he was able to take a prominent part in the Second Civil War of 1648 (*see* GREAT REBELLION). He commanded the Kentish levies, which Fairfax dispersed at Maidstone and elsewhere, and was forced to surrender unconditionally at Colchester. He was condemned to death on March 6, but petitions for mercy were presented to parliament, and Norwich's life was spared by the Speaker's casting vote. He then joined the exiled court of Charles II., by whom he was employed in fruitless negotiations with the duke of Lorraine. He became captain of the king's guard at the Restoration, and in consideration of the fortune he had expended in the king's service a pension of £2,000 a year was granted him. He died at Brentford on Jan. 6, 1663.

NORWICH, city and county town of Norfolk, England, 114m. N.E. by N. from London. Pop. (1921) 120,661. It is served by the L.N.E., the L.M.S., and the M. and G.N. railways. Caistor-by-Norwich, 4 m. S. of Norwich, is on the site of what was probably a Romano-British town. According to tradition Uffa made a fortification here about 570, but its history as a royal borough cannot be traced before the reign of Aethelstan (924–940), when it possessed a mint. After being destroyed by the Danes Norwich enjoyed a period of prosperity under Danish influence and was one of the largest boroughs in the kingdom at the Conquest. Ralph de Guader, earl of East Anglia under William I., formed the nucleus of a French borough with different customs from the English, and after his forfeiture a castle was built and the centre of burghal life gradually transferred to the new community west of it. By 1158, when Henry II. granted the burgesses a charter confirming their previous liberties, the two boroughs seem to have amalgamated. A fuller charter given by Richard I. and confirmed by later sovereigns made Norwich a city enjoying the same liberties as London. The city lies in the valley of the Wensum, which joins the Yare immediately below. The ancient city lay in a deep bend of the Wensum, and the walls (1294–1342), with their many towers and 12 gatehouses, of which fragments only remain, were 4 m. in circuit. These narrow limits, however, were outgrown even by 1671. The castle, standing high upon a steep mound, is still partly surrounded by earthworks and a ditch spanned by a very early bridge. Only the early Norman square keep remains, with four tiers of arcading without, and an ornate doorway into the great tower. The building was acquired in 1884 by the corporation and in 1894 adapted as a museum and art gallery.

The cathedral church of the Holy Trinity lies between the castle and the river. In 1094 the seat of the East Anglian bishopric was removed by Bishop Herbert de Lozinga or Lorraine from Thetford to Norwich, where in 1096 he laid the foundation of the cathedral and dedicated it in 1101, establishing at the same time a Benedictine monastery. As completed by his successor before the middle of the 12th century the cathedral was purely Norman; and it still retains its original Norman plan. The Early English lady chapel (demolished about 1580) belonged to the middle of the 13th century; the Perpendicular spire, erected after the collapse of two spires of wood, belongs to the 15th; the west window and porch and the lierne stone vaulting of the nave, with its 328 bosses, to the 15th, and to the 16th the vaulting of the transepts and Bishop Nix's chantry, whilst the fine cloisters, with 45 windows, were begun in 1297 and not completed till 1430. The chief entrance on the west is a Perpendicular archway, above which is a window filled with modern stained glass. The nave is divided by 14 semicircular arches, whose piers are in two instances ornamented with spiral mouldings. The triforium is composed of similar arches. The choir is of unusual length, and terminates in an apse. The oak stalls and *misereres* are of the 15th century. Of three circular apsidal chapels two remain. Two richly sculptured gateways lead to the cathedral—the Erpingham gate (1420) and the Ethelbert gateway (*c.* 1300). The bishop's palace and the deanery have undergone many alterations. The latter has a well-restored chapel. An Early Decorated ruin in the palace garden, known as "Bishop Salmon's gateway," is supposed to have been the porch to the great hall (*c.* 1319).

The citizens obtained a charter (1404), making their city a county with a mayor and two sheriffs instead of four bailiffs, and Henry V. added 24 aldermen and 60 common councilmen (1418). The cathedral precinct became parcel of the city at the Dissolution and in 1556 the neighbouring hamlets were incorporated in the county of Norwich. The charter of Charles II. (1683) remained in force till 1835, when one sheriff was removed and the number of aldermen, common councilmen and wards diminished. Since 1298 Norwich has been represented in parliament by two members. Two annual fairs, existing before 1332, were formally granted to the city in 1482. One was then held in Lent, the other began on the feast of the Commemoration of St. Paul (June 30). These have been succeeded by the Maunday Thursday horse and cattle fair, and the pleasure fairs of Easter and Christmas. The market, which must have existed before the Conquest, was held daily in the 13th century, when citizens enclosed stalls by royal licence. Edward III. made Norwich a staple town, and the importance of its trade in wool and worsted dates from his reign.

The majority of the Norwich churches are of Perpendicular flint work, mostly of the 15th century. At Carrow, east of the city, there remain the hall, a doorway, and other fragments of a Benedictine nunnery. The house in which Borrow resided with his parents when in Norwich is now a Borrow museum, presented by A. M. Samuels in 1913. The Stranger's Hall, a 15th century house on Charing Cross, was given as an English Folk museum by L. G. Bolingbroke. In 1921 Sir Eustace Gurney presented to the city the Lazar House, a Norman relic contemporary with the cathedral, for the purpose of a branch public library. In 1925 Miss E. M. Colman, the first lady in England to be Lord Mayor, and her sister restored and presented to the city the 14th century Suckling House.

The grammar school is a Decorated edifice, formerly a chapel of St. John, of *c.* 1316, with crypt below. Sir Edward Coke, Lord Nelson, Raja Brooke and George Borrow were educated here. St. Andrew's Hall is the seven-bayed nave of the Black Friars' church, rebuilt with the aid of the Erpinghams between 1440 and 1470. It is Perpendicular, with 28 clerestory windows and chestnut hammer-beam roof, and has served since the Reformation as a public hall. It was restored in 1863. The guild-hall, on the site of an earlier tolbooth, is a flint Perpendicular structure of 1408–13; the mayor's council-chamber, with furniture of the time of Henry VIII., is a specimen of a court of justice of that period. The city regalia, kept here, include several objects of historical interest, amongst them a sword of a Spanish admiral captured by Nelson, with his autograph letter presenting it to the city, and a curious figure formerly used in the procession of the mayor elect through the city. The Norfolk and Norwich library was rebuilt in 1900 after a fire. The charitable institutions include St. Giles's or old men's hospital (an ancient foundation), and Doughty's hospital (1687).

Norwich is extending and enlarging its industries, which include foundries and engineering works, iron and wire fence works, brewing, brick works, chemical works, tanneries, and the production of mustard, starch, malt vinegar, and crêpe, gauze and lace; and there are large boot and shoe factories. The great cattle market lies below the castle. The chief magistrate was created lord mayor in 1910.

NORWICH, a city of south-eastern Connecticut, U.S.A., situated at the confluence of the Yantic and the Shetucket rivers to form the Thames. It is served by the Central Vermont and the New York, New Haven and Hartford railways and steamers to New York. Pop. (1920) 22,304 (26% foreign-born white); 1928 local estimate 26,000. It is the seat of a State hospital for

the insane and a State tuberculosis sanatorium. Under a monument in Sachem street is buried the Mohegan chief Uncas, a friend to the early settlers; and in the eastern part of the city is a monument to Miantonomo, a Narragansett sachem who was put to death here. The channel of the Thames is 14 ft. deep to Norwich. Its manufactures are varied, including cotton and woollen goods, velvets, fire-arms, thermos bottles, locks, leather and rubber goods, buttons, trunks, boilers and many kinds of machinery. The aggregate output in 1925 was valued at $20,908,609. Norwich was settled in 1659 by colonists from Saybrook, led by Capt. John Mason, who had crushed the Pequots in 1637, and the Rev. James Fitch, who became a missionary to the Mohegans. The land was bought from three Mohegan chiefs, and until 1662 the settlement was called Mohegan. It was the home of the Huntington family, which furnished many leaders in the civil and military affairs of the Colony, the State and the nation; and the birthplace of Benedict Arnold, Mrs. Lydia H. Sigourney and Donald G. Mitchell ("Ik Marvel"). Before and during the Revolution the people of Norwich were ardent Whigs, boycotting English goods in 1767, ostracizing a schoolmaster (1770) who continued to drink tea, and disregarding the Stamp Act in 1776. The town was chartered as a city in 1784. The *Courier*, a newspaper established in 1796, is still published.

NORWICH, a city of New York, U.S.A., on the Chenango river and the Chenango trail, 42 m. N.E. of Binghamton; the county seat of Chenango county. It has an airport, and is served by the Lackawanna and the New York, Ontario and Western railways. Pop. (1920) 8,268 (89% native white). Norwich is a manufacturing city, in one of the principal dairying districts of the State. Its leading products are pharmaceutical preparations, condensed milk, silos, wire baskets, silk and knit goods, hammers and hangars. There are railroad shops here. Norwich was settled in 1792, incorporated as a village in 1857 and as a city in 1915.

NORWOOD, a residential area of London, England, partly in Surrey and partly in the county of London (metropolitan borough of Lambeth). The district is hilly and well wooded. It is divided into Upper, Lower, South and West Norwood.

NORWOOD, a town of Norfolk county, Massachusetts, U.S.A., 14 m. S.W. of Boston, on the Neponset river and served by the New York, New Haven and Hartford railroad. Pop. (1920) 12,627 (34% foreign-born white), 14,151 in 1925 (State census); 1928 local estimate 15,000. It is a residential suburb, and it has important manufactures, notably the plants of three large printing and publishing houses. Norwood was incorporated (from parts of Dedham and Walpole) in 1872. Since 1915 it has had a municipal-manager form of government.

NORWOOD, a city of Hamilton county, Ohio, U.S.A., adjoining Cincinnati on the north-east. It is served by the Baltimore and Ohio, the Pennsylvania and (for freight) the Norfolk and Western railways. Pop. (1920) 24,966 (93% native white); estimated locally at 35,000 in 1928. Developed originally as a residential suburb, it now has extensive manufacturing industries, with an output in 1925 valued at $57,217,181. Playing cards, office furniture, safes, stationery, electric goods, pianos, tools and house furnishings are leading products, and there are large printing and lithographing establishments. Norwood was founded (as Sharpsburg) about 1798, laid out in 1873, incorporated as a village in 1888 and chartered as a city in 1903.

NOSARI or **NAVSARI,** a town in India, in the state of Baroda, and the capital of the Gaekwar's southern possessions. It lies on the left bank of the Purna river, 147 m. by rail N. of Bombay. Pop. (1921) 19,437. It is an ancient place, known to Ptolemy as Nasaripa. It was one of the earliest settlements of the Parsees in Gujarat, after their banishment from Persia in the 12th century. It is still the home of their *mobeds*, or sacerdotal class, and contains their most venerated "fire temple." The public buildings and the private houses, especially those in the suburbs, are unusually good.

NOSE, the organ of the sense of smell (*q.v.*) in man and other animals (*see* OLFACTORY SYSTEM).

NOSOLOGY, that branch of medical science which deals with classification of diseases; also, a collection of diseases.

NOSSI-BÉ, properly Nòsy-bé, *i.e.*, "Great island," an island about 8 m. off the N.W. coast of Madagascar, in 13° 23′ S., 48° 15′ E. It has an area of 130 sq.m. Nossi-bé is volcanic, the North and South parts of older, the central part of more modern date. There are numerous volcanic craters and crater-lakes. (Lòkobé, the highest point, is 1,486 ft. above the sea.) The climate is trying, but European colonization is, nevertheless, highly developed. Pop. about 10,000. Hellville, the chief town (pop. 2,500) is a port of call for the Messageries Maritimes and a centre for the coasting trade along the western shores of Madagascar. There is excellent anchorage. The soil is very fertile, and there are forests of palms and bamboos. The chief products are coffee, the sugar-cane, cocoa, vanilla and tobacco. There are numerous sugar factories and rum distilleries. Shellfish, shells, mother of pearl, pearls and sponges are objects of trade.

In 1837 Tsioméko, chieftainess of one of the numerous divisions of the Sàkalàva, was expelled by the Hova and fled to Nossi-bé and to the neighbouring islet of Nossi-komba. She accepted French protection in 1840, ceding such rights as she possessed on the N.W. coast of the mainland. The French took possession in 1841. Nossi-bé is placed under the administration of Madagascar (*q.v.*).

NOSTRADAMUS (1503–1566), the assumed name of MICHEL DE NOTREDAME, French astrologer, of Jewish origin, who was born at St. Remi in Provence on Dec. 13, 1503. After studying humanity and philosophy at Avignon, he took the degree of doctor of medicine at Montpellier in 1529. He settled at Agen, and in 1544 established himself at Salon near Aix in Provence. Both at Aix and at Lyons he acquired great distinction by his labours during outbreaks of the plague. In 1555 he published at Lyons a book of rhymed prophecies under the title of *Centuries*, which secured him the notice of Catherine de' Medici; and in 1558 he published an enlarged edition with a dedication to the king. The seeming fulfilment of some of his predictions increased his influence, and Charles IX. named him physician in ordinary. He died on July 2, 1566.

The *Centuries* of Nostradamus have been frequently reprinted, and have been the subject of many commentaries. Nostradamus wrote a number of smaller treatises. *See* Bareste, *Nostradamus* (Paris, 1840).

NOTARY or **NOTARY PUBLIC.** In Roman law the *notarius* was originally a slave or freedman who took notes (*notae*) of judicial proceedings in shorthand. The modern notary corresponds rather to the *tabellio* or *tabularius* than to the *notarius*. In canon law it was a maxim that his evidence was worth that of two unskilled witnesses.

The office of notary in England is a very ancient one. It is mentioned in the Statute of Provisors, 25 Edward III. stat. 4. The English notary is an ecclesiastical officer, nominated, since the Peterpence Dispensations Act 1533–34, by the archbishop of Canterbury through the master of the faculties (now the judge of the provincial courts at Canterbury and York), in order to secure evidence as to the attestation of important documents. All registrars of ecclesiastical courts must be notaries. A notary's duties, however, are mainly secular. "The general functions of a notary consist in receiving all acts and contracts which must or are wished to be clothed with an authentic form; in conferring on such documents the required authenticity; in establishing their dates; in preserving originals or minutes of them which, when prepared in the style and with the seal of the notary, obtain the name of original acts; and in giving authentic copies of such acts" (Brooke, *On the Office of a Notary*). The act of a notary in authenticating or certifying a document is technically called a "notarial act." In most countries the notarial act is received in evidence as a semi-judicial matter, and the certificate of a notary is probative of the facts certified. But English law does not recognize the notarial act to this extent. An English court will, in certain cases, take judicial notice of the seal of a notary, but not that the facts that he has certified are true, except in the case of a bill of exchange protested abroad. The file of a year's documents is often termed the protocol.

The most important part of an English notary's duty is the noting and protest of foreign bills of exchange in case of non-acceptance or non-payment. This must be done by a notary in

order that the holder may recover. He also prepares ship protests relating to mercantile matters, and authenticates and certifies copies of documents and attests instruments to be sent abroad. The office of notary is now usually held by a solicitor. In London he must be free of the Scriveners' Company.

In Scotland the office of notary is *munus publicum* and his notarial acts are probative. A roll of notaries public is kept, and under the Law Agents (Scotland) Act, 1873, any law agent is entitled to admission to the roll on payment of additional stamp duty. In addition to noting and protest of bills of exchange, notaries in Scotland have important functions in relation to completion of titles to land. They act as commissioners of the Sheriff Court of Chancery for taking affidavits in the process of service of heirs, they prepare and execute notarial instruments for giving service in land, and they may execute deeds notarially on behalf of persons who cannot write. Notaries also are supposed to keep their protocol books which are probative of the intimation of certain protests by mariners and others. Modern legislation, however, has made serious inroads on the exclusiveness of the notary's functions.

In France, notaries receive all acts and contracts to which the parties thereto must give or desire to give the authenticity attached to the acts of a public authority; they certify the date, preserve the originals and give copies or duplicates. Notaries are nominated by the president of the republic on the recommendation of the keeper of the seals. They cannot act as notaries and also practise as advocates, or hold any magisterial office, nor must they engage in business.

In the more important British colonies and in foreign countries generally notaries are governed by special statutory legislation.

In the United States, the President appoints notaries in the District of Columbia, and the governor alone appoints them in most States. Many states have laws limiting the numbers who may be appointed for a particular county, usually a number in proportion to the population. Notaries are not empowered to act outside their own states, and often not outside their own counties. In most cases their seals must be affixed to the affidavit or other document. They attest deeds and other instruments, take affidavits and depositions and protest bills of exchange. Certain other officials may have notarial functions in addition, such as commissioners of deeds in New York state.

NOTE, a mark, particularly a sign by which a musical sound (also called a note) is indicated in writing (*see* MUSICAL NOTATION). A comment or addition, added to a passage in a book, or a communication in writing shorter or less formal than a letter. The term is also applied to an abstract or memorandum of documents, speeches, etc., especially in the process of the transfer of land by fine and recovery (*see* FINE).

The ordinary distinction between note and letter is reversed in diplomacy. *Diplomatic notes* are written communications exchanged between diplomatic agents or between them and the ministers of foreign affairs of the government to which they are accredited. Sometimes, by agreement, a mere exchange of notes has the force of a convention. *Collective notes* are those signed by the representatives of several powers acting in concert. Sometimes *identical notes* are substituted for collective, *i.e.,* notes identical as to form and substance, but signed and delivered separately by the representatives of the several powers. *Circular notes* are those addressed by one power to the other powers generally. *Confidential notes* are directed to inspiring confidence by giving an explicit account of the views and intentions of the plenipotentiaries and their governments. The so-called *notes verbales* are unsigned, and are merely of the nature of memoranda of conversations, etc. *Notes ad referendum* are addressed by diplomatic agents to their own governments asking for fresh powers to deal with points not covered by their instructions. Diplomatic notes are usually, but not invariably, written in the third person.

For notes of hand or promissory notes *see* NEGOTIABLE INSTRUMENTS and BILL OF EXCHANGE, and for notes passing as currency *see* BANKS, HISTORY OF, BANK-NOTE and POST.

NOTHOMB, JEAN BAPTISTE, BARON (1805–1881), Belgian statesman and diplomat, was born at Messancy in Luxemburg on July 3, 1805. He was educated at the Athenaeum of Luxemburg and the university of Liége. He was in Luxemburg when the revolution of August broke out, but was nominated a member of the commission appointed to draw up the constitution. He was a member of the national congress, and became secretary-general of the ministry of foreign affairs under Surlet de Chokier. He supported the candidature of the duke of Nemours, and joined in the proposal to offer the crown to Prince Leopold of Saxe-Coburg, being one of the delegates sent to London. When the Eighteen Articles were replaced by the Twenty-four less favourable to Belgium, he insisted on the necessity of compliance, and in 1839 he faced violent opposition to support the territorial cessions in Limburg and Luxemburg, which had remained an open question so long as Holland refused to acknowledge the Twenty-four Articles. His *Essai historique et politique sur la révolution belge* (1838) won for him the praise of Palmerston and the cross of the Legion of Honour from Louis Philippe. In 1837 he became minister of public works, and to him was largely due the rapid development of the Belgian railway system, and the increase in the mining industry. In 1840 he was sent as Belgian envoy to the Germanic confederation, and in 1841, on the fall of the Lebeau ministry, he organized the new cabinet. In 1845 he retired. He died at Berlin on Sept. 6, 1881.

See T. Juste, *Souvenirs du baron Nothomb* (Brussels, 1882); and F. de Ryckman de Betz, *Le Baron Nothomb et la question Luxembourg* (1918).

NOTICE, a term primarily meaning knowledge as in "judicial notice"; thence it comes to signify the means of bringing to knowledge, as in "notice to quit"; at last it may be used even for the actual writing by which notice is given. The most important legal uses of the word are judicial notice and the equitable doctrine of notice. Judicial notice is the recognition by courts of facts or events without proof. Thus in England and the United States the courts take judicial notice of the existence of States and sovereigns recognized by the sovereign of England, of the dates of the calendar, the date and place of the sittings of the legislature, etc. The equitable doctrine of notice is that a person who purchases an estate, although for valuable consideration, after notice of a prior equitable right, will not be enabled by getting in the legal estate to defeat that right. On the other hand, a purchaser for valuable consideration without notice of an adverse title is as a rule protected in his enjoyment of the property. Other common uses of the word are notice to quit, *i.e.,* a notice required to be given by a landlord to tenant, or by tenant to landlord in order to terminate a tenancy (*see* LANDLORD AND TENANT); notice of dishonour, *i.e.,* a notice that a bill of exchange has been dishonoured; notice of action, *i.e.,* a notice to a person of an action intended to be brought against him, which is required by statute to be given in certain cases; notice of trial, *i.e.,* the notice given by a plaintiff to a defendant that he intends to bring on the cause for trial; notice in lieu of personal service of a writ, *i.e.,* by advertisement or otherwise; notice given by one party in an action to the other, at a trial, to produce certain documents in his possession or power; notice to treat, given under the Land Clauses acts by public bodies having compulsory powers of purchasing land as a preliminary step to putting their powers in force. Notice may be either express or constructive. The latter is where knowledge of a fact is presumed from the circumstances of the case, *e.g.,* notice to a solicitor is usually constructive notice to the client. In the United States the doctrine of constructive notice is particularly important in view of the recording acts subordinating purchasers of real estate who have no actual notice of prior encumbrances on land to those whose rights have been placed on record in the registry of deeds, such purchasers being deemed to have constructive notice of whatever could have been discovered by an examination of the records. (*See* LAND REGISTRATION.)

NOTKER, a name of frequent occurrence in the ecclesiastical history of the middle ages. NOTKER BALBULUS (*c.* 840–912) was a native of northern Switzerland, and for many years *magister* in the school of St. Gall. He compiled a martyrology and other works, but is famous for his services to church music and for the "sequences" of which he was the composer. He was canonized in

1513. His life is in the Bollandist *Acta Sanctorum*, April 6th. NOTKER LABEO (d. June 29th, 1022) was also an instructor at St. Gall. His numerous translations, including those of the Old Testament Psalms, the categories of Aristotle, the *De nuptiis Mercurii et Philologiae* of Martianus Capella, and the *De consolatione* of Boëthius, into Old High German, may possibly have been the work of his pupils. They possess considerable philological interest, and have been edited by E. G. Graff (Berlin, 1837–1847), and by P. Piper under the title *Notkers und seiner Schule Schriften* (1883–1884).

See J. Kelle, *Di Sankt Galler deutschen Schriften und Notker Labeo* (Munich, 1888); G. Meyer von Knonau, "Lebensbild des heiligen Notker," in *Mitteil. Antiq. Gesellschaft Zürich* (1877).

NOTO, city, Sicily, province of Syracuse, 20 m. S.W. of it by rail, 520 ft. above sea-level. Pop. (1921) 17,443 (town), 32,336 (commune). The present town, rebuilt after the earthquake of 1693, has some fine buildings of the early 18th century. The older town lies 10 m. direct to the north (1,378 ft.). It was the ancient *Netum*, a city of Sicel origin, left to Hiero II. by the Romans by the treaty of 263 B.C. Little remains but the ruins of the mediaeval town. But four cemeteries of the third Sicel period, and one of the Greek period, of the 3rd and 2nd centuries B.C., have been excavated.

See P. Orsi in *Notizie degli scavi* (1899) 241.

NOTT, ELIPHALET (1773–1866), American divine, was born on June 25, 1773, at Ashford (Conn.). Through his brother's assistance and his own efforts while successfully teaching, he was enabled to pass the Brown college examinations. He was pastor and teacher at Cherry Valley (N.Y.) (1796–97), pastor of the Presbyterian church in Albany (1798–1804), and thereafter president of Union college, Schenectady (N.Y.), a position which he held till his death on Jan. 29, 1866. He found the college financially embarrassed, but succeeded in placing it on a sound footing. He was known also as the inventor of the first stove for anthracite coal. His publications include sermons, *Counsels to Young Men* (1810), and *Lectures on Temperance* (1847).

See *Memoirs of Eliphalet Nott* by C. van Sant Voord (ed. Tayler Lewis, 1876).

NOTT, SIR WILLIAM (1782–1845), English general, was the second son of Charles Nott, a Herefordshire farmer, obtained a cadetship in the Indian army and proceeded to India in 1800. In 1839, he held a command at Quetta and in November 1840 he captured Khelat, and in the following year compelled Akbar Khan and other tribal chiefs to submit to the British. On receiving the news of the rising of the Afghans at Kabul in November 1841, Nott took energetic measures. On Dec. 23, the British envoy, Sir William Hay Macnaghten, was murdered at Kabul; and in Feb. 1842 the weak and incompetent commander-in-chief, General Elphinstone, sent orders that Kandahar was to be evacuated. Nott at once decided to disobey, on the supposition that Elphinstone was not a free agent at Kabul; and as soon as he heard the news of the massacre in the Khyber Pass, he urged the Government at Calcutta to maintain the garrison of Kandahar with a view to avenging the massacre and the murder of Macnaghten. In March he inflicted a severe defeat on the enemy near Kandahar, and in May drove them with heavy loss out of the Baba Wali Pass. In July he received orders from Lord Ellenborough, the governor-general of India, to evacuate Afghanistan, with permission to retire by Kabul. Nott arranged with Sir George Pollock, now commander-in-chief, to join him at Kabul. On Aug. 30 he routed the Afghans at Ghazni, and on Sept. 6 occupied the fortress, from which he carried away, by the governor-general's express instructions, the gates of the temple of Somnath; on the 17th he joined Pollock at Kabul. The combined army recrossed the Sutlej in December. (*See* AFGHANISTAN: *History*). Nott was appointed resident at Lucknow and received the G.C.B. and a pension. He died at Carmarthen on Jan. 1, 1845.

See *Memoirs and Correspondence of Sir William Nott,* edited by J. H. Stocqueler (2 vols., 1854).

NOTTINGHAM, EARLS OF. The English title of earl of Nottingham has been held by different families, notably by the Mowbrays (1377 to 1475; merged in the Norfolk title from 1397), the Howards (1596–1681), and the Finches (1681; since 1729 united with that of Winchilsea).

HENEAGE FINCH (1621–1682), first earl of Nottingham in the Finch line, lord chancellor of England, was descended from an old family (*see* FINCH, FINCH-HATTON), and was the eldest son of Sir Heneage Finch, recorder of London. He was educated at Westminster and at Christ Church, Oxford, and was called to the bar at the Inner Temple in 1645. He was a member of the convention parliament of April 1660, and shortly afterwards was appointed solicitor-general, being created a baronet. He sat in parliament for Oxford. In 1670 he became attorney-general, and in 1675 lord chancellor. He was created Baron Finch in 1674, and earl of Nottingham in May 1681. He died in Great Queen Street, London, on Dec. 18, 1682, and was buried in the church of Ravenstone in Bucks.

His most important contribution to the statute book is "The Statute of Frauds"; he also superintended the edition of Sir Henry Hobart's *Reports* (1671).

He also published *Several Speeches and Discourses in the Tryal of the Judges of King Charles I.* (1660); *Speeches to both Houses of Parliament* (1679); *Speech at the Sentence of Viscount Stafford* (1680). He left Chancery Reports in ms., and notes on Coke's *Institutes.*

NOTTINGHAM, CHARLES HOWARD, 1ST EARL OF (in the Howard line) (1536–1624), English lord high admiral (also known as 2nd Lord Howard of Effingham), was the eldest son of William, 1st Baron Howard of Effingham, lord high admiral. He was nearly connected with Queen Elizabeth, his father's sister, Elizabeth Howard, being mother of Anne Boleyn. In 1559 he was sent as ambassador to France to congratulate Francis II. on his accession, and in 1569 was general of the horse under the earl of Warwick for suppressing the Roman Catholic rebellion in the north. The next year he commanded a squadron to watch the Spanish fleet which came to conduct the queen of Spain from Flanders, on which occasion "His lordship, accompanied with 10 ships only of Her Majestie's Navy Royal, environed their Fleet in a most strange and warlike sort, enforced them to *stoop gallant* and to vail their bonnets for the queen of England." (Fuller's *Worthies* ii. 361.) In the parliaments of 1563 and 1572 he represented Surrey, and succeeded to his father's title in 1573. He was installed a knight of the Garter in 1574, and made lord chamberlain of the household, an appointment which he retained till May 1585, when he became lord high admiral of England. He also filled the offices of lord-lieutenant of Surrey and high steward of Kingston-upon-Thames. He was one of the commissioners at the trial of the conspirators in the Babington Plot and of Mary, queen of Scots, in 1586.

In Dec. 1587 he hoisted his flag on the "Ark." His letters at this time reflect vividly his sense of the impending danger. "For the love of Jesus Christ, Madam," he writes to Elizabeth, "awake thoroughly and see the villainous treasons round about you, against your Majesty and your realm, and draw your forces round about you like a mighty prince to defend you. Truly, Madam, if you do so, there is no cause for fear." On the approach of the Armada on July 6, 1588, Howard describes thus the disposal of his forces: "I have divided myself here into three parts, and yet we lie within sight of one another, so as if any of us do discover the Spanish fleet we give notice thereof presently the one to the other and thereupon repair and assemble together. I myself do lie in the middle of the channel with the greatest force. Sir Francis Drake hath 20 ships and 4 or 5 pinnaces which lie beyond Ushant and Mr. Hawkins with as many more lieth towards Scilly." He directed the various engagements (*see* ARMADA), and stayed himself to conduct the attack on the "San Lorenzo," stranded off Calais, arriving in consequence at the great fight off Gravelines some time after the engagement had begun. His tactics have been criticized both by contemporary and by later authorities. Instead of risking all in a pitched battle with the enemy, he resolved to pursue the less heroic method of "plucking their feathers little by little"; and his prudence, while justified by the extraordinary results, was also greatly praised by so good a judge as Raleigh. Shortly afterwards, under Howard's directions, a "Relation of Proceedings" was drawn up (now printed in the *Navy Records*

Society Publications, i. 1–18).

In 1596 Howard and Essex commanded the expedition against Cadiz, when a squadron of the enemy's ships was destroyed and two of the number brought home. Essex insisted on landing, and Howard, who had been specially charged by Elizabeth to protect her favourite, was obliged to follow in his support. The town was sacked and the forts destroyed. Howard was created (Oct. 22, 1596) earl of Nottingham.

In February 1598, and again in 1599, when there were fears of invasion, Howard was appointed "Lord Lieut.-general of all England," and exercised full authority both over the army and the navy. He took a leading part in suppressing the rebellion of Essex, and served as a commissioner on his trial in 1601. It was to Nottingham that Elizabeth named James as her successor on her deathbed. He continued to hold office as lord high admiral under the new king, and in 1605 was despatched as ambassador to Spain, where he secured peace. He served on numerous commissions, including those on the union of the two kingdoms in 1604, for the trial of the conspirators of the Gunpowder Plot and of Henry Garnett in 1606, and for reviewing the articles and rules of the order of the Garter in 1618, and he attended Princess Elizabeth on her marriage to the elector palatine with a squadron to Flushing in 1613. Nottingham, who, unlike many of the Howards, was a staunch Protestant, was commissioner in Surrey for inquiring after recusants, and in the diocese of Winchester for hearing ecclesiastical causes; he sat on the government commission for discovering and expelling Roman Catholic priests, and was mentioned in 1602 from Douay as one of the three enemies most feared by the recusants.

On the report of the commission on the navy in 1618 and of the abuses then exposed, Lord Nottingham, though no blame was attached to himself, being now over 80 years of age, vacated his office of lord high admiral. He died at Haling House, near Croydon, on Dec. 14, 1624, and was buried at Reigate, a monument being afterwards placed to his memory in St. Margaret's church at Westminster. He was a striking and almost heroic figure in the Elizabethan annals. By his splendid character and services he was placed beyond the reach of the intrigues which troubled the reputation of many of his contemporaries.

Lord Nottingham married (1), in 1563, Catherine, daughter of Henry Carey, 1st Lord Hunsdon, (2), when in his 68th year, Margaret, daughter of James Stuart, earl of Murray.

NOTTINGHAM, a city and county of a city, municipal and county town of Nottinghamshire, England. Pop. (1921) 262,624.

The highly advantageous position of Nottingham (*Snotengaham, Notingeham*) on the Trent, where it was crossed by an ancient highway, accounts for its origin. The Saxon form of the name is taken to refer to the caves, anciently used as dwelling-places, which were hollowed out in the Castle rock, in the Rock Holes west of the castle, in the suburb of Sneinton and elsewhere. It was chosen by the Danes for their winter quarters in 868, and constituted one of their five burghs. In 922 it was secured and fortified by Edward the Elder, who in 924 built a second "burgh" opposite the first and connected with it by a bridge over the river. Aethelstan, the successor of Edward the Elder, established a royal mint there. In 1013 the town submitted to Sweyn. William I. erected a castle, and mention of a new borough occurs in Domesday Book, and this seems to be the first evidence of the existence of the "French borough" which grew up in Nottingham under the Normans, and was distinguished from the English borough by the different customs which prevailed in it. Parliaments were held at Nottingham in 1334. 1337 and 1357, and it was the scene of the conference of the judges with Richard II. in August 1387. David II. of Scotland was imprisoned in the castle. Edward IV. assembled his troops at Nottingham in 1461; and it was the headquarters of Richard III. before the battle of Bosworth in 1485. In 1642 Charles I. finally broke with the Parliament by setting up his standard at Nottingham, and during the ensuing Civil War the castle was held by each of the two parties more than once. In 1644 it was dismantled by Cromwell's orders.

The first charter (Henry II.) confirmed to the burgesses the liberties they had under Henry I., referred to a market on Saturdays, and forbade the working of dyed cloth, except in Nottingham, within ten leagues of the borough. John confirmed this and granted a gild-merchant. Henry III. allowed the burgesses to hold the town in fee-farm, and Edward I. granted them a mayor and two bailiffs, one to be chosen from each borough. Henry VI. confirmed all preceding privileges, first incorporated the mayor and burgesses, and granted that the town, except the castle and gaol, should be a county of itself. Two sheriffs were to replace the two bailiffs. This charter remained, except for temporary surrenders under Charles II. and James II., the governing charter of the corporation until the Municipal act of 1835. Nottingham returned two members to parliament from 1295 until 1885, when the number was increased to three, and again to four in 1918. Edward I. granted an eight-days' fair in September and a fifteen-days' fair in November, the last altered by Richard II. to a five-days' fair in February. Two other fairs were granted by Anne; one large fair, Goose fair, is still held. This begins on the first Thursday in October and lasts three days. The markets on Wednesdays and Saturdays are held by prescriptive right. Besides the Reform riots of 1831, Nottingham witnessed in 1811 the Luddite disturbances. In 1870 Nottingham was made the seat of a suffragan bishop of the diocese of Lincoln, but as it is now in the diocese of Southwell there is no suffragan bishopric. In 1921 the Elizabethan Wollaton hall was bought from Lord Middleton by the corporation.

Nottingham stands on the Trent and Leen, 125 m. N.N.W. of London by the L.M.S.R.; it is also served by the L.N.E.R. Water communications are afforded by the Grantham canal, the Nottingham and Erewash canals, communicating with the Cromford canal in Derbyshire, and by the Trent. A railway line to Mansfield was opened in 1917, giving access to the docks at Immingham. The plan of the town is irregular and in the centre is an open market place 5½ ac. in area. Nottingham castle occupies a fine site to the south, on an abrupt rocky hill. The ancient remains include a restored Norman gateway and fragments of the fortifications. In 1878 the site was acquired on lease by the corporation, and the building was opened as the Nottingham and Midland Counties Art museum. The church of St. Mary is a Perpendicular cruciform structure, with a central tower. St. Peter's church is mainly Perpendicular, but shows traces of an earlier building. St. Nicholas' church, near the castle, is a plain building of brick dating from 1676.

The University college, opened in 1881, contains the free municipal library. The museum of natural history was transferred from the University college to Carltonrood in 1920. New buildings have been built for the University college by Sir Jesse Boot, on the west side of the town, on a site of 220 ac. called Highfields. The free grammar school, founded in 1513, for some time in disuse, was revived in 1807, and on its removal in 1868 to new buildings, became known as the High school. There are also the Nottingham High school for girls; the blue-coat school, founded in 1723; and the Nottingham school of art, for which a fine building was erected in 1865 in the Italian style. The Midland Baptist college was transferred from Chilwell to Nottingham in 1882.

The General hospital was founded in 1781. The Arboretum and the Forest are the principal public pleasure-grounds; the county cricket club plays matches on the Trent Bridge ground, and there is a racecourse at Colwick, east of the city. To the north-west, but within the city boundaries, are the industrial districts of Radford and Basford, beyond which lies Bulwell, with collieries, limestone quarries and earthenware manufactories. Bestwood park, in the vicinity, contained a hunting lodge of Henry I., being included in Sherwood forest. To the north, Sherwood is a growing residential district; another extends towards Gedling on the east. Southward, across the Trent, West Bridgford is another large residential suburb. To the west is Lenton, and Beeston has become a populous suburb mainly owing to the establishment of large cycle and motor works.

Nottingham itself became an important seat of the stocking trade towards the close of the 18th century. It was here that

Richard Arkwright in 1769 erected his first spinning frame, and here James Hargreaves had the year previously removed with his spinning jenny, after his machine had been destroyed by a mob at Blackburn. Nottingham has devoted itself chiefly to cotton, silk and merino hosiery. Up to 1815 point lace was also an important manufacture. In 1808 and 1809 John Heathcoat obtained patents for machines for making bobbin net, which inaugurated a new era in the lace manufacture. The industries also include bleaching, the dyeing, spinning and twisting of silk, the spinning of cotton and woollen yarn, hosiery and drugs; the leather industry has grown considerably, and manufacture of boots and shoes, furniture making, rubber manufacture, engineering and brewing, cycle works and tobacco factories are important, and the industries, especially the iron and steel and manufacture of machinery, have the advantage of the close proximity of coal-mines. There is a large cattle market.

Nottingham was created a city and county of a city by letters patent 1897. The parliamentary borough returns four members to parliament.

NOTTINGHAMSHIRE, a county of England, area 843·4 square miles. The highest land, in places exceeding 600 ft., is found in the west between Nottingham and Mansfield. The hills die away eastward towards the basin of the Trent and Idle. In the Dukeries portions of the Sherwood forest are still preserved.

Early History.—In the limestone caves near Cresswell implements of presumably the Paleolithic age have been found along with remains of the mammoth, cave-lion, rhinoceros, etc., otherwise Nottinghamshire does not seem to have been inhabited until Neolithic times. The chief evidences of settlement in the Neolithic and Bronze ages come from the more open county of the south-east. The town of Nottingham, even in pre-Roman times, seems to have marked the point where the Trent was crossed by the tracks along which salt was distributed from Cheshire and Worcestershire. The presence of river and forest seemed to have caused the Romans to deflect the course of the Fosse Way north-eastward from Leicester via Newark to Lincoln, and so they did not influence the history of the county profoundly. The earliest Teutonic settlers were an Anglian tribe who, not later than the 5th century, advanced from Lincolnshire along the Fosse Way, and settled in the fertile districts of the south and east. At the end of the 6th century Nottinghamshire already existed as organized territory, though its west limit probably extended no farther than the Saxon relics discovered at Oxton and Tuxford. Nottingham after the treaty of Wedmore became one of the five Danish boroughs. On the break-up of Mercia, Nottinghamshire was included in the earldom of the Middle English, but in 1049 it again became part of Leofric's earldom of Mercia. The first mention of the shire of Nottingham occurs in 1016, when it was harried by Canute. The boundaries have remained practically unaltered since the time of the Domesday Survey.

The most interesting historic figure in the Domesday Survey of Nottinghamshire is William Peverel. His fief represents the honour of Nottingham, and in 1068 he was appointed constable of the castle which William the Conqueror had raised at Nottingham. The chief lay tenant was Roger de Busli, while the majority of the church lands belonged to the archbishop of York. The Cliftons of Clifton and the Byrons of Newstead held lands in Nottinghamshire at the time of the Survey. Holme Pierrepoint belonged to the Pierrepoints from the time of Edward I.; Shelford was the seat of the Stanhopes, and Langer of the Tibetots, afterwards earls of Worcester. Archbishop Cranmer was a descendant of the Cranmers of Aslockton near Bingham. Of the old castles the principal remains are those at Newark, but there are several old mansions, as at Kingshaugh, Scrooby, Shelford, Southwell, Wollaton Hall, near Nottingham (*c.* 1580). The more modern mansions are Welbeck and others in the Dukeries (*q.v.*). Nottinghamshire was originally included in the diocese and province of York, and in 1291 formed an archdeaconry. After the Conquest several monastic establishments were founded, and at the dissolution of the monasteries there were no fewer than 40 religious houses. The only important monastic remains, however, are those at Newstead.

Until 1568 Nottinghamshire was united with Derbyshire under one sheriff, the courts and tourns being held at Nottingham until the reign of Henry III., when with the assizes for both counties they were removed to Derby. In the time of Edward I., the assizes were again held at Nottingham, where they are held at the present day. The Peverel Court, founded before 1113 for the recovery of small debts, had jurisdiction over 127 towns in Nottinghamshire, and was held at Nottingham until 1321, in 1330 at Algarthorpe and in 1790 at Lenton, being abolished in 1849.

In the Wars of the Roses the county as a whole favoured the Yorkist cause, Nottingham being one of the most useful stations of Edward IV. In the Civil War of the 17th century most of the nobility favoured the Royalist cause, but Nottingham Castle was garrisoned for the parliament, and in 1651 was ordered to be demolished.

Industries.—The malting and woollen industries flourished in Norman times. The latter declined in the 16th century, and was superseded by the hosiery manufacture which sprang up after the invention of the stocking-loom in 1589. The smiths of Nottingham were also famous in the middle ages, smelting the ore with charcoal from Sherwood. The earliest evidence of the working of the Nottinghamshire coalfield is in 1259, when Queen Eleanor was unable to remain on account of the smoke of the sea-coal. In 1881, 39 collieries were at work in the county. Hops were formerly grown, and Worksop was famous for its liquorice. Numerous cotton-mills were erected in Nottinghamshire in the 18th century, and there were silk-mills at Nottingham. The manufacture of tambour lace existed in the 18th century, and was facilitated in the 19th century by the manufacture of machine-made net. Now-a-days coal is mined chiefly around Nottingham, Mansfield and Worksop. Clay, sandstone and limestone are also extensively raised. Nottingham is the principal centre of the lace and hosiery industries. There are silk, worsted and cotton mills. A large number of hands are employed in machinery works, and cycle and motor manufactures are important. The manufacture of tobacco is considerable at Nottingham and Hucknall Torkard.

In 1926, 426,966 ac. were under crops and grass, the most fertile land lying on the alluvium along the Trent. The chief grain crops are wheat and oats, with barley covering about half as great an acreage. Root crops and potatoes also take up a large acreage, while there were 18,602 ac. of clover and rotation grasses for hay. Beans occupied 6,658 and sugar beets 3,231 acres. Apples and pears are grown but there are no large orchards. The shire raises cattle, chiefly shorthorn, and dairying is extensively practised. Sheep are not numerous, the chief breed being Leicesters and various crosses. The old local forest breed is almost extinct.

Communications.—The L.M.S.R. and L.N.E.R. serve the county. The Trent is navigable throughout the county and the Idle between Bawtry and the Trent. A few canals centre upon Nottingham. The area of the administrative county is 540,123 ac., with a population (1921) of 641,149. The county contains the city and county and municipal borough of Nottingham and the municipal boroughs of Retford or East Retford, Mansfield and Newark. For parliamentary purposes the county is divided into five divisions (Bassetlaw, Broxtowe, Newark, Rushcliffe and Mansfield), each returning one member; and the parliamentary borough of Nottingham returns one member for each of its four divisions. There is one court of quarter sessions.

See *Victoria County History, Nottinghamshire;* R. Thoroton, *The Antiquities of Nottinghamshire* (Lond., 1677; republished with additions by J. Thoresby, 3 vols., London, 1797); Thomas Bailey, *Annals of Nottinghamshire* (4 vols., 1852–56); J. P. Briscoe, *Old Nottinghamshire* (1881); J. Ward, *Descriptive Catalogue of Books relating to Nottinghamshire* (Nottingham, 1892).

NOÜMENON, a philosophical term put into currency by Kant and not much used except in definite reference to his doctrine. In the Kantian system the term "noümena" means things in-themselves as opposed to "phenomena" or things as they appear to us. According to Kant the human mind is such that it can never penetrate by its speculative powers to things-in-themselves, but can only know phenomena. Thus we have the odd position that noümena, or the contents of the intelligible world, are just the things to which thought can never penetrate. The term,

however, is a relic of an early period of Kant's mental development. In his fully mature or critical position he held that the noümenal was inaccessible to the speculative reason, and yet that we are not altogether excluded from it, since the practical reason, *i.e.*, our capacity for acting as moral agents, assures us of the existence of a noümenal world wherein freedom, God and immortality have a real place.

The relation of noümena to phenomena in the Kantian system is a most difficult one; and, in view of the fact that the acutest intellects in Europe have been engaged vainly for more than a century in reconciling the various passages on the subject, the safest conclusion is that they are irreconcilable. The course adopted by Kant's immediate successors in German idealism was to reject the whole conception of noümena, for the reason that what is essentially unknowable has no existence for our intelligence. Kant, however, protested strongly against this development when it was propounded by Fichte, and held that he had precluded it by his "refutation of idealism": he stood unshakably to the belief in an absolutely real world behind phenomena.

Kant's position may be illogical as he himself stated it, but it is the expression of a sound principle: we must connect it with his general tendency to recognize the dynamic side of things. He saw, what so many of his successors failed to see, that the world as we know it is an expression of power; and he could not imagine whence the power could come if not from a world beyond phenomena. (*See* KANT; PHENOMENA.)

NOVA. A nova may be defined as a variable star which brightens up for a short time to a luminosity far exceeding that of its normal condition, and does so only once over a long interval of time. The facts observed are (1) a very rapid brightening (frequently many thousandfold in two or three days) followed by a slower fluctuating fall in brightness; (2) a steady sequence of changes in the star's spectrum, which in the beginning consists of lines, due to ionized atoms of such elements as calcium, iron and titanium, and finishes with those due to ionized atoms of oxygen, nitrogen and helium; (3) the rapid expansion of a disc round a central bright nucleus, with evidence of complex internal motions.

The first nova which counts in modern astronomy was that of Tycho Brahé, *N Cassiopeiae*, 1572, the first nova definitely allotted not to the solar system but to the stellar universe by measure of its distance. This nova was brighter than Jupiter or Venus, was easily visible at midday, and remained a naked-eye object for 16 months. *N Coronae Borealis*, 1866, was the first nova to be examined through the spectroscope, and its spectrum was found by Sir William Huggins to consist of bright hydrogen lines on a continuous spectrum which also showed many absorption lines. Ten years later Cornu noticed that the bright line spectrum of *N Cygni*, 1876, was very like that of the chromosphere, the layer of the sun's atmosphere which flashes into view just as the disc of the sun passes behind the moon at a total eclipse. This was amply confirmed in the case of later novae, the next point to be noticed being that this spectrum is in general, at discovery, a dark line spectrum; the dark lines are always displaced markedly to the violet, suggesting that the gases which give rise to them are moving rapidly towards the observer.

The majority of novae appear either in the Milky Way, *i.e.*, with galactic latitudes less than 20°, or else in spiral nebulae. In the Milky Way they are concentrated in the direction of the star clouds of *Sagittarius*, in galactic longitude, 320° to 340°, and judging from analogy with the 86 novae discovered mainly by Hubble in the *Andromeda* nebula, this means that the conditions are most favourable for the production of novae in the central regions of the Milky Way and of the spiral nebulae. Many novae settle down again as faint variable stars of about their initial magnitude, showing very little sign if any of the upheaval through which they have passed. The range of magnitude involved in their outbursts may be from 9 to 14 magnitudes, the rate of rise just before maximum varying from 7·6 to $0.^{m}2$ *per diem*, the rate of fall, *per diem*, being from 10 to 50 times as slow. The brightness at maximum is probably about −5·0 absolute magnitude, though values have been found ranging from 0·0 to −15·4 absolute magnitude. In general it may be said that the more violent the outburst, the greater the contrast between the rates of rise and fall, and the more rapidly the star runs through its spectral changes.

To explain the startlingly high velocities of the out-rushing gases, reaching at times the value of 3,000km. sec. or $\frac{1}{100}$ the velocity of light, E. A. Milne has advanced the theory that a sudden brightening of a stellar nucleus, with the accompanying increased pressure of radiation, involves the blowing out of the gases of the outer atmosphere of the star with accelerations which might easily lead to limiting velocities of the values found in novae. Atoms just balanced under gravity and radiation pressure are driven outwards by the increase in the radiation pressure; they then absorb light of a shorter wave-length coming from the star and are no longer screened by the intervening layer of atoms which absorb light of the wave-length which has been mainly involved in supporting them before the outburst. A stream or shell of atoms thus driven out gives the dark lines displaced to the violet which are seen by the distant observer. It is possible to explain in terms of Milne's theory many of the miscellaneous complications observed in the multiple dark lines with their varying shifts, but, as special assumptions have to be made for each complication, it is wiser at this stage of our knowledge not to strain the one hypothesis but to wait the ripe time for further simplifications.

It remains to be asked what leads to the sudden brightening of a faint star, which results in the production of the aforementioned phenomena. There are two main lines of explanation available. Newton was one of many enquirers who have looked outside the star for the source of the necessary energy and have postulated collision or the inflow of matter as the exciting cause. Laplace held the view that a great surface conflagration of a star was all that was involved and this view has been held in varying form by many others. The breakdown of equilibrium in a cooling star through chemical combination at low temperature, through radioactive forces, or through unstable pulsations, have all been suggested, as have also tidal eruptions through the close passage of a second star or companion. The latter theory is the bridge to the view that we have a collision between a star and a planet or comet, or even a collision between two stars. The frequency of the phenomenon makes an explanation in terms of the collision of two stars difficult to accept, and Seeliger's view, that what we behold in a nova's outburst is the result of a star (or a binary star) entering into a nebula, seems on the whole the best solution of the problem so far proposed. E. W. Brown has worked out the effect to be observed when a star enters a nebula, and his picture closely resembles what the camera shows at the present time for the region round *N Persei*, 1901—a spherical expanding shell and a fan-like appendage on one side of the star. In the case of this star there was evidence of nebulosity round the star at the time of outburst. It seems then not unlikely that some of the novae are to be explained in terms of Seeliger's hypothesis of an encounter of a star with dark nebulosity. Differences between the behaviour of various novae may well argue against a common cause for the initial brightening of all novae. It is, perhaps, fairest to return an open verdict on the cause for the nova's original brightening, though we can now follow with reasonable certainty the main effects which follow the great outburst of radiation.

See *Handbuch der Astrophysik, Bd. VI.* (1927). (F. J. M. S.)

NOVALICHES, MANUEL PAVIA Y LACY, 1ST MARQUIS DE (1814–1896), Spanish marshal, was born at Granada on July 6, 1814. In 1833 lieutenant in the guards of Queen Isabella II., he became general of division during the Carlist war (1833–40). Senator in 1845, war minister in 1847, and marquis in 1848, he went out to Manila in 1852 as captain-general of the Philippine Islands, crushed a formidable insurrection in 1854 and carried out many useful reforms. He commanded the reserves in the Peninsula during the Moroccan war, twice refused the war portfolio offered him by O'Donnell and Narvaez, and when the revolution broke out in September 1868 accepted the command of Queen Isabella's troops. He was defeated by Marshal Serrano at the bridge of Alcolea on September 28, 1868, and was so badly wounded in the face that he remained disfigured for

life. He kept apart during the revolution and went to meet King Alfonso when he landed at Valencia in January 1875. The Restoration made him senator, and King Alfonso gave him the Golden Fleece. He died in Madrid on Oct. 22, 1896.

NOVALIS, pseudonym of Friedrich Leopold, Freiherr von Hardenberg (1772–1801), German poet and novelist, one of the pioneers of the Romantic movement, was born on May 2, 1772, on his father's estate at Oberwiederstedt in Prussian Saxony. He studied philosophy at Jena, and law at Leipzig and Wittenberg. At Tennstedt, near Langensalza, he was betrothed to Sophie von Kühn. He became auditor to the salt works at Weissenfels where he heard (1797) of Sophie's death. He expressed his grief in the beautiful *Hymnen an die Nacht,* in which the religious poetry of the Romantics reaches its greatest height. He then entered the Mining Academy at Freiberg, in Saxony, to study under A. G. Werner, whom he immortalized as the "Master" in *Die Lehrlinge in Sais.* In the autumn of 1799 he read to the circle of young Romantic poets at Jena his *Geistliche Lieder.* In 1800 he was appointed local magistrate in Thuringia, and after a short illness he died at Weissenfels on March 25, 1801.

His all too short life did not permit him to blend his mystic and philosophical conceptions into a harmonious whole, but his work, fragmentary as it was, and his lovable personality left a strong mark on the Romantic school. Novalis had dreamed of an all-embracing formula which would bring life and poetry, science and religion, in tune with one another. His longest work was the unfinished romance, *Heinrich von Ofterdingen;* its hero's search for the mysterious blue flower is an allegory of the poet's life. More popular, however, are his shorter lyrics, ranging from *Auf grünen Bergen wird geboren der Gott der uns den Himmel bringt,* to the hymn, *So bleib' ich dir doch treu, wenn alle untreu bleiben.*

There are modern editions of the collected works of Novalis by E. Heilborn (3 vols., 1901), and by J. Minor (3 vols., 1907; rep., 1923). His *Briefwechsel* with the Schlegels was edited by J. M. Raich in 1880. *See* also E. Heilborn, *Friedrich von Hardenberg* (1901); T. Carlyle's essay on "Novalis"; Obenauer, *Novalis Gesammelte Studien* (1925); H. Hesse and Isenburg, *Novalis. Documente seines Lebens und Sterbens* (1925).

NOVARA, town and episcopal see, Piedmont, Italy, capital of the province of Novara, 31 m. by rail W. of Milan, 538 ft. above sea-level. Pop. (1921) 50,965 (town), 56,260 (commune). Till 1839 surrounded by Spanish ramparts, Novara is now an open, modern town. The cathedral, except for the octagonal dome-roofed baptistery (10th century), was rebuilt (1863–65); the church of S. Gaudenzio, dedicated to Bishop Gaudentius (d. 417), who is buried under the high altar, rebuilt by Pellegrino Tibaldi about 1570, has a baroque campanile and a dome (1875–78) 396 ft. high. The two first contain pictures by Gaudenzio Ferrari, a native of the town. The city also contains handsome market buildings erected in 1817–1842, a large hospital dating from the 9th century and a court-house constructed in 1346. The town has also a museum of Roman antiquities. The principal industry is the carding and spinning of silk; there are also iron-works and foundries, cotton mills, rice-husking mills, organ factories, dye-works, printing and map-making works.

Novara, the ancient *Novaria,* lay on the road between Vercellae and Mediolanum. Its rectangular plan probably survives from Roman days. A dukedom of Novara was constituted by the Lombards, a countship by Charlemagne. In the 12th century it accepted the protection of Milan. In 1706 it was occupied by Savoy troops. At the Peace of Utrecht it passed to Austria with Milan; but was granted to Charles Emmanuel in 1735. Under the French it was the chief town of the department of Agogna. Restored to Savoy in 1814, it was in 1821 the scene of the defeat of the Piedmontese by the Austrians, and in 1849 of the more disastrous battle which led to the abdication of Charles Albert and an Austrian occupation of the city. Peter Lombard and Dolcino (*see* APOSTOLICI) were natives of Novara.

In the church of San Pietro del Rosario was pronounced the papal anathema against the followers of Fra Dolcino.

NOVARA was the scene of a battle on March 23, 1849, between the Austrians, 70,000 strong with 182 guns, under Radetsky and King Charles Albert, who led the Sardinian forces, 65,000 men with 140 guns. Chzarnowski, a Pole, virtually directed the army. Armistice, concluded Aug. 9, 1848, was to terminate March 20. Radetsky retreated from Milan on March 17, feigning to retire to Lodi-Cremona, but on reaching San Angiolo he made for Pavia, crossing the Ticino on March 20. Meanwhile Chzarnowski marched on Magenta without encountering the enemy, but here news reached him that the Austrians, whom he had believed were retiring beyond the river Adda, were already at Pavia; thereupon he halted the army and turned it back to Vigevano. Radetsky had advanced so swiftly that Ramorino's Sardinian division south of the Po was cut off, the bridge at Mezzano Corte being destroyed, though it had orders to stand at Cava, threatening the hostile advance. Fighting took place at Mortara on March 21, the Sardinians falling back on Novara, where Chzarnowski decided to await Radetsky. The Austrian leader received a false report that there was only a rearguard at Novara, the main hostile force being at Vercelli. Radetsky moved with his troops on Vercelli, sending the II. Corps on Novara. On approaching this town the II. Corps, March 23, was confronted by the whole Sardinian army, drawn up in a strong position. Fighting began at 11 A.M., and for hours it had to contend against serious odds, showing great tenacity against hostile attacks. At 4 o'clock, Radetsky having recalled the III. Corps, sent it to its assistance, shortly followed by the Reserve Corps. Two hours later the IV. Corps, hearing the sound of guns, came on the scene, threatening the Sardinian right wing and rear by the Vercelli-Novara road, cutting off their retreat. Radetsky now ordered a general advance, and the Sardinians were swept off the Vercelli road, retreating hastily to Novara from all points. Numerous bodies deserted during the night and confusion was general. Charles Albert abdicated that night. His son, Victor Emanuel, the new sovereign, concluded an armistice with Radetsky, the Sardinians escaping a surrender, which would have been inevitable; thereupon the Austrian advance on Turin came abruptly to a close.

NOVA SCOTIA, a province of the Dominion of Canada, lying between 43° 25′ and 47° N. and 59° 40′ and 66° 25′ W., and composed of the peninsula proper and the adjoining island of Cape Breton (*q.v.*), which is separated from the mainland by the Strait of Canso. The extreme length from south-west to north-east is 376m. (N.S. 268, C.B. 108); breadth 60 to 100m.; area 21,428 sq. miles. The isthmus of Chignecto, 11½m. wide, connects it with the province of New Brunswick.

Geology and Physical Features.—Nova Scotia may be described as an ancient mountain land almost completely worn down. The original folds apparently ran either east or north-east and were complicated by intrusive granite in the country south-west of Halifax. The fact that some Carboniferous beds, at any rate, transgress upon the worn folds, indicates that the folding is either Carboniferous or earlier in date. The general disposition of the folds seems to be indicated in the coast-line and in the lines of higher land, which, however, rarely reach above the 1,000ft. level, save in the Cobequid mountains, which rise to a few feet above this figure. They occupy the neck between New Brunswick and Nova Scotia, and represent the axis of a fold. The Chignecto bay to the north-west, and the Minas basin and Cobequid bay to the south, indicate by their directions the divergence of the old worn folds of Nova Scotia on the one hand, and of St. John, New Brunswick, on the other. Around the south-east of the Bay of Fundy are horizontal Triassic deposits including volcanic elements, which give rise to a precipitous coast from Brier island to Cape Split. The western railway of Nova Scotia runs on low ground between this structural feature and the main mountain fold-axis farther south-east. This feature is broken at Digby Gut, and a portion of the lowland within it is submerged as the long Annapolis basin (called the garden of Nova Scotia).

One of the last geological changes has been a land-sinking, which has given rise to the remarkable succession of cliff-fringed rias, with islands offset along the Atlantic coast, Halifax harbour being the most famous of these. The north shore is, as a rule, low, and Pictou has its chief harbour.

Cape Breton island is essentially a continuation across the

narrow strait of Canso. The granitic south-west is rugged and barren, with many small lakes and peat bogs. The coasts of the province are famous for its tides. Though they rarely exceed 8ft. at Halifax, they are said to average 42·3ft. in the Bay of Fundy, and, at the top of the funnel in Cobequid bay, they even reach 53 feet.

Climate.—The maritime influences are more marked in this province than in New Brunswick (*q.v.*). The average rainfall is between 40 and 45in., except along the southern coast-line, where it is nearly 10in. greater. The winter snowfall is slight. At Yarmouth, in the extreme south-west, the temperature ranges from 25·4% (February) to 60–70 (July).

Area and Population.—The area of the province is 21,428 sq.m., of which 21,068 are land area and 360 water area. The population (1921) was 523,837. In 1871 it was 387,800, the percentage increase over the 50 years being 35·08%. The increase was most marked in the decade 1871–1881. The great mass of the people are of British descent, but in parts of Cape Breton are found descendants of the early French settlers; in Lunenburg and the south-east is a large German colony; near Halifax are a number of negroes from the West Indies, and scattered through the province are a few Micmac Indians. Few are of absolutely pure Indian blood. The settlers of English and Scottish descent are about equal in numbers, but the latter have been more prominent in the development of the province. The Irish are found chiefly in Halifax and in the mining towns of Cape Breton. Roman Catholics, Presbyterians and Baptists predominate, though the Church of England is strong in Halifax, as in most administrative centres.

Administration.—The executive authority is in the hands of a lieutenant-governor, appointed for five years by the Federal Government, and of a council appointed from and responsible to the local legislature. This consists of a lower house of assembly, and of a legislative council of 20 life members, which the assembly has frequently, but in vain, endeavoured to abolish. The municipal system was introduced subsequent to federation on July 1, 1867. Nova Scotia and Quebec possess a legislative council as well as a legislative assembly.

The revenue is chiefly made up of the Dominion subsidy and of royalties on mining concessions, chiefly those on coal and other special taxes. The province is represented in the Dominion senate by ten members and in the House of Commons by 14 (1926).

Education.—Primary education is free and compulsory, and undenominational; secondary education is also free, but optional. There are also many private schools under denominational control. Besides the elementary high schools and academies there are four universities: King's college, Windsor (Anglican), founded in 1790; Acadia university, Wolfville (Baptist, 1839); St. Francis Xavier, Antigonish (Roman Catholic, 1866); and Dalhousie university, Halifax (undenominational), established by charter in 1818, reorganized in 1863, the largest possessing faculties of arts, science, medicine and law.

Commerce and Manufactures.—Nova Scotia is naturally a sea-going province, and till about 1881 had the largest tonnage, in proportion to population, in the world. Halifax is still one of the chief winter ports of the Dominion, and Sydney is also a favourite port of call for steamers in need of "bunker" coal. The water-power provided by the rivers supports many manufactures. Several sugar-refineries exist, and a large trade is carried on with Bermuda and the West India islands.

The fisheries of Nova Scotia are the next most important in Canada, after those of British Columbia. Lobsters, cod and mackerel, herring and haddock, constitute the bulk of the catch. Many boats are also fitted out in Lunenburg, Digby, Yarmouth and other ports for the Grand Banks of Newfoundland. A large number are employed in the lobster canneries and other kindred industries. Trout and salmon abound in the inland lakes and streams.

Lumber.—Lumbering was long the chief industry of the province, and is still very important, though the forest left uncut is only some 12,000 sq.miles. The network of small lakes and rivers enables the logs to be brought to the mills with great ease, and little rough timber is now exported. The chief trees include spruce, fir, pine, birch, oak and maple. The manufacture of wood-pulp for paper is also carried on.

Minerals.—Bituminous coal is mined in various parts of Cape Breton (*q.v.*) and in the counties of Cumberland and Pictou. The seams dip at a low angle, and are of great thickness, especially in Pictou county. The known coal-fields cover some 1,000 sq.miles. Other important centres are Springhill, Acadia Mines, Stellarton and Glace Bay (C.B.). It is shipped as far west as Montreal, and to the New England States. The by-product industries are very important. Iron is largely produced, chiefly in the vicinity of the Cumberland and Pictou coal-fields. The deposits include magnetite, red haematite, specular, limonite and carbonate ores. Blast furnaces are in operation, especially at New Glasgow, Sydney and North Sydney, though most of the ore used at Sydney is imported from Newfoundland. The quarries of easily worked limestone, the product of which is used as a "flux" in the blast furnaces, add to the value of the iron deposits. Gold occurs in workable quantities in the quartz all along the Atlantic coast, and several small but successful mining enterprises are in operation. Large deposits of gypsum occur, especially at Windsor, in Hants county. Manganese and copper are also worked on a small scale.

Agriculture.—The attention paid to lumbering, fishing and shipping, and the subsequent emigration westwards have lessened the importance of this industry. Mixed farming is, however, largely carried on, and of late years dairy farming has been greatly extended and improved, and much butter and cheese is exported to England. Both the Dominion and the Provincial Governments have endeavoured to introduce scientific methods. Nova Scotia is specially famous for its fruits, the export of apples being the main feature. The centre of this industry is the valley of the Annapolis. At the head of the Bay of Fundy and on Minas basin the low-lying meadows produce splendid crops of hay and good pasture, while the cool climate and abundant moisture make the region well suited for dairy farming and stock raising.

Communications.—The country is covered by a network of railways, with a total length of 1,451 miles. The roads are good and cover some 18,000 miles. Telegraph and telephone lines extend all over the province, with cable stations at Canso and Sydney. There are Government owned and commercial radio stations at Halifax, Seal island and Sambro outer Bank lightship; direction-finding stations at Canso, Chebucto, St. Paul island and Yarmouth; and three licensed public commercial stations at Louisburg.

Bibliography.—Sir J. W. Dawson, *Acadian Geology* (1891), *Canada and its Provinces*, 23 vols. (Toronto, 1914); *Chronicles of Canada*, 32 vols. (Toronto, 1914); *The Natural Resources of Nova Scotia* (1923); *Canada Year-Books; Publications of the Geological Survey of Canada.*

History.—Nova Scotia may well have been the Markland of early Norse and Icelandic voyages, and Cape Breton was visited by the Cabots in 1497–98, but not till 1604 was any attempt at permanent colonization made by Europeans. In that year an expedition was headed by a Frenchman, Pierre de Guast, Sieur de Monts (1560–*c.* 1630), who had received from Henry IV. full powers to explore and take possession of all lands in North America lying between the 40th and 46th parallels of north latitude. De Monts and his friend de Poutrincourt (d. 1615), endeavoured to form settlements at Port Royal (now Annapolis), St. Croix (in New Brunswick) and elsewhere, but quarrels broke out with the Jesuits, and in 1613 the English colonists of Virginia invaded the settlement and expelled the greater part of the inhabitants. In 1621 Sir William Alexander obtained from James I. a grant of the whole peninsula, which was named in the patent, Nova Scotia, instead of Acadia, the old name given to the colony by the French. During the reign of Charles I. the still existing order of baronets of Nova Scotia was instituted, and their patents ratified in parliament. The Treaty of St. Germain-en-Laye (1632) confirmed France in the possession of Acadia, Cape Breton and New France; but fierce feuds broke out among the French settlers, and in 1654 a force sent out by Cromwell took possession of the country, but

by the Treaty of Breda (1667) it was restored to France by Charles II. Continual fighting went on between the French and the British colonists of New England, the Indians taking part, usually on the side of the French; in 1710 the province was finally captured by Great Britain and ceded to her in 1713 by the Treaty of Utrecht, under the name of "Acadia or Nova Scotia," the French remaining masters of Cape Breton. In 1749 Halifax was founded as a counterpoise to Louisbourg in Cape Breton, and over 4,000 colonists sent out. In 1769 Prince Edward island (formerly Isle St. Jean) was made a separate government. An influx of American Loyalists led in 1784 to the erection of New Brunswick into a separate colony.

During the wars of the American and French revolutions Halifax grew apace. Between 1784 and 1828, a large Scottish emigration, chiefly from the Highlands, had settled in the counties around Pictou, and the lumbering industry rose to great proportions. Agriculture was for some time neglected, but in 1818 the letters of "Agricola" (John Young, 1773–1837) gave it an impetus. Representative institutions had been granted as early as 1758, but power long rested mainly in the hands of a Council of Twelve, comprising the chief justice, the Anglican bishop and other high officials. In 1848, after a long struggle, responsible government was won by the legislature, led by Joseph Howe.

In these political struggles, education was often the battle-ground, the fight ending in 1864 in the establishment of free primary and secondary schools by Dr. (afterwards Sir Charles) Tupper, and the re-organization on an undenominational basis of Dalhousie university. (*See* HALIFAX.) In 1867 the province entered the new Dominion of Canada. For some years afterwards an agitation in favour of repeal was maintained, but it has died away.

After several previous attempts, an effort was made in 1926 to abolish the second chamber (or legislative council), the premier, the Hon. E. N. Rhodes, suggesting that the members of the legislative council should vote themselves out of office. This was declined, and the opinion of the judicial committee of the Privy Council in England was sought on the competence of the lieutenant-governor either to dismiss members of the upper house or to increase their numbers above 21 by Order in Council. On Oct. 19, 1927, it was determined that the lieutenant-governor had power to appoint any number of members to the legislative council, such members being appointed "during the pleasure of His Majesty represented in that behalf by the lieutenant-governor acting by and with the advice of the executive council." The Government thereupon proceeded in its determination to abolish the house. Some members of the upper chamber were dismissed and 13 new members were appointed, with the result that on Feb. 29, 1928, the bill for its own abolition was passed by the upper chamber of the Nova Scotia legislature.

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NOVATIANUS, Roman presbyter, and one of the earliest antipopes, founder of the sect of the Novatiani or Novatians, was born about the beginning of the 3rd century. On the authority of Philostorgius (*H.E.* viii. 15) he has been called a native of Phrygia. He was ordained at Rome by Fabian, or perhaps by an earlier bishop; and during the Decian persecution he maintained the view which excluded from ecclesiastical communion all those (lapsi) who after baptism had sacrificed to idols—a view which had frequently found expression, and had caused the schism of Hippolytus. Bishop Fabian suffered martyrdom in January 250, and, when Cornelius was elected his successor in March or April 251, Novatian objected on account of his known laxity on the above-mentioned point of discipline, and allowed himself to be consecrated bishop by the minority who shared his views. He and his followers were excommunicated by the synod held at Rome in October of the same year. He is said by Socrates (*H.E.* iv. 28) to have suffered martyrdom under Valerian. After his death the Novatians spread rapidly over the empire; they called themselves *καθαροί*, or Puritans, and rebaptized their converts from the Catholic view. The eighth canon of the council of Nice provides in a liberal spirit for the readmission of the clergy of the *καθαροί* to the Catholic Church, and the sect finally disappeared some two centuries after its origin. Novatian has been confounded with Novatus, a Carthaginian presbyter, who held similar views.

Novatian was the first Roman Christian who wrote to any considerable extent in Latin. Of his numerous writings three are extant: (1) a letter written in the name of the Roman clergy to Cyprian in 250; (2) a treatise in thirty-one chapters, *De trinitate;* (3) a letter written at the request of the Roman laity, *De cibis judaicis.* They are well-arranged compositions, written in an elegant and vigorous style. The best editions are by Welchman (Oxford, 1724) and by Jackson (London, 1728); they are translated in vol. ii. of Cyprian's works in the *Ante-Nicene Theol. Libr.* (Edinburgh, 1869). The Novatian controversy can be advantageously studied in the *Epistles* of Cyprian.

NOVATION, a legal term derived from the Roman law, in which *novatio* was of three kinds—substitution of a new debtor, of a new creditor, or a new contract. In English law the term (though it occurs as early as Bracton) is scarcely naturalized; substitution of a new debtor or creditor being generally called an assignment. A new contract either tacitly or expressly operates as a release from the original contract. Where the substituted contract is one of a higher nature, as where a contract under seal supersedes a simple contract, it is called a merger. The extinction of the previous contract is held to be sufficient consideration. The particular points on which novation turns are whether the new firm or company has assumed the liability of the old, and whether the creditor has consented to accept the liability of the new debtors and discharge the old. The question is one of fact in each case. (*See* especially the Life Assurance Companies' Act, 1872, s. 7, where the word, "novations" occurs in the marginal note to the section, and so has quasi-statutory sanction.) Scots law seems to be more stringent than English law in the application of the doctrine of novation, and to need stronger evidence of the creditor's consent to the transfer of liability. In American law, as in English, the term is something of a novelty. In Louisiana, and generally in systems much influenced by Roman law, novation forms a more specific department of the law of contract (*q.v.*).

NOVAYA ZEMLYA. An Arctic land off the coast of European Russia, to which it belongs, consists of two large islands separated by a narrow winding channel 56 m. long, the Matochkin Shar. It lies between 70° 31′ and 77° N., and between 51° 35′ and 69° 2′ E. and forms an elongated crescent, being nearly 600 m. long with a width of 30 to 90 m., and an area of about 30,000 sq. miles. It separates the Barents sea on the west from the Kara sea on the east. With Vaigach island 30 m. to the south, and the mainland, Novaya Zemlya forms a continuation of the Pai-Khoi hills, a branch of the Ural folds.

The greatest heights occur in the neck of the south islands where near Matochkin Shar are altitudes of about 4,000 ft. In the middle part of the south island there are few elevations over 1,400 ft., but in the south the summits rise to over 2,000 ft. The north island seldom rises to greater altitudes than 3,000 ft.

Geology.—A central zone of upper Cambrian and Devonian rocks extends along the islands. These quartzites, conglomerates and dolomites are flanked by carboniferous shales and limestones. The minerals of value are some lignite and a little copper ore.

Climate.—Novaya Zemlya is colder than Spitsbergen (which lies more to the north) as in some degree it shares in the continental conditions of northern Russia and Siberia. The middle and northern parts of the west coast are not so cold as the east. Temperatures at Karmakul are 2·3° F (Feb.) and 43·2° (July). Snow is universal from October to May.

Flora and Fauna.—Vegetation is solely tundra and decreases from south to north. It is most luxuriant in Gooseland on the south-west. There are no trees or bushes. The flowering plants number 187.

In the ice-free areas there are foxes, lemmings, bears, reindeer and an occasional wolf. Insects are numerous near the coast. Countless birds come from the south for the breeding season, and at certain parts of the sea-coast the rocks are covered with

millions of guillemots, while great flocks of ducks of various sorts, geese and swans swarm every summer on the valleys and lakes of the south. Whales, walruses and various seals are frequently seen. The goltzy occurs in the rivers.

The numbers of sea mammals and birds attracted Russian hunters, and even in the 16th century they had extended their huts (stanovishtcha) to the extreme north of the island. Many of them wintered for years on Novaya Zemlya. Owing to the ice in the White sea Russian hunters found Novaya Zemlya less easy of access than did the Norwegians. But about 1877 systematic attempts at settlement were begun by the Russian Government, several families of Samoyedes being established at stations on the west coast of the south island, including Karmakul on Moller bay, Pomorskaya bay and Byeloshya bay. There is a Russian observatory on Matochkin Shar.

History.—Novaya Zemlya was probably known to Novgorod hunters in the 11th century and to Norse hunters a century earlier. In 1553 Sir Hugh Willoughby may have sighted Gooseland. In 1556 Stephen Borough reached the south extremity of the Novaya Zemlya, being the first western European to do so. William Barents touched the island (1594) at Sukhoi Nos (73° 46′) and followed the coast north to the Orange islands and south to the Kostin Shar. In 1596, after his discovery of Spitsbergen, Barents wintered at Ice haven in 76° 12′ N. (*see* ARCTIC REGIONS). Rumours of silver ore led the Russian Government to send out expeditions. In 1760 Savva Loshkin cruised along the east coast, spent two winters there, and in the next year returned along the west coast, thus accomplishing the first circumnavigation; but the records of his voyage have been lost. In 1768 Lieut. Rozmyslov explored Matochkin Shar, where he spent the winter. The first scientific information about the island is due to the expeditions (1821–24) of Lütke (1797–1882) after whom part of the north island is named Lütkeland. Nearly all the west coast as far as Cape Nassau, as well as Matochkin Shar, was mapped, and valuable scientific information obtained. In 1832 and 1835 Lieut. Pakhtusov mapped the east coast as far as 74° 24′. The work of Karl von Baer in 1837 was untrustworthy. In 1870 the Norwegian, Capt. L. E. H. Johannesen, accomplished the second circumnavigation of Novaya Zemlya and in 1871 E. Carlsen found Barents's winter hut. In 1878 M. Grinevetskiy crossed the south island. Among later expeditions may be mentioned those of C. Nossilov (1887–92), T. N. Chernychev (1895), who made a crossing of the S. island, H. J. Pearson (1895 and 1897), A. A. Borisov (1899 and 1900) O. Ekstam (1900 and 1903), W. Russanov (1908), who crossed the south of the island, Pavlov and Weise (1912) of the Sedov expedition, who crossed the north island (*see* ARCTIC), as did O. Holtedahl (1921). P. V. Vittenburg explored the south island in 1925.

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(R. N. R. B.)

NOVEL, the name given in literature to a sustained story which is not historically true, but might very easily be so. The novel has been made the vehicle for satire, for instruction, for political or religious exhortation, for technical information; but these are side issues. Its plain and direct purpose is to amuse by a succession of scenes painted from nature, and by a thread of emotional narrative. It was not until the 18th century that it began to be a prominent factor in literary life, and not until the 19th that it took a place in it which was absolutely predominant.

It was Voltaire, in his *Pyrrhonisme de l'histoire,* who set the fashion of calling the *Cyropaedeia* a novel, but it is probable that Xenophon had a purpose that was didactic and historical rather than imaginative. The vogue of the novel really began in Alexandrian times, when social life was so far settled in tradition that the pleasure of reflecting on reality had definitely set in. In the 2nd century B.C. a certain Aristides wrote, in six books, the *Milesiaka,* which was probably the beginning of the modern novel. These Tales of Miletus, the town in which Aristides lived, are lost, but from existing imitations of them in Greek and Latin we can gather that they consisted of humorous and sarcastic episodes of contemporary life. There seems to be good evidence that the bulk of these novelettes, and of the tales which followed them, dealt mainly with the adventures of lovers. In the 2nd century A.D. Lucian preserved for us invaluable pictures of the life in which he moved: his *Lucius or the Ass* and his *True History* are fantastic and extraordinary fictions in which the nature of the novel is not infrequently approached. But a Syrian Christian, Heliodorus, bishop of Tricca in the 4th century, may claim to have come much closer to it in his *Aethiopica,* which has the unique merit of being a perfectly pure love story, in which the marvellous is not absolutely banished, but in which on the whole the solid structure of experience is preserved. In the 6th century, as is supposed, a Greek who is called Longus, but of whose life nothing is known, wrote the voluptuous pastoral story of *Daphnis and Chloë,* which is far superior to all other remnants of Greek fiction which have come down to us, and is the only one of them which can strictly be called a novel. In Latin literature, the *Golden Ass* of Apuleius is manifestly a translation of a lost Greek book, to which Lucian also was indebted. If the *Satyricon* of Petronius was not an isolated phenomenon—and it is highly improbable that this was the case—then the Romans of the Neronian epoch understood to the full the secret of how to produce in prose a satirical, not to say cynical, study of manners in fiction. The *Satyricon* is not less skilfully managed than such later novels as *Gil Blas* or *Peregrine Pickle,* and it is of the same class. From the extent of the principal episode which has been preserved, it is supposed that this novel was not a short tale of intrigue, but was a sustained record, drawn up with careful and lengthy observation of manners, for the single purpose of entertainment. Unfortunately this extraordinary work remains not merely solitary in its class, but itself a fragment. In early Christian times, such books as *The Shepherd of Hermas,* and the productions of Palladius and of Synesius, testified to a certain appetite for prose fiction.

Italy.—It is from northern Italy that the novel of modern Europe (both the literary type and the name) derives. An early collection of tales, called *Il Novellino* or *Cento novelle antiche* (although only 66 of the 100 survive), was composed at the end of the 13th century, and started this class of literature in Europe. These anonymous stories are of extraordinary diversity, chivalrous, mythological, moral and scandalous. The mediaeval view of women and priests and peasants is found in its full development, and there is something of the realistic reflection of customs which was to flourish later in a whole class of fiction. The earliest Italian novelist whose name is connected with his writings is Francesco da Barberino (1264–1348), whose *Documenti d'Amor* was first printed in 1640. He was followed by Giovanni Boccaccio, who wrote his *Filocopo* about 1339 and the *Decameron* some nine years later. Of his disciples the most eminent was Francesco Sacchetti (1335–1400), a Florentine. Sacchetti's *Trecente novelle,* which remained in ms. until the 18th century (1724), are ironical and realistic studies of the life around him in Tuscany. To Giovanni Fiorentino is attributed a collection of 50 tales, called *Il Pecorone,* printed first in 1558, but written in 1378. A great name in the evolution of European fiction is that of Tomaso Guardato, called Masuccio (1415?–1477?); he was a native of Salerno, and was the first of the south Italian novelists. Masuccio imitated no one; his conceptions and his observations are wholly his own. His *Novellino,* printed at Naples in 1476, is divided into five books, each containing ten stories. These deal satirically with the three favourite subjects of the age—namely, jealous husbands, unfaithful wives and debauched priests. He was followed in this, as well as in his vivacity, by Antonio Cornazzano (1431?–1500?), an inhabitant of Piacenza, who wrote Italian with much greater purity than Masuccio, but less vigour. His stories were frequently reprinted, under the title of *Proverbii.* Of the novels of Giovanni Brevio (1480?–1562?) only five have been preserved, but these are of unusual merit. We then reach Matteo Bandello (1480–1561), long the most famous of all the Italian

novelists, whose *Novelle*, first issued in 1554, were eagerly read in all parts of Europe; they are 214 in number. After Bandello the decline of the Italian *novella* is evident. Francesco Maria Molza (1489–1544), whose stories appeared in 1547, was a rival to Bandello, and has been preferred to him by several modern critics. The *Ragionamenti d'Amor* (1548) of Agnolo Firenzuola (1493–1545) was the work of a poet writing in richly embroidered prose. After Firenzuola the great school of Italian story-tellers declined. There was no more novel writing of any importance in Italy until the close of the 18th century, when an admiring study of German literature produced the romances of Alessandro Verri (1741–1816) and Ugo Foscolo (1778–1827). The first Italian novelist of merit in recent times, however, is Alessandro Manzoni (1785–1873), whose *I Promessi Sposi* (1825) enjoyed an unbounded popularity. Manzoni had imitators, but no rivals. In the fourth quarter of the 19th century Italy produced some brilliant and original novelists, in particular Giovanni Verga (1840–1922), Matilda Serao (1856–1927) and Gabriele d'Annunzio (b. 1863).

France.—It was not until about 1450 that the anonymous *Quinze joies du mariage* showed the French to be influenced by the Italian discovery of the novelette of manners. The author of this extraordinary work was perhaps Antoine de la Sale who seems certainly to have written the whole of the *Cent nouvelles nouvelles*, imitated from Boccaccio and Sacchetti. This bud of realistic fiction, however, was immediately nipped by the romances of chivalry, of Spanish extraction, which were only destroyed by the vogue of *Don Quixote*. The translation of Montalvo's celebrated *Amadis de Gaula* enjoyed at this time an extraordinary popularity.

The habit of telling tales freely in prose was not, however, formed in France until after 1500. Bonaventure Despériers (d. 1544) was the author of the *Cymbalum mundi* and of *Nouvelles récréations*, mordant satires and gay stories. Probably to this age also belongs the semi-fabulous Béroalde de Verville, who is supposed to be the author of a collection of facetious anecdotes and conversations, *Le Moyen de Parvenir*. These and other experiments in fiction lead us up to Rabelais, whose magnificent genius adopted as its mode of address the chain of burlesque prose narratives which we possess in *Gargantua* and *Pantagruel*, but his influence on the novel is insignificant. It was half a century later that, in the romantic pastoral of *Astrée*, published in 1610, France may be said to have achieved her first attempt at a novel. This famous book was written by Honoré d'Urfé; in spite of its absurdities it is full of talent, and succeeds, for the first time in the history of French narrative, in depicting individual character. D'Urfé was followed, with less originality, by Marin Le Roy de Gomberville (1600–74), who was the author of a Mexican romance, *Polexandre*, and by Gombauld (1570?–1666), the author of *Endymion* (1624). These were fictions of interminable adventures, broken by an infinite number of episodes; they seem tedious enough to us nowadays, but with their refinement of language, and their elevation of sentiment, they fascinated readers like Mme. de Sévigné. To Gomberville, who has been called the Alexandre Dumas of the 17th century, succeeded Mlle. de Scudéry (1607–1701), who preserved the romantic framework of the novel, but filled it up with modern and familiar figures disguised under ancient names. But in the meantime, the elephantine heroic romances were ridiculed by Charles Sorel in his *Francion* (1622) and *Le Berger extravagant* (1628). Later examples of a realistic reaction against the pompous beauty of Gomberville and Scudéry were the *Roman comique* (1651) of Scarron and *Le Roman bourgeois* (1666) of Furetière.

All these, however, were mere preparations. The earliest novelist of France is Marguerite de la Vergne, comtesse de La Fayette (1634–93), and the earliest genuine French novels were her *Princesse de Montpensier* (1662), and her far more important *Princesse de Clèves* (1678). Mme. de La Fayette was the first writer of prose narrative in Europe who portrayed, as closely to nature as she could, the actual manner and conversations of well-bred people. To show that she was capable of writing in the old style, she published, with the help of Segrais, in 1670, a *Zayde*, which is in the Spanish manner affected by Mlle. de Scudéry. It was long before the peculiar originality of the *Princesse de Clèves* was appreciated. Meanwhile La Fontaine, in 1669, published a fine romance of *Psyché*, partly in verse, and Fénelon, in 1699, his celebrated *Télémaque*. The influence of La Bruyère on the novelists, although he wrote no novels, must not be overlooked. But the *Princesse de Clèves* remained the solitary novel of moral analysis when its author died and the 17th century closed. The successes of Lesage seemed to be wholly reactionary. His realistic novels, *Gil Blas* and *Le Diable boiteux*, depended upon their comic force, their picaresque vivacity, rather than upon the sober study of average human character. But Marivaux (1688–1763) took up the psychological novel again, and produced in *Marianne* (1731) and *Le Paysan parvenu* (1735) analytical stories of Parisian manners and character which were wholly modern in form. If *Marianne* was deliberate, the exquisite *Manon Lescaut* (1731), by the Abbé Prévost d'Exiles (1697–1763), was almost an accident; but, between them, these simultaneous works started the French novel of the analysis of emotion. The brilliant stories of Voltaire, which began with *Zadig* and included *Candide*, hardly belonged to this category; they are rather satires and diversions, in which class must also be placed the fashionable boudoir novels of Crébillon *fils*, La Morlière and others. But the English taste, exemplified mainly by Richardson, Sterne and Fielding, prevailed, and its effect was seen again in the imperfect novels of Diderot and Rousseau. The *Nouvelle Héloïse* and the *Émile* of the latter are not skilfully constructed as stories, but they mark the starting-point of the novel which aims at familiarizing the public mind with great ideas in an attractively romantic form. The moral purpose is equally evident in the famous *Paul et Virginie* of Bernardin de St. Pierre. It was less didactically present in Mme. de Staël's *Delphine* (1802) and *Corinne* (1807), where the misinterpreted woman of genius, so often depicted since, is first introduced to French novel-readers. It was not, however, until about 1830 that the novel began to be one of the main channels of imaginative writing in France, and the development of this kind of fiction was one of the main features of the romantic revival. Stendhal showed that, without any of the charms of style, and relying exclusively upon minute psychological observation, the record of a human life could be made enthrallingly interesting. Alexandre Dumas, under the direct influence of Sir Walter Scott, allowed his tropic imagination to revel and riot in brilliant chains of adventure. The imaginative novel was admirably conceived by George Sand. But it was Balzac who filled canvas after canvas with the astounding intensity of life itself, and who insisted with irresistible force that the function of the novel is to draw a consistent and unprejudiced picture of humanity under the strain of a succession of probable passions. This has been clearly comprehended by a host of later French novelists, whose record cannot be traced here, to be the function of the novel, as Mme. de La Fayette invented it, as Marivaux and Prévost developed it, and as George Sand and Balzac finally laid down its laws and settled its borders. Certain dates, however, must be recorded in the briefest record of the evolution of the French novel, and 1856 is one of these; in that year Gustave Flaubert published *Madame Bovary*, a work in which the rival realistic and romantic tendencies are combined with a mastery that had not been approached and has not since been equalled. Another is 1871, when Zola began to roll out the enormous canvas of *Les Rougon-Macquart*. Yet another is 1880, when *Boule de suif* first revealed in Maupassant a novelist whose creations were not merely amusing and striking, but absolutely convincing and logical.

England.—If we take no heed of translations of Latin stories, such as those from the *Gesta Romanorum*, we may say that the beginning of prose fiction in England is *Le Morte d'Arthur*, of Sir Thomas Malory, finished in or about 1470, and printed by Caxton in 1485. The great merits of this writer were that he got rid of the mediaeval burden of allegory, essayed an interpretation of the human heart, and invented a lucid and vigorous style of narrative. But his book became, as Prof. W. Raleigh has said, "the feeder of poetry rather than of prose," and it gave no inkling of the methods of the modern novel. The same may be said of such versions of the Charlemagne, Amadis and Palmeria cycles of romances as *Huon of Bordeaux*, published by Lord Berners, per-

haps in 1535, and innumerable others. It was the *novella* of Italy from which the English novel first faintly started. Between 1560 and 1580 versions of the Italian novelists became exceedingly popular in England. Paynter in introducing the tales of Bandello and Straparola struck the true novelist's note by offering them not as works of morality or edification, but "instead of a merry companion to shorten the tedious toil of weary ways." The appreciation of these Italian stories led to the composition of the *Euphues* of Lyly (1579), a book of great interest and merit, which has been called "the first original prose novel written in English." This is somewhat to exaggerate, since *Euphues* is rather a work of elegant philosophy than a narrative. Lyly had many imitators, Munday, Greene, Dickenson, Barnabe Rich, Lodge, Nash and others, who formed a school of prose fiction which was not without a certain romantic beauty, but possessed as little narrative vigour as possible. To compare a story written by Sacchetti in 1385 with one written by Greene in 1585 is to perceive that not merely had no progress been made towards the modern novel, but that a great deal of ground had been lost. The absence of the comic element in Elizabethan romances is very marked. M. Jusserand has claimed a peculiar merit in this and other respects for the *Jack Wilton* of Nash (1594), which, as he points out, is the earliest English example of picaresque literature. During the reign of the heroic romances in France, their vogue violently affected the English book-market. The huge stories of Calprenède and Gomberville were translated and imitated to the exclusion of every other species of prose fiction, between 1645 and 1670. The long-winded books of Mlle. de Scudéry, especially *Cassandra* and *The Great Cyrus*, were read so universally in England as to leave their stamp on the national manners. Of original English romances written in competition with the French masterpieces of chivalry, the *Parthenissa* of Lord Orrery (1654) is the best known. The first definite stand against these Gallicized romances was made by two dramatists, Aphra Behn and William Congreve. Congreve's *Incognita* (1692) is remarkable for its light raillery and humour, and perhaps deserves as well as any 17th century composition to be called the earliest novel in English. The stories of Mrs. Behn have the merit of a romantic simplicity in narrative, but they are dull. It was Daniel Defoe who introduced a minute and rude system of realistic observation which exactitude he combined with a survival of the old picaresque method, the result being those entertaining works *Colonel Jack* (1722) and *Roxana* (1724). He came to positive success in the immortal narrative of *Robinson Crusoe*.

The 18th Century.—Not even yet had the English novel been invented. It came into the world in 1740 from the unconscious hands of Samuel Richardson (1689–1761), who had hit upon the notion that morality might be helped and young persons of inexperience protected by the preparation of a series of letters exchanged between imaginary persons. The result was *Pamela: or Virtue Rewarded*. Henry Fielding's *Joseph Andrews* (1742), which started as a mere burlesque of *Pamela*, proceeded upon admirably original lines of its own, in a study of the humours and manners of contemporary country life. Fielding rejected the epistolary artifice of Richardson, and told his story in a straightforward narrative, broken indeed by arguments and ejaculations which bound the new novel to the old essay of the *Spectator* type. The creative force of Fielding filled the pages of this book with a crowd of vividly-presented characters, and this marked a step in advance. In 1748 appeared the *Roderick Random* of Smollett, and here we have neither the sculptural manner of Richardson nor the busy world of Fielding's realism, but a comic impression founded on an artful employment of emphasis and exaggeration. The next move was made by Fielding, who in 1749 published his *Tom Jones*. Starting with the pungent horror of hypocrisy ever before him, Fielding constructs a fragment of the world in which men and women are seen without exaggeration, plying their daily trades under the eye of an impartial observer who can penetrate to their secret motives. This was a great advance, and a still greater one was the sustained skill with which the author conducted the plot, the interwoven series of the actions of his characters. It may almost be said that until the publication of *Tom Jones* no novel with a real plot had been conceived in English. The rivalry of the great novelists of this time was of signal help to them, and there can be no question that the astounding richness of *Tom Jones* stirred Smollett to the exercise of increased energy in *Peregrine Pickle* (1751), a coarse and savage book, illuminated by brilliant flashes of humour. A better, because a tenderer and truer study of life was *Amelia*, which Fielding published in the same year; yet most readers have found this novel a little languid after *Tom Jones*. Now Richardson, who had long been silent, reasserted his mastery of epistolary analysis in the huge *History of Sir Charles Grandison* (1753), in which, as its admirers claimed, "all the recesses of the human heart are explored and its whole texture unfolded."

New forms, and also new subjects, were to present themselves to the imagination of capable British novelists, but the starting-point of every experiment was to be discovered in the ripest work of Richardson, Fielding and Smollett. Their influence was manifest in the writings of the second school of English novelists, in whom, however, several interesting varieties of subject and treatment were discovered. The *Tristram Shandy* (1759–66) of Sterne, is the most masterly example in English of a humour which goes direct to pathos for its most "sentimental" effects, and of the kind of loosely-strung, reflective fiction which is hardly a narrative at all. Neither *Tristram Shandy* nor *A Sentimental Journey* (1768) can properly be included among novels. In *Rasselas* (1759) Dr. Johnson showed that the new kind of writing could be used to give entertainment to a sermon, and in this he was to have a multitude of followers. In *Chrysal* (1760) Charles Johnstone (d. 1800) showed that the picaresque romance could still exist, tinctured by the newly-found art of the novelist. In *The Castle of Otranto* (1764) Horace Walpole adapted the methods of the novelist to a pseudo-historical theme of horror and romance, and prophesied of Walter Scott. In *The Vicar of Wakefield* (1766) Oliver Goldsmith was indebted to most of his immediate predecessors, but fused their qualities in an amalgam of gentle wit and delicate sweetness and conversational brevity which has made his one loosely-constructed novel a foremost classic of our literature. Thus, in the one quarter of a century which divides *Pamela* from *The Vicar of Wakefield*, English novel-writing was born, grew into full maturity, and adopted its adult and final forms. During the remainder of the 18th century, little or nothing was done to extend the range of prose fiction in England, but one or two of those departments of novel-writing which had already been invented were developed and adapted to changing taste. In particular, the rapid increase of reticence and refinement in conversation made such a novel in letters as Smollett's *Humphrey Clinker* (1771) repulsively coarse to women of delicacy, who were charmed on the other hand with the *Evelina* of Frances Burney (1778). These two typical books are composed on the same plan, yet essentially a whole age lies between the former and the latter. What has been called "the novel of the tea-table" now came into existence, and the 18th century was about to close in mediocrity, when its credit was partially saved by a development of Horace Walpole's romance of terror in the vigorous and sensational narratives of Anne Radcliffe (1764–1823), whose *Mysteries of Udolpho* appeared in 1794. The same year saw the publication of *Caleb Williams*, in which William Godwin (1756–1836) evolved a tragic theory of politics.

The 19th Century.—The two schools here indicated, and they may be roughly defined as the school of the Tea-Table and the school of the Skeleton-in-the-Cupboard, did not, however, betray their real significance until the second decade of the 19th century, when they developed into the novel of psychological satire and the romance of historical imagination. Two writers, the greatest who had yet attempted to address English readers through prose fiction, almost simultaneously came forward as the protagonists in these two spheres of work. Jane Austen published *Sense and Sensibility* in 1811, Walter Scott *Waverley* in 1814. These were epoch-making dates; in each case a new era opened for the countless readers of novels. The first-named writer, all exactitude, conscience and literary art, worked away at her "little bit (two inches wide) of ivory"; the other, with bold and flowing brush, covered vast spaces with his stimulating and noble compositions. It is,

however, to be noted that the isolation in which we now regard these great writers—a *solitude à deux* only broken in measure by the presence of Miss Maria Edgeworth—is an optical illusion due to the veils of distance. The bookshops from 1810 to 1820 and onwards were thronged and glutted with novels, many of them infinitely more successful, so far as sales were concerned, than the most popular of Miss Austen's works. The novels of Miss Austen were written between 1796 and 1816, although published from 1811 to 1818; those of Sir Walter Scott date from 1814 (*Waverley*) to 1829 (*Anne of Geierstein*).

The next artist in prose fiction whose force of invention was sufficient to start the novel on wholly fresh tracks was born 40 years later than Scott. This was Charles Dickens, whose *Pickwick Papers* (1836) marks another epoch in novel writing. His career of prodigal production ceased abruptly in 1870, by which time it had long been obvious that he was the pioneer of a great and diverse school of novelists, all born within the second decade of the century. Of these Thackeray was not really made obvious until *Vanity Fair* (1849), nor Charlotte Brontë till *Jane Eyre* (1847), nor Mrs. Gaskell till *Mary Barton* (1848), nor George Eliot till *Adam Bede* (1859). The most noticeable point on which the five illustrious novelists of the Early Victorian age resembled one another and differed from all their predecessors, was the sociological or even humanitarian character of their writings. All of them had projects of moral or social reform close at heart, all desired to mend the existing scheme of things. (E. G.)

AMERICA

In America during the greater part of colonial life before the Revolution there was no fiction written because there was no fiction-reading public. After the middle of the 18th century novels began to find their way into the hands of the curiosity-seekers and adventurers in literature. By 1800 a change had come. Naturally among the English colonies English models were followed in fiction quite as closely as they already had been in architecture, music, poetry and the drama. Three women wrote of a Richardsonian world as sentimentally as their master: Sarah Wentworth Morton in *The Power of Sympathy* (1789), Susanna Haswell Rowson in *Charlotte* (1794), later *Charlotte Temple* and Hannah Webster Foster in *The Coquette* (1797). Gilbert Imlay in *The Emigrants* (1793) superimposed the formula for Frances Burney's stories of the English town on a shifting American scene from the seaboard over the Alleghenies to the western valley of the Ohio river. Hugh Henry Brackenridge between 1792 and 1805 published the successive parts of *Modern Chivalry*, and wrote them avowedly after the fashions of Hume, Swift and Fielding. Royall Tyler smacked rather more of Smollett in *The Algerine Captive* (1797).

The reading of William Godwin's *Caleb Williams* (1794) led Charles Brockden Brown (1771–1810) to attempt the treatment of a social thesis in the "Gothic" manner. *Arthur Mervyn* (1799–1800), especially in the first half, pursued Godwin's theme of an innocent youth branded as an outlaw by the malignance of a guilty patron. In both *Arthur Mervyn* and *Ormond*, another English predecessor, Defoe, with his *Journal of the Plague Year* (1722) is paralleled in Brown's lurid circumstantial memories of the yellow-fever epidemics in Philadelphia, 1793, and New York city five years later. In his most completely gothicized story, and his most powerful one, *Wieland* (1798), Brown dealt with a devastating pseudo-supernatural influence rationalized away as a feat of diabolical ventriloquism. In *Edgar Huntly* (1799), he turned to frontier adventure in anticipation of Cooper.

Twenty years later James Fenimore Cooper (1789–1851) discovered in his negligible domestic romance *Precaution* (1820) that he had a hitherto undiscovered gift. Stimulated by friendly critics to write of matters more nearly native to his experience, he followed with *The Spy* (1821), a tale of the Revolution, which was set in his own neighbourhood, with *The Pioneers* (1823), a story of the frontier on which he had grown up and with *The Pilot* (1824), a sea-story for which his years in merchant shipping and the navy had equipped him. With these three tales, American in subject matter and point of view, natural and spirited in treatment and peopled with real characters acting against real backgrounds, the genuine American novel came into existence. In his nearly 30 years of authorship Cooper completed the Leatherstocking series of which *The Pioneers*, first to be written, is fourth to be read. The others in story progression are *The Deerslayer* (1841), *The Last of the Mohicans* (1826), *The Pathfinder* (1840) and *The Prairie* (1827), in which he showed how vainly he struggled to reconcile aristocratic prejudice with democratic theory.

By the time of Cooper's death in 1851 the output of novels, which largely paralleled his in their resort to the settlement, the frontier and the Revolutionary War, was considerable in size but inconsiderable in value. In New England John Neal, with *The Down-Easters* (1833), D. P. Thompson, with *The Green Mountain Boys* (1839) and Sylvester Judd, with *Margaret* (1845) took up the chronicle. J. P. Kennedy expounded Virginia in *Swallow Barn* (1832) and the Carolinas in *Horse-Shoe Robinson* (1835). And the inclination to follow the retreating frontier was marked by J. K. Paulding's *Westward Ho!* (1832), R. M. Bird's *Nick of the Woods* (1837) Mrs. C. M. S. Kirkland's *A New Home—Who'll Follow* (1839) as well as by most of the voluminous work of Wm. Gilmore Simms (1806–70). Just as Cooper was often referred to as the American Scott, Simms, with better reason, was frequently called the Southern Cooper. He complemented Cooper's success with the frontier by his own with the settlement and the Revolution. Of his seven novels of the war *The Partisan* (1835) is the sturdiest survivor, and of his many tales of the settlement, *Beauchampe* (1842) is perhaps pre-eminent.

In these years, however, Herman Melville (1819–91) began the work which culminated in the year of Cooper's death with *Moby Dick* (1851), one of the greatest novels of the century in the English language. Several years in early manhood spent in merchant shipping and whaling supplied him with his philosophic point of view and with most of his material. *Typee* (1846) and *Omoo* (1847) were the first literary fruits of his wanderings, a continuous narrative of South Sea adventure interlarded with drastic criticism of the invading whites. *Mardi* (1849), retaining all his zest for the sea, passed over to the realm of allegory from which Melville was never to return, in the tale of a world-wide quest for Unattainable Beauty, incarnate in the maiden, Yillaz. And *White Jacket* (1850), the story of his return to Western life on an American warship, is characteristic of its author in its combination of cyclopaedic fact and elaborate allegory. *Moby Dick*, Melville's masterpiece, the pursuit of a hopeless conflict with fate waged by Captain Ahab, a Promethean whaler, is a story which moves with grim relentlessness to its tragic conclusion. With *Moby Dick* Melville's major achievement was at an end, though the early successes cannot be fully understood without careful reading of *Pierre* (1852), *Israel Potter* (1855), *Piazza Tales* (1856), *The Confidence Man* (1857), his privately printed verse and the posthumous novel *Billy Budd* (1924).

America had as yet shown no bent for realism in fiction except in one or two distorted satires by Cooper. The turn to Nathaniel Hawthorne (1804–64) is a turn only to another type of romance. An unusually long period of solitary preparation, marked only by a few score short tales and sketches brought him to maturity and recognition at the age of 46 with *The Scarlet Letter* (1850). He is known as a novelist for *The Blithedale Romance* (1852), *The House of the Seven Gables* (1851) and *The Marble Faun* (1860); although in addition to the suppressed *Fanshawe* (1828), *Septimius Felton* (1872), *Dr. Grimshawe's Secret* (1882) and the uncompleted *Dolliver Romance* were all posthumously published. His romances proceed almost by formula, each dominated by a physical symbol, each told in terms of a small group of characters with a hyper-sensitive central figure, each developed mainly through analysis and interpretation of the changing moods of the markedly inactive actors, each garnished with many a meditative commentary on the text, each critical of the Puritan tradition which dominated the author's past and present and each inquisitive as to the mystery of life and the hidden sources of its visible phenomena.

The decade which was ushered in by *Moby Dick* was escorted to its end by a host of sentimental tales for girls and robust

adventure stories for boys. Only one novel was taken seriously by adults, Mrs. H. B. Stowe's (1811–96) enormously successful propagandist tale, *Uncle Tom's Cabin* (1852). Mrs. Stowe felt no pride in it as a story, but as a popular document she composed it with great skill and through it she discovered the inherent ability which she vented not only in the second anti-slavery tale *Dred* (1856), but also in a succession of discriminating pictures of New England life, of which *The Minister's Wooing* (1859) and *Oldtown Folks* (1869) are worthy of remark. Her work marks the turn to a definite current of realism.

It is not without significance that the new tendency gained momentum most rapidly in the new West. With the close of the Civil War the movement began with a fresh depiction of the American scene, and swept in a great cyclonic curve from the Pacific coast past the shores of the Gulf of Mexico, up through the South-eastern States into New England, across to the Middle West and back into the Ohio valley, until every part of the country was represented by its descriptive story-tellers. The course of this newer provincial fiction is suggested by such book titles as Mark Twain's *Jumping Frog* (California, 1867); Bret Harte's *The Luck of Roaring Camp* (California, 1871); G. W. Cable's *Old Creole Days* (Louisiana, 1879); Joel Chandler Harris's *Uncle Remus: His Songs and Sayings* (Georgia, 1880); Charles Egbert Craddock's (Mary N. Murfree) *In the Tennessee Mountains* (1884); Thomas Nelson Page's *In Ole Virginia* (1887); Mary E. Wilkins's *A New England Nun* (1891); Hamlin Garland's *Main Traveled Roads* (1891); James Lane Allen's *Flute and Violin* (1891).

Mark Twain (Samuel Langhorne Clemens, 1835–1910) was an insistent anti-sentimentalist and anti-traditionalist, and free from any dominating literary influence. His *Innocents Abroad* (1869) was an account of what he saw in Europe in contrast with what the American pseudo-aesthete was supposed to see. His *Tom Sawyer* (1876) and *Huckleberry Finn* (1884) were written in honest contempt for the prevailing goody-goody boy story. *The Gilded Age* (1873), in collaboration with Charles Dudley Warner, was a relentless satire on the time, as was *The Man that Corrupted Hadleyburg* a quarter of a century later. During the latter part of his life Mark Twain wavered between a relative faith in democracy—*The Prince and the Pauper* (1882), *The Connecticut Yankee* (1889), *Joan of Arc* (1896) and a positive despair in humankind—*What is Man?* (1906) *The Mysterious Stranger* (1916) and other posthumous works.

William Dean Howells (1837–1920) was the only American to rival Mark Twain in the long period when they were contemporaries and friends. Howells's career falls into two clearly marked periods before and after he had come under the acknowledged influence of Tolstoi. A trained observer in the school of journalism, he was content in the first period to focus his attention on the interplay of contrasting cultures, Western and Eastern, American and European, as in *A Foregone Conclusion* (1875), *The Lady of the Aroostook* (1879), *The Rise of Silas Lapham* (1884) and *Indian Summer* (1886). But when, through Tolstoi, he "began at last to discover [his] relations to the race," his novels, while retaining their earlier charm, carried on their shoulders the Pilgrim's pack of a social burden, as in *A Hazard of New Fortunes* (1889), *The Quality of Mercy* (1892), *The World of Chance* (1893), *A Traveler from Altruria* (1894) and many another. He was extremely prolific, though scrupulous in his art; and he exerted a wide influence over the oncoming generation.

Henry James (1843–1916) furnishes an inevitable parallel to Howells. Throughout his authorship he followed the path of the psychological realist from which Howells was diverted in mid-career. In this pursuit he penetrated to the inner shrines of sophisticated life: *The American* (1877) presents a robust compatriot cruelly wronged by an alien society. Later, American society had become alien to James. The writing of *Washington Square* (1881) a purely American narration, made him "feel acutely the want of the 'paraphernalia,'" of a matured society. *The Portrait of a Lady* (1881) he built "large, in fine embossed vaults and painted arches" which were for the most part located in Europe. *The Tragic Muse* (1890), one of his simplest works, portrays the security of conservative England threatened by an invasion from the Bohemia of art. From this point on James can hardly be claimed as American. And from this point too both his thinking processes and his style became so involved as to demand the loyal and painstaking attention of a highly eclectic body of readers.

In the 1880's, the decade in which Howells learned from his Russian master to "set life forever above art" the output of American fiction had become abundant and varied. The sentimental domestic story, the romance of adventure, the historical tale, the international novel, the provincial picture and the purpose novel all flourished. From them all only a few survive in memory, and these with such religious or ethical thesis as Lew Wallace's *Ben Hur* (1880), Helen Hunt Jackson's *Ramona* (1884), Margaret Deland's *John Ward, Preacher* (1888) and Edward Bellamy's *Looking Backward* (1888). Of the novelists who emerged at this time into a popularity not without literary basis the chief was Francis R. Stockton (1834–1902), a lord of whimsical misrule in his day, and F. Marion Crawford (1854–1909), prolific author of romances located in Europe and the Near East.

The current of romance, of course, did not cease to flow, but from 1890 to 1910 the most marked tendency in American fiction was toward the ethical realism of Tolstoi or the naturalism of Zola. With the outbreak of the brief war with Spain in 1898 an awakened national self-consciousness recognized or inspired such historical novels as Weir Mitchell's *Hugh Wynne, Free Quaker* (1897), Thomas Nelson Page's *Red Rock* (1898), Mary Johnston's *To Have and to Hold* (1900), Winston Churchill's *Richard Carvel* (1899) and Paul Leicester Ford's *Janice Meredith* (1899). More important than this were the social novels reflective of Howells's later period written by Hamlin Garland, Brand Whitlock, Winston Churchill and Thomas Nelson Page, and still more important was the fresh naturalism of Stephen Crane (1871–1900) in *Maggie* (1896), *George's Mother* (1896) and the extraordinary expressionism of *The Red Badge of Courage* (1895) and *The Open Boat* (1898). With Frank Norris (1870–1902) the new century was greeted in another succession of naturalistic stories of which the two members, *The Octopus* (1901) and *The Pit* (1903), of the incompleted trilogy, *The Epic of the Wheat,* are the most important.

The present century has seen the sustained work of one distinguished successor to Howells and James, Edith Wharton. Of the novelists in mid-career the most important are James Branch Cabell, ironic romanticist, Joseph Hergesheimer, who writes a compound of romanticism and naturalism, Theodore Dreiser and Sherwood Anderson, naturalists, Sinclair Lewis, a mordant journalist with a gift for critical narrative, and Willa Cather, the most distinguished expositor of the retreating frontier which was conquered and populated in the closing years of the 19th century.

(P. H. B.)

OTHER COUNTRIES

Spain.—Prose narrative in Spain practically begins in the 15th century with chronicles and romances of chivalry, tempered occasionally and faintly by some knowledge of what had been attempted in Italy by Boccaccio. The Spanish version of *Amadis de Gaula,* in which the romance of knight errantry culminated, belongs to 1508; the lost original is supposed to have been Portuguese. This was the only book of its class which is saved from the burning in *Don Quixote*; it was followed by *Palmerin of England.* These interminable books and a hundred worse than they, occupied the leisure of 16th century readers of both sexes. Without approaching the form of novels, they prepared the ground for novel-reading. The exploration of America led to the composition of monstrous tales of the New World, which generally took the form of continuations of *Amadis.* A new thing was begun in 1554, when the anonymous picaresque romance of *Lazarillo de Tormes* started the story of fantastic modern adventure; this highly entertaining book has been called the 16th century *Pickwick,* and Fitzmaurice-Kelly remarks that it "fixed for ever the type of the comic prose epic." The pastoral romance, in the hands of Jorge de Montemayor (d. 1561), who wrote an insipid *Diana* which was

popular for a while throughout Europe, took readers a step backward, away from the ultimate path of the novel. It is of interest to us, however, to note that it was in one of these "vain imaginings," in his pastoral romance of *Galatea,* that Cervantes approached the field of fiction in 1585. Few of his peculiar merits are to be found in this early work; he turned for the present to the composition of plays. It was not until 1604 that he returned to prose fiction by printing his immortal *Don Quixote,* which made an epoch in the history of the novel. This book was originally intended to ridicule the already fading passion for the romances of chivalry, but it proceeded much further than that, and there is hardly any branch of fiction which may not be traced back to the splendid initiation of some chapter of *Don Quixote.* In 1613 Cervantes published his 12 *Exemplary Novels*; these are not so well known as the great romance, and they owed not a little of their form to Italian sources, but they are very brilliant. One of the best anonymous Spanish stories of the period, *The Mock Aunt,* is a type of excellence in facetious narrative of the sarcastic class; it has been attributed to Cervantes himself. No other novelist of Spain has moulded the thought of Europe, but the heroic romance which occupied so much of the attention of France in the 17th century was invented by a little-known Spanish soldier, Pérez de Hita, who, about 1600, wrote fantastic stories about Granada and the Moors. The farcical romance of *Fray Gerundio de Campazas,* 1758, by J. F. de Isla (1703–18) competed in popularity with *Gil Blas.* Speaking broadly, however, Spain made no appreciable progress in novel-writing from the days of Cervantes to those of Walter Scott, when the *Waverley Novels* began to find such artless imitators as Martínez de la Rosa and Zorilla. But the first original novelist of Spain was Cecilia Böhl de Faber (Fernán Caballero) (1796–1877), whose *La Gaviota* (1848), a study of life in an Andalusian village, was the earliest Spanish novel, in the modern sense. She was followed by Valera (1824–1904), by Alarcón (1833–91), by Pereda (1834–1906), by Perez Galdós (1845–1920) and by Palacio Valdés (b. 1853), in whom the tendencies of recent European fiction have been competently illustrated without any striking contributions to originality.

Germany.—The cultivation of the novel in its proper sense began late in Germany. It is usual to consider that H. J. C. von Grimmelshausen (1625?–75) as the earliest German novelist; his very curious romance, *Abenteuerliche Simplicius Simplicissimus,* was printed at Mömpelgard in 1669. This is an account of the adventures of a simple-minded fellow during the Thirty Years' War, and is a chain of episodes, brilliantly recorded, but hardly a novel. Early in the 18th century, an extraordinary number of imitations of Defoe's great romance were published in Germany, and these are known to scholars as the *Robinsonaden.* Later on, Wieland imitated *Don Quixote,* but the earliest German novel which possesses original value is the celebrated work of Goethe, *The Sorrows of Young Werther* (1774). The still more celebrated *Wilhelm Meister* did not appear until 1796. A third novel, *Elective Affinities,* was published by Goethe in 1809. Meanwhile a very characteristic group of picturesque stories had been issued by Johann Paul Richter (Jean Paul) (1763–1825), destined to have a wide influence upon romantic literature throughout Europe. Purely romantic were the stories of Tieck, of Brentano, of Arnim, of Fouqué, of Kleist, of Immermann. The German novelists of this period wrote like poets, deprived of the discipline of verse. In later times novels of high merit have been written by Gustav Freytag, Wilibald Alexis (1798–1871), called the German Walter Scott, Laube, Fontane, Ebers, Jeremias Gotthelf, Berthold Auerbach, Spielhagen, Heyse and many others, but the 19th century produced no German novelist of commanding originality.

Russia.—In Russia alone, among the countries of central and eastern Europe, the novel has developed with a radical originality. Until the second quarter of the 19th century the prose fiction of Russia was confined to imitators of Sir Walter Scott, but about the year 1834 Gogol (1809–52) began to revolt against the historico-romantic school and to produce stories in which an almost savage realism was curiously blended with the Slavonic dreaminess and melancholy. Since then the Russian novel has consistently been the novel of resignation and pity, but wholly divorced from sentimentality. Gogol was succeeded by Gontcharov, Tourgéniev, Dostoïevski, Pissemski (1820–81) and Tolstoi, forming the most consistent and, doubtless, the most powerful school of novelists which Europe saw in the 19th century. The influence of these writers on the rest of the world was immense, and even in England, where it was least acutely felt, it was significant.

Oriental.—In a primitive form the novel has long been cultivated in Asia. It was introduced into China, but whence is unknown, in the 13th century, and Le Kuan-chung was the first Chinese novelist. The productions of this writer and of his followers are tales of bloody warfare, or record the adventures of travellers. The novel called *The Twice-Flowering Plum-Trees,* belonging to the 16th (or 17th) century, is a typical example of the moral Chinese novel, written with a virtuous purpose. Prof. Giles holds that the novel of China reached its highest point of development in *The Dream of the Red Chamber,* an anonymous story of the end of the 17th century; this is a panorama of Chinese social life, "worked out with a completeness worthy of Fielding." Prose stories began to be met with in the literature of Japan early in the 10th century. But the inventor of the Japanese novel was a woman of genius, Murasaki no Shikibu, whose *Genji Monogatari* has been compared to the writings of Richardson; it was finished in 1004 and may, therefore, be considered the oldest novel in the world. This book, which is one of the great classics of Japan, was widely imitated. After the classic period novel-writing was long neglected in Japan, but the humours of 17th century life were successfully translated into popular fiction by Saikaku (1641–93), and later by the collaborators Jisho and Kiseki. (E. G.)

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NOVEL, MODERN DEVELOPMENTS IN THE.

Towards the close of the last century, there arose as a reaction from the naturalistic novel, a school of neo-romantic psychologists, sceptically sentimental, and fond of lyrical "nuances." Types such as Oscar Wilde's *Dorian Grey* were popular, also the gentle, pallid, aristocratic, weary heroes of the Danish author, Hermann Bang. The erotic was the favourite theme, either sublimated, delicately portrayed in many beautiful shades, or else traced in glowingly pathetic frescoes. Atmosphere, tact, a great knowledge of women, good form, scepticism, and up-to-date-ness were the qualities valued in a novelist. Leading literary criticism asserted that Art has little to do with character and all that was written was appraised in accordance with a strongly underlined "Art for Art" principle.

The New Novelists.—Strange to say, only a few of the novelists who in the long run proved themselves great and lasting belonged to this tendency favoured by official literature. Independently of it, it may be mentioned, Romain Rolland wrote his vast life history of the musician Jean Christophe, and Anatole France his gentle, sceptical, wise novels. Rudyard Kipling composed his ballads and his great ballad-like Indian tales, and, following on Dostoievski and Tolstoi, Maxim Gorki appeared, melancholy and powerful upon the European horizon. Independently also of this officially favoured tendency August Strindberg cried aloud his maniacal, embarrassing confessions; Hamsun, with biting lyrics, placed his quiet, queer characters in a grand landscape; Selma Lagerlöf wrote her wild, sweet novels; and Johannes V. Jensen transformed the doctrines of Darwin and his own views on America into literature.

Of American novelists after E. A. Poe and Mark Twain no

more were sighted in the continent of Europe. A master of story writing of the rank of Stevenson was at best only known there through little read translations of *The Master of Ballantrae* and *Treasure Island*. Strindberg's novels, hardly accepted by a wider public, aroused in the connoisseurs admiration and displeasure. Dostoievski and Tolstoi were looked upon by the Europe of their day as gifted lunatics in much the same way as was Shakespeare by the French of the 18th century. It was Paris that dominated. France—at least in fiction—played the part which Greece had played in the ancient world. French novels even of mediocre importance were everywhere translated and imitated. They ruled the entire East, Russia, the Balkans. Practically the whole of European society modelled itself, in all aesthetic questions, on the pattern portrayed in this novel. Only that which had withstood the criticisms of the Paris salons was considered as of real artistic merit. Each country sought to adapt the French mode to its own atmosphere. In Italy, D'Annunzio exaggerated the main feature of the French style, pathetically overcolouring it. In Hungary, the French style was highly seasoned, banalized and provincialized. Among German-speaking authors the Viennese especially showed great zeal in emulating the French example. They decreed, nearly without any contradiction, that love, comedy and death should be the themes of literature.

Novels After the World War.—With the war the position of the novel changed swiftly and fundamentally. At the front the boredom of the trenches, at home the want of other distractions, won for the novel new readers, who, accustomed to a hard existence, compelled to struggle with stark reality, found that literature was dealing with affairs of secondary importance and did not touch the real centre of life, at any rate, not of their lives. They had no use for the erotic futilities, for the artistic "drawing room" philosophy of life, for the psychology—subtle as it was superficial—so popular in literature. They demanded reality. If, up till now, the reader had been drawn to the novel by a longing for entertainment and suspense, now it was the films which responded to this longing in a more agreeable and intensive way.

All around were to be seen vast changes, social and political; in the common life of every day, almost every function had been enormously changed through technical progress; Russia and America now appeared as decisive factors on the horizon of the rest of the world. The reader now demanded of the novelist that he should weigh the merits of these problems; at any rate, that he should expose them and catalogue them clearly. The author now suddenly found himself confronted with a much more alert, more distrustful, and more illuminated public.

Changing Subject-Matter.—The erotic, with its innumerable species, now moves away from the centre. No longer are the members of the ruling classes the only popular heroes of novels. Substance to the front; the artistic into the background! Even the old subject-matter is looked upon in a new light. Instead of portraying the setting of a period, the novel now sheds light on its social and economic structure, on the sociological aspect instead of on the erotic. It gives a representation and analysis of facts instead of coloured, lyrical, sentimental impressions.

This revolution did not accomplish itself without an aesthetic struggle. The antithesis, ever popular—especially in Germany—between the descriptive writer ("Schriftsteller") and the creative poet ("Dichter") was emphasized afresh, defended and attacked with animosity. The question was discussed as to whether the novel was in principle a form of poetry or not. The decay of the epic in every form was proclaimed. Distinction was drawn between creations (of poetical fancy) and (mere) description. A German historian of literature proclaimed that the mission of German literature was the romantic, and that this rationalistic period was an empty hour for German poetry.

Intermediate tendencies are perceptible. Towards the end of the war and immediately after it there broke out all over Europe a tendency to make the novel pathetic and prophetic. Even in fiction, writers like to fling open their inmost hearts and to cry aloud with wild bluff gestures that society was badly organized but that Man was good. This tendency only lasted a short time. Shorter still lasted the symbolical tendency which flared up afresh in various literatures. In contrast to these passingly fashionable vacillations the main rationalistic tendency, which since the war has gained the upper hand in every literature, is all the more clearly distinguishable.

The Poetical Novel.—The purely poetical novel proceeding from the individual poetic vision which follows exclusively the author's need of self-expression, not aiming at the exposition of a great continuity of ideas, nor at a fixed sociological goal, has, in this quarter of a century, found great representatives. But their influence rarely extends beyond readers of their own mentality, or beyond the poetic perceptions of their own intellectual atmosphere. Germany counts a whole series of such novelists, of doubtless great talents, whose native limitations and restrictions, however, bar their way to international importance: Hermann Hesse, Jakob Schaffner, Emil Strauss, W. von Scholz, H. Stehr and Arnold Ulitz.

Scandinavians, Swiss and Dutch have also produced the same kind of remarkable but limited novels. (Two noteworthy examples offer themselves by way of contrast, the English-writing Pole, J. Conrad, and the English-writing Swiss, John Knittel.) The great poet Knut Hamsun has unquestionably world-wide literary fame; but while, before the war, he found many imitators, to-day his reputation is greater than his influence. Among the Anglo-Saxons of this class, Rudyard Kipling rose to international importance, while the great Thomas Hardy has not to this day penetrated beyond the Anglo-Saxon world.

Romance and Colour.—The romantically artistic novel had, at the beginning of the century, to a great extent, replaced the naturalistic novel. Great was the delight in colour, in play of phantasy, in the sparkling, polished word. From Italy, D'Annunzio launched a pathetically high flown style. In Germany, Heinrich Mann triumphed with the strong colours and gestures of his fiction, finding numerous minor imitators; Eduard Stucken extended the wide, brilliant horizon of his books; and Alfred Döblin exaggerated this style, overcolouring it, turning it into a grotesque turmoil of gestures and actions. In Spain, Miguel De Unamuno; in France, André Gide; in England, Chesterton, clothed what they had to say in fantastically glittering forms. Nor did the delight in colour lose itself later on. For example, in America to-day, Joseph Hergesheimer artistically and playfully blends his ice-cold, glowing psychology with a hitherto unheard of variety of colour. Nevertheless, this delight in colour is being pushed into the background by the demand for substance, for a clear outline, for stronger, more controllable construction.

The purely fantastical, purely Utopian novel provides documentary evidence of the rationalizing tendency of the times. At the beginning of the century Hanns Heinz Ewers strives after effect in his ghastly stories; Gustav Meyrink writes his mystically magical novels. In France, Renard applies his extraordinary art of story telling to fantastic themes. But since the World War the lawless roaming of imagination has been rendered more and more difficult; its direction is more and more decided by a biological and sociological point of view. The dream landscapes of the great vision of the Bohemian poet, Franz Kafka, are psychoanalytically traced out, and the Utopian novels of H. G. Wells are carefully founded upon the results of modern research.

Films and Fiction.—The films, with their manifold opportunities for creating suspense, with their immediate appeal to the senses, are becoming a dangerous competitor to the purely fictional novel, written merely for the sake of telling a story. Some authors of the anecdotal novel take refuge in an artistically refined, at times pseudo-classical technique, as for instance Paul Ernst, or Bruno Frank, also Thomas Mann (in *Death in Venice*, in his short stories), and in England such writers as D. H. Lawrence. As this epoch has a whole series of authors of vigorous imagination and original delight in story telling an astonishingly high level is reached in this field. Writers such as M. Renard, Blasco Ibañez, Margaret Kennedy, Leo Perutz and Wilhelm Speyer and Franz Molnar write entertaining novels of a considerably higher quality than is to be found in the entertaining novels of a former period. Some of these stories are very pointed and not without ingenious jests; most of them penetrate into

other fields, attaching themselves carefully to the historical or to the sociological. Or with worldly wise, cleverly interpreted imagination they paraphrase on actual life (Maurois, the life of Shelley in *Ariel,* and Maugham, the life of Gauguin in *The Moon and Sixpence*). A very fortunate combination of circumstances has made *The Adventures of the Brave Soldier, Schwejk,* by Jaroslav Hesek, a sort of national epic of international reputation.

At the beginning of the century the society novel possessed important exponents, who found numerous imitators. Fritz Mauthner, Guy de Maupassant and young Bernard Shaw wrote their criticisms of society. These were justified at the time, as the conventions of society were still a problem. To-day, when they are so no longer, criticism of society is at most a pretext for authors who wish to preserve the society novel as a portraiture of the fashionable world—Arlen, Dekobra, Morand, Colette and Pitigrilli. Even in Germany, where society in this special sense of the word has never existed, the society novel is now being attempted; Edschmidt and Speyer.

Psychology and the Novelist.—At the close of the last century the psychological novel was at its height. Taught by Dostoievski, leading authors in every literature sought more and more to shade the characters of their novels, to differentiate them more and more finely (Meredith, Wassermann, Henrik Pontoppidan, and Theodore Dreiser). But whilst at the beginning of this century it was the individual case, the glaring, sensational case that was the chief interest, the novelist now lays the chief stress on portraying the individual going to mingle with the masses. The Russians of the school of Dostoievski; the followers of Chekhov, writers such as T. Shmeliov and their fellow-aspirants, are overshadowed by the sociologically inclined pupils of Tolstoi and Gorki. The books of the Viennese authors, such as Schnitzler and Stefan Zweig, and their languid knowledge of the human heart, with their esprit and their idle cautious psychology, are being dislodged by the books of the Anglo-Saxons, Galsworthy, Bennett and Sinclair Lewis, in which the hero interests, not as an individual, but as a type. If psychology be admitted at all, then much colder and more unsentimental artistic shading is demanded by the younger school (somewhat after the style of Joseph Hergesheimer), or scientifically founded psycho-analysis, as, for instance, is attempted by James Joyce.

Novels with a Purpose.—The novel with a purpose, the novel with a thesis, triumphs. Already, their titles openly proclaim such themes as: "Not the Murderer, but the Murdered is Guilty," "All Roads Lead to Golgotha," "Thou Mayest Commit Adultery," "Man is Good." In Germany, Heinrich Mann emphasizes with force the democratic, humanistic tendency in his great biting novels dealing with the Kaiser's period. (The development of the times shows itself typically in this author. He begins with criticisms of society, then writes highly-coloured, romantically artistic books with a psychological strain, whose subject-matter consists of tempestuous emotions, fierce landscapes, and an intensely demoniacal heroine. To-day, he is writing great sociological novels with a purpose.) Everywhere there appear violent anti-war novels. Already, long before the war, Bertha von Suttner had the greatest success with her weak, well-meant, pacifist novel, *Down with Arms.* Some of the anti-war novels, *Fire,* by Barbusse; *Three Soldiers,* by Dos Passos; *Sergeant Grischa,* by Arnold Zweig, although undisguised polemics, created a directly artistic effect. The didactic political tendency becomes strongly accentuated. Originating in Russia, there arises a mixture of fiction-writing and a reporting of facts. Moreover, the moment favours bellicose emotions, and clear, undisguised attitudes. The gentle scepticism of Anatole France is too quietistic for these times. Strongly polemic themes predominate throughout the Utopian, society-criticizing novels of Wells. Broadly didactic passages may already be found in Tolstoi's *War and Peace.* Upton Sinclair's novels, however, are solely and purely propaganda fiction, in which the rhetoric greatly outweighs the creative tendency. The novels of the Soviet writers (Gladkov's *Cement* and Kollontai's *Ways of Love*) are also unscrupulous propaganda. On the other hand, in the novels of the Americans, Jack London, Sinclair Lewis, Dos Passos, and Theodore Dreiser, propaganda is subordinate to creative desire.

The Historical Novel.—The historical novel, as it was presented at the close of the last century, springs from a delight in gaily-coloured story telling and in the decorative. *Ben Hur,* by Wallace, and *Quo Vadis,* by Sinkiewicz, creates enthusiasm in millions of readers. In Germany, Alfred Doeblin, in his books *The Three Leaps of Wan Lung* and *Wallenstein,* brings to perfection the artistically-coloured novel as based upon the works of Flaubert and of the Swiss author, C. F. Meyer. But it is just in the historical novel and its metamorphoses that the tendency of the times is most clearly to be traced. Whilst, before the World War, the historical novel was popular due to its colour and its background, after the war it was the pragmatical that was sought for in it. It was popular because it strengthened in the reader the illusion of reality and imparted to him a conviction of documentary evidence and reliability. The Russian novels of D. Merejkovski form a connecting link between the earlier kind of historical novel and the modern one.

Two styles seem to be the peculiarity of the historical novel of to-day; the biographical, with a psychological strain (Maurois, Emil Ludwig, and Werfel in his *Verdi*), and especially the new historical novel which does not restrict itself to portraying, in the form of a sensational anecdote, an individual drawn more or less graphically after the person of the author, but in which the characters are embedded in the environment of their period, in which is traced an outline of the structure of the times. The author of this new historical novel does not lay stress on the colour of a period, but on its substance. He does not care for what is curious and strange, does not seek to emphasize the romantic. He does not underline those qualities which mark the distance between those times and our own, but preserving historical reality, he underlines the very qualities which are common to our own time (Feuchtwanger's *Jew Süss* and *The Ugly Duchess*). In this way does he trace unchanging man through the everchanging periods of history and endeavours to transform history into politics.

Sociological Fiction.—Here he touches the field in which the modern novel flourishes best, the sociological. Since to-day the individual is linked more than ever before with the whole world through newspapers, better communications, brisker exchange of merchandise, films and wireless; the sociological interests of the reader have become broader, deeper and more varied.

This sociological novel develops the novel of environment of the 19th century, as it culminated in Zola, and changes it from within. For while that naturalistic novel constructed its setting from single events carefully put together so as to cause suspense, the modern post-war sociological novel endeavours to comprehend in one glance the whole class which it portrays. It has learnt much from the films, in particular the technique of building up a comprehensive picture from many small individual pictures. (Thus, for instance, Dos Passos, in his *Manhattan Transfer,* intentionally—after the manner of the films—rings the changes between a "close-up" of the individual and a general view of the crowd, showing the simultaneousness of many events in order to give a better view of the events as a whole.) In logical transition between the Zolaesque novel and the sociological novel of to-day stand novels such as Zangwill's *Children of the Ghetto, The Buddenbrooks,* by Thomas Mann, and Galsworthy's *Forsyte Saga.* The sociological novels of the times, the works of Jack London, Sinclair Lewis, Upton Sinclair, Dos Passos, the books of Gladkov and Kollontai, the prose epics of Bennett, Galsworthy and Wells, take for their subject-matter not one arbitrary individual, but the whole society of to-day. It is for that reason that, notwithstanding the attractions of sport and wireless, they have won the entire world of to-day as their ardent readers, a somewhat superficial world, perhaps, but certainly a very enlightened one. Their works teach their readers to understand and to sympathize with the life of the citizen, and disclose the outlook of the proletariat. They impart a knowledge of those two opposite poles, Russia and America. And Russians and Anglo-Saxons have proved themselves masters of this form of novel, dislodging the French novel without a struggle. This new sociological fiction

has converted the novel from a luxury for the idle rich into a necessity for busy workers. For it originates, not from the need for self-expression of a single arbitrary author, but from a universal need for self-expression. (L. F.)

NOVELDA, a town of east Spain, in the province of Alicante, on the right bank of the river Vinalopó, and on the railway from Madrid to Alicante. Pop. (1920) 11,994. The country around is flat and fertile, producing much wine, dates, oranges, oil, saffron and aniseed. In the town there are tanneries, and manufactures of alcohol, chocolate and soap. The women make fine lace. At Salinetas de Elda nearby, there are warm sulphur and saline baths.

NOVELLO, CLARA ANASTASIA, Countess Gigliucci (1818–1908), English operatic singer, was born in London on June 10, 1818, and was trained under Miss Hill and John Robinson, at York and at Choron's academy in Paris. She returned to England after the revolution of 1830 and made her first public appearance at Windsor on Oct. 22, 1832. At the age of 14 she took the soprano part in Beethoven's "Missa Solemnis." By 1835 she was the leading soprano in England, and in 1837 appeared, by Mendelssohn's invitation, at the Gewandhaus concerts, visiting Berlin, Dresden, Prague, Vienna, etc., after which she studied opera for a year at Milan, appearing at Padua (July 6, 1841) in Rossini's "Semiramide," and later in other Italian cities. In 1843, owing to mismanagement, her engagements at Rome and Genoa clashed. She was arrested in Rome and detained at Fermo, where the governor, Count Gigliucci, fell in love with her. She returned to England, appeared at Drury Lane, and married Count Gigliucci in Nov. 1843.

After some years in retirement in Italy she was obliged by financial losses in the revolution of 1848 to take up her profession again. She appeared in opera in Rome and Lisbon in 1850, and in London (1851) in Handel's "Messiah." She sang in opera at Milan in the carnivals of 1854–56, but in England became the leading concert soprano. She retired finally in 1860, living with her husband at Rome and Fermo. She died on March 12, 1908.

NOVELLO, VINCENT (1781–1861), English musician, son of an Italian who married an English wife, was born in London on Sept. 6, 1781. He was a chorister at the Sardinian chapel in Duke Street, Lincoln's Inn Fields, where he learnt the organ; and from 1796 to 1822 he was successively organist of the Sardinian, Spanish (in Manchester Square) and Portuguese (in South Street, Grosvenor Square) chapels, and from 1840 to 1843 of St. Mary's chapel, Moorfields. He was an original member of the Philharmonic Society, of the Classical Harmonists and of the Choral Harmonists, officiating frequently as conductor. In 1849 he went to live at Nice, where he died on Aug. 9, 1861. He composed an immense quantity of sacred music, much of which is still deservedly popular; but his great work lay in the introduction to England of unknown compositions by the great masters. The Masses of Haydn and Mozart were absolutely unknown in England until he edited them, as were also the works of Palestrina, the treasures of the Fitzwilliam Museum, and innumerable great compositions now well known to everyone. His first work, a collection of *Sacred Music, as performed at the Royal Portuguese Chapel,* which appeared in 1811, marks the founding of the publishing house of Novello.

His son, Joseph Alfred Novello (1810–1896), who had started as a bass singer, became a regular music publisher in 1829. He really created the business, and has the credit of introducing cheap music, and departing from the method of publishing by subscription. From 1841 Henry Littleton assisted him, becoming a partner in 1861, when the firm became Novello & Co., and, on J. A. Novello's retirement in 1866, sole proprietor. Having incorporated the firm of Ewer & Co. in 1867, the title was changed to Novello, Ewer & Co., and still later back to Novello & Co., and on Henry Littleton's death in 1888, his two sons carried on the business.

NOVEMBER, the ninth month of the old Roman year [Lat. *novem,* nine], which began with March. By the Julian arrangement, according to which the year began with Jan. 1, November became the eleventh month and had 30 days assigned to it. Nov. 11 was held to mark the beginning of winter; it is now the day of solemn commemoration of the end of the World War. The Senate desired to rename the month in honour of Tiberius—his birthday occurring on the 16th, but the emperor declined, saying, "What will you do, Conscript Fathers, if you have *thirteen* Caesars?" The Anglo-Saxon names for November were *Windmonath,* "wind month" and Blodmonath "bloodmonth."

NOVERRE, JEAN GEORGES (1727–1810), French dancer and ballet master, was born in Paris on March 29, 1727. He composed his first ballet in 1747 for the Opéra Comique. After a year spent in Berlin, he mounted the ballets of Gluck and Piccini in Paris in 1749. He was in London (1755–57) and in Lyons (1758–60). From the publication of *Lettres sur la danse et les ballets* may be dated the revolution in the art of the ballet for which Noverre was responsible. (*See* Ballet.) He was next engaged by the duke of Württemberg, and afterwards by the empress Maria Theresa, until, in 1775, he was appointed, at the request of Queen Marie Antoinette, *maître des ballets* of the Paris Opera. This post he retained until the Revolution reduced him to poverty. He died at St. Germain on Nov. 19, 1810.

Noverre's friends included Voltaire, Frederick the Great and David Garrick (who called him "the Shakespeare of the dance"). The ballets of which he was most proud were his *La Toilette de Vénus, Les Jalousies du sérail, L'Amour corsaire* and *Le Jaloux sans rival.* Besides the letters, Noverre wrote *Observations sur la construction d'une nouvelle salle de l'Opéra* (1781); *Lettres sur Garrick écrites à Voltaire* (1801); and *Lettre à un artiste sur les fêtes publiques* (1801).

NOVGOROD (formerly known as *Velikiy-Novgorod,* Great Novgorod), a town of Russia, in the Leningrad area, in 58° 33′ N., 31° 20′ E., on the navigable Volkhov, 2 m. below the point where it issues from Lake Ilmen. Pop. (1926) 31,120. The town has saw-mills and manufactures boots and shoes, candles, bricks and tiles and has a brewery and a distillery.

The date at which the Slavs first erected forts in the marshy region of the Volkhov near Lake Ilmen is unknown. That situated on a low terrace close by Lake Ilmen was soon abandoned, and Novgorod or "New-town" (in contradistinction to the Scandinavian Aldegjeborg or Ladoga) was founded by Scandinavian searovers as Holmgård on another terrace which extended a mile lower on both banks of the river. The older fort (Gorodishche) existed in the 13th century. Even in the 9th century the new city on the Volkhov exercised a kind of supremacy over the other towns of the lake region, when its inhabitants in 862 invited the Varangians, under the leadership of Rurik, to the defence of the Russian towns of the north. Down to the end of the 10th century Novgorod to a certain extent depended on Kiev; yet in 997 its inhabitants obtained from their prince Yaroslav a charter which granted them self-government. For five centuries this charter was the bulwark of the independence of Novgorod. From the end of the 10th century the princes of Novgorod, chosen either from the sons of the great princes of Kiev (until 1136) or from some other branch of the family of Rurik, were always elected by the *vyeche;* but they were only its military defenders, and their delegates were merely assessors in the courts which levied taxes for the military force raised by the prince. The *vyeche* invariably expelled the princes as soon as they provoked discontent. Their election was often a subject of dispute between the wealthy and the poorer classes; and Novgorod, which was dependent for its corn supply upon the land of Suzdal, was sometimes compelled to accept a prince from the Suzdal branch instead of from that of Kiev. After 1270 the city often refused to have princes at all, and the elected mayor was the representative of the executive. Novgorod in its transactions with other cities took the name of "Sovereign Great Novgorod" (*Gospodin Velikiy Novgorod*). The supreme power was vested in the *vyeche.* The city, with a population of over 80,000, was divided into wards, each ward constituting a distinct commune. The wards were subdivided into streets, which corresponded to the occupations of their inhabitants, each being quite independent with regard to its own affairs.

Trade was carried on by corporations. By the Volkhov and the Neva, Novgorod—then known also as Naugart and Novwerden—had direct communication with the Hanseatic and Scandinavian cities, especially with Visby or Wisby on the island of Gotland. The Dnieper brought it into connection with the Bosporus, and

it was an intermediary in the trade of Constantinople with northern Europe. The Novgorod traders penetrated to the White Sea shores, hunted on Novaya Zemlya in the 11th century, colonized the basins of the northern Dvina, descended the Volga, and as early as the 14th century extended their trading expeditions beyond the Urals into Siberia. Two great colonies, Vyatka and Vologda, organized on the same republican principles as the metropolis, favoured the further colonization of north-east Russia.

It is said that the population of Novgorod in the 14th century reached 400,000, but the pestilences of 1467, 1508 and 1533 carried off no fewer than 134,000 persons. These figures seem to relate rather to the whole Ilmen region.

Invasions of Novgorod.—Novgorod's struggle against the Suzdal region (now the government of Vladimir) began in the 12th century. In the following century it had to contend with the Swedes and the Germans, who were animated not only by the desire of territorial acquisition, but also by the spirit of religious proselytism. Their advances were checked by battles at Ladoga and Pskov in 1240 and 1242 respectively. Protected by its marshes, Novgorod escaped the Mongol invasion of 1240–2, and repelled the attacks of the princes of Moscow by whom the Mongols were supported. It also resisted the attacks of Tver.

The first serious invasion, in 1332, was rolled back with the aid of the Lithuanians. But in 1456 the great prince of Moscow imposed a heavy tribute. Ivan III. of Moscow took possession of the colonies in the northern Dvina and the Perm regions, and began two bloody wars, during which Novgorod fought for its liberty under the leadership of Martha Boretskaya, the mayor. In 1475–1478 Ivan III. entered Novgorod, abolished its charters, and carried away 1,000 of the wealthier families, substituting for them families from Moscow; the old free city then recognized his sovereignty. A century later Ivan IV. (the Terrible) abolished the last vestiges of the independence of the city. Having learned that a party favourable to Lithuania had been organized in Novgorod, he took the field in 1570, and entered the city (much weakened by the recent pestilences) without opposition. His followers killed the heads of the monasteries, the wealthier of the merchants and clergy, and burned and pillaged the city and villages. No fewer than 15,000 were massacred at Novgorod alone (60,000 according to some authorities). A famine ensued, and the district of Novgorod fell into utter desolation. Thousands of families were transported to Moscow, Nijni-Novgorod, and other towns of the principality of Moscow.

In the beginning of the 17th century Novgorod was taken and held for seven years by the Swedes; and in the 18th century the founding of St. Petersburg (now Leningrad) finally destroyed its trade. Its position on the water highway from the Volga to St. Petersburg and on the trunk road from Moscow to the capital, still gave it some commercial importance; but even this was destroyed by the opening of the Vishera canal, connecting the Msta with the Volkhov below the city, and by the construction of the railway from St. Petersburg to Moscow, which did not reach Novgorod. Later a branch loop linked the town with the main line and its position improved.

Antiquities.—The town consists of a Kremlin (old fortress), and of the city, which stands on both banks of the river, connected by a handsome stone bridge. The Kremlin was much enlarged in 1044, and again in 1116. Its stone walls, originally palisades, were begun in 1302, and much extended in 1490. Its historical monuments include the cathedral of St. Sophia, built in 1045–1052 by architects from Constantinople to take the place of the original wooden structure (989), destroyed by fire in that year. Apart from minor changes the building remained unaltered until its restoration in 1893–1900. It contains highly-prized relics, including 12th century bronze doors, one brought reputedly from Sigtuna, the ancient capital of Sweden. Another ancient building in the Kremlin is the Yaroslav tower. Other remarkable monuments are the church of St. Nicholas (1135), the Snamenski cathedral (14th century), and churches of the 14th and 15th centuries. Within the town itself there are four monasteries and convents, two of them dating from the 11th century and two from the 12th century; and the large number in the immediate neighbourhood shows the great extent which the city formerly had. A monument to commemorate the 1,000th anniversary of the foundation of Russia (the calling in of the Varangians by Novgorod in 862) was erected in 1862. Another monument commemorates the repulse of the Napoleonic invasion of 1812.

NOVI PAZAR (ancient *Rashka*), the capital of the department of Novi Pazar, South Serbia, Yugoslavia, lies at the head of the fertile valley of the Upper Rashka, on the site of the ancient Serbian city of Rashka. Pop. (1921) 11,207, comprising Serbs, Albanians and some Greeks. Agriculture is the only industry. There are Roman baths in the vicinity, and in the old church of St. Peter and St. Paul, the metropolitan church of the bishopric of Rashka, Stephen Nemanya, founder of the Serbian empire, passed from the Roman to the Greek church in 1143. The town was taken by the Serbs and Montenegrins in the Balkan Wars (1912–13), and assigned to Serbia by the Treaty of Bucharest (1913).

NOVI SAD (German *Neusatz*), a town of the Voivodina, Yugoslavia. Pop. (1921) 39,147. It is the seat of a Greek Orthodox bishop, and is a prosperous town with wide, well-paved streets, public gardens, a cathedral, a hospital, schools, theatres and barracks. Novi Sad is the headquarters of one of the five Army provinces, and outside the town is a large aerodrome. There is a daily market for household commodities, and for the artistic pottery and cotton goods manufactured in the town. Before the union of the province with Yugoslavia at the close of the World War (1914–18) Novi Sad was the literary and religious centre of the Serbians in Hungary, especially since the foundation in 1864 of the *Matica Srbska*, or Serbian Literary Society. The town was founded in the middle of the 18th century, and was almost totally destroyed during the revolution of 1848–9.

NOVOCAINE, an artificial alkaloid, and the most satisfactory of the local anaesthetics introduced in recent years. The hydrochloride is employed in medicine ($C_{13}H_{21}O_2N_2Cl$) and it is a substitute for cocaine. It is very soluble in water and for subcutaneous injections is far superior to cocaine for several reasons: its solutions can be sterilized by boiling whereas cocaine would decompose; it has no irritant action and is of very low toxicity, whereas cocaine is both irritant and toxic. (*See* DRUG ADDICTION and COCAINE.)

NOVOCHERKASSK, a town of Russia in the North Caucasian area, at the confluence of the Don and Aksai rivers, in 47° 28′ N., 40° 5′ E. Pop. (1926) 55,448. It manufactures cloth and machinery and is a collecting centre for corn, wine and timber exports. It was founded in 1805, when the inhabitants of Old Cherkassk were compelled to leave the site because of the frequent inundations of the Don.

NOVO-GEORGIEVSK, now PLOTSKOI (*q.v.*).

NOVOMOSKOVSK, a town of the Ukrainian S.S.R., 16 m. N.E. of Dnepropetrovsk (Ekaterinoslav), in 48° 38′ N., 35° 16′ E. Pop. (1926) 10,564. It extends some distance along the right bank of the Samara river, a tributary of the Dnieper; its main industry is brick-making. The Zaporogian Cossacks occupied the site in the 17th century, when it was known as Samarchik. In 1687 Prince Golitsuin founded the Ust-Samara fort here, destroyed after the Treaty of Pruth (1711), but rebuilt in 1736. Near it is the Samarsko-Nikolayevskiy monastery.

NOVOROSSIYSK (nŏv-ŏ-rŏss'isk), Russian port on N.E. coast of the Black Sea in 44° 42′ N., 37° 45′ E., in the North Caucasian area. Pop. (1926) 65,887. It has connections with the net of Russian railways, with Baku, and with Rostov-on-Don. It has large cement works, and its exports are mainly cement, naphtha, potash, leaf tobacco and champagne, its imports being machinery, coke and coal. Its grain export-trade, formerly about 70%, is insignificant at present (1928), naphtha and cement having largely replaced it. The bay, nearly 3 m. wide at its entrance and 5 m. deep from east to west, is exposed to the violent north-east wind (bora), sweeping down from the Caucasus. There is accommodation for 36 steamers. The town became Russian in 1829.

NOVO-SIBIRSK (formerly Novo-Nikolayevsk), the chief town in the Siberian Area of the Russian S.F.S.R., in lat. 55° 6′ N., long. 83° 6′ E., situated on the navigable Ob river, where the

trans-Siberian railway crosses it on a 9 span bridge 30 ft. above high water level. The town was founded in 1896, but had in 1926 a population of 120,771. In 1915 a branch line was opened from Novo-Sibirsk going through Barnaul, with a branch to Biisk, and on to Semipalatinsk, and a link with the railways of the Central Asiatic Russian republics is being pushed forward rapidly (1928). There is telegraphic communication with Mongolia. The town is a centre for distributing agricultural machinery. There are also grain elevators, one with a capacity of 16,070 tons, and several well set up flour mills. Butter trains, with ice trucks, start daily for the west, and frozen meat is also exported to Leningrad and Moscow. There are three electric sawmills in Novo-Sibirsk dealing with the timber from this region. The town also exports the woodcock, hazelhen and quails. Other industries are brickmaking, iron-smelting, oil pressing, distilling, brewing, and leather preparation.

NOWATA, a city of north-eastern Oklahoma, U.S.A., in the valley of the Verdigris river; the county seat of Nowata county. It is served by the Missouri Pacific and electric railways. Pop. (1920) 4,435 (83% native white). It is the trade centre of a farming, stock-raising, and oil-producing region. The city was founded in 1889, when the Missouri Pacific came through, and was incorporated in 1892. Since 1913 it has had a commission-manager form of government.

NOWAWES, a town of Germany, in the province of Brandenburg, 2 m. E. from Potsdam, on the Berlin-Potsdam railway. Pop. (1925), 26,957. The town was founded by Frederick the Great in 1754 and in 1907 the village of Neuendorf was incorporated with it. Its industries include the spinning and weaving of jute and silk and the manufacture of cloth, electrical apparatus, boots and locomotives.

NOWELL, ALEXANDER (1507?–1602), dean of St. Paul's, London, son of John Nowell of Read Hall, Whalley, Lancashire, was educated at Brasenose College, Oxford, where he is said to have shared rooms with John Foxe. He was elected fellow of Brasenose in 1526. He became master of Westminster school (1543), and prebendary of Westminster (1551). In Mary's reign he was deprived of his prebend, probably as being a married man, before May 1554, and sought refuge at Strasbourg and Frankfort, where he developed puritan and almost presbyterian views. He submitted, however, to the Elizabethan settlement of religion, and was rewarded with the archdeaconry of Middlesex, a canonry at Canterbury and in 1560 with the deanery of St. Paul's. His sermons occasionally created some stir, and on one occasion Elizabeth interrupted his sermon, telling him to stick to his text and cease slighting the crucifix. He held the deanery of St. Paul's for forty-two years, surviving until Feb. 13, 1602. Nowell is believed to have composed the Catechism inserted before the Order of Confirmation in the Prayer Book of 1549, which was supplemented in 1604 and is still in use. Early in Elizabeth's reign he wrote a larger catechism, to serve as a statement of Protestant principles; it was printed in 1570, and in the same year appeared his "middle" catechism, designed for the instruction of "simple curates."

See R. Churton, *Life of Alexander Nowell* (1809); G. Burnet, *History of the Reformation* (new ed., 1865); and R. W. Dixon, *History of the Church of England.* Also the *Works* of John Strype; the *Publications* of the Parker Society; the *Calendar of State Papers, Domestic;* and the *Dict. Nat. Biog.*, vol. lv.

NOWGONG, a town and district of British India, in the Brahmaputra valley division of Assam. The town is situated on the Kalang river. The district of Nowgong has an area of 3,699 sq.m. and a population (1921) of 397,921. It consists of a wide plain overgrown with jungle and canebrakes, intersected by numerous tributaries of the Brahmaputra, and dotted with shallow marshes. The Mikir hills cover an area of about 65 m. by 35 in the south of the district; the highest peak is about 3,500 ft. The slopes are very steep, and are covered with dense forest; reserved forests cover 500 square miles. The Kamakhya hills near the bank of the Brahmaputra are about 1,500 ft. high. On the summit of the highest peak is a celebrated temple of Kamakhya, the local goddess of love, where three annual festivals are held. The staple crop is rice. Tea cultivation and manufacture are carried on but the soil and climate are not so favourable as in Upper Assam. The section of the Assam-Bengal railway from Gauhati to the hills passes through part of the district, and a branch runs through it from Chaparmukh to Silghat steamer station. Lumding is a railway centre of some importance.

NOWGONG, a town of India, headquarters of the Bundelkhand agency and a military cantonment, in the state of Chhatarpur, on the border of the British district of Jhansi. Pop. (1921) 7,141. It has accommodation for a force of all arms. The college for the education of the sons of chiefs in Central India, opened here in 1872, was abolished in 1898, owing to the small attendance.

NOWY SANCZ, town, Poland, in the province of Cracow. Pop. (1921), 26,300. It grew to importance along with the capital through the oriental trade in the 14th century and owed much to the patronage of Casimir the Great. It is situated near the Carpathians, in the beautiful valley of the Dunajec, in the country of the Gorale or Polish Highlanders. It has a church originally founded by the Franciscans in the 14th century.

NOYES, ALFRED (1880–), English poet, was born in Staffordshire on Sept. 16, 1880, and educated at Exeter college, Oxford. *The Loom of Years,* his first volume of poems, appeared in 1902, and his *Collected Poems* in 1910, 1920, and 1927. His *Forty Singing Seamen* (1907) and *Drake* (1908) struck the patriotic note of a poet of the sea. A volume of lectures given in America, *The Sea in English Poetry,* was published in 1913, and in 1914 he was elected to a professorship of modern English literature at Princeton university, which he resigned in 1923. He was a frequent contributor to *Blackwood's Magazine,* the *Cornhill,* etc. His other publications include: *The Wine Press* (1914); *A Salute from the Fleet* (1915); *Rada* (a play, 1915); *Walking Shadows* (short stories, 1917); *The Elfin Artist* (new poems, 1920); *The Watchers of the Sky* (1912); *The Hidden Player* (a novel, 1912); *Aspects of Modern Poetry* (essays, 1924); *The Book of Earth* (1925) and a poetic drama, *Robin Hood,* produced in 1927.

NOYON, a city of N. France, in the department of Oise, 67 m. N.N.E. of Paris by the railway to Brussels. Pop. (1926) 5,891. Noyon is built at the foot and on the slopes of a hill.

Noyon, the ancient Noviomagus Veromanduorum, was christianized by St. Quentin at the end of the 3rd century; and about 530 St. Medard, bishop of the district of Vermandois, transferred his see thither from St. Quentin. St. Eligius was bishop in the 7th century, Pepin le bref was crowned here in 752 and his infant son Carloman was then crowned king of Noyon, Charlemagne was crowned here in 768 and Hugh Capet elected in 987. Till the Revolution the bishopric was one of the ecclesiastical peerages of the kingdom. At the beginning of the 12th century Noyon obtained a communal charter through the favour of its bishops. Towards the middle of the 12th century the diocese of Tournai was split off. Noyon was ravaged by the English and the Burgundians during the Hundred Years' War. The city was captured by the Spaniards in 1552, and by the Leaguers, who were expelled in 1594 by Henry IV. John Calvin was born here in 1509.

Noyon was occupied by the German army in 1914 and was abandoned, bombarded and reduced to ruins 1917–18. Its beautiful transitional Romanesque Gothic cathedral was burned, and so was the old *hôtel-de-ville.* A good deal of the stone work of the cathedral survived the fire and it is being restored, the work on the chapter house being now (1928) practically completed. The town has good trade in live stock and grain and contains chemical and artificial manure works and iron foundries.

NUBA, THE. The Nuba may be regarded as the negro or negroid aborigines of Kordofan, although at the present day the northern half of this area is inhabited by Arabic-speaking tribes professing Islam, so that Dar Nuba, the country of the Nuba, occupies only the southern half of the administrative province, extending over 2½° to 10° N.

One of the most remarkable features of Dar Nuba is the multiplicity of languages spoken within its bounds. The inhabitants of hills only a few miles apart may speak languages mutually unintelligible, and even on the same *massif,* there may be two or three communities speaking different languages and coming little in contact with one another, though their customs and beliefs are fundamentally the same.

The inhabitants of the hills of southern Kordofan situated but little north of the Bahr-el-Ghazal have a series of languages with grammatical structure and vocabularies differing substantially from the Berberine dialects. The resemblances noted between the latter and those of Kordofan apply only to those spoken by a limited number of northern communities which have been subjected to foreign, *i.e.* Berberine, influence for a considerable period. Moreover, as Meinhof points out, such "Nubian" or "Hamitoid" languages extend scarcely a hundred miles south of El Obeid. Further south in the territory recognized by the Arabs as the true home of the Nuba (Dar Nuba corresponding on the administrative side roughly to the Jebel sub-province) two groups of languages must be recognized. One includes a number of "Sudan" languages, the other a series of tongues, called by Meinhof "pre-Hamitic," which, in some respects, resemble Bantu and Fulani and which Struck now terms "Bantoid." These latter languages, first noted in 1910, differ from the Berberine dialects, in which grammatical changes in both nouns and verbs are produced by suffixes, in that in the Bantoid languages these are brought about by initial change.

Struck, who has also studied the Nuba physical material available from the standpoint of its distribution among the linguistic groups considers that each is to be distinguished physically, and although the small number of individuals measured belonging to the Nubian and Sudanic groups renders some of Struck's conclusions premature it is probably true to say that the Bantoid group, with an average stature of 68in. and a cephalic index of 76·5, is rather longer headed and narrower nosed than the Sudanic who are themselves rounder-headed than the Nubian-speaking group from whom they do not substantially differ in breadth of nose or face.

Mode of Life.—The Nuba are for the most part agriculturists, the regulation of public life in each community being ultimately in the hands of the rainmaker. There is no clan organization among the southern Nuba and no restrictions upon marriage other than those imposed by blood relationship. No bride-price is paid, and either party can break the marriage at pleasure; property passes in the female line. This applies especially to the southern communities speaking Bantoid languages; further north, where a bride-price is paid, matters are less simple. Neither circumcision nor infibulation is practised, but the women of Jebel Talodi and the hills round it perforate the lower lip, in which they wear a quartz ornament. On many hills, especially where the lip ornament is worn, the lower incisors are removed in both sexes.

Darfur.—The non-Arab races of Darfur belong ethnically to, or originated from (many are now mixed) the hill stock, spoken of in Kordofan as Nuba (*supra*). In the north are the Bedayat, a nomad people related to Zaghawa; to the north of these are the Kura'an, who have been identified with the ancient Garamantes. The Zaghawa to the south are mentioned by Mas'udi, while Ibn Khaldun speaks of them as living further east, and at the present day there is a colony of them at Jebel Kagmar in Kordofan. These folk, although Mohammedans, have not yet given themselves Arab pedigrees; they retain their belief in rainmakers and are noted as potters. The people of Jebel Midob about 400m. west of Khartoum, described by MacMichael, differ but little from the Nuba of Kordofan; they are perhaps the least unknown of the pagan tribes of Darfur. The Tungur and Dargu are other ancient peoples of Darfur, the latter living by cultivation and breeding cattle in the fertile areas to the west of Dara. None of these peoples are as important as the Fur, from whom the country takes its name. Their stronghold is or was the considerable range known as Jebel Marra, whence they descended probably in the 17th century. Now nominally Mohammedans they still worship stones or trees to the extent that certain spots associated with rocks or trees are regarded as holy and are the scenes of sacrifice. (C. G. S.)

NUBAR PASHA (1825–1899), Egyptian statesman, was born at Smyrna in January 1825, the son of an Armenian merchant named Moghreditch, who had married a relative of Boghos Bey, an influential minister of Mehemet Ali. He was educated at Vevey and by the Jesuits at Toulouse. After some eighteen months' training as secretary to Boghos, who was then minister of both commerce and foreign affairs, he was made second secretary to Mehemet Ali. In 1845 he became first secretary to Ibrahim Pasha, the heir apparent, and accompanied him on a special mission to Europe. Abbas Pasha, who succeeded Ibrahim in 1848, maintained Nubar in the same capacity, and sent him in 1850 to London as his representative to resist the pretensions of the sultan, who was seeking to evade the conditions of the treaty under which Egypt was secured to the family of Mehemet Ali. Here he was so completely successful that he was made a bey; in 1853 he was sent to Vienna on a similar mission, and remained there until the death of Abbas in July 1854. The new viceroy, Said, at once dismissed him from office, but two years afterwards appointed him his chief secretary, and later gave him charge of the important transport service through Egypt to India. Here Nubar was mainly instrumental in the completion of railway communication between Cairo and Suez. After a second time falling a victim to Said's caprice and being dismissed, he was again sent to Vienna, and returned as principal secretary to Said, a position he held till Said's death in January 1863.

On the accession of Ismail Pasha, Nubar Bey was in the prime of life. He was already on friendly terms with Ismail; he even claimed to have saved his life—at all events, it was a coincidence that the two had together refused to travel by the train the accident to which caused the death (on May 14, 1858) of the prince Ahmed, who would otherwise have succeeded Said. Ismail charged him with a mission to Constantinople, to notify his accession, and to smooth the way for various projects, notably the completion of the Suez Canal, the change in title to that of khedive and the change in the order of succession. The sultan, believing as little as every one else that the canal was anything more than a dream, gave his consent at a price the moderation of which he must afterwards have regretted. The gratified Ismail created Nubar a pasha, and the sultan himself, persuaded to visit Cairo, confirmed the title so rarely accorded to a Christian. Nubar was sent to Paris to complete the arrangements, and to settle the differences between Egypt and the Canal Company.

On his return Nubar created the department of public works; but in 1866 he was made minister of foreign affairs, and at once went on a special mission to Constantinople, where he obtained the sultan's consent to the adoption by Ismail of the title of Khedive and the change in the law of succession. Nubar now had a harder task to undertake than ever before. The antiquated system of "capitulations" which had existed in the Ottoman empire since the 15th century had grown in Egypt to be a practical creation of seventeen *imperia in imperio*. (*See* EGYPT: *History*.) That in spite of the jealousies of all the powers, in spite of the opposition of the Porte, he should have succeeded in replacing the seventeen consular courts by mixed international courts with a uniform code, puts him in the first rank of statesmen of his period.

The extravagant administration of Ismail, for which perhaps Nubar can hardly be held wholly responsible, had brought Egypt to the verge of bankruptcy, and Ismail's disregard of the judgments of the Court at last compelled Great Britain and France to interfere. Under pressure, Ismail, who began to regret the establishment of the International Courts, assented to a mixed ministry under Nubar, with Rivers Wilson as minister of finance and de Blignières as minister of public works. Nubar, finding himself supported by both Great Britain and France, tried to reduce Ismail to the position of a constitutional monarch, but he lost the support of Great Britain and France, and was dismissed. (*See* ISMAIL.) Nubar remained out of office until 1884, when he was induced to become premier as the instrument of British policy, but he presently found himself in disagreement with Lord Cromer, and was dismissed by the khedive Tewfik in 1888.

Riaz Pasha, who succeeded him, was, with one interval of eight months, prime minister until April 1894, when Nubar returned to office. By that time Cromer had more completely grasped the reins of administration as well as of government, and Nubar had realized more clearly the rôle which an Egyptian minister was called on to play: Lord Cromer was the real ruler of Egypt, and

the death of Tewfik in 1890 had necessitated a more open exercise of British authority. In 1895 Nubar completed his fifty years of service, and retired. He died in Paris in January 1899.

NUBIA, a region of north-east Africa, bounded by Egypt, the Red sea and the Libyan desert, and extending south indefinitely to about Khartoum. It includes the Nile valley from Aswan near the first cataract to the confluence of the White and Blue Niles, stretching for about 560 m. between 16° and 24° N. Nubia, however, has no strictly defined limits, and is little more than a geographical expression. It is first associated historically, with the Nobatae, a negro people removed by Diocletian from Kharga oasis to the Nile valley above Egypt, whence the Blemmyes had been driven eastwards. From Nūba, the Arabic form of the name of this people, comes the modern Nubia.

The country consists mainly of sandy desert and rugged and arid steppes and plateaux through which flows the Nile. In this section of the river there occurs a continuous series of slight falls and rapids, and between Khartoum and Philae it makes a great S shaped bend, the region west of the Nile within the lower bend being the Bayuda Desert, and that east of the Nile the Nubian Desert, which districts roughly correspond to the conventional divisions of Upper and Lower Nubia respectively. Most of Nubia is within the almost rainless zone. An auriferous district lies between the Nile and the Red Sea, in 22° N. Politically the whole of Nubia is now included either in Egypt or the Anglo-Egyptian Sudan and has no administrative existence.

The life and agriculture of Egypt and the Sudan depend upon the Nile, which, for a great part of its course, flows through Nubia. To make irrigation possible in Egyptian territory a dam was constructed at Aswan, and barrages at Esna, Asyut and Zifta. Until 1919 the Nile waters were utilized solely by Egypt, but in that year the Sudan Government commenced a scheme to irrigate part of the Great Gezira plain by an enormous dam across the Blue Nile at Sennar, above Makwar, which was completed in 1925, when irrigation commenced and 300,000 feddans of land were irrigated. The cotton produced in this area is estimated at 40,000,000 lb. of lint. A barrage is in course of erection at Jabal Awliya (Gebel Aulia) about 35 m. south of Khartoum on the White Nile. Work was suspended in 1921 but recommenced in 1925.

Proposals have also been put forward to build a dam at the foot of Lake Albert in Uganda territory, to put a second dam across the Upper Blue Nile above the Sennar dam and also to erect a barrage at Nagh Hamadi in Egypt. The Government of Egypt naturally watches very closely the construction of irrigation works in the upper reaches of the Nile, so that the whole irrigation problem of the Nile bristles with economic, and unfortunately, political difficulties which have more than once assumed a very serious character. The construction of barrage works at Lake Tsana, in Abyssinia, has been suggested for the purpose of regulating and increasing the flow of water down the Blue Nile. This has led to a political controversy between Great Britain, Italy and Abyssinia. Attention has also been directed to the river Gash for irrigation purposes.

Linked up with the problem of irrigation is that of communication in this region. The railway from Alexandria and Cairo terminates at Aswan. The Nubian portion of the Nile is served by rail from Wadi Halfa via Berber, Khartoum to Sennar, with branches from the north of Abu Hamed to Merowi, from Sennar to El Obeid crossing the White Nile at Kosti, and from Berber eastwards to the Red sea at Port Sudan and Suakin. From Haiza Junction on the latter section a branch passes southwards to Kassala and it is proposed to continue it to Sennar. (X.)

ARCHAEOLOGY

The archaeology of Nubia begins with a rare palaeolithic (Acheulian) implement of white quartz from Faras below the Second Cataract. Prehistoric settlements of the copper age spreading from Upper Egypt reached Dakkeh in the early period and held an isolated post at the Second Cataract in the later period. About the time of the 1st dynasty the two cataracts and all the intervening valley were occupied by small communities with the same culture as their Egyptian neighbours, but with two distinctive features in the grave deposits—the best pottery is soft but very thin with brilliant black polish inside, the outside yellow brown variegated with red haematite, and the palettes are of local quartz instead of slate. This culture seems to have soon disappeared. The Pharaohs of the 5th and 6th dynasty sent exploring and trading parties through Nubia and drew contingents for their armies from the Wawat, Aam, Meza and other tribes; but except some fortresses and an advanced trading post at Kerma beyond the Third Cataract they have left little trace. After the fall of the Old Kingdom a native civilization (known as the C-group) sprang up and long flourished between the first two cataracts. No dwellings of these nomad pastoral people have been recognized; they buried their dead in pits beneath orderly circular heaps of stones in the desert at some distance from the river. They used much leather, their black or red polished bowls are decorated with elaborate strap-work or plaited patterns, sometimes intensified by filling with white or with red, yellow and green earths; they made also the "prehistoric" sort of haematitic polished black-mouthed and other kinds of ware. Wawat ŏf the valley and Meza (Beja, Blemmyes of the eastern desert?) alone were then the mercenary soldier tribes. The mother of Amenemhe I., founder of the 12th dynasty, was a Nubian and it is likely that these C-group people were on excellent terms with Egypt throughout that dynasty, whereas beyond the Second Cataract "Cush" appears as the object of conquest, and a series of elaborate fortresses was built all through the cataract region, each with its temple, up to Kerma, the residence of a wealthy Egyptian governor, who imported Egyptian statuary and manufactures and skilled workmen, and developed native-coloured industries in pottery, glazed-ware, etc. The Egyptian governors, and the native kings who succeeded them after the fall of the 12th dynasty, were interred in huge tumuli with multitudes of slaves and retainers buried alive in native fashion. The dead were laid on beds with their daggers, spears and knives; ostrich feathers and figures cut out of sheets of mica adorned the persons of the chiefs; exquisite haematitic pottery abounds, highly polished with grey and orange line between the black top and the red. Kerma was a great city in the midst of a barbarous and benighted kingdom of Cush (very different from the uniform wide-spread C-group), and only isolated burials of the same character generally associated with Egyptians, are found throughout Lower Nubia and Egypt.

Amasis I., his brother and founder of the 18th dynasty, began or added to the temple of Buhon, near Halfa, and in the next reign the Cushite kingdom was crushed out of existence. The first viceroy of the whole region was appointed by Thutmosi I. and entitled "king's son," a title which was afterwards changed to "king's son of Cush" or perhaps "son of the king of Cush," and the southern outpost of the empire was established by Thutmosi III. at Napata. Every king of the 18th dynasty built one or more temples in Nubia or had a shrine cut for him in the rock by his viceroy, and some kings built many temples. The most splendid was that of Soleb dedicated to himself and Ammon by Amenhotep III., who also built a lesser one at Sedēnga to the divinity of his queen, Taia; its name Ha-taia survives to this day in the place-name Adai. The series continued under Seti I. and Rameses II. in the 19th dynasty. The latter is everywhere between the first two cataracts. His new temples and shrines include the two great temples at Abusimbel to himself and Queen Neferteri, also Gerf Husên, Beit el-Weli, Wadi Sabu'a, Dirr, Ibrim, Faras, Aksha; and like Seti I. he was active in far off Napata. After Rameses II. only modest stelae or graffiti are found; even these cease at the end of the 20th dynasty. By the time that Thutmosi III. established his empire, Nubia had no independent vigour left, and even the C-group people had faded away to nothing. The antiquities of Nubia under the New Kingdom, both large and small, are entirely Egyptian. They include at Anibe tombs built with pyramidal roofs like those of Deir el-Medineh. The land between the First and Second Cataracts, *i.e.*, apparently the region named Wawat, was divided into districts like the nomes of Egypt with separate rulers. The first was centred at Dakkeh (Baki), the second at Anibeh (Maam), and the third opposite Halfa (Buhon), the capital in each case apparently at the southern end of its

district. Each was presided over by a Horus-divinity, representing the power of Pharaoh and dating back to the 12th dynasty, when strong fortresses existed at each of these places. There were also smaller districts subject to Hathor-goddesses, Bīgeh to Hathor of Senemt, and Faras to Hathor of Ibshek, whereas in the old Kingdom we hear only of a god Dedun of aromatic Nubia. In the shrines built further south in the New Kingdom the gods of the empire naturally take the lead—Amen-rē‘ of Thebes, Harmachis of Heliopolis and Ptah of Memphis.

The chiefs of Libyan mercenaries in Egyptian pay founded princely families at the southern outpost at Napata. The earliest of the Ethiopian-Libyan princes was buried at Kurrū with his flint-tipped arrows. A few generations later, about 725 B.C., Pankhy, after extending his power over Upper Egypt, triumphed completely over Tefnakhte of Sais. With artisans brought from Egypt Pankhy added to and adorned the temple of Ammon at Napata. The conquest of Egypt by Shabako followed and the throne of the Pharaohs was occupied for about 50 years by Ethiopians. Under the first two, Shabako and Shebitku, building proceeded in Egypt, but in Nubia their only monuments are pyramids in the ancestral burial place at Kurrū. The third Pharaoh, Tirhaqa, built more than one temple at Napata and the first and by far the largest pyramid of a new group at Nūri; at Sanam opposite Napata he built a temple and the extensive cemetery has many relics of his reign. Even in Lower Nubia, at Buhon and at Ibrīm, Tirhaqa's name occurs on temple-constructions and isolated graves have been found of his time. When his nephew, Tandamane, retired from Egypt before Psammetichus I. the line of Ethiopian kings continued to reign at Napata, with a palace also at Meroe, and were buried at Nūri. But their borrowed Egyptian culture fell lower and lower. Their sculptures and inscriptions, their glazed amulets and ushabti became ever more barbarous; mummification was abandoned and crouched burial, hand-made pottery (some of it reminiscent of prehistoric black-mouthed ware) became the rule. The pyramids lost their enduring form and sacrificed solidity to height. In Lower Nubia the only records of this time are graffiti of the Greek and Syrian mercenaries of Psammetichus II. (594–589 B.C.) on the colossus of Abusimbel, which must fall in the reign of Aspalta according to Reisner's chronology. The Persians are said to have invaded Ethiopia under Cambyses in 522, but they left no mark, and Ethiopians served in the army of Xerxes. According to Dr. Reisner, Meroe became the chief capital of the Ethiopians about 300 B.C.

At length, towards the end of the 3rd century, Ergamenes, a contemporary of Philadelphus who broke the political power of the priests at Napata, and certainly built his pyramid at Meroe, seems to have joined with Philopator (Ptolemy IV.) in adding to the temple of Isis at Philae and founding a new shrine of Thoth at Dakkeh; Azakheramani, succeeding him, built a shrine at Debod and gave aid to the rebel native kings of Thebes, Harmakhis and Ankhmakhis, until they were suppressed by Epiphanes (Ptolemy V.). The Triacontaschoenus between the first two cataracts was now claimed by the Ptolemies, but nothing was done there after Euergetes II., and his activity was probably confined to the Dodecaschoenus, the southern end of which at Dakkeh commanded the route to the gold mines of the Wadi Allāgi. The natives of Nubia, subject to Meroe, were beginning to acquire wealth and culture and had pushed up, chiefly on the west bank, to the frontier of the Dodecaschoenus.

UNDER AUGUSTUS

After the conquest of Egypt by Augustus the first prefect appointed or agreed to a native ruler for the Triacontaschoenus, but while the next prefect was engaged in Arabia, an army under the command of the Meroitic crown-prince, Akinirar, in the reign of Teriteqas and Amenirenas-Candace, attacked and captured Philae, Syene and Elephantine, and established itself at Dakkeh (Pselcis). Petronius, however, the third prefect, quickly captured their headquarters, almost annihilating the Meroitic army, and following up the Nile, reached Napata and destroyed it. After a Roman garrison had held Ibrīm for several months Augustus decided to limit the possessions of the empire above Syene to the Dodecaschoenus, and soon temple-building began again in this Roman territory all along the west bank, the east bank being more open to attack from the Blemmyes of the desert. The punitive expedition of Petronius had been disastrous for the Meroites from Napata northward, and two centurions who spied out Ethiopia for Nero found nothing but scattered villages and a very impoverished people. Prosperity returned, and in the reign of Natakamani and his queen Amanitēre Candace a temple was built at Amāra between the Second and Third Cataract; the Napata temple was restored and important buildings were erected in the far south at Nāga and Ben-nāga and Meroe itself, towards the end of the 1st century A.D. The Faras cemetery, a type of many others, now becomes full of graves with decorated wheel-made pottery in abundance, vessels of bronze and glass, bead necklaces and trinkets, indicating a large and prosperous community. Many of the objects were imported; much is childish or in bad taste, but some of the local pottery is handsome in shape and decoration and much, such as the well-preserved barbotine cups, is of archaeological interest. The traditional hand-made wares (except black topped red ware) also recur. A century later the pottery is all wheel-made but less varied and interesting though still quite characteristic. Dating from A.D. 252 is a very long inscription in demotic writing at Philae recording a religious mission sent to the temple by King Teqreramani, whose monuments are amongst the latest found at Meroe. During all this time the Dodecaschoenus remained outside the Meroitic rule, and its antiquities are of Late Roman style and totally distinct from the Meroitic series on the other side of the border line. Soon after this date the Meroitic culture in Lower Nubia was destroyed by the Blemmyes of the eastern desert who from time to time laid waste Upper Egypt. About A.D. 285 Diocletian withdrew the garrisons from the Dodecaschoenus and invited the Nobadae from the western desert to settle there, subsidising them as a protection against the Blemmyes. The remnants of Meroitic civilization in the south were wiped out early in the 4th century by Aeizanes the powerful king of Axum. The Blemmyes were now established in the valley of the Dodecaschoenus and as far up the Nile as Ibrīm and their king reigned at Talmis (Kalabsheh). In the middle of the next century the Nobadae united with the Blemmyes in fresh outrages on Egypt; they were compelled by Florus in 452 to keep the peace for a hundred years but were allowed to visit the temple of Philae and borrow the statue of Isis for consultation in their own country. About the end of that century Silco, king of the Nobadae, conquered the Blemmyes from Ibrim to the First Cataract. We next discern at least five peoples in Nubia; the Nobadae in the valley between the two cataracts with capital probably Pachoras; the Blemmyes in the eastern desert; the Makurians (perhaps the old Magabari) south of the Nobadae, with capital perhaps at Dongola; and the kingdom of 'Alwa (Alodia) with capital 'Alwa or Sōba on the Blue Nile near Khartoum. In A.D. 543 the pagan temple of Philae was definitely closed and the statues then taken to Constantinople. A Christian missionary, Julian, of the Monophysite creed, with Theodore the bishop of Philae, began the conversion of the Nobadae, and after an interval of 18 years the conversion was consolidated by Longinus, another Monophysite, from 569 onwards. At about that time, under a king Eirpanome, the temple of Debōd was converted into a church. In 580 Bishop Longinus accepted the invitation of the king of 'Alwa and was escorted by the friendly Blemmyes through the deserts to the Blue Nile; 'Alwa at once became Christian, although the intervening Makuria remained stoutly pagan for a time.

Little is known of the history of Christian Nubia. For a century Lower Nubia probably enjoyed peace and prosperity. Makuria and Nobadia uniting in one Christian kingdom ruled from Dongola. In 652 a Muslim army from Egypt under 'Abd-allah-ibn Sa'ad captured Dongola, and required all the inhabitants of the kingdom to pay tribute to Egypt. Arabic historians often refer to the dealings of Egypt with Nubia, and the names of many kings are known from literary sources or from monuments, some of them being native as the above Eirpanome and Kudanbes (A.D. 1320), others biblical, as David, Abram, others again Christian-Greek as Basil, Mercurius.

The churches in Nubia were singularly small, when not simply adaptations of heathen temples or parts of them, or of tomb-grottoes. The more pretentious were built with carved stone columns and lintels, the walls of stone up to the level of the windows and above that of crude brick; others were entirely of crude brick, for which material in the more rainy districts of the south burnt brick was substituted. Many bear the marks of Muslim ruin and progressively inferior repair, with inappropriate re-use of the carved stones. There were two principal types, basilican and domed. The apse was single with altar in front and a sacristy on either side; the nave was with aisles, the ambo on the north side of the nave, a chamber at the north-west corner and a stairway to the roof at the south-west corner. Painted figures of Christ, saints and angels, and scenes from the Old and New Testaments covered a large part of the walls. Little now remains of them, much having been ruined in the last hundred years, not only by the natives, but by archaeologists clearing away without record all Christian work from the temples. Pottery was, as always in Nubia, the best product of the arts, the most attractive sort being shallow cups of fine thin ware coated with a thick white slip and painted in various designs in sepia.

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NUBIAN LANGUAGE AND WRITING. Nubian is the name given to the language of the Barabra or Nubians in the Nile valley, between Merawi, a few miles below the ancient Napata, and the First Cataract at Aswān. It has here two principal dialects, the Mahass-Fadīja being spoken in the central portion, from a little south of the Third Cataract, and the Dongola-Kenzi at either end of the region; the speech of these Barabra is now pervaded with Arabic words. Moreover, in the hills of Kordofān, dialects of Nubian are spoken by many small communities amongst other languages only remotely akin, and are found westward as far as eastern Darfūr. Nubian is without gender, agglutinative and mainly monosyllabic. Nubian roots are traceable in Ethiopian geographical names handed down by classical authors; but perhaps the chief interest of the language is its use in the writings of the Nubian Church. Probably to fortify their independence against Muslim encroachment, the Nubians adapted the Greek alphabet, with necessary additions from the Coptic and perhaps the Meroitic alphabets, to the purpose of writing their own language. The rare examples of Nubian writing that have been discovered, besides graffiti and two legal documents, comprise portions of a lectionary, homilies and edifying narratives, obviously translated from Greek and not from Coptic. The earliest dates from the end of the 8th century, the latest from the beginning of the 14th.

See H. N. Almquist, *Nubische Studien im Sudān 1877–78* (ed. Zetterstéen), Uppsala, 1911 (Bibl.); F. Ll. Griffith, *The Nubian Texts of the Christian Period*, Berlin, 1913; H. Junker and W. Czermak, *Kordofān Texte im Dialekt von Gebel Dair*, Vienna, 1913.
(F. Ll. G.)

NUBIANS: *see* BARABRA.

ÑUBLE, a province of central Chile, bounded on the north by Maule, east by the Argentine Republic, south by Concepción and west by Concepción and the Pacific ocean. Area, 4,592 sq. m. including the *departamento* of Itata added in 1928; pop. (1920) 210,763 including that of Itata. The province lies partly in the great central valley of Chile, noted for its fine climate and fertility, and partly on the western slopes of the Andes. The Itata river, which forms the southern boundary, and its principal tributary, the Nuble, form the drainage system of the province. Agriculture and grazing are the principal industries. Wheat is largely produced, and there are vineyards in some localities. Stock-raising is pursued in the east. The State railway from Santiago to the southern provinces passes through Nuble, from north-north-east to south-south-west, and sends off a branch from Bulnes west to Tomé on the Bay of Concepción. The capital is Chillán, pop. (1920) 30,881, and the only other important town is Bulnes. The hot baths of Chillán, in the eastern part of the province on the slope of the volcano of that name, are very popular in Chile.

NUCERIA, an ancient city, Magna Graecia, on the west coast of Italy near the modern Nocera Tirinese. It was a small city in an important strategic position between two rivers, the valley of one of which affords a route to the valley of the Crathis, but had no harbour.

NUCLEUS, in biology the term first introduced by Miescher (1871), employed to describe a structure found in the cells of which the tissues of animals and plants are composed. In general it is a viscous spherical body containing a structure known as the *plasmosome* (or *nucleolus*) and a tangle of material *chromatin* characterised by a special affinity for basic dyes. The importance of the latter is set forth in the article on CYTOLOGY (*q.v.*). Discrete nuclear structures can be found in many micro-organisms, but cannot be identified with certainty, as yet, in the living substance of bacteria and *Cyanophyceae* (blue-green algae).
(L. T. H.)

NUCLEUS. Modern physical research has led to the theory that an atom of any given element, far from being the minute, impenetrable solid entity which it was supposed to be before the discovery of the electron, is a very open structure. It consists of a small, relatively compact particle at the centre, carrying a net positive charge, which is surrounded by a number of electrons sufficient to make the atom, as a whole, neutral. This central particle, in which practically the whole mass of the atom is concentrated, is exceedingly small, even compared to the atom. It is about a million-millionth of a centimetre in diameter, while the atom itself is a few hundred millionths of a centimetre across. These figures must not be taken to do more than give a rough estimate of the kind of sizes in question, for not only is it difficult to define precisely the size of a particle without a sharp boundary, such as an atom or its parts, but also the size is known to vary somewhat from atom to atom. The minute central particle is called the nucleus of the atom, the term having been first suggested by Rutherford in 1912 (*Philosophical Magazine*, xxiv, 461), to whom the nuclear theory owes its origin.

The nuclear theory of the atom is discussed under ATOM, where, however, attention is directed mainly to the widely-spaced electrons which surround the nucleus, the nucleus itself being considered merely as supplying a central attractive force which governs the number and behaviour of these electrons. In this article the properties of the nucleus itself will be treated in more detail.

Nuclear Properties.—The nucleus being at the centre of the atom, and surrounded by a strong electric field, is inaccessible to ordinary laboratory agencies, such as heat, strong electric or magnetic fields, mechanical pressure, and so on. Chemical combination affects only the outer regions of the atom, and has no influence on the nucleus itself. Nuclear properties are therefore atomic properties, rather than molecular properties: that is, they persist unchanged as properties of the atom, no matter how it may be combined. Such a property is mass, which has been experimentally shown, to a very high degree of accuracy, to be unchanged by chemical reactions. Another property of the nucleus is its net positive charge, which determines how many electrons an atom can possess in its neutral state, and so determines its chemical properties, since a given number of electrons controlled by a given central charge take up a definite disposition. To these mass and charge properties of the nucleus we attribute the existence of isotopes (*q.v.*), since, as we shall see, a given nuclear charge is not invariably associated with the same nuclear mass. The radioactive properties, which no laboratory agent can produce or modify, hurry up, or slow down, are also of an atomic nature. There is strong evidence that the radioactive processes which give rise to the discharge of α-, β-, and γ-rays arise in the

nucleus: radioactivity is a nuclear process. It is, in fact, mainly from the radioactive side that our knowledge of nuclear structure, scanty though it may be, has come.

The experiments, mainly carried out by Aston, which have established firmly the existence of isotopes, reveal the net charge and mass of the nucleus, but tell us little of any mechanism which may exist within the nucleus. We may therefore say that the study of isotopes reveals the static properties of the nucleus. On the other hand radioactive processes arise in energy charges which are taking place within the nucleus. Their study reveals the dynamical aspect of the nucleus.

Origin of the Theory of the Nucleus.—Rutherford was led to enunciate the nuclear theory of the atom as a result of a study of the scattering of α-particles by matter. The α-particles are atoms of helium, carrying a positive charge $2e$ (where e is the magnitude of the electronic charge), which are shot off spontaneously by certain radioactive bodies. (*See* RADIOACTIVITY.) The α-rays from a given radioactive element are homogeneous in velocity (except for a few longer range particles present in certain cases), and thus provide a very valuable instrument for investigation. Those from Radium C, for instance, which have been chiefly, though not exclusively, used for the scattering experiments, are discharged with a velocity of about $1{\cdot}922\times10^{9}$ cm./sec., and an energy of $1{\cdot}224\times10^{-5}$ ergs. Swift α-particles can be detected by their action on a phosphorescent screen. If a surface be covered with phosphorescent zinc sulphide, which is the substance usually employed, and the soft glow produced in the sulphide by the near presence of a radioactive substance be examined with a low power microscope, it is found that the light is not uniform, but made up of evanescent specks of light, which are referred to as scintillations. These scintillations are due to the impact of α-rays on the screen. (*See* RADIOACTIVITY.) With suitable precautions every α-particle can be made to produce a scintillation so long as its energy has not been too much diminished by passage through matter before the impact. A phosphorescent screen placed at right-angles to the path of a pencil of α-rays gives us, then, a method of ascertaining how many α-particles fall in a given time within a given small area, that is, proceed in a given direction, and it is by the scintillation method that the scattering of α-particles has been investigated. A narrow beam of α-rays of homogeneous velocity, say from a source of Radium C, produces a sharp spot on the screen. If a very thin metal foil be introduced in the path of the beam the spot loses its sharp outline and becomes diffuse, and a study of the scintillations makes it possible to say what fraction of the particles has been deflected through a given angle by the passage through the foil.

Studying the scattering in this way Geiger and Marsden found that the distribution of the scattered particles in the neighbourhood of the original beam was such as to accord with the view that each particle had suffered a large number of encounters, each encounter producing a small deflection in a random direction. In other words, the scattering through small angles obeys a law which can be calculated from the theory of probability, applied to calculate the final effect of many scatterings in chance directions. In addition to these α-particles scattered through small angles there are a few scattered through large angles, and among these there are even some that have been so far deflected from their original direction that they issue from the foil on the same side as they went in, being thus, in a sense, "reflected." It might at first be supposed that a large number of small deflections conspire to produce such a very large deflection, but, from the probability considerations that give the distribution for small angle scattering, the number of particles to be anticipated at any given large angle can be calculated, and turns out to be far less than the number of large angle scatterings actually observed. In other words, there are far too many particles scattered through large angles for it to be possible to explain them on the basis of a multiple scattering through small angles in random directions. It was from this apparently insignificant quantitative observation that the nuclear theory sprang.

In 1911 Rutherford pointed out that large angle scatterings of the α-particle, in the number actually observed, could only be explained as the result of single encounters with very intense centres of force. To provide those centres of force he assumed that each atom contained a central positive charge, with which the mass of the atom was associated, the remainder of the atom being made up of rings of electrons, maintained in a stable position by rotation. The central charge (or nucleus, as it was called later) was assumed to occupy a very small space, the diameter being taken as of the order 10^{-12} cm. in Rutherford's original paper. It becomes clear that in this case very few of the α-particles passing through a thin foil, which may be some thousands of atoms thick, will approach near the nucleus: rather they will pass near outlying electrons in several atoms, experiencing a small deflection at each near passage. This accounts for the distribution of the particles deflected through small angles. An occasional α-particle, however, will pass close to the nucleus, and will then experience, owing to the intense field of force caused by the big positive charge, a deflection which will be the larger the closer the approach. We thus distinguish between two different processes, multiple scattering, which denotes repeated small deflections in the majority of the particles which traverse the foil, and single scattering, which denotes the occasional very large deflection due to passage close to the nucleus. With foils such as are used in the experiment the chance of a given α-particle experiencing more than one close approach to a nucleus, and hence more than one large deflection, is negligibly small.

This theory of single scattering survives severe quantitative tests. With the help of the simple theory of the dynamics of a particle, as applied in elementary considerations of planetary motion, the behaviour of a particle projected towards another particle repelling it with an inverse-square law of force can be easily worked out. Let the mass of the nucleus be so large that it may be considered infinite, and let its charge be Ze, where e is the magnitude of the electronic charge: let the mass, charge and velocity of the α-particle be M, E and v. Then it can be shown that

$$p = \frac{ZeE}{Mv^2}\cot\tfrac{1}{2}\varphi$$

where p is the length of the perpendicular from the centre of the nucleus onto the original direction of motion, and φ is the angle through which the particle is deviated. (Fig. 1.) This gives a relation which can clearly be used to find the chance of a given large angle of deviation, since the probability of a given p can be found immediately if we know the number of nuclei (*i.e.*, of atoms) per unit area of foil. If n be the number of atoms per unit volume, t the thickness of the scattering foil, the chance q of a particle having an original direction such that p lies between p_1 and p_2 is

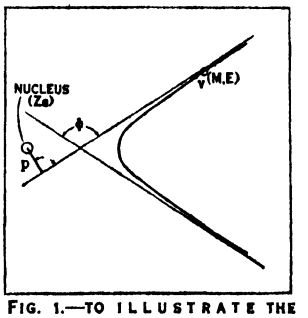


FIG. 1.—TO ILLUSTRATE THE THEORY OF SINGLE SCATTERING OF PARTICLES BY A HEAVY NUCLEUS

$$q = \pi(p_1^2 - p_2^2)\, nt$$

so that the fraction of the incident particles deviated at an angle between φ_1 and φ_2 is

$$q = \pi\frac{Z^2e^2E^2}{M^2v^4}\, nt\,(\cot^2\tfrac{1}{2}\varphi_1 - \cot^2\tfrac{1}{2}\varphi_2).$$

Since it is usual to arrange the little phosphorescent screen so as to be normal to the particular direction of scattering which is being investigated the equation is usually transformed so as to give the number **A** of particles turned through a given angle φ which fall per unit of area on such a screen placed at distance r from the point where the original beam hits the foil. This is

$$\mathbf{A} = \frac{QntZ^2e^2E^2\operatorname{cosec}^4\tfrac{1}{2}\varphi}{4r^2M^2v^4} \qquad (1)$$

when Q is the number of particles in the original beam.

Now this formula can be checked experimentally:

(1) By measuring the number of particles turned through dif-

ferent large angles, to investigate the proportionality to cosec $4\frac{1}{2}\varphi$.

(2) By investigating the connection between the number scattered at a given fixed angle φ and the velocity: the number should be inversely as the fourth power of the velocity.

(3) By varying the thickness of the foil, and measuring the variation of the number of particles scattered at a given fixed angle, which should be proportional to the thickness.

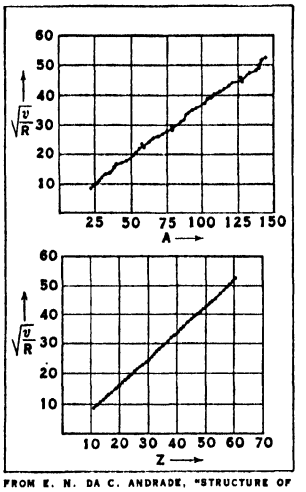
In these points the formula was satisfactorily confirmed. The proportionality to thickness is particularly important. Quite apart from the formula, it is easy to see that the theory of single scattering gives this result, since the number of nuclei behind a given surface area of foil is proportional to the thickness, and the chance that the close approach needed for large angle scattering shall take place with more than one nucleus is negligibly small with the thicknesses of foil which are practicable. On the other hand any theory of multiple scattering gives a proportionality to the square root of the thickness of foil.

To help the reader to form an idea of the chance of a single scattering through a large angle, and of the unlikelihood that a single particle shall make two encounters of the type which lead to such scattering, the following picture may be offered. One of the thicker gold foils used in the scattering experiments, actually some few hundred-thousandths of an inch thick, may be considered to be magnified until it is a mile thick. The centres of the individual gold atoms will then be about a yard apart. The α-particle on the same scale will be represented by a tiny grain of dust, something less than a thousandth of an inch across. To be deflected through 45° this grain, in its passage through the mile-thick foil, must pass within four thousandths of an inch of one of the yard-separated centres. For larger angles of scattering an even closer approach is necessary.

The large angle scattering of α-particles thus afforded, at the hands of Rutherford, certain evidence as to the nuclear structure of the atom. The great advantage of the α-particle as a probe to investigate the fields of force which make up atomic structure is, firstly, that a single radioactive element gives a beam of homogeneous velocity, and, secondly, that single particles can be detected. A great deal of work has been done on the scattering of β-particles, from which a degree of confirmation of these views as to the mechanism of single scattering and multiple scattering can be derived. The intermediate case, where the number of deflections suffered by a particle is neither one, nor very large, also comes into account with β-particles with a certain thickness of foil and a certain angle of scattering. The problem of β-ray scattering, while of considerable interest, has not, however, on the whole, given us any fresh information on the nucleus, and therefore only receives passing reference here. It should not, however, be forgotten that, as a result of experiments on the absorption by matter of electrons of different speeds, including β-rays, Lenard, as long ago as 1903, put forward the view that the impenetrable part of the atom was very small. This impenetrable part, however, he considered to be located in a large number of small electrical doublets, which he called dynamids, each dynamid being, as a whole, electrically neutral. While this view has perforce been abandoned it is of great historical importance.

The Charge and Mass of the Nucleus.—If the elements be arranged in order of atomic weight, and then numbered successively, starting with hydrogen as 1, helium as 2, and so on, the number pertaining to a given element is known as the atomic number, a number often denoted by Z, which symbol is used throughout this article. The charge on the nucleus is then Z times the magnitude of the electronic charge e. That this is so was first suggested by van den Broek in 1913, and confirmation of his hypothesis was speedily furnished by the experiments of Moseley. Moseley used the method of crystal reflection, which had just been discovered by W. H. and W. L. Bragg (*see* under article X-Rays), to measure the wave length of the characteristic X-rays given out by different elements subjected to suitable electronic bombardments, and found that the X-ray spectrum of every element conformed to a single type, consisting of a group of a few lines of shorter wave length and another group of a few lines of longer wave length. These groups corresponded to the so-called K and L radiations discovered by Barkla from the difference of their penetrating power, and were accordingly called the K and the L series.

The K and L radiations are characteristic of the atom, not of the molecule: they are not affected by the state of chemical combination in which the atom may be held (except for certain small secondary effects, discussed under X-rays, *Röntgen*). Moseley found that the wave length of a given line in the X-ray spectrum decreased from element to element, taken in order of increasing atomic weight, and also that the frequency of such a line followed a simple law. This law, known as Moseley's Law is that, if corresponding lines be selected in the spectra of the various elements, then the square root of the frequency increases by a constant amount from element to successive element. Now while the atomic number, as defined, increases by 1 from element to element, the atomic weight increases by irregular steps. The law is exhibited in fig. 2, where $\sqrt{\nu/R}$ is plotted above against atomic weight, below against atomic number: it is obvious that regularity exists in the latter case only. Here ν is the frequency of the selected line, in the case of fig. 2 the so-called Kα line, and R is the constant, of fundamental importance for the theory of line spectra, known as Rydberg's constant. (*See* Spectroscopy.) These results clearly show that there is some fundamental feature of the atom which is proportional to the atomic number, but has no reference to the atomic weight. A comparison of the simple formulae found by Moseley for the relationship between the frequency of the X-ray lines and the atomic number Z, which can be written



FROM E. N. DA C. ANDRADE, "STRUCTURE OF THE ATOM" (G. BELL & SONS)

FIG. 2.—THE SQUARE ROOT OF THE FREQUENCY OF AN X-RAY SPECTRAL LINE PLOTTED (ABOVE) AGAINST ATOMIC WEIGHT, AND (BELOW) AGAINST ATOMIC NUMBER, SHOWING THAT A SINGLE RELATION EXISTS IN THE LATTER CASE ONLY

$$\frac{\nu}{R}=(Z-1)^2\left(\frac{1}{1^2}-\frac{1}{2^2}\right) \text{ for the } K\alpha \text{ line}$$

and

$$\frac{\nu}{R}=(Z-7.4)^2\left(\frac{1}{2^2}-\frac{1}{3^2}\right) \text{ for the } L\alpha \text{ line}$$

with the general formula, deduced by Bohr, for a series in the line spectrum of a hydrogen-like atom (*see* Atom), namely

$$\frac{\nu}{R}=Z^2\left(\frac{1}{n'^2}-\frac{1}{n^2}\right)$$

where Ze is the nuclear charge, shows that Moseley's Z, multiplied by e, must also be the nuclear charge. The constants subtracted from Z in Moseley's formula represent, speaking roughly, a shielding effect of the inner electrons. (*See* X-Rays.) Thus Moseley's work, as represented by fig. 2, proves that the net positive charge on the nucleus is given by the atomic number, which thus has a fundamental significance for the nuclear theory of the atom. Moseley's linear relation is shown by more recent experiment not to be exact, but the departure, which is in the sense of a slightly more rapid increase of $\sqrt{\nu}$ with increasing Z, does not affect in any way this deduction, the curve remaining smooth, and the deviation from linearity being attributable to secondary effects.

The magnitude of the nuclear charge can be deduced directly from experiment by applying the formula (1) for single scattering, whose verification has already been discussed. **A** can be experimentally determined, by counting the scintillations due to particles scattered through a given large angle; n is known from the atomic weight and the density; the thickness t of the foil can be easily

measured; e, E, M, v are all known; and r and φ merely express details of the experimental disposition. The only unknown in the equation is therefore Z. Rutherford in his original paper merely made a rough estimate, from which he conjectured that Z was about half the atomic weight, which is, in fact, a fair approximation. In 1920 Chadwick carried out the scattering experiments in a modified form, with greater accuracy, and obtained for platinum, silver, and copper values of Z which were respectively 77·4, 46·3, and 29·3. The atomic numbers of the elements in question are 78, 47, and 29 respectively, so that the hypothesis that the number of electronic charges, of positive sign, in the nucleus is equal to the atomic number has been confirmed by the scattering experiments for elements of widely different atomic number.

The nuclear theory of the atom has been confirmed by another method of studying single scattering. The Wilson cloud chamber (*q v.*) gives us a method of rendering visible the path of an α-particle, by means of a condensation of minute droplets of water on the ions produced by its passage. A study of photographs of these so-called ray tracks shows that some of the tracks end in forks, both prongs of the fork making an angle with the original direction of the α-ray. The one prong is due to the α-particle itself, turned through a large angle by collision with a nucleus of a gas atom, the other prong is due to the struck nucleus, which likewise produces ionisation, and consequent condensation, along its path. A single photograph will not enable us to measure accurately the angle which the forked tracks make with one another and with the original ray, since the plane containing the three paths makes an unknown angle with the direction from which the photograph is taken. If, however, two photographs are taken of a single ray track, from mutually perpendicular directions, it is a simple matter of geometry to find these angles. Now, on the assumption that the collision of α-particles obeys the ordinary laws of mechanics for the collision of perfectly elastic bodies (conservation of energy and momentum) it is easy to calculate a theoretical value for the angles involved in the collision, but such a calculation involves the ratio of the mass of the struck particle to that of the striking particle Comparison of the theoretical and experimental values enables us to find a value for this ratio. Blackett, from a study of the passage of α-particles through oxygen, obtained in this way for the mass of the oxygen nucleus 16·72, which is in good enough agreement with the chemically known value 16. Examples of his photographs are given in the article WILSON CLOUD CHAMBER. Calculation shows that if the masses of striking and struck particles are equal, a case that can be realized experimentally by letting α-particles pass through helium, the two branches of the fork should always be at right angles to one another, no matter what angle the α-particle itself be turned through. This result has also been confirmed experimentally, the actual value found being, for instance, 89° 27′ in one case. Since all the calculations are based upon the assumption that the whole mass of the atom is concentrated in a minute nucleus these ray track experiments give a brilliant confirmation of this feature of the theory.

The Size and Field of Force of the Nucleus.—In the case of an entity like the nucleus, whose existence is revealed to us by experiments on the deflection of particles, no definite boundary is defined by the conditions, and we must discuss what we mean by its size before we can attempt to form an estimate of it. Let us first consider what we mean by size in the case of other entities. In the case of an ordinary body, such as a metal wire, we can measure the thickness either by visual methods, such as the use of a reading microscope, depending upon the fact that there is an abrupt change of optical properties at the surface of a metal (revealing itself, for instance, by a reflection of the light taking place at a definite plane) or by mechanical methods, such as a micrometer screw. The reading of the micrometer depends to a slight extent upon how hard we screw it up, or the recorded size of the wire depends upon the force we exert. In other words, what we are really measuring is the place at which the resistance to the jaws changes abruptly, the force being negligibly small just outside the surface, and increasing rapidly but continuously as we force the jaws together. In the case of the dimensions of an atom, as measured by methods depending on the kinetic theory of gases, the diameter of the atom is taken as the distance between the centres of two atoms at the moment of closest approach. This depends markedly upon the relative speed of the two atoms, decreasing as the speed increases, that is, as the temperature of the gas is raised. The size of the atom usually accepted is that given by the distance of closest approach in a gas at ordinary temperatures, but some other methods, such as the distance of closest approach of atoms in a crystal of known structure, may also be used, and give somewhat different values.

We note the condition of arbitrariness in statements of atomic size: an atom has no sharp boundaries. Similarly, some convention must be adopted in speaking of the size of the nucleus of the atom. Either we can make an attempt to estimate the distance between the centres of the nucleus of an atom and of the α-particle at the moment of closest approach, the α-particle having a given velocity, or we can investigate the distance from the centre at which the inverse-square law of repulsion breaks down. Whether this distance be called the size of the nucleus is a matter of definition, and in any case it becomes necessary to state within what degree of accuracy we require the inverse-square law to be obeyed outside the boundary so specified. As with the atom, what we call the size is, within limits, a convention.

The investigations of the scattering of α-particles, to which extensive reference has already been made, shows that with gold, for instance, the inverse-square law holds in cases where the angle of scattering is anything between 5° and 150°, since the formula (1) is based upon the assumption of an inverse-square law, and it represents experimental fact within this range of angle. For an actual head-on collision, the distance b of closest approach of centres is given by

$$\tfrac{1}{2}Mv^2 = \frac{ZeE}{b}$$

from which b can be calculated, and for an angle of scattering of 150° the distance of closest approach is only slightly greater. This gives 3×10^{-12} cm. as an upper limit for the radius of the gold nucleus. A study of the photographs of the forked ray tracks also enables us to estimate limits within which the inverse-square law holds, and leads to the conclusion that it is still valid for a distance 7×10^{-12} cm. between centres of nucleus and α-particle in the case of argon and 3×10^{-12} cm. in that of air. The dimensions of the helium nucleus are probably smaller than those of the heavier nucleus, so that the general results of these estimates is 3×10^{-12} cm. as the order of nuclear radius, as compared to 2×10^{-8} cm. as the order of atomic radius. It may be added that the approach for the smaller angles at which the scattering law holds indicates that the inverse-square law is still valid at distances as great as $\cdot36\times10^{-10}$ cm. for gold, 5×10^{-10} cm. for air and 10^{-9} cms. for argon, or a space surrounding the nucleus of the order 10^{-10} cm. in radius is free from any marked concentration of electrons.

Rutherford has experimentally studied the impact of α-particles on hydrogen nuclei, as further described when the disruption of the nucleus is considered. He comes to the conclusion that, while for very slow α-particles the number of hydrogen nuclei (to which the name protons, suggested by Rutherford, is often applied) knocked forward at different angles agrees with that calculated on the assumption of an inverse-square law of repulsion between the striking and the struck nuclei, with fast α-particles the number thrown directly forward is much larger than is to be anticipated on this basis, a fact which he explains by supposing that at very close approach of α-particles and hydrogen nucleus the α-particle (helium nucleus) behaves as if flattened into a plate-like form, the plane of the plate being normal to the path of the nucleus, or, since the collision in such cases of very close approach is practically "head-on," to the line joining the centres of the two nuclei. This would clearly give a preferential projection of the struck nucleus in the line of motion of the α-particle. Chadwick and Bieler experimented on the direction in which hydrogen nuclei were thrown forward by α-particles, by letting α-particles pass through a thin film of paraffin wax: the fact that the hydrogen atoms are here combined with carbon atoms has no effect on the

behaviour of the nuclei, the forces of chemical binding being negligible compared to those involved in these collisions. Applying Rutherford's line of argument to these experiments, they came to the conclusion that an α-particle behaves in these collisions like an oblate spheroid of semi-axes 8×10^{-13} and 4×10^{-13} cm., the proton being treated as a point charge, on account of its presumably very simple structure.

To investigate in detail the departure of the field of force surrounding a nucleus from the inverse-square law it is clearly necessary to force the α-particle which acts as our probe as close to the nucleus as possible. The energy of the α-particle cannot be made to exceed that offered by the natural radioactive sources, so that two courses are open:

(1) to investigate the scattering by light elements, where the nuclear charge is low, and so the nuclear field comparatively weak;

(2) to work with very large angles of scattering, which correspond to intimate approach.

Rutherford and Chadwick therefore examined the scattering by foils of aluminium and magnesium, choosing fixed large angles, namely 135° and 90°. They used α-particles of different energy, obtained from Radium C by the interposition of absorbing screens of various thickness, to vary the distance of approach. They found that the inverse-square law was followed with both these elements for distances of approach greater than $1{\cdot}5\times10^{-12}$ cm., but that the ratio of the number actually scattered to the number calculated on the inverse-square law rapidly decreased for closer approach, then attained a minimum and increased again. The minimum was found at 7×10^{-13} cm. for magnesium ($Z=12$) and for a slightly greater distance of approach in the case of aluminium ($Z=13$). The closest distance of approach measured was 6×10^{-13} cms. With gold and silver ($Z=79$ and $Z=47$), where the nuclear field is strong, the inverse-square law was obeyed up to the closest distance of approach obtainable, about 3×10^{-12} cm. and 2×10^{-12} cms. respectively. If we may treat in these experiments the α-particle as a point-charge these results can be interpreted to mean that, with the aluminium and magnesium nuclei at any rate, the repulsive force exerted by the nucleus decreases for distances between 15×10^{-13} and 7×10^{-13} cm., but increases again for closer distances, the inverse-square formula being taken as a standard of comparison. A physical explanation can be given by supposing that the outer parts of the nucleus consist of a layer of positive charge, within which is a layer of negative charge; when the α-particle penetrates the positive layer the effective nuclear charge is diminished, but when it goes further and penetrates the negative layer, the effective nuclear charge increases again. This conception receives further reference when the radioactive nuclei are discussed.

These experiments confirm and extend earlier results found with aluminium and magnesium, which indicated that the inverse-square law held to within one per cent or so for distances greater than 3×10^{-12} cm. Speaking generally, then, we may say that the radius of nuclei, apparently not very different for different elements, is of the order 2×10^{-12} cm., in the sense that at this distance there is a rapid change in the law of force, while it is possible to force a proton to within a distance of 4×10^{-13} cm. from the centre of an α-particle.

Very interesting results have been obtained by Rutherford and Chadwick in their recent (1927) experiments on the scattering of α-particles by helium. The difficulty presented by the fact that a gas like helium cannot be obtained in a thin plate was surmounted by the use of diaphragms, which isolated an incident and a scattered pencil of rays in such a way that all particles reaching the phosphorescent screen must have come from a small annulus of the gas. The experiments were complicated by the fact that both scattered particles and struck nuclei are of the same nature, but skilful interpretation of the results allowed definite conclusions to be drawn. It was deduced that, for central collision, departure from the inverse-square law occurs at distances of about $3{\cdot}5\times10^{-13}$ cm. between the centres, while for glancing collisions (small angles of scattering) the departure occurs at about 14×10^{-13} cm. This indicates a plate-like form for the α-particles, confirming the conclusions reached by Chadwick and Bieler from an exhaustive study of the collision of the α-particles with hydrogen nuclei.

It does not appear that these results are to be attributed to the departure from the classical laws of mechanics embodied in the new wave-mechanics (*see* QUANTUM THEORY), but rather that they are best explained on ordinary mechanical principles applied to a field of force departing from the inverse-square. Rutherford has suggested tentatively that the departures have their physical origin in a definite magnetic moment associated with the helium nucleus, which produces a magnetic force becoming prominent at distances of the order of 4×10^{-13} cm. The turning couple due to two such magnetic moments would explain the orientation of the particles during collision. Of course a magnetic moment must be assumed for the proton itself, the moment of the helium nucleus being a resultant of the moments of its components. The introduction of a consideration of magnetic forces, so long neglected in the internal physics of the atom, seems likely to prove fruitful in the future.

We are faced with the paradox that, while the nucleus must, as we shall see, contain electrons (in the case of a heavy element like gold a great many electrons) yet the size of the nucleus is not much larger than that of the electron, for which the diameter is generally given as 4×10^{-13} cm. The size of the electron, however, is far less directly determined than that of the nucleus. The estimate just quoted is based upon the assumption that the mass is entirely electro-magnetic, and is that which is produced by a distribution of the electronic charge throughout the volume of a small sphere. The electromagnetic mass of such a sphere, moving at slow speeds, is

$$m=\frac{4e^2}{5a}$$

where e is the charge in electromagnetic units, and a is the radius. If instead we assume that the charge is spread over the surface of the sphere we have

$$m=\frac{2e^2}{3a}.$$

Where so little is known it does not matter which formula we adopt. The assumption of such a formula is our only way of obtaining an estimate of the size of the electron, for there is no way at present known of investigating the field of force round an electron, which is the only really significant thing. The paradox of the approximate equality of electronic and nuclear size is therefore really explained by the fact that little significance can be attached to the value given for the radius of the electron, and we may further say that, whatever the radius of a free electron, the radius of an electron in close combination with other electrons and protons may be quite different.

The Structure of the Nucleus.—The constitution of the nucleus has been the subject of much speculation. The positive charge is ultimately due to the presence in the nucleus of protons, whose mass is that of the hydrogen atom and whose positive charge is 1 in terms of the electronic charge. If these were the only constituents the atomic number of any nucleus should be equal to its mass in terms of hydrogen as 1, but it is well-known that the atomic number—the *net* positive charge—is always markedly less than this, being usually less than half of the atomic weight. This indicates that the nucleus itself must contain a number of electrons, whose presence diminishes the positive charge, but leaves the mass practically unaltered. The expulsion of β-particles of very high energy might be taken to indicate the presence of such electrons in the nuclei of radioactive elements, but the occurrence of the β-particles by itself would not be convincing, as they might, without further experiments, be supposed to come from the outer parts of the atom, being ejected by a secondary action of nuclear γ-rays. However, it is found that strong β-radiators are transformed to elements whose chemical behaviour indicates a place in the periodic table corresponding to an increase of atomic number by unity, that is, to a gain of one unit of positive charge by the nucleus. This is equivalent to the loss of one electron by the nucleus, so the behaviour of radioactive ele-

ments affords strong evidence for the presence of electrons in the nucleus.

The occurrence of elements of different chemical properties, but the same mass, the so-called isobares (*see* ISOTOPES), also indicates a difference of nuclear charge with no difference of nuclear mass, which can be best explained as the effect of a difference in number of electrons in the nucleus. For the addition of an electron to the nucleus will diminish Z by 1, but not appreciably change the mass. The existence of isotopes (*q.v.*) is also easily explained upon the hypothesis that the nucleus is ultimately built up of protons and electrons. Isotopes are elements which have the same chemical properties, that is, the same Z, but different masses. If, to a given nucleus we add n protons and n electrons we do not change the charge, but increase the mass by n units.

It being established that the nucleus consists of protons and electrons, the question arises as to whether any special combinations exist as sub-groups within the nucleus. The expulsion of α-particles by radioactive nuclei suggests that, inside heavy nuclei at any rate, we have particles composed of four protons and two electrons, existing as particularly stable units. The stability of the α-particle is further discussed in the last section of this article. Meitner has further invoked the existence of particles composed of four protons and four electrons to explain certain peculiarities of the transformations of the radioactive families. (*See* RADIOACTIVITY.) Two of the electrons are assumed to be less firmly attached than the other two, so that the combination is really a neutralised α-particle. When one electron leaves such a neutralised α-particle, the rest is assumed to become unstable, so that a sequence of changes is to be expected, in which two β-ray emissions and one α-ray emission are associated in some order or other. In the general run of the radioactive transformations this does, in fact, occur, as, for example, where Thorium emits an α-particle, changing to Mesothorium I, followed by two β-ray changes, or where Uranium Y is transformed with a β-emission, to be followed by an α and a β change. The branching of the radioactive series (such as follows, for example, the transformation of Radium B), where a β emission is followed either by a β and an α change, or alternatively by an α and a β change (*see* RADIOACTIVITY) is also explicable on Meitner's hypothesis.

The hypothesis that the nucleus of radioactive atoms contains α-particles, each neutralised by two tightly bound electrons, has also been used by Rutherford to explain the origin of the α-rays. The α-particle, with its double positive charge will be strongly repelled if it once be released from whatever forces may be supposed to bind it in the nucleus. We can calculate the energy with which the particle will leave the atom, supposing it to be all gained by virtue of the work done on it by the nuclear field of force, if we know the distance from the centre of the nucleus at which it starts. Thus the charge on the rest of the nucleus being $Z'e$, while $2e$ is the charge on the α-particle, this energy is

$$\frac{2Z'e^2}{r}$$

which, taking the slowest α-particle, that from Uranium I, with energy $4{\cdot}07\times10^6$ electron-volts, gives the value $6{\cdot}3\times10^{-12}$ cm. for r, and any assumption that the α-particle possesses an initial velocity would lead to an increased value of r. Scattering experiments, however, show that the inverse-square law holds for distances as small as 3×10^{-12} cm., which could not be the case if there were particles with two positive charges in the region of the nucleus indicated by the above estimate. If, however, the α-particles at distances 6×10^{-12} cm. from the centre of the nucleus normally exist in a neutralised state they will have no effect on the scattering, and the two estimates can be reconciled. The electrons which neutralise the α-particles cannot, of course, exist in the kind of outer orbits which they occupy for the neutral helium atom, for there would be no room for them, but must be held in some much more intimate manner. Rutherford's supposition is that the neutral α-satellite, as we may call it, is attracted to the central bulk of the nucleus by the polarisation forces set up in it by the nuclear field, and that, controlled by these forces, the satellite executes a quantum orbit, something like that of an electron in the outer parts of the atom. (*See* ATOM.) When the satellite loses, by some unknown mechanism, its two electrons, it is repelled, gaining its final velocity of expulsion in its passage to confines where the nuclear field is negligible. The electrons are retained by the nucleus, and ultimately discharged in β-ray

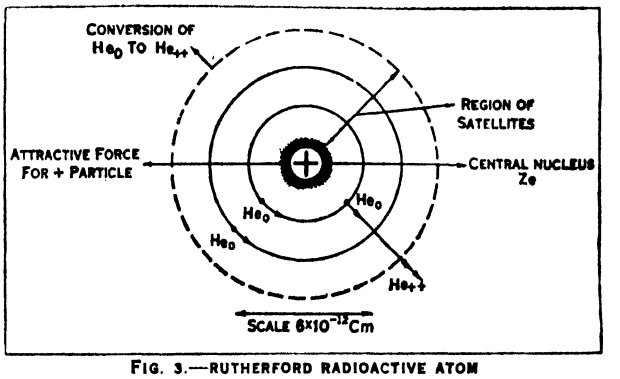


FIG. 3.—RUTHERFORD RADIOACTIVE ATOM

charges. A sketch to illustrate this conception of the radioactive nucleus is given in fig. 3.

The general arguments give us information as to the kind of particles which may be expected to exist within nuclei, at any rate within very heavy nuclei.

A line of argument as to the structure of the radioactive nuclei has been put forward by C. D. Ellis. He has made extensive measurements on the energies of the β-rays liberated from heavy metals by the action of γ-rays from a radioactive substance. (*See* PHOTOELECTRICITY.) These electrons may be liberated from the K or from the L levels of the atom (*see* RÖNTGEN RAYS, ATOM) and the study of the X-ray spectra enables us to find the work required to take an electron from any one of these levels to the surface. A comparison of the spectra of the β-rays excited by the same γ-rays in different metals enables us to attribute the origin of certain observed β-rays to certain levels; if we correct the observed energy by adding the work of release, we obtain the same energy for a given β-ray, no matter from which element it has come, or, otherwise expressed, a β-ray spectrum is found which is independent of the element and expresses the energy initially communicated to the β-particle by the incident γ-ray. The quantum theory leads us to believe that the β-particle in these circumstances takes the whole of the energy of the γ-ray which releases it. These observations of the secondary β-ray spectrum therefore serve to reveal the wave length of the incident γ-rays, since the relation between wave length and energy is given by the simple quantum relation.

$$\text{energy} = E = h\nu = h\frac{c}{\lambda}.$$

Ellis has thus measured γ-rays of much greater energy, or short wave-length, than those measured by Rutherford and Andrade. Considering the complete γ-ray spectrum of an element, say Radium B, he has found that the different γ-ray energies can be accounted for by assuming a small number of energy levels in the nucleus, quantum transitions between suitably selected pairs of which give the frequency of the γ-rays in the same way as quantum transition between the levels of energy in the outer parts of the atom give rise to spectral lines. (*See* QUANTUM THEORY.)

We have, then, this evidence for energy levels within the radioactive nuclei, but we do not know to what mechanism these energy levels are to be attributed. It has been supposed that they could be best explained by electron orbits within the nucleus, corresponding to the quantised electron orbits in the outer parts of the atom so much invoked in the explanation of optical line spectra, but Kuhn has criticised this view, and suggested that it is more satisfactory to attribute the energy levels to the suitably quantised movements of massive positive particles.

This part of the subject is in its infancy, and we can say little with any degree of certainty. There is good evidence for a structure of protons and electrons; for a subdivision of the nucleus into energy levels, originating in circulating particles; for the existence of α-particles, and of α-particles neutralised by two electrons, as components of the radioactive nuclei. Beyond this speculation has an untrammelled range.

The Disruption of the Nucleus.—The nuclei of radioactive atoms, which are all heavy and correspondingly complex, are unstable and disrupt spontaneously, giving out either an α- or a β-particle, with a corresponding change in the chemical nature of the atom. The ejection of an α-particle decreases the mass by 4 units and the atomic number by 2 units: the ejection of a β-particle makes practically no difference in the mass, but increases the atomic number by 1 unit. (*See* RADIOACTIVITY, ISOTOPES.) The lighter elements (with the possible exception of potassium and rubidium) are all stable, and, even after the discovery of radioactivity and the later theory of the nuclear atom, were supposed to be proof against any agencies available in the laboratory. It was known that the outer electrons could be removed by irradiation, or by the impact of particles of sufficient energy, but as long as the nucleus is intact the atom will repair itself by taking up electrons again at the first opportunity. The atom can be *permanently* changed in kind only by adding or subtracting particles from the nucleus, and the expression "breaking the atom" is generally used in popular parlance to indicate such a tampering with the nucleus.

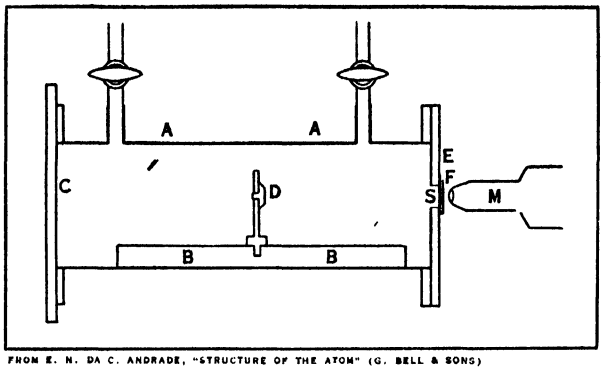
Of recent years Rutherford has shown that we have in the swift α-particle a localisation of energy intense enough to effect a disruption of the nucleus. The experiments are of great importance not only as advancing knowledge of the constitution of the nucleus, but also as the first in which a change in the chemical nature of an atom has been deliberately provoked. (*See* TRANSMUTATION OF ELEMENTS.)

As a preliminary to the description of Rutherford's method it may be well to consider the impact of an α-particle on a very light nucleus. Whereas in the case of heavy nuclei (the nucleus of a gold or of a silver atom, say) we can neglect the motion of the struck nucleus, in the case of a hydrogen nucleus we must devote special attention to the motion produced by the collision. It is easy to show that the velocity u of the struck nucleus will depend upon the masses M and m of the α-particle and struck nucleus respectively, and upon the angle θ which the path of the nucleus makes with the original path of the α-particle, whose velocity is v. If there is no loss of energy in the collision it is given by the expression:

$$u = 2v\frac{M}{M+m}\cos\theta \qquad (2)$$

which becomes 1·6 v $\cos\theta$ when the struck nucleus is a proton ($M=4$, $m=1$). It can further be shown that the range of a proton in a given gas is nearly the same as (actually a little less than) that of an α-particle of the same initial velocity, the effect of the reduced mass and of the reduced charge nearly annulling one another in this respect. It is an established result that the range of an α-particle is proportional to the cube of its velocity, whence for a direct impact ($\theta=0$) the range of a struck proton is about $(1{\cdot}6)^3=4{\cdot}1$ times the range of the α-particle itself in the same gas. With an α-particle from Radium C, whose range in hydrogen is 31 cm., the range of the proton which it strikes centrally should be 117 cm. in hydrogen. This result makes it possible to distinguish easily between struck protons and α-particles themselves, since the greater range of the former allows them to be detected much further from the source than the latter. It is only the full collisions that lead to so large a range: protons struck at glancing angles have, by equation (2), smaller velocities, and hence smaller ranges. A connection between range and angle can be calculated for equation (2), and this distribution is actually confirmed for slow α-particles. It is a significant observation, however, that for swift α-particles passing through hydrogen far more protons are thrown directly forward than the formula indicates. It was this consideration that first led Rutherford to assume the plate-like form of the α-particle in close collision, to which reference has been made.

The great range of the light proton struck by the heavier α-particle is the key to Rutherford's first experiments on the disruption of the nucleus. The apparatus used is represented in fig. 4. The brass disc D bears a deposit of radium C, which is the source of the α-particles. This is contained in a brass box



FROM E. N. DA C. ANDRADE, "STRUCTURE OF THE ATOM" (G. BELL & SONS)

FIG. 4.—TO ILLUSTRATE RUTHERFORD'S SUGGESTION AS TO THE CONSTITUTION OF A RADIOACTIVE NUCLEUS

AA which can be exhausted or filled with any gas. An opening S in one end is closed by a thin metal foil, which, as far as its power of stopping α-particles is concerned, is equivalent to about 5 cm. of air. The particles which pass through this foil, and any other foils which may be placed between S and F, produce scintillations on the phosphorescent zinc sulphide screen F. These scintillations are observed with the microscope M. With this apparatus filled with dry hydrogen various results on the range of the struck protons were obtained, of which mention has already been made.

Long-range protons were also obtained from hydrogen compounds, such as paraffin wax in thin films. The particles were identified as protons not only by their range, but also by deflection in an electric and magnetic field. More recently Stetter has also shown that the ratio e/m for the particles knocked out of paraffin wax has the value pertaining to a proton, by using as a source a very thin tube of wax containing radium emanation, and employing an apparatus built on the lines of Aston's mass spectrograph. (*See* POSITIVE RAYS, ISOTOPES.) The mean of his determinations agrees within 1% with the value to be expected.

When the apparatus of fig. 4 was filled with air, or pure nitrogen (for the effect was soon traced to this gas) particles were observed whose range in air was not less than 28 cm., which is about four times that of the α-particles themselves, or just what we should expect the range of a struck hydrogen nucleus to be. The particles are not due to hydrogen contaminations, such as films of grease, for their number is proportional to the pressure of the nitrogen. Further, when oxygen or oxygen compounds, such as carbon dioxide, are substituted for the nitrogen, nothing but an occasional long-range particle is detected. A large number of control experiments were made, as a result of which it was definitely established that the passage of the α-particles through nitrogen produces particles whose long range gives very strong reason to believe that they must be protons. Rutherford proved that this really was the nature of the particles by deflecting them in a magnetic field.

The only possible source of the long range protons, whose existence is established by these experiments, is the nucleus of the nitrogen atom. We are forced to the belief that the α-particle, when it hits a nitrogen nucleus fair and square, is able to detach from it one of the protons which go to make up its structure, and hurl it in the forward direction. The extreme forward range was later found to be not 28 cm., but 40 cm., which makes the proof of the nuclear origin of the proton even more definite, energy being derived from the nucleus itself. More precise information as to the direction in which the expelled proton proceeds has been furnished by subsequent experiments of Rutherford and Chadwick.

Rutherford and Chadwick have investigated the passage of α-particles through various light elements, with the object of finding out if protons are expelled from their nuclei. (With heavy nuclei this is not to be expected, as the high nuclear charge exerts so large a repulsive force on the α-particle that the close approach necessary to detach a proton cannot occur.) Films of solid compounds of the various metals were placed in the path of the α-particles, and a search made for long-range particles. Such particles were detected with the elements boron, fluorine, neon, sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine, argon, and potassium, as well as the original nitrogen, careful controls in each case establishing that the particles were actually protons, and that their source was the element named. The results obtained with these elements indicate the generalisation that the nuclei of atoms of odd atomic number are more easily broken, at any rate by α-particles, than those of even atomic number, since with the latter the protons, if present at all, are of comparatively short range.

It was found that, whereas, using hydrogen, the free protons are always thrown in the forward direction—a large proportion directly forward—with the other elements the expelled protons proceed in all directions, although the range of the forward ones always exceeds that of the particles proceeding in the backward direction. This indicates that in the mechanism of release of the proton from the nucleus the nuclear forces play a large part: the proton is not just knocked out of a passive nucleus by the passage of the α-particle, as an apple might be knocked from a bough by a tennis racket, but rather the close passage of the α-particle releases some trigger action, the particle being expelled at the expense of nuclear energy. Rutherford and Chadwick have suggested a mechanism in which the expelled proton is assumed to be revolving as a satellite before the expulsion initiated by the α-particle, and the difference of forward and backward velocity is expressed in terms of the path of the struck satellite within the nuclear system before expulsion. Against this Pettersson has put forward what he calls an explosion hypothesis, which supposes that the α-particle starts a disturbance by which the proton is shot out in a random direction with a definite velocity *relative to the nucleus,* which is itself thrown forward. The experimental evidence is insufficient to enable very much to be urged in favour of either hypothesis.

Particular interest attaches to the case of aluminium. The protons expelled in the forward direction from this element have a range of 90 cm. in air, as contrasted with a range of 7 cm. for the α-particles themselves, or 29 cm. for a free proton thrown straight forward by impact of an α-particle. The energy of the long-range proton from aluminium is considerably in excess of that of the α-particle which produces it, involving an actual gain of energy as the result of the collision, independent of the fate of the α-particle. There has in this case been a considerable release of nuclear energy—considerable in relation to amounts of energy involved in the motions of the particles. The actual excess of energy of expelled proton over energy of incident α-particle is, however, only of the order of 5×10^{-6} ergs, so that it would require some ten million million impacts to produce a gain of one calorie. As successful impacts are very rare, the gain of energy is not a matter of immediate practical use.

The fact that the protons are expelled at right angles to the path of the incident α-particles, and also in a retrograde direction, has proved of great service in the investigation of elements for expelled protons. One great difficulty of these experiments is to distinguish between protons due to hydrogen contaminations (either occluded gas or solid or liquid hydrogen compound) and protons originating in complex nuclei. Now whereas the long-range protons from hydrogen contamination are all thrown in a forward direction, those from complex nuclei, released by a trigger action of the passing α-particle, are, on the whole, discharged in much the same numbers in all directions. If, therefore, observations are made at right angles to the path of the incident α-particle, or in a direction making an acute angle (on the side near the source) with the path, the protons observed will be those that originate in the complex nuclei. This method has been used by Rutherford and Chadwick, and also by Kirsch and Pettersson. As a result Rutherford and Chadwick have given the elements already named as those which show nuclear disintegration under the bombardment of α-particles. They have never found evidence of nuclear disintegration with carbon or beryllium. Kirsch and Pettersson, however, have found protons of 3 cm. range with carbon, and also protons with beryllium, copper, and nickel, using the retrograde method for these elements, and later added to the list ten elements between titanium and iodine. In fact, these workers and their school seem to have seen far more scintillations than other workers, for even in the case of aluminium the number of protons which they give is five times as many as those observed by Rutherford and Chadwick under similar conditions. The discrepancies have not yet been explained. It may be taken as certain that with the elements in Rutherford and Chadwick's list nuclear disintegration can be produced by the bombardment with α-particles, but for other elements final decision must be reserved.

Decisive confirmation of the disruption of the nitrogen nucleus by an α-particle has been supplied by photographs of ray tracks taken with the Wilson Cloud Chamber (*q.v.*). By this method Blackett has taken a very large number of pictures of the passage of α-particles through nitrogen, each picture showing, from two different directions, a bundle of many ray tracks. Altogether 23,000 photographs were taken, showing some 270,000 tracks of α-particles of range 8 and 6 cm. and 145,000 tracks of range 5 cm. from a source of Thorium B+C. As a result 8 tracks were obtained showing the expulsion of a proton, the path of the proton being visible as a long thin beaded track, quite different in appearance from the tracks of an α-particle or struck nucleus. (*See* Plate I., fig. 6, WILSON CLOUD CHAMBER.) The proportion of α-particles producing disintegration agrees well with Rutherford and Chadwick's estimate from scintillations. Among the eight disruptions recorded one shows a proton ejected backwards, a further confirmation of the scintillation results.

A striking feature of these photographs is that, in the disruption cases, there is no track corresponding to the α-particle *after* collision. This indicates that the α-particle enters into the nucleus and remains there, forming a nucleus of mass $14-1+4=17$, and of nuclear charge $7-1+2=8$. This would be an isotope of oxygen, whose existence has not been detected by the ray spectrograph. (*See* ISOTOPES.) However, ray-track photographs of Harkins and Ryan, and of Akiyama, taken in air, show, in the case of disintegration, a track of the α-particle after the disrupting collision, indicating that the α-particle does not always stick in the nucleus. The reason for this difference of behaviour is not yet explained.

Stability of Nucleus. Atomic Energy.—The evidence which has been considered clearly shows that the nuclei of all atoms are ultimately built up of electrons and protons in intimate combination. It is clear that combinations containing more than a certain number of these component parts are not stable, for the very heavy nuclei pertain to radioactive atoms, and break up spontaneously. However, of the radioactive nuclei the heaviest are not the most unstable, for Uranium I. and Uranium II., both of atomic number 92, and of atomic weight 238·2 and 234·2 respectively, have very large half-value periods (*see* RADIOACTIVITY), that is, break down very infrequently, while Actinium C′ and Radium C′, both of atomic number 84, and of atomic weight 210 and 214 respectively, are extraordinarily unstable. The explanation of the relative instability of the radioactive nuclei in terms of their structure or composition is still to seek. Fajans, however, has enunciated a rule that all nuclei of atomic mass $4n$, where n is a whole number, and of odd nuclear charge, are very unstable. The only radioactive nuclei which fall in this class are those of Thorium C″, Thorium C, and Mesothorium II., which are all β-radiators of comparatively short life. Nuclei of the general composition specified are not found among the other elements, so that the rule, which is purely empirical, does seem to have a general application.

Evidence of relative stability among the nuclei of non-radioactive elements has been sought by Harkins in the comparative

abundance in which different kinds of atoms occur in nature, the assumption being that elements of rare occurrence are comparatively unstable. The commonest elements, both in meteorites, which may be regarded as samples from extra-terrestrial sources, and in the earth, as far as we can judge from geological evidence, are oxygen, silicon, magnesium, and iron, all comparatively light elements of even atomic number. Taking the figures as a whole, elements of even atomic number are much commoner than elements of odd atomic number. Further consideration of the conjunction of atomic weights and atomic numbers in individual elements leads to the conclusions that the number of nuclear electrons is generally even, or nuclear electrons tend to occur in pairs. There are a fair number of empirical rules of this nature, which enunciate generalities, but no laws of universal application. This aspect of the subject still awaits a co-ordinating theory.

The α-particle itself is a particularly stable entity, consisting of four protons and two electrons: the two electrons which it picks up when it becomes a neutral helium atom do not, of course, form any part of the nucleus, but are, relatively speaking, very distant and very loosely held. Evidence of the stability is obtained by consideration of the peculiar fact that, while the mass of the two electrons is negligible, the mass of the helium nucleus is not exactly equal to that of four protons, for the atomic weight of helium in terms of oxygen as 16, is 4·00, while the atomic weight of hydrogen is 1·0077. We might expect the atomic weight of helium to be 4·0308: the difference between this number and the actual number 4·00 is called the *mass defect.*

The explanation of the mass defect is to be sought in the electromagnetic nature of mass. If an electric charge be concentrated in a very small space it requires a force to produce an acceleration of its movement, or, in other words, it possesses inertia. The smaller the volume into which it is crowded, the greater the inertia. Making, for the sake of precision, the very simple, and somewhat improbable, assumption that elementary charges behave as small charged spheres, the electron must have a diameter of $3{\cdot}8\times10^{-13}$ cm., the proton a diameter of 2×10^{-16} cm. to give the required masses. Even without this assumption we may say, quite generally, that the electromagnetic mass depends not only on the charge but on the capacity of the system. If we bring two small charged spheres of opposite sign close together the capacity of the system is not the sum of that of its parts, considered separately, so that the electromagnetic mass of the two together is less than the sum of the two separately. In general, whenever we pack protons close together with electrons we might anticipate a diminution of mass due to this close packing. The fact that the mass of a nucleus is always less than the mass to be anticipated, by simple addition, from the number of protons it contains is said to be due to the "packing effect." (*See* Isotopes, *Packing Fraction.*)

Quite apart from any mechanism, such as that just considered, we can get an estimate of the stability of the helium nucleus from the mass defect, by taking into account Einstein's relation between mass and energy. (*See* Relativity.) This relation is

$$m=E/c^2$$

where m is the mass, E the energy, c the velocity of light, which is 3×10^{10} cm./sec. If a system loses mass it loses energy to an amount represented by this formula. For the helium nucleus the energy per gram molecule, *i.e.*, per 4 grams of the gas, is

$$E=\cdot0308\times9\times10^{20}=\cdot28\times10^{20}\text{ ergs}=7\times10^{11}\text{ gram calories.}$$

In the language of the chemist a helium nucleus is an endothermic compound giving out $1{\cdot}75\times10^{11}$ gram calories per gram when it is formed from four protons and two electrons and similarly requiring this amount of energy to dissociate it back into its component parts. The energy per atom works out to be $4{\cdot}6\times10^{-5}$ ergs, which is nearly three times the kinetic energy of the swift α-particle, of range 8·6 cm. of air, from Thorium C′. As the swift α-particle represents the greatest localisation of energy at our disposal we may confidently say that the helium nucleus is likely to withstand any agent which we may bring to bear upon it without disrupting.

The enormous energy which, as these calculations show, would be released if we could make hydrogen nuclei combine with electrons to form helium nuclei offers a starting point for daring speculation as to the possibilities of atomic energy, that is, nuclear energy, as a source of power. It may be noted that this is energy which would result from building atoms, not from breaking atoms. The disruption of the aluminium nucleus, with its release of energy, or the spontaneous disruption of the radioactive atoms may be taken as examples of the breaking of atoms with release of energy. If 4 grams, that is one-seventh of an ounce, of helium could be built up from hydrogen we should anticipate a release of nuclear energy equivalent to about a million horse power for an hour. It does not follow that this energy would be released in a form which we know how to handle profitably—it might appear as a very penetrating radiation which would pass through all our screens set to catch it. Speculation has a free range. It has been suggested that a small rate of formation of helium from hydrogen may be responsible for the maintenance of the sun's heat.

The packing effect with heavier nuclei, as represented by the departure of the atomic weights, in terms of oxygen as 16, from whole numbers is a very important study which is being investigated by Aston with a sensitive mass spectrograph. (*See* Isotopes.) His results can be interpreted as supporting the view that the light elements of odd atomic number all have a loosely packed outer structure which has no counterpart in the more stable nuclei. The whole question of the structure of the nucleus, the detailed nature and arrangement of its parts, is still obscure. It is beset with great difficulties, in view of which the progress that is recorded in this article, which deals almost entirely with the work that has been done since 1910, is very encouraging. If at that date the investigation of the composition and structure of a particle some 10^{-12} cms. across had been suggested as a study for the immediate future, few would have taken the matter seriously. (*See* also Transmutation of Elements.)

Bibliography.—E. N. da C. Andrade, *The Structure of the Atom,* 1927 (contains numerous references to work up to end of 1926); H. Pettersson and G. Kirsch, *Atomzertrümmerung,* 1926; E. Rutherford, "Structure of the Radioactive Atom and Origin of the α-Rays," *Philosophical Magazine,* 4, 580, 1927; E. Rutherford and J. Chadwick, "The Scattering of α-Particles by Helium," *Philosophical Magazine* 4, 605, 1927. *See* also bibliography to Radioactivity, Isotopes, Transmutation of Elements. (E. N. da C. A.)

NUER: *see* Nilotes.

NUEVO LEON, a northern State of Mexico. Pop. (1921) 336,412; area 25,136 sq. miles. Nuevo Leon lies partly upon the great Mexican plateau and partly upon its eastern slopes, the Sierra Madre Oriental crossing the State north-west to south-east. A branch of the Sierra Madre extends northward from the vicinity of Salinas, but its elevations are low. The average elevation of the Sierra Madre within the State is slightly under 5,500 feet. The general character of the surface is mountainous, though the western and south-western sections are level. In the north the general elevation is lower, the surface sandy and covered with cactus and mesquite growth. The eastern slopes are well clothed with vegetation, but the lower valleys are subtropical in character and are largely devoted to sugar production. The higher elevations have a dry, temperate, healthy climate. There are many rivers and streams, notably the Salado and Pesqueria.

Agriculture is the principal industry, the chief products being sugar, barley, Indian corn and wheat. Rum is a by-product of the sugar industry, and "mescal" is distilled from the agave. The gathering and preparation of "ixtle" fibres from the agave and yucca forms another important industry, the fibre being sent to Tampico for export. Considerable progress has been made in manufacturing industries, and there are a large number of sugar-mills, cotton factories, woollen mills, important smelting works and iron and steel works. The State is well served with railways. The Mexican National line crosses the northern half of the State and has constructed a branch from Monterrey to Matamoros, and a Belgian line (F. C. de Monterrey al Golfo Mexicano) runs from Tampico north-north-west to Monterrey, and thence westward to Coahuila. The other principal towns, with their population in 1921, are: Linares, or San Felipe (9,810) 112 m. by rail S.E. of

the capital in a rich agricultural region; Montemorelos (6,643); Naranjo (7,704), 96 m. by rail N.W. of the capital; Cadereyta, Jiménez, García, Santiago and Doctor Arroyo.

NUISANCE, that which gives offence or causes annoyance, trouble or injury. In English law nuisance is either public or private. A public or common nuisance is defined by Sir J. F. Stephen as "an act not warranted by law, or an omission to discharge a legal duty, which act or omission obstructs or causes inconvenience or damage to the public in the exercise of rights common to all His Majesty's subjects" (*Digest of the Criminal Law*).

A private nuisance is an act or omission which causes inconvenience or damage to a private person. There must be some sensible diminution of these rights affecting the value or convenience of the property. "The real question in all the cases is the question of fact, whether the annoyance is such as materially to interfere with the ordinary comfort of human existence" (Lord Romilly in *Crump* v. *Lambert,* 1867, L.R. 3 Eq. 409). A private nuisance, differing in this respect from a public nuisance, may be legalized by uninterrupted use for 20 years. (*See* ANNOY.)

The remedy for a public nuisance is by information, indictment, summary procedure or abatement. An information lies in cases of great public importance, such as the obstruction of a navigable river by piers. In some matters the law allows the party to take the remedy into his own hands and to "abate" the nuisance. Thus, if a gate be placed across a highway, any person lawfully using the highway may remove the obstruction, provided that no breach of the peace is caused thereby. The remedy for a private nuisance is by injunction, action for damages or abatement. An action lies in every case for a private nuisance; it also lies where the nuisance is public, provided that the plaintiff can prove that he has sustained some special injury. In such a case the civil is in addition to the criminal remedy.

In Scotland there is no practical distinction between public and private nuisances, the remedy against either being interdict or damages. The law as to what constitutes a nuisance is substantially the same as in England. There is a list of statutory nuisances in the Public Health (Scotland) Act 1867, and amending acts.

The American law on the subject is practically the same as the English law.

NUKHA, a town of Russia in the Azerbaijan S.S.R. in 41° 11′ N., 47° 8′ E., on a winding road linking Baku with Tiflis, and on the Nakhichevan river. Pop. (1926) 22,965. It is occupied in the breeding of silkworms and has five silk spinning factories. Hajji Chelyabi, the founder of the khanate of Sheki, chose the town as his residence in the 18th century and it remained the capital of the khanate until 1819, when it finally became Russian.

NULLIFICATION, the process of making null or of no effect (Lat. *nullus,* none). In United States history the term is applied to the process by which a state either (*a*) in fact suspended, or (*b*) claimed a constitutional right of suspending, the operation of a federal law within its own territory. The doctrine of nullification as a constitutional theory was probably never held by a majority of the states or of the American people at any one time, though before 1860 most of the states asserted or practised it. The belief in nullification was based on the theory that the union of the states was a voluntary one, each member retaining its sovereignty, though for purposes of convenience delegating certain powers of government to an agent—the federal government. The powers of this agent were strictly limited by the Constitution, and should it transcend these powers the states must interpose to protect their rights. This view held that the Supreme Court created by the Constitution was not a proper tribunal to decide causes arising beyond the Constitution or relating to the nature of the Union, but that its jurisdiction was limited to cases arising under the Constitution. If the Federal Government usurped a right belonging to the state, the latter, being a sovereignty, must judge for itself.

As later perfected by John C. Calhoun (*q.v.*), the theory of nullification required a practice as follows. A state aggrieved by a law of the Federal congress might, in constituent convention, suspend the operation of the objectionable law, and report its action to the other states. If three-fourths of them should decide that the law in question was not unconstitutional, then in effect it became ratified (*see* United States Constitution, art. v.). The dissatisfied state must then submit or draw out of the Union by secession (*see* SECESSION, and CONFEDERATE STATES).

The earliest assertions of the doctrine of nullification are found in the Kentucky and Virginia resolutions of 1798–99, written respectively by Thomas Jefferson and James Madison in protest against the Alien and Sedition Acts of Congress. Nullification was first practised in 1809 by Pennsylvania, the governor ordering out the state troops to resist the execution of a decree of a Federal court. In the New England states, 1809–15, the United States laws relating to embargo, non-intercourse and army enlistments were nullified by state action. From 1825–29 the state of Georgia forcibly prevented the execution of Federal laws and court decrees relating to the Indians within her borders and in Alabama, 1832–35, there was a similar nullification. The only example of nullification in which theory and practice coincided was the nullification in 1832 by South Carolina of the Federal tariff laws. In this the state acted upon the theory outlined above which was perfected by Calhoun. In the last decade before the Civil War 14 of the Northern states in the so-called "Personal Liberty laws" nullified the Federal statutes relating to slaves and slavery by making it a crime for their citizens to obey these laws. Since the Reconstruction the Southern states have in practice effected a nullification of the Fourteenth and Fifteenth amendments to the Constitution providing for negro suffrage.

See John C. Calhoun, *Works,* vols. i. and vi. (1853–55); D. F. Houston, *Critical Study of Nullification in South Carolina* (1897); C. W. Loring, *Nullification and Secession* (1893); E. P. Powell, *Nullification and Secession in the United States* (1897); and U. B. Phillips, *Georgia and States Rights* (Washington, 1902); D. W. Howe, *Political History of Secession to the Beginning of the American Civil War* (1914); C. S. Boucher, *The Nullification Controversy in South Carolina* (Chicago, 1916); P. M. Hamer, *The Secession Movement in South Carolina, 1847–52* (Allentown, Pa., 1918); L. T. Lowery, "Northern Opinion of Approaching Secession," *Smith College Studies in History,* vol. 3 (Northampton, Mass., 1918); and E. S. Corwin, *John Marshall and the Constitution* (New Haven, Conn., 1919).

(W. L. F.)

NULLITY OF MARRIAGE, a judicial declaration that a marriage was null and void *ab initio* (from the beginning). In the 12th century the Roman law doctrine of nullity of marriage was developed in order to deal with hard cases under the principle of the indissolubility of marriage laid down by the Church of Rome, whose canons at that date governed the matrimonial law for the whole of Christendom. Nullity could be sued for on the grounds of affinity, into which the law of adoption entered very largely, or a previous unconsummated marriage, which latter was a ground for nullity in England as late as 1750. There were, and continue to be in Roman Catholic countries, various other grounds for nullity, but the grounds of nullity in England are at present limited to the following: (1) Where the parties are not by reason of age (14 for a male and 12 for a female), mental capacity, or otherwise capable of contracting marriage; (2) where the parties are within the prohibited degrees of affinity or relationship; (3) where one of the parties is already married; (4) where one of the parties does not freely consent to marry the other or does not understand the nature of the contract or ceremony; (5) where certain forms have not been observed; (6) where the form of marriage is essentially polygamous. Forms of marriage which offend against these rules are void *ab initio.* If at the time of the marriage one of the parties is and continues to be incapable of consummating the marriage by reason of some incurable physical defect, or of some incurable mental disability on the part of the man preventing him from consummating the marriage, or on the part of the woman resulting in her refusal of marital rights, the marriage may be annulled on the petition of the other party. A person may claim as a ground of nullity that he or she was insane at the time of the marriage. For the prohibited degrees of affinity *see* MARRIAGE.

The Royal Commission on Divorce which reported in 1913

recommended the following additional grounds of nullity of marriage: (1) When the other party, though of sufficient understanding to consent to a marriage, is at the time of the marriage either of unsound mind in other respects, or in a state of incipient mental unsoundness which becomes definite within six months after marriage, and the first party is at the time of the marriage ignorant of the defect, provided that (*a*) the suit is instituted within a year of the celebration of the marriage; (*b*) there has been no marital intercourse after discovery of the defect; (2) where the other party at the time of the marriage is subject to epilepsy or to recurrent insanity, and such fact is concealed by such party or his or her parents or either of them, or by anyone who has control over such party and is aware of the intended marriage, and the first party remains ignorant of the fact at the time of the marriage, subject to the same limitations for petitioning as in (1) above; (3) where one of the parties at the time of the marriage is suffering from a venereal disease in a communicable form, and the fact is not disclosed to the other party; (4) where a woman is pregnant by some other man at the time of the marriage and the husband is ignorant of the fact; (5) where there has been wilful refusal, without reasonable cause to allow intercourse, and where in fact there has been no intercourse owing to such refusal. (*See* also DIVORCE.)

See W. Rayden, *Practice and Law in the Divorce Division* (2nd. ed., by C. Mortimer, 1926); Sir L. Dibdin, *Reformatio Legum Ecclesiasticarum*, vol. iii. (1912); Report of the Royal Commission on Divorce and Matrimonial Causes (1913). (W. LA.)

United States.—Three different situations relating to the nullity of marriage must be distinguished. A marriage may in the first place be totally void. No suit is necessary for its annulment and third parties can set up the fact of its invalidity. This, for example, is generally true of a bigamous marriage. Secondly, a marriage may be voidable at the election of one of the parties. No judicial decree is in theory necessary, though it is customary to secure a judicial declaration of nullity. Non-age of a party generally permits him thus to avoid the marriage, rendering it invalid *ab initio*, but until avoided by the act of the party it is valid, and third parties have no rights to contest its validity. Thirdly, as in the cases of marriage within the prohibited degrees of affinity, a suit to annul the marriage may be essential and such suit must be brought within the lifetime of one of the parties. The decree of annulment also relates back to the time of the marriage. The chief tendencies manifested by the many statutes in this field, apart from specifying the grounds for annulment, relate to: preserving the legitimacy of children born prior to the decree of annulment; making all annulments dependent upon judicial action and, in some instances, permitting the court in its discretion to deny or withhold relief; limiting the right to sue for annulment to a short space of time after discovery of the cause for annulment; permitting courts to award alimony upon decreeing annulment; allowing the injured party to a subsisting marriage to bring suit for its annulment; permitting courts in their discretion to hold trials for annulment in camera.

The grounds for annulment commonly recognized are: bigamy, impotency, non-age, marriage within the prohibited degrees of affinity, non-compliance with an essential statutory formality, mental incapacity existing at the time of the marriage. Among grounds that are recognized in some States by legislation, though not generally recognized, are: fraud, duress or mistake in the granting of consent to marriage, wilful refusal of a party to consummate the marriage by sexual intercourse, venereal disease or other serious illness existing at the time of the marriage and unknown to the other party, pregnancy due to some third party at the time of marriage and unknown to the other party. The causes for annulment are now generally specified by statute and these vary from State to State. Wide legislative activity in this field is due to the fact that in the United States no courts succeeded to the jurisdiction of the English ecclesiastical courts. Consequently no action for annulment on grounds entertained by the English ecclesiastical courts could be maintained in the absence of statute though equity courts would entertain such actions on grounds other than the canonical disabilities. Under such a theory the intervention of the legislature became necessary and in short time legislation expanded to bring the entire field within its control. (J. M. LA.)

NUMANTIA, an ancient hill fortress in northern Spain, in the province of Soria (Old Castile), overhanging the village of Garray, near the town of Soria, on the upper Douro. Here, on a small isolated high plateau in the middle of the valley, was the stronghold which played the principal part in a famous struggle between the conquering Romans and the native Spaniards during the years 154–133 B.C. Numantia was especially concerned in the latter part of this war from 144 onwards. It was several times unsuccessfully besieged. Once the Roman general Hostilius Mancinus with his whole army was compelled to surrender (137). Finally, Scipio Aemilianus, Rome's first and only general in that age, with some 60,000 men drew round the town 6 m. of continuous entrenchments with seven camps at intervals. After 15 months (134–133) he reduced by hunger the 6,000–8,000 Numantine soldiers, much as Caesar afterwards reduced Alesia in Gaul. The result was regarded as a glorious victory, and in Roman literature the fall of Numantia was placed beside the fall of Carthage. The site was, under the Roman Empire, occupied by a Roman town called Numantia, and the *Itinerary* tells of a Roman road which ran past it. It is to-day a "Monumento Nacional" of Spain, and has yielded remarkable discoveries to the skilful excavations of Dr. Schulten (1905–1910), who has traced the Celtiberian town, the lines of Scipio and several other Roman camps dating from the Numantine Wars. (F. J. H.)

NUMA POMPILIUS, second legendary king of Rome (715–672 B.C.), was a Sabine, a native of Cures, and his wife was the daughter of Titus Tatius, the Sabine colleague of Romulus. He was elected by the Roman people at the close of a year's interregnum, during which the sovereignty had been exercised by the members of the senate in rotation. Nearly all the early religious institutions of Rome were attributed to him. He set up the worship of Terminus (the god of landmarks), appointed the festival of Fides (Faith), built the temple of Janus, reorganized the calendar and fixed days of business and holiday. He instituted the flamens (sacred priests) of Jupiter, Mars and Quirinus; the virgins of Vesta, to keep the sacred fire burning on the hearth of the city; the Salii, to guard the shield that fell from heaven; the pontifices and augurs, to arrange the rites and interpret the will of the gods; he also divided the handicraftsmen into nine gilds. He derived his inspiration from his wife, the nymph Egeria, whom he used to meet by night in her sacred grove. After a long and peaceful reign, during which the gates of Janus were closed, Numa died and was succeeded by the warlike Tullus Hostilius. Livy (xl. 29) tells a curious story of two stone chests, bearing inscriptions in Greek and Latin, which were found at the foot of the Janiculum (181 B.C.), one purporting to contain the body of Numa and the other his books. The first when opened was found to be empty, but the second contained fourteen books relating to philosophy and pontifical law, which were publicly burned as tending to undermine the established religion.

No single legislator can really be considered responsible for all the institutions ascribed to Numa; they are essentially Italian, and older than Rome itself. Even Roman tradition itself wavers; *e.g.*, the *fetiales* are variously attributed to Tullus Hostilius and Ancus Marcius. The supposed law-books, which were to all appearance new when discovered, were clearly forgeries.

See Livy i. 18–21; Plutarch, *Numa;* Dion. Halic. ii. 58–76; Cicero, *De republica*, ii. 13–15. For criticism: Schwegler, *Römische Geschichte*, bk. xi.; Sir G. Cornewall Lewis, *Credibility of early Roman History*, ch. xi.; W. Ihne, *Hist. of Rome*, i.; E. Pais, *Storia di Roma*, i. (1898), where Numa is identified with Titus Tatius and made out to be a river god; J. B. Carter, *The Religion of Numa* (1906); O. Gilbert, *Geschichte und Topographie der Stadt Rom im Altertum* (1883–1885); and ROME: *Ancient History*.

NUMBER, an abstract term for the integers 1, 2, 3, . . . as well as for the various mathematical generalizations of the integers, such as fractions and irrational quantities. It is also used as a concrete term. The practice of specifying the multiplicity of classes of objects by means of marks (integers) is found at an early stage in all civilizations, and has led to various systems of

numeration (*see* NUMERALS and ARITHMETIC). The ordinary decimal system is now in general use. While the particular system of numeration to be adopted is a matter of no theoretic importance, nevertheless, to insure the free development of the concept of number, some symbol for zero must be introduced, as well as symbols for addition, subtraction, multiplication and division. Over two thousand years ago the Greek philosopher Pythagoras (*q.v.*) foresaw the fundamental rôle of number and gave it a central place in his philosophy. The actual progress made however in the development of the concept of number is not to be found in the many philosophical speculations on the subject, but rather in the technical researches of mathematicians. In what follows our purpose will be to outline the essential ideas involved in this development.

INTEGERS

The simplest and most fundamental type of number is that of the integers. This type may be analyzed in the following manner. Consider two classes of objects A and B, each of which has only a finite number of constituent elements. Suppose that the elements of A and of B can be put in "one-to-one correspondence." In other words suppose that the elements of A can be paired with the elements of B just as the fingers of one hand can be paired with those of the other. Suppose, furthermore, that the elements of A and of a third class C can be put in one-to-one correspondence in the same way. It is then evident that the elements of B and of C can also be put in one-to-one correspondence. Thus the various classes B, C, . . . in one-to-one correspondence with A are also in one-to-one correspondence with one another.

An integer may be defined as a mark associated with such a collection of classes A, B, C . . . ; *e.g.*, the integer 5 is the mark associated with the class of fingers on a hand and with all other classes in one-to-one correspondence with this particular class. It is reasonable to believe that even before the dawn of primitive civilization the first step in the use of the integer must have been taken in some such way as the following. A herdsman might set one stone aside for each animal in the herd. By use of the pile of stones he would be able to determine at any time whether or not his herd was complete. Later a series of scratches might serve as a simplified mark, and it is easy to see how the long continued use of such methods would lead to complete systems of numeration.

In basing the notion of the integer upon that of one-to-one correspondence, the classes were assumed to have only a finite number of constituent elements. Since the notion of a finite number of elements is thus involved at the outset, our analysis might seem to involve circular reasoning. This is not really the case since the notion of one-to-one correspondence of itself furnishes a method of distinguishing between finite and infinite classes. We may *define* an "infinite" class as one which can be put in one-to-one correspondence with a part of itself. For example, the class of integers 1, 2, 3, . . . will be infinite according to this definition since it may be put in one-to-one correspondence with the class of even integers 2, 4, 6, . . . ; we need only make an integer n of the first class correspond to its double $2n$ of the second class:

$$1,\ 2,\ 3,\ 4,\ \cdots$$
$$2,\ 4,\ 6,\ 8,\ \cdots.$$

Likewise we may *define* a "finite" class as one which cannot be put in one-to-one correspondence with a part of itself.

Operations with the Integers.—If a and b are the integers for two classes A and B having no elements in common, and if these classes be combined to form a new class S, the integer s for S is determinable from the integers a and b. Indeed the underlying notion of correspondence shows that if A' and B' are any two other classes having no elements in common, whose integers are also a and b, then the integer for the combined class S' formed from A' and B' will be the same integer s as before. To make this fact clear, we need only observe that when A and B are put in one-to-one correspondence with A' and B' respectively, S is put coincidently in one-to-one correspondence with S'. The integer s is called the "sum of a and b"; in the language of algebraic symbolism we write $s=a+b$. The operation of determining s when a and b are given is called *addition*. Thus the operation of addition corresponds to the fundamental logical process of combination of two classes.

Similarly there may be a classes, each of which contains the same number b of elements, while no two of these classes have an element in common. If these classes be combined to form a new class composed of all these elements, its integer p is determinable from a and b, as follows in a similar manner. The integer p is called the "product of a and b": $p=a\times b$, and the corresponding operation is called *multiplication*. Thus the operation of multiplication corresponds to the combination of a number of distinct classes, themselves in one-to-one correspondence with each other.

The two operations of addition and multiplication are usually considered to be the two fundamental operations. The inverse operations of subtraction and division may be defined by means of the respective equations

$$(a-b)+b=a,\quad \left(\frac{a}{b}\right)\times b=a.$$

Consequently the symbol $a-b$ will represent an integer if and only if b is smaller than a (*i.e.*, some class B can be put in one-to-one correspondence with a part of some class A). Likewise a/b will represent an integer if and only if a contains b as a factor. The successive integers may be defined in terms of addition as follows:

$$1+1=2,\ 2+1=3,\ 3+1=4,\ \cdots.$$

Here 1 is to be regarded as the integer for any unit class. The definition of multiplication makes it clear that multiplication of any integer by 1 does not affect the integer.

The Five Fundamental Laws of Operation.—The notion of the integer, as based upon the one-to-one correspondence of classes, shows immediately that certain simple laws must hold. For instance since the class C, obtained by the combination of two classes A and B, is the same whichever class is mentioned first, we infer that the sum of two integers is independent of the order in which they are taken. This law has been termed the *commutative law of addition* (*see* COMMUTATIVE LAWS), and is the first of the five fundamental laws written below in algebraic form:

(i) $a+b=b+a$,

(ii) $(a+b)+c=a+(b+c)$,

(iii) $a\times b=b\times a$,

(iv) $(a\times b)\times c=a\times(b\times c)$,

(v) $a\times(b+c)=(a\times b)+(a\times c)$.

The second *associative law of addition* (*see* ASSOCIATIVE LAWS) declares that if a third integer be added to the sum of a first and second integer, then the sum obtained is the same as if the sum of the second and third integers were added to the first; either process will give the sum of all three integers. In fact if the combination of two classes A and B is followed by a combination of the resulting class with a third class C, the combination of A, B, and C is obtained, just as when A is combined with the combination of B and C. Consequently the first two laws embody the principle that when integers are added, the final sum obtained is the same, no matter in what arrangement the operations of addition are performed.

The third and fourth laws embody an entirely analogous principle in connection with multiplication; viz., that when integers are multiplied, the final product obtained is the same, no matter in what arrangement the operations of multiplication are performed. However the reason for this principle is not quite so immediate. It may be formulated as follows: First consider two distinct classes A and B with a and b elements respectively. A class may be formed whose elements are all possible pairs of elements, one from A and the other from B. For each element of A there will be b elements of B which may be associated with it. Consequently by the definition of multiplication there will be $a\times b$ pairs in all, or equally $b\times a$ of course. Thus we obtain the

third *commutative law of multiplication*. The same justification may be presented in a simple graphical form. A rectangular array of $a \times b$ dots may be regarded either as a rows of b dots each or as b rows of a dots each.

Secondly, consider three distinct classes A, B and C with a, b, and c elements. A class may be formed whose elements are all possible triples of elements, one from A, one from B, and one from C. Evidently the class of triples so obtained may also be formed by taking the class of pairs from A and B mentioned above, and associating any such pair with any element of C to form a triple. Likewise the same class of triples may be constructed by taking the class of pairs from B and C and associating any such pair with any element of A. In this way the fourth *associative law of multiplication* is justified. This justification may also be given graphical form by use of an array of $a \times b \times c$ dots in space arranged in the form of a rectangular parallelepiped.

The fifth *distributive law of multiplication* (*see* DISTRIBUTIVE LAW) may be seen to hold as follows. The class of pairs of elements taken one from the class A and the other from the combination of B and C is evidently merely the combination of the class of pairs taken from A and from B, with the class of pairs taken from A and C. This, too, admits of graphical justification, since an array of $a \times (b+c)$ dots is evidently made up of an array of $a \times b$ dots and an array of $a \times c$ dots.

These five general laws contain all of the principles necessary for the manipulation of the integers, provided that we take for granted the special law, $a \times 1 = a$. In particular we can deduce the usual addition and multiplication tables for the integers by the aid of these laws; as an illustration we find

$$2+2=2+(1+1)=(2+1)+1=3+1=4,$$
$$2\times 2=2\times(1+1)=(2\times 1)+(2\times 1)=2+2=4.$$

THE REAL NUMBER SYSTEM

Positive or Ordinary Numbers.—The concept of quantity expressed in terms of a suitable unit of measure is of almost the same intuitive nature as the concept of the integer. This is particularly true of geometric quantities such as lengths, areas and volumes. In the case in which the given quantity contains the unit an exact number of times, it is clear that the quantity may be designated by means of the corresponding integer. For similar reasons a fraction $\frac{m}{n}$ (m and n being integers) may be taken to represent the nth part of m units.

Fractions were employed as early as 1700 B.C. by the ancient Egyptians, but the concept of ordinary number was first adequately presented by Euclid. In the tenth book of his *Elements* he considered geometric magnitudes, and distinguished between commensurable and incommensurable quantities. For instance he established that the hypotenuse of an isosceles right triangle is incommensurable with the other two equal sides. In other words the number $\sqrt{2}$, representing the hypotenuse in terms of one of the equal sides taken as unit, is an *irrational* number, not expressible as a fraction $\frac{m}{n}$. How then shall such irrational numbers be represented by means of marks? This must be accomplished with the aid of a sequence of fractions which approach the irrational number as a *limit*. For instance when $\sqrt{2}$ is represented in the form of an infinite decimal: $\sqrt{2}=1.4142\ldots$, this amounts to a specification of $\sqrt{2}$ by means of the sequence of fractions

$$1, \frac{14}{10}, \frac{141}{100}, \frac{1414}{1000}, \frac{14142}{10000}, \ldots.$$

The fundamental operation of addition of two such numbers may be interpreted geometrically, and in this way it is intuitively evident that the first two general laws must continue to hold.

Zero and Negative Numbers.—The real number system includes not only the positive or ordinary numbers, but zero and the so-called negative numbers, and is the system of most theoretical importance in the actual application of number to scientific questions. It might be shown how in various fields such a further extension is very natural; for instance in dealing with temperature we must select an initial or zero point of the scale and must differentiate between temperatures above and below this point. Instead of doing so we propose to indicate how more purely mathematical considerations suggest this further extension. Similar considerations also suggest the extension already made from the integers to the fractions, but this extension can be based so directly upon experience as to make the statement of the purely mathematical considerations seem superfluous. The mathematical considerations entering are the following:

For the free manipulation of numbers the use of the inverse operations is an indispensable adjunct. We may deduce the general laws for such operations from the five fundamental laws. One illustration of this must suffice. The usual algebraic rule for the addition of two fractions with a common denominator is embodied in the formula

$$\frac{a}{d}+\frac{b}{d}=\frac{a+b}{d}.$$

To establish this law we may write $\frac{a}{d}=x, \frac{b}{d}=y$, whence we find $xd=a$, $yd=b$, in virtue of the definition of division. By addition we infer that

$$xd+yd=(x+y)\times d=a+b,$$

whence follows $x+y=\frac{a+b}{d}$, which it was desired to prove.

In this free manipulation of quantities with the aid of these inverse operations, such symbols arise as $1-1$, $1-2$, which do not represent ordinary numbers. Yet it is soon found that if formally correct manipulations are made regardless of the meaning of the symbols, the correct result is always obtained. This situation suggests inevitably that such symbols in reality represent a valid kind of number.

Let us assume that this is the case and consider the conclusions which follow. For brevity let us write $a-a=0$. This definition will be legitimate since we can establish formally that the equality

$$a-a=b-b$$

holds whatever a and b may be. The two further special laws $a \times 0=0$, $a+0=a$ are obeyed by this symbol 0, and are of the same nature as the special law $a \times 1=a$ already mentioned.

Next write for the sake of brevity

$$0-a=-a$$

in case a is a positive number. Such a quantity may be called *negative*. With this extension of the number system to include 0 and the negative quantities, all symbols are found to be formally reducible to the same type, provided that division by 0 is excluded. Consequently the extension of the ordinary numbers by the introduction of zero and the negative numbers follows from the free formal use of the laws of operation. Furthermore the rules for dealing with such numbers are obtained in the same way; for example the conclusion that the product of $-a$ and $-b$ is ab follows in this way.

Up to this point the method of approach has been heuristic rather than logical. It is now a simple matter to explain the method by which the real numbers can be satisfactorily defined in terms of ordinary numbers. We propose to consider ordinary numbers, the number 0, and ordinary numbers with a $-$ symbol prefixed. The first type of mark will be referred to as a positive number and the last type as a negative number. The number 0 will be regarded as a member of either type; *i.e.*, $-0=0$ by convention. The rules of combination of these marks under the operations $\oplus$ and $\otimes$ (which are not to be confused with the operations $+$ and $\times$) will be defined in the following manner: If a and b are positive $a \oplus b$ is the positively taken sum; if either a or b is negative $a \oplus b$ is their difference considered as positive if the positive term is numerically greater, and negative in the contrary case; if both a and b are negative, $a \oplus b$ is their ordinary sum taken as negative. Likewise if a and b are both positive or both negative $a \otimes b$ is the positively taken product; and if one

is positive and the other negative, $a \otimes b$ is the negatively taken product. Finally we define $a \oplus o$ and $o \oplus a$ to be a in all cases, and $a \otimes o$ and $o \otimes a$ to be o in all cases.

It may then be verified, upon the basis of the properties of ordinary numbers, that the *extended real number system* satisfies the general and special laws of operation in all cases whatsoever; for example it may be verified that the commutative law of addition holds always. Furthermore it is readily verified that the inverse operations (except division by o) can be performed. These inverse operations will of course obey the usual formal laws which can be deduced from the five general laws for the direct operations. Hence we are fully justified in regarding the real number system so obtained as a complete generalization of the ordinary number system.

THE COMPLEX NUMBER SYSTEM

As soon as equations of the second and higher degree are considered, a further and (in some ways) final extension of the number system is suggested. In fact the general formula for the solution of an equation of the second degree involves the extraction of the square root of a quantity which may be negative. But no real quantity has a negative square. Hence we are again led to meaningless symbols. However the symbol for the solution can be reduced formally to $a+bi$ where i stands for $\sqrt{-1}$ so that $i^2=-1$. Here bi is an abbreviation for $b \times i$.

The question then arises as to whether these symbols can be regarded as an appropriate generalization of the real numbers. If we write

$$(a+bi)+(c+di)=(a+b)+(c+d)i,$$

$$(a+bi)\times(c+di)=ac+(ad+bc)i+bdi^2=(ac-bd)+(ad+bc)i,$$

we define thereby the operations of addition and multiplication of these complex or imaginary numbers. It may then be verified that the usual formal laws will be satisfied in all cases. Consequently the further extension of the number system must be regarded as legitimate.

The above treatment may be clarified as follows. Let us begin by defining a complex number as a pair of associated real numbers (a, b). The definitions of addition $\oplus$ and multiplication $\otimes$ may be written

$$(a, b) \oplus (c, d) = (a+c, b+d)$$

$$(a, b) \otimes (c, d) = (ac-bd, ad+bc).$$

Furthermore as a means of abbreviation we may write $(a, o)=\underline{a}$ and call these pairs $\underline{a}$ the real numbers of the extended system; in particular we have $(o, o)=\underline{o}$, $(1, o)=\underline{1}$. Likewise we write $i=(o, 1)$, and find from the definition of multiplication

$$i^2=i \otimes i=(-1, o)=-\underline{1}.$$

We are now in a position to deduce

$$(a, b)=(a, o) \oplus (o, b)=(a, o) \oplus (b, o) \otimes i=a \oplus (b \otimes i),$$

which is essentially the form of expression $a+bi$ with which we started.

When this complex number system is adopted the solution of all algebraic equations of any degree may be accomplished, even when the coefficients are themselves complex numbers. Thus from an algebraic standpoint no further generalization is called for. The so-called Argand diagram represents complex numbers by means of the points of a plane, and makes it evident graphically that these numbers satisfy the general and special laws. (*See* COMPLEX NUMBERS.)

BASIS OF THE NUMBER SYSTEM

The Integers as Basis.—We are now in a position to indicate in what sense the integers alone may be regarded as basis for these extensions. Our first step is to define a fraction as a pair of associated integers $\frac{p}{q}$, and to define addition and multiplication of fractions by the usual algebraic formulae. It is then readily verified on the basis of the properties of the integers that such fractions obey the five general laws. We regard two fractions $\frac{p}{q}$ and $\frac{p'}{q'}$ as "equal" if $pq'=qp'$. Furthermore we write $\frac{a}{1}=a$, and find that the first special law also holds. We may next introduce the inverse operations and obtain the usual corresponding laws from the five fundamental laws.

The System of Postulates.—In the course of the preceding development certain general and special laws were found to be characteristic of various types of number systems. It is of decided interest to investigate the question as to whether these laws are sufficient to characterize such systems. This can be accomplished by means of the postulational method. Here certain postulates are formulated in terms of certain elements and operations, and it is then proved that the elements and operations are essentially the numbers and the operations of addition and multiplication.

A natural set of postulates with which to begin is the following. The set of elements and $+$, $\times$ obey the fundamental laws $I-V$; there are two special elements o, 1 which obey the special laws. The equations

$$a+x=b, \quad a \times x=b$$

have a unique solution x for all values of a and b, except for $a=o$ in the second case.

These postulates however do not suffice. In fact they hold for the set of positive and negative fractions, for the real number system, and for the complex number system. They also hold for certain modular number systems referred to later in which there are only a finite number of elements; the simplest such system contains only three marks o, 1, 2 with addition and multiplication defined by the following tables:

+	o	1	2
o	o	1	2
1	1	2	o
2	2	o	1

×	o	1	2
o	o	o	o
1	o	1	2
2	o	2	1

The complete treatment of the ordinary number system which Huntington has given introduces the further relation $<$ (less than).

The advantage of such a postulational analysis is that we are led to see what are the essentially independent properties of an assigned number system. By the modification or removal of one or more of the postulates other types of number are obtained; *e.g.*, if to the above set we add the postulate that there are three distinct elements, it may be proved immediately that the modular system specified is obtained.

SYMBOLIC LOGIC AND THE INTEGER

Symbolic logic attempts to reduce the so-called logical processes of thought to explicit objective form in such wise that logical reasoning may be comparable in its mechanical precision and objective quality with a game such as chess. Here the paper on which the symbolic propositions are written corresponds to the chessboard, and the symbols correspond to the chessmen. There is given an initial set of "true" propositions which corresponds to the initial position of the chessmen with which we start.

Now this logical game and its rules, as ordinarily conceived, do not have any reference to number or even to the integers. It would of course be possible to insert at the outset a given set of true propositions (*i.e.*, postulates) sufficient to characterize the set of integers. It would then be possible in accordance with the strictly prescribed logical processes to define the fractions. In developing the ordinary number system, it would be necessary to deal with an infinite ordered sequence of fractions.

Our method of approach to the ordinary integers was itself of a logical character, since it defined the integers in terms of the notion of one-to-one correspondence of classes, which is a purely logical one. Thus the fundamental and interesting question is suggested: in a symbolic logic not containing initial propositions which state the existence of the integers, might it not be possible to define the integers in purely logical terms? The kind of definition that has been considered by Frege, Russell and Whitehead

may be stated as follows in ordinary language: an integer is the class of all classes in one-to-one correspondence with some specified finite class. The one-to-one correspondence between two classes is a relation R between the elements of the classes which may be expressed in the form: for each element x of the first class there exists one and only one element y of the second class such that $x\ R\ y$; likewise for each y of the second class there exists one and only one x of the first class such that $x\ R\ y$.

The attempt to devise a satisfactory system of symbolic logic is beset with many difficulties. In particular it must be able to deal with certain paradoxes which have been encountered in the theory of infinite classes. A theory of types of proposition has been devised by Whitehead and Russell with this purpose in view. At the present time there is no general agreement among mathematicians as to the proper foundation of symbolic logic; but on the basis of the work of Whitehead and Russell it seems clear that if symbolic logic can be given a definite form, it will prove to be possible to define the positive integers in purely logical terms.

FURTHER GENERALIZATIONS

Modular and Hypercomplex Numbers.—There are many generalizations and modifications of number besides those referred to above. In particular there are the modular and Galois number fields in which there are only a finite number of marks (numbers) and in which all the usual formal laws are satisfied (*see* NUMBER, THEORY OF). There are also various hypercomplex number systems such as quaternions (*see* QUATERNIONS) in which there are more than the two "fundamental units" such as 1 and i of the ordinary complex number system. In these hypercomplex number systems, however, the commutative law of multiplication does not hold.

Transfinite Numbers.—The above-mentioned directions of generalization are technical in character. Of a much more fundamental nature is the extension of the notion of the integer as the mark of a finite class so as to apply to infinite classes. These *transfinite numbers*, discovered by G. Cantor, have attracted much interest and have led to certain paradoxes to which we cannot do more than allude. An infinite class has the property that it can be put into one-to-one correspondence with part of itself. This was illustrated above by means of the infinite sequence (*see* NUMBER SEQUENCES) of integers 1, 2, 3, . . . ; but from any infinite class we may remove such an infinite sequence.

Consider now a collection of classes which can be put in one-to-one correspondence with one another. These can be regarded as associated with a mark which is an ordinary integer if the classes contain a finite number of elements, and which is called a *transfinite cardinal*, if there are infinitely many elements in each class. The simplest such mark ω is that attached to the class of positive integers; ω is the mark characteristic of enumerable classes, *i.e.*, of classes which may be put in one-to-one correspondence with the infinite sequence of integers 1, 2, 3. . . . The class of all fractions $\frac{m}{n}$ has also this transfinite cardinal ω, for these fractions may be ordered according to the size of the sum of numerator and denominator:

$$\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{2}{3}, \frac{3}{2}, \cdots.$$

A first conjecture might be that all infinite classes have the transfinite cardinal ω. The following simple reasoning shows, however, that the class of all ordinary numbers between 0 and 1 has a greater transfinite cardinal than ω.

Suppose it possible that the class of these numbers has the transfinite cardinal ω. This would signify that all of these numbers could be written in a sequence S just as the integers 1, 2, 3, . . . can be written. First let us imagine the numbers of this sequence to be written in decimal form. Now certain rational numbers admit of double representation, as is evident from the fact that 0·879999 . . . = 0·880000. . . . Let us agree, in all such cases, to use the mode of representation by 9's, so that every number shall have a unique decimal representation. We may now construct another number less than 1 as follows: Let the first figure after the decimal point be chosen apart from 0 and the first figure of the first number of S; the second figure be chosen apart from 0 and the second figure of the second number of S, and so on. There will then be defined a number in decimal form which is obviously distinct from all the numbers of S. Hence the hypothesis that the sequence contains all of the numbers between 0 and 1 is incorrect. The conclusion may be stated in the form: The continuum of numbers between 0 and 1 is not enumerable. By an extension of this method it is possible to define greater and greater transfinite numbers.

In the consideration of the transfinite cardinals various paradoxes arise unless some definite logical theory such as the theory of types of Russell and Whitehead is carefully adhered to. Moreover the precise structure of these transfinite numbers is not known except in the case of the least such number ω; thus it is not known whether or not the transfinite cardinal of the continuum is the first exceeding ω or not.

Cardinal and Ordinal Numbers.—In the account of number given above no reference has been made to the usual elementary distinction between the cardinal and ordinal integers. Up to the time of the discovery of transfinite number this distinction possessed merely elementary pedagogical significance, and the mathematical treatment of number dealt exclusively with the cardinal integers. With the invention of the transfinite numbers, however, it appeared immediately that this distinction, although mathematically barren in the case of ordinary integers, lead to two distinct types of number when applied to infinite classes, namely to the transfinite cardinals and to the transfinite ordinals.

The distinction between cardinal and ordinal number may be expressed as follows in the case of finite classes. In the case of the cardinal type of integer we have a mark characteristic of the class without reference to any order of its elements; in the case of the ordinal type of integer the class is ordered and its elements are supposed to be counted in this order, the mark 1 being attached to the first element, the mark 2 to the second, and so on, to the end of the sequence. This gives an ordinal number for each element. Of course if the last element has the mark n, the cardinal number of the class is also n. Thus the two kinds of integer are very intimately related.

When we deal with infinite classes and attempt to extend the notion of ordinal number, it is necessary first of all to define what is meant by an ordered infinite class. First we have an infinite sequence 1, 2, 3, · · · as before. To continue with the ordinal numeration we call the next mark ω; after it the successive marks are denoted by $\omega+1, \omega+2, \cdots$, although this is merely by convention. Immediately after this sequence appears the next ordinal, denoted by $\omega\cdot 2$, followed by $\omega\cdot 2+1, \omega\cdot 2+2, \cdots$, then $\omega\cdot 3, \omega\cdot 3+1, \cdots$. Evidently this process of ordinal numeration is now part of a more extensive sequential process which may be written symbolically

$$\begin{aligned}
&1, 2, \cdots\\
&\omega, \omega+1, \omega+2, \cdots\\
&\omega\cdot 2, \omega\cdot 2+1, \omega\cdot 2+2, \cdots\\
&\quad\cdots\\
&\omega^2, \omega^2+1, \omega^2+2, \cdots\\
&\omega^2+\omega, \omega^2+\omega+1, \omega^2+\omega+2, \cdots.
\end{aligned}$$

Thus a series of order types of increasing complexity is formed, and the process may be continued indefinitely. These give the sequence of transfinite ordinals, appropriate to the numeration of well-ordered infinite classes. A class is said to be "well-ordered" if the elements are not only ordered but are such that every element or ordered sequence of elements has an immediately following element.

The marks for the transfinite ordinals are not the same as for the cardinals. Thus it is immediately evident that the set of transfinite ordinals up to ω^2 are enumerable; *i.e.*, they have the transfinite cardinal ω. It is not as yet known whether or not every class, *e.g.*, the continuum of numbers between 0 and 1, can be well-ordered or not.

The theory of the transfinite cardinal and ordinal numbers, and their interrelations is of great philosophical as well as mathematical interest. The subject requires much further development. In particular the underlying basis of symbolic logic has not been agreed upon.

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(G. D. BI.)

NUMBERS is the fourth book of the Pentateuch, as the five books of the Law, or of Moses, have come to be called. The three previous books carried on the story of Israel's history from the creation, through the captivity in Egypt and the escape therefrom, down to the sojourn at Sinai. Numbers traces out the march from Sinai, the wanderings in the wilderness and the final arrival on the steppes of Moab within sight of the Promised Land. Like the other books of the Pentateuch, it consists of earlier (JE) and later (P) sources; *see* BIBLE: *Old Testament*. But, although the sources come from different ages and from writers of different schools of thought, yet if its significance is properly to be apprehended, it is necessary to remember that for more than 2,000 years it has been a complete whole.

The book falls naturally into three sections which follow a chronological sequence; (1) Chaps. i.–x. 10 (P) Israel's sojourn at Sinai, the census and the promulgation of various laws by Moses. (2) Chaps. x. 11–xxii. 1 (JE and P), incidents which occurred during the wanderings between Sinai and the arrival at the steppes of Moab. These incidents seem to have been chosen mainly for the purpose of casting light on the religious history and character of the people and also to explain the meaning of various place-names (*cf.* Taberah and Kibroth hattaavah, xi. 3, 34). They also attempt to give an account of the origin of some religious objects of worship (*e.g.*, the brazen serpent, xxi. 4–11). (3) Chaps. xxii. 2–xxxvi. (mainly P) the sojourn on the steppes of Moab, the incident of Balaam, the second census and the giving of additional laws, together with various other incidents.

The middle section contains important passages from J and E: the twelve spies, the rebellion of Korah, and Balaam's mission to Balak (no signs of P). J, E. and P can be readily separated in chaps xi. and xii. To E belongs the passage describing the outpouring of the Spirit on Eldad and Medad and the remarkable prayer of Moses in xi. 29, "Would God that all Yahweh's people were prophets that Yahweh would put his Spirit upon them," *cf.* the idea that Christians are "priests unto God" (Rev. i. 6). As usual the J and E elements possess such a vivid character as to render them familiar to ordinary readers; contrast P's legislative and statistical style, and his diffuseness (which reaches a climax in ch. vii.). The most illuminating example of the difference between JE and P is found in the passage that occurs after the first long section of P describing the order of march of the several tribes and the position of the ark in the very centre of the host, both when encamped and on the march. In x. 30 Moses entreats Hobab, the son of Reuel his father-in-law, to come with the Israelites to be "eyes" unto them; and in x. 33 it is stated that the ark went *before* them to seek out a resting-place for them. It is clear that these statements directly contradict P's elaborate scheme, according to which the people march mechanically, tribe by tribe, with the ark in the very centre of the square, and guided by the pillar of cloud by day and the pillar of fire by night. Moses, instead of simply following the pillar of cloud, requests Hobab to determine the line of march and select the sites for encampment. No clearer proof could be desired of the nature of early methods of compilation than that the detailed account in ch. i.–x. 28 should be immediately followed by two short paragraphs in palpable contradiction of the whole plan of camp and march so elaborately worked out in the preceding narrative.

Of very great interest is the account of Korah's revolt in ch. xvi. which is composed of J, E, and P in a most intricate manner. Literary analysis has unravelled three stages of development: (*a*) two *Reubenites*, Dothan and Abiram, rebel against the *civil* authority of Moses; (*b*) Korah the Levite, with 250 *Israelites*, rebels against the *religious* authority of Moses and Aaron, and (*c*) Korah at the head of 250 *Levites* protests against the priestly privileges of Aaron (for details *see* the commentaries). The analysis (which is generally accepted) is of extreme value for the difficult study of the history of the Levites (*q.v.*).

Another very important narrative is that of Balaam (*q.v.*). It includes a number of poetical quotations which help to determine its date and also indicate the value of poetry in its bearing on history. Also in xxi. 14 we have a poetical quotation from a lost volume of early poetry entitled "The Book of the Wars of Yahweh." Deborah's song was probably originally in this book; and when we compare its statement as to Israel's full fighting strength, viz., 40,000 men, with the statements in the prose of Numbers as to 600,000 men and more, we at once realize how much closer to actual facts we are brought by early poetry than by the later prose of writers like P. Perhaps it is in chap. xxxi. that we have the clearest proof of P's non-historical character. There we are told that 12,000 Israelites, without losing a single man, slew every male Midianite, children included, and every Midianite woman that had known a man, and took so much booty that there had to be special legislation as to how it should be divided. But if this were actual fact, how could the Midianites have ever reappeared in history? And yet in Gideon's time they were strong enough to oppress Israel.

See Commentaries of G. B. Gray, *Internat. Crit. Com.*, L. E. Binns *Westm. Comm.*, McNeile *Camb. Bible*, A. R. S. Kennedy *Century Bible*.

(J. A. P.; L. E. B.)

NUMBERS, THEORY OF. The theory of numbers deals primarily with positive and negative whole numbers, called integers. For example, to take the simplest kind of proposition, if n is any integer, $n(n+1)$ is divisible by 2, $n(n+1)(n+2)$ is divisible by 3, etc. Many apparently very simple theorems concerning integers require for their actual proof various branches of mathematics. Frequently a proof employs the theory of algebraic numbers (such as $2+5\sqrt{3}$), which is one of the advanced parts of the theory of numbers.

MAIN PROPERTIES OF DIVISIBILITY

Theorems of Fermat and Euler. Primitive Roots.—A positive integer, like 7, is called a *prime* if it has no factor except itself and 1. But $6=2\times3$ is composite. Two integers, like 8 and -15, are called *relatively prime* if they have no common factor >1.

In 1640 Fermat stated that, if p is any prime and if n is any integer not divisible by p, then $n^{p-1}-1$ is divisible by p. For example, $3^4-1=80$ is divisible by 5. The generalization by Euler in 1760 states that if m is any positive integer, prime or composite, and if n is relatively prime to m, then $n^{\phi(m)}-1$ is divisible by m. Here $\phi(m)$ denotes the number of positive integers not exceeding m which are relatively prime to m. For example, these are 1, 5, 7, and 11 when $m=12$, so that $\phi(12)=4$, and $5^4-1=624$ is divisible by 12.

Euler's theorem shows that the linear equation $nx\pm my=c$, in which n and m are relatively prime, has the integral solution $x=cn^k$, $y=\mp cq$, where $k=\phi(m)-1$ and q is the quotient of $n^{\phi(m)}-1$ by m.

A *primitive root* n of m is such that $\phi(m)$ is the least positive exponent e for which n^e-1 is divisible by m. For example, 2 is a primitive root of 5, since 2^4-1 is divisible by 5, while no one of $2-1$, 2^2-1, 2^3-1 is divisible by 5. Again, 5 and 7 are primitive roots of 9. There exist primitive roots of m if and only if m is 2, 4, p^k, or $2p^k$, where p is an odd prime.

Quadratic Residues. Law of Reciprocity.—When the squares 1^2, 2^2, 3^2 are divided by 7, the positive remainders <7 are 1, 4, 2, which are called *least quadratic residues* of 7. Evidently the squares of $4=7-3$, $5=7-2$, $6=7-1$ have the same remainders as the squares of 3, 2, 1. Likewise, 8^2, 9^2, $\cdots$ have the same remainders as 1^2, 2^2, $\cdots$. Finally, the square of a multiple of 7 has the remainder zero, which is not counted as a

quadratic residue. Hence when all squares relatively prime to 7 are divided by 7, the only remainders <7 are 1, 2, 4, which are therefore the only least quadratic residues of 7. The remaining positive integers 3, 5, 6 less than 7 are called the *least quadratic non-residues* of 7. Then if t is any integer, $3+7t$, $5+7t$, and $6+7t$ are called non-residues of 7; while $1+7t$, $2+7t$, and $4+7t$ are called residues of 7. Clearly the product of any two residues or of two non-residues is a residue, while the product of a residue by a non-residue is a non-residue.

The generalization from 7 to any m is immediate. If an integer r is relatively prime to m and if r differs from some square by a multiple of m, then r is a *quadratic residue* of m. But if n is relatively prime to m and if there is no integer x such that x^2-n is divisible by m, then n is a *quadratic non-residue* of m. If $m=15$, we need only test the squares of 1, 2, 4, 7; their remainders 1 and 4 are the only least quadratic residues of 15. The remaining positive integers <15 and relatively prime to 15 are 2, 7, 8, 11, 13, 14 and give all the least non-residues of 15.

If p is a prime >2, and if s is any integer not divisible by p, *Legendre's symbol* (s/p) is defined to have one of just two values, viz., $+1$ when s is a quadratic residue of p, and -1 when s is a non-residue. The earlier results give $(2/7)=+1$, $(3/7)=-1$. By use of the formulas

$$(s/p)(t/p)=(st/p),\quad (-1/p)=(-1)^{(p-1)/2},\quad (2/p)=(-1)^{(p^2-1)/8},$$

the computation of any symbol (s/p) is evidently reduced to that of (l/p) where l is an odd prime $\neq p$. In case $l>p$, we have $l=ap+r$, where $0<r<p$. Since l and r are either both quadratic residues or both non-residues of p, $(l/p)=(r/p)$. Hence the computation always reduces to that of (q/p), where q and p are distinct odd primes and $q<p$. We now make use of the reciprocity law:

$$(q/p)\,(p/q)=(-1)^e,\quad e=\frac{p-1}{2}\cdot\frac{q-1}{2}.$$

Hence (q/p) will be known as soon as (p/q) has been found. Since $p>q$, our former method applies to (p/q). All these principles are illustrated in the following example:

$$(-22/73)=(-1/73)(2/73)(11/73),\ (-1/73)=+1,\ (2/73)=+1,$$
$$(11/73)=(73/11)=(7/11)=-(11/7)=-(4/7)=-1.$$

Here it was necessary to know that 73, 11, and 7 are all primes. The removal of the restriction to primes would obviously save much work. Partly for this reason, but mainly on account of its importance in many investigations, we shall discuss *Jacobi's symbol*.

Let P be a positive odd integer. If $P=1$, we take

$$(s/P)=(s/1)=+1.$$

But if $P=p_1p_2\cdots p_r$, where $p_1, p_2\cdots$ are odd primes, not necessarily distinct, we define Jacobi's symbol to be

$$(s/P)=(s/p_1)\,(s/p_2)\cdots(s/p_r).$$

In case an even number of these factors is -1, the symbol (s/P) is $+1$ and yet s is a non-residue of P. While therefore Jacobi's symbol does not admit of the same interpretation as Legendre's, yet all the above formulas hold true, including the reciprocity law, provided p and q are now any relatively prime positive odd integers. If for $n=-P$ we define (s/n) to be (s/P), we see that the reciprocity law holds also when just one of p and q is negative.

CLASSES OF FUNCTIONS. REPRESENTATION OF INTEGERS BY FUNCTIONS

Equivalent Functions and Equations.—The problem to find all solutions of $x^2+y^2=41$ in integers is equivalent to that for $X^2+4XY+5Y^2=41$, which is derived from the first equation by the substitution $x=X+2Y$, $y=Y$. The discussion is not more difficult if we start with any substitution

$$x=aX+bY,\qquad y=cX+dY, \tag{1}$$

in which the coefficients a, b, c, d are integers whose *determinant* (*see* DETERMINANT) $ad-bc$ is $+1$. Solving equations (1) for X and Y, we get

$$X=dx-by,\qquad Y=-cx+ay.$$

Hence to any pair of integers x and y corresponds a single pair of integers X and Y, and conversely by (1). Let the substitution (1) replace the function $f(x, y)$ by $F(X, Y)$. Then if g is any given integer, the integral solutions of $f=g$ are put into one-to-one correspondence with those of $F=g$ by the substitution (1), so that the problem to find all solutions of $f=g$ in integers is evidently equivalent to that for $F=g$. We therefore need only treat one of the infinitely many equivalent equations.

These two functions f and F are called *equivalent*. Let $F(X, Y)$ become $G(u, v)$ when we apply the new substitution

$$X=qu+rv,\qquad Y=su+tv, \tag{2}$$

with integral coefficients whose determinant $qt-rs$ is $+1$. If we eliminate X and Y between the four equations (1) and (2), we evidently obtain equations of the form

$$x=Au+Bv,\qquad y=Cu+Dv. \tag{3}$$

The coefficients are seen to be integers whose determinant is unity. This substitution (3) is called the product of the substitutions (1) and (2) taken in that order. Since (1) replaces f by F, and (2) replaces F by G, evidently (3) replaces f by G. This proves that if f and G are both equivalent to F, they are equivalent to each other. Hence all the functions which are equivalent to a given one f form a *class* of functions any two of which are equivalent. It is easy to extend this discussion for two variables x and y to any number of variables.

When $f(x, y, \cdots)=g$ has integral solutions, g is said to be *represented* by f. In case $x, y, \cdots$ have no common factor >1, g is *properly represented* by f. For example, $2^2+3^2+4^2=29$, whence 29 is properly represented by $x^2+y^2+z^2$.

Positive Binary Quadratic Forms.—The function

$$f=ax^2+bxy+cy^2$$

is called a binary quadratic form and is denoted by (a, b, c). Its *discriminant* is b^2-4ac. Two equivalent forms have the same discriminant.

Let A be properly represented by f, whence $f=A$ for relatively prime integers $x=r$, $y=s$. As shown above, there exist two integers t and u such that $rt-su=1$. The substitution

$$x=rX+uY,\qquad y=sX+tY,$$

whose determinant is unity, replaces f by an equivalent form in which the coefficient of X^2 is A.

Let $a>0$ and let the discriminant of f be a negative number $-\Delta$. Then

$$4af=(2ax+by)^2+\Delta y^2$$

shows that f is positive for all real numbers x and y not both zero. Hence f is called a *positive form* (*see* ALGEBRAIC FORMS). Let A be the least positive integer which is represented by this f. If $f=A$ when $x=r$, $y=s$, and if r and s have a common factor $d>1$, then $f=A/d^2$ when $x=r/d$, $y=s/d$, which contradicts the definition of A as least. Thus A is properly represented by f. As shown above, f is equivalent to some form $g=(A, \beta, \gamma)$ with A as first coefficient. The substitution $x=X+nY$, $y=Y$ replaces g by $F=(A, B, C)$, where $B=\beta+2nA$. Evidently the integer n may be chosen so that $-A<B\leqq A$. Since C is represented by F, C is not less than the minimum A. In case $C=A$, the substitution $x=-Y$, $y=X$, whose determinant is unity, replaces F by $(A, -B, A)$. This proves that every positive form is equivalent to a *reduced form* (A, B, C) in which

$$A<B\leqq A,\quad C\geqq A,\ \text{with } B\geqq 0 \text{ if } C=A. \tag{4}$$

Then $$4A^2\leqq 4AC=\Delta+B^2\leqq\Delta+A^2,\ 3A^2\leqq\Delta.$$

Hence if Δ is given, there is a limited number of positive integral values of A. The same is now true for B by (4). Each pair of integers A and B determines at most one integer C for which $4AC=\Delta+B^2$. Hence there is only a finite number of positive

reduced forms having a given discriminant.

Example 1. To find the reduced forms whose discriminant is -4. Since $3A^2 \leqq 4$, the positive integer A is 1. By (4), $B = 0$ or 1. Then $4C = 4 + B^2$ gives $B = 0$, $C = 1$. Hence $x^2 + y^2$ is the single reduced form.

Example 2. Let the discriminant be -12. Then $A = 1$ or 2. If $A = 1$, we get $F = x^2 + 3y^2$ as in Ex. 1. If $A = 2$, $8C = 12 + B^2$ shows that B is even and $\neq 0$. Then (4) gives $B = 2$. The resulting reduced form (2, 2, 2) represents only even integers and hence is not equivalent to F.

The last example illustrates the theorem that no two reduced forms having the same negative discriminant are equivalent. This implies that the number of classes of positive binary quadratic forms having a given negative discriminant is exactly the number of reduced forms.

The importance of these ideas will become clear by considering the theorem that every prime p of the form $4n+1$ is sum of two squares. This fact was recognized by Girard in 1625. Euler was the first to publish proofs (1749, 1773, 1783). In 1854 Hermite gave the following immediate proof: Since $(-1/p) = +1$, -1 is a quadratic residue of p. In other words, there exist integers t and q such that $t^2 + 1 = pq$. Hence the discriminant of

$$f = pX^2 + 2tXY + qY^2$$

is -4. By Example 1, f is equivalent to the single reduced form $x^2 + y^2$ of discriminant -4. This means that there is a substitution (1) which replaces $x^2 + y^2$ by f. Equating the coefficients of X^2, we get $p = a^2 + c^2$.

Euler noted that if we multiply $(a \pm bi)$ $(c + di)$ by its conjugate imaginary, we obtain the identity

$$(a^2 + b^2)(c^2 + d^2) = (ac \mp bd)^2 + (ad \pm bc)^2 \qquad (5)$$

known by Diophantus (*c.* 275; *see* DIOPHANTINE EQUATIONS). It now follows that an integer is a sum of two squares if and only if its quotient by the largest square dividing it is a product of primes all of the form $4n+1$, or the double of such a product.

If $p = a^2 + b^2$ and $q = c^2 + d^2$ are distinct primes of the form $4n+1$, the two numbers whose squares appear in the second member of (5) cannot have a common factor $f > 1$, since f^2 does not divide the first member pq. For all combinations of signs, $(\pm a, \pm b)$ and $(\pm b, \pm a)$ give the 8 representations of p by $x^2 + y^2$, and all 8 are proper. Hence there are 16 proper representations of pq as a sum of two squares. But if $p = q$, we may take $c = a$, $d = b$. For the lower signs, the final number in (5) is zero, and the resulting representation $p^2 + 0$ of p^2 is not proper. This illustrates and makes plausible the important theorem that a product of powers of k distinct primes each of the form $4n+1$ has exactly 2^{k+2} proper representations by $x^2 + y^2$.

The number of all representations of a positive odd integer m by $x^2 + y^2$ is the quadruple of the excess of the number of divisors of the form $4n+1$ of m over the number of divisors of the form $4n+3$ of m.

Hermite's method is not restricted to $x^2 + y^2$. If p is a prime of either of the forms $8n+1$ or $8n+3$, then $(-2/p) = +1$, and $t^2 + 2 = pq$ is solvable for integers t, q. Then f is equivalent to the single reduced form (1, 0, 2) of discriminant -8. Hence p is represented by $x^2 + 2y^2$. Again, if $p = 3n+1$ is a prime,

$$(-3/p) = (p/3) = +1,$$

and $t^2 + 3 = pq$ is solvable; hence p is represented by $x^2 + 3y^2$. The method applies directly when no two reduced forms have the same *divisor, i.e.*, the greatest common divisor of the three coefficients of a form.

But the two reduced forms (1, 0, 5) and (2, 2, 3) of discriminant -20 have the same divisor 1. The primes p of the forms $20n+1$, 3, 7, 9 are the only ones distinct from 2 and 5 for which $(-5/p) = +1$. Hence any product m of powers of primes of these four types is represented by one of the reduced forms $g = x^2 + 5y^2$, $h = 2x^2 + 2xy + 3y^2$. To decide which one, note that $g = m$ gives $(m/5) = +1$, while $h = m$ gives

$$2m = (2x+y)^2 + 5y^2, \quad (2m/5) = 1, \quad (m/5) = (2/5) = -1.$$

Hence the representation is by g if $m = 5k \pm 1$, but by h if $m = 5k \pm 3$.

Positive Ternary Quadratic Forms.—If we write

$$F = ax^2 + by^2 + cz^2 + 2ryz + 2sxz + 2txy, \qquad (1)$$

$$d = \begin{vmatrix} a & t & s \\ t & b & r \\ s & r & c \end{vmatrix} \qquad \begin{aligned} L &= ab - t^2, \\ M &= ar - ts, \\ N &= ac - s^2, \end{aligned}$$

then d is called the *determinant* of the ternary form F. For real values of the coefficients and variables, F is called a *positive form* if every value of F is $\geqq 0$ and if $F = 0$ only when $x = y = z = 0$. We have

$$aF - (ax + ty + sz)^2 = f = Ly^2 + 2Myz + Nz^2, \qquad (2)$$

$$Lf = (Ly + Mz)^2 + adz^2, \qquad LN - M^2 = ad. \qquad (3)$$

Hence if a, L, and d are all positive, F is a positive form. The converse is easily proved.

Let ϕ be any positive ternary quadratic form of determinant d with integral coefficients (those of cross products being even as in F). Let a be the least positive integer which is represented by ϕ. The main theorem states that ϕ is equivalent to a form (1) such that (2) is a reduced binary form of discriminant $-4ad$, and such that $-a < 2s \leqq a$, $-a < 2t \leqq a$. Since F and hence also ϕ represents b, we have $a \leqq b$. Thus

$$a^2 \leqq ab = L + t^2 \leqq L + \tfrac{1}{4}a^2, \quad 3a^2 \leqq 4L.$$

Our earlier work on reduced binary forms f gives $3L^2 \leqq 4ad$. Hence

$$a \leqq \sqrt[3]{2}\sqrt[3]{d}. \qquad (4)$$

Thus when d is given, there is only a finite number of sets of integers a, s, t satisfying our inequalities. We saw that there is only a finite number of reduced binary forms f of given discriminant $-4ad$. Hence there is only a finite number of classes of positive ternary quadratic forms of given determinant.

Let $a = 1$. Then $s = t = 0$, and (2) becomes $F - x^2 = f$. The substitution which merely changes the signs of x and y is of determinant 1 and merely changes the sign of M. Hence we may take $M \geqq 0$.

Let $d = 1$ or 3. Then $a = 1$ by (4). Applying also the conclusions found in Examples 1 and 2 under binary quadratic forms, we have the following theorem: Every positive ternary quadratic form of determinant 1 is equivalent to $x^2 + y^2 + z^2$; every one of determinant 3 is equivalent to $P = x^2 + y^2 + 3z^2$ or

$$Q = x^2 + 2y^2 + 2yz + 2z^2.$$

We are now in a position to discuss one of the most useful theorems in the theory of numbers: If a is any positive integer not of the form $4^k(8n+7)$, then a is a sum of three squares having no common factor > 1. Complicated proofs were first given by Legendre in 1798 and by Gauss in 1801. The simplest proof is that by Dirichlet in 1850. It employs a positive form (1) whose determinant d is unity. Take $s = 1$, $t = 0$. Then $d = a\Delta - b$, where Δ denotes $bc - r^2$. Let a be double an odd integer. There are infinitely many primes in any arithmetical progression whose first term and common difference are relatively prime. Hence we can choose a positive integer l so that $b = 4al + a - 1$ is a prime. Take $\Delta = 4l + 1$. Then $(-\Delta/b) = +1$. Hence there is an integer r such that $(r^2 + \Delta)/b$ is an integer c. The resulting positive form (1) of determinant unity must be equivalent to $X^2 + Y^2 + Z^2$ by our previous theorem. Hence $X = \alpha x + \cdots$, $Y = \beta x + \cdots$, $Z = \gamma x + \cdots$ have integral coefficients whose determinant is unity. Hence $a = \alpha^2 + \beta^2 + \gamma^2$, where α, β, γ are integers with no common factor > 1. The proof is similar for the remaining numbers a.

We saw that all positive ternary forms of determinant 3 are equivalent to P or Q. To show that P represents every positive integer a not divisible by 3, Dirichlet used (1) with $s = 1$, $t = 0$ and $b - 5$ a multiple of 8. It is easily verified that $Q - 5$ is never divisible by 8. Since (1) is of determinant 1 and represents b, while Q does not represent b, (1) must be equivalent to P. But he did not prove that P represents every positive integer $9n+3$.

Its proof requires a serious modification of his method and was given, along with a complete study of various new ternary forms, in several papers published in America in 1927. The complete theorem for $P=x^2+y^2+3z^2$ is that a positive integer can be represented by P if and only if it is not of the form $9^k(9n+6)$.

The forms P and $x^2+y^2+z^2$ are called *regular* since all the positive integers not represented by one of them coincide with all the positive integers in certain arithmetical progressions. The form $g=x^2+y^2+10z^2$ is regular with respect to even integers since it represents no number $4^k(16n+6)$, but represents all the remaining even integers. However, g is irregular with respect to odd integers. It was proved in 1927 that if k is any one of the odd integers 3, 7, 21, 31, 33, 43, 67, 79, 87, 133, 217, $\cdots$ not represented by g, then every arithmetical progression which contains k will contain integers represented by g. Only a few forms are regular.

Positive Quaternary Quadratic Forms.—One of the most remarkable theorems is that every positive integer p is a sum of four squares. Diophantus seems to have recognized this fact. In 1659 Fermat stated that he possessed a proof by descent from p to smaller numbers, and a short proof of this kind was published in 1924. Euler tried for 40 years to find a proof. The first proof published was that by Lagrange in 1772. The next year Euler gave a much simpler proof which is still quoted in text-books.

Every p is represented by each of $x^2+y^2+z^2+su^2$ ($s=1, \cdots, 7$). Except when $p=4^k(8n+7)$, we may take $u=0$ and apply the earlier result that p is a sum of three squares. We shall next prove that $8n+7$ is represented, whence $2^kx, \cdots, 2^ku$ give a representation of $4^k(8n+7)$. We have only to exhibit a value of u for which $8n+7-su^2$ is positive and not of the form $4^h(8m+7)$ and hence is a sum of three squares. For $s=1, 2, 4, 5$, or 6, take $u=1$. For $s=3$, take $u=1$ or 2 according as $n=0$ or $n>0$. For $s=7$, take $u=1$ if $n=0, 1$, or 2; but take $u=2$ if $n\geqq 3$.

The same proof applies to $x^2+2y^2+2z^2+su^2$. A similar proof shows that every p is represented by each of

$$\begin{aligned}
&x^2+y^2+2z^2+lu^2 \quad (l=2, \cdots, 14),\\
&x^2+y^2+3z^2+mu^2 \quad (m=3, 4, 5, 6),\\
&x^2+2y^2+3z^2+nu^2 \quad (n=3, \cdots, 10),\\
&x^2+2y^2+4z^2+qu^2 \quad (q=4, \cdots, 14),\\
&x^2+2y^2+5z^2+ru^2 \quad (r=6, \cdots, 10).
\end{aligned}$$

Besides these 54 forms there is no new form of the type $ax^2+by^2+cz^2+du^2$ which represents every p when a, b, c, d are positive integers. This is easily verified by using the values 1, 2, 3, 5, 6, 7, 10, 14, 15 of p.

Recently the problem has been completely solved for forms q involving also products like xy. The main point in the solution is a simple application of the principles which have been developed above in detail. It will be explained for the important typical case $q=u^2+\tau$ where τ is a positive ternary quadratic form. Let m be the least positive integer represented by τ. Unless m is 1 or 2, q would not represent 2. Let $m=1$ and let d denote the determinant of 2τ. The main theorem quoted under ternary forms shows that 2τ (whose minimum is $a=2$) is equivalent to a form $2T=F$ such that $4T-X^2$ is the reduced binary form f in (2), where $X=2x+ty+sz$, $t=0$ or 1, $s=0$ or 1. By hypothesis, $q=u^2+T$ represents all positive integers. Hence $Q=4q=4u^2+X^2+f$ represents all positive multiples of 4. The positive minimum of the reduced f is L. If $L>12$, $Q=12$ requires that $f=0$. But $12=4u^2+X^2$ is impossible in integers. Hence $L\leqq 12$. Since the coefficients of y^2 in X^2+f and $4T$ are equal, t^2+L is a multiple of 4. Hence the only possible values of L are 4, 8, 12, 3, 7, 11. In these respective cases the least positive multiple of 4 not represented by $4u^2+X^2+Ly^2$ (or Q with $z=0$) is found to be $l=28, 56, 24, 24, 84, 88$, respectively. Since Q shall represent l, we have $f\leqq l$ for certain integers y and z such that $z\neq 0$. Then (3) evidently implies that $2d\leqq Ll$. Hence there is a limited number of values of d, and therefore of reduced forms f of discriminant $-8d$. This proves that the number of forms T is finite.

In addition to the above 54 forms involving only squares, there are exactly 299 further forms u^2+T which represent all positive integers. If we multiply them by 4, 8, 12, 28, or 44, we may complete the squares and obtain forms involving only squares. The following are samples of the resulting equivalent theorems: If $r=4m-1$ or $4m-2$, $m=1, \cdots, 7$, then $x^2+y^2+z^2+rw^2$ represents all positive multiples of 4. If $k=1, \cdots, 6$, and $s=0$ or 1, then $x^2+3y^2+3z^2+4(3k-s)w^2$ represents all positive multiples of 12. If $3\leqq k\leqq 22$, $s=0$ or 1, $0\leqq M\leqq 5$, with $M+s$ even, then $x^2+11y^2+11z^2+(44k-Ls-M^2)w^2$ represents all positive multiples of 44.

The number of representations of any positive integer N as a sum of four squares is $8s$ or $24s$, according as N is odd or even, where s is the sum of the positive odd divisors of N. If N is odd, the number of representations of $4N$ as a sum of four odd squares is $16s$.

Let w be odd and S be the sum of its divisors not divisible by 3. The number of representations of 2^rw by $x^2+y^2+3z^2+3u^2$ is $4(2^{r+1}-3)S$ if $r>0$, but is $4S$ if $r=0$.

Analogous theorems have been found for many forms whose four coefficients are all products of powers of 2 and 3, or when each coefficient is 1 or 5. Also the number of proper representations was found.

Waring's Problem.—Without proof, Waring stated in 1770 that every positive integer is a sum of 9 integral cubes $\geqq 0$, a sum of 19 biquadrates, etc. In 1859 Liouville employed an identity equivalent to

$$6(x_1^2+x_2^2+x_3^2+x_4^2)^2=\Sigma(x_i+x_j)^4+\Sigma(x_i-x_j)^4, \qquad (1)$$

summed for $i, j=1, \cdots, 4$; $i<j$. Since every integer $n\geqq 0$ is a sum of four squares, this proves that $6n^2$ is a sum of 12 biquadrates. Every integer $p\geqq 0$ is of the form $6q+r$, where r is one of 0, 1, $\cdots$, 5 and is evidently a sum of five biquadrates 0 or 1. Since $q=n_1^2+\cdots+n_4^2$, $6q$ is a sum of 4×12 biquadrates. Hence every p is a sum of 53 biquadrates.

Later writers gradually reduced this limit 53 to 37. The latest result is that every p is a sum of 17 biquadrates and 10 doubles of biquadrates.

That every p is a sum of nine integral cubes $\geqq 0$ was first proved by Wieferich in 1909; a gap in his proof was first filled by Kempner in 1912. A simpler proof was given by Dickson in 1927, who proved also that, if $t\leqq 23$, every p is represented by tx^3+C_8, where C_8 is a sum of 8 integral cubes $\geqq 0$, and $x\geqq 0$; also by $kx^3+2y^3+C_7$ if $k\leqq 34$, $k\neq 10, 15, 20, 25, 30$; also by $lx^3+3y^3+C_7$ if $l\leqq 9$, $l\neq 5$; and for $p<40{,}000$ by $x^3+y^3+2z^3+2u^3+3v^3$.

In 1909 Hilbert proved that every p is a sum of N_k positive or zero kth powers. The long proof gives no clue as to the value of the finite number N_k. By means of a fivefold integral, he proved the existence of an identity, of type (1), which expresses $M(x_1^2+x_2^2+x_3^2+x_4^2)^k$ as a sum of $2k$th powers of linear functions of x_1, x_2, x_3, x_4 with integral coefficients. Here M is a positive integer depending on k. Later writers established this identity by algebraic methods.

In 1913 Baer gave $N_5=58$ and $N_6=478$, which are less than earlier limits. Wieferich gave $N_7=3{,}806$. Writing $(1_r, 8_s)$ for a sum of r sixth powers and the products of s sixth powers by 8, Dickson proved that every p is represented by each of the forms

$$(1_{115}, 8_{108}), \quad (1_{178}, 8_{99}), \quad (1_{10}, 2_{90}, 3_{72}, 4_{18}).$$

Identities of Hilbert's type leading to explicit finite values of N_k were given by A. Hurwitz for $k=8$, by I. Schur for $k=10$, and by Kempner for $k=12$ and 14.

By intricate analytic investigations, Hardy and Littlewood recently obtained remarkable results. First they gave a new proof that N_k is finite. Next, they proved that, for all sufficiently large numbers, $N_k\leqq(k-2)2^{k-1}+5$ (9 cubes, 21 biquadrates, 53 fifth powers, etc.). Finally, when $k\geqq 4$ they obtained in 1925 a limit involving logarithms which gives the best results to date: Every sufficiently large integer p is a sum of 19 biquadrates, 41 fifth powers, 87 sixth powers, 193 seventh powers, 425 eighth powers, 949 ninth powers, or 2,113 tenth powers. No determination was made for the limit beyond which p must

lie, but it would be excessively large. Landau simplified this theory in his 1927 text.

In 1909 Landau proved that all sufficiently large integers p are sums of 8 cubes. That this holds if $p \geqq 23\times 10^{14}$ was proved by Baer by technical results in the analytic theory of primes. For $l=1, \cdots, 5$, Dickson proved that lx^3+C_7 represents all sufficiently large integers.

Sums of Values of a Polynomial.—In 1636 Fermat stated that every positive integer p is a sum of $m+2$ *polygonal numbers* $\frac{1}{2}m(x^2-x)+x$ of order $m+2$. For $m=1$, the latter is a triangular number $\frac{1}{2}x(x+1)$ and is the number of shot arranged in a triangle with x shot in the base. That every p is a sum of three triangular numbers is equivalent to the fact that $8p+3$ is a sum of three odd squares $(2x+1)^2$. For $m=2$, the theorem states that every p is a sum of four squares. Cauchy gave the first proof in 1815, and showed that all but four of the polygonal numbers may be chosen from the special ones 0 and 1. He employed the following lemma: If a and b are positive odd integers and if b lies between $\sqrt{(3a-2)}-1$ and $\sqrt{4a}$, there exist four integers t, u, v, w, each $\geqq 0$, such that

$$a=t^2+u^2+v^2+w^2, \quad b=t+u+v+w.$$

When a and b are even, this holds if also $a-b^2/4$ is a sum of three squares.

In 1921 Kampke considered any polynomial $P(x)$ with rational coefficients whose values are integers $\geqq 0$ for every integer $x\geqq 0$, and proved that every integer $p\geqq 0$ is a sum of s such values of $P(x)$ and e numbers 0 or 1, where s and e are finite integers depending on $P(x)$, but not on p. This existence proof gives no clue to the values of s and e. He also generalized Cauchy's lemma from 2 to n simultaneous equations

$$l_k=x_1{}^k+\cdots+x_N{}^k \quad (k=1, \cdots, n),$$

where $l_2, \cdots, l_n$ lie between specified limits, and N is to be chosen.

The complete solution for quadratic functions was given by Dickson in 1928. Consider $f(x)=\frac{1}{2}m(x^2-x)+tx+c$, where m, t, c are integers and $m>0$, $t>0$, $c\geqq 0$. A quadratic function takes integral values $\geqq 0$ for every integer $x\geqq 0$ if and only if it is either $f(x)$ or $f(x-k)$ with $k\geqq 1$, $m\geqq t$. Since c is the least such value of $f(x-k)$, sc is the least sum of s values. The problem is to find the least integer e_s such that every integer $\geqq sc$ is a sum of s values of $f(x-k)$ for integers $x\geqq 0$ and e_s numbers 0 or 1. We may take $c=0$ without loss of generality. First, let $s\geqq 5$. If $k=0$, then $E_s=e_s+1$ is t or $m-(s-3)t$, according as $m<(s-2)t$ or not. If $k>0$ and $m\geqq 2t$, then E_s is t or $m-(s+1)t$, according as $m<(s+2)t$ or not. When $m<2t$, write q for $m-t$. If $k\geqq 2$, E_s is q or $t-3q$, according as $t\leqq(s+1)q$ or not. When $k=1$, $E_5=q$ if $t\leqq 3q$, $E_5=t-2q$ if $t\geqq 3q$. But if $k=1$, $s\geqq 6$, $E_s=q$ or $t-(s-2)q$, according as $t\leqq(s-1)q$ or not. We now know the minimum L for all $s\geqq 5$ of the number $s+e_s$ of summands. Whenever $4+e_4$ is less than L, it is exactly $L-1$. The minimum of all $s+e_s$ for $s\geqq 1$ is L or $L-1$ except when $k=0$, $m\leqq t$, and then is $L-2$.

Every integer $p\geqq 0$ has been recently proved to be a sum of ten pyramidal numbers $\frac{1}{6}(x^3-x)$ for integers $x\geqq 0$; also a sum of nine if p is sufficiently large.

If in the formula for polygonal numbers we employ negative as well as positive integral values of x, we obtain the generalized polygonal numbers. Every positive integer is a sum of N generalized polygonal numbers of order k, where $N=3$ for $k=3$, 5 or 6; $N=4$ for $k=4$, 7 or 8; $N=k-4$ for $k>8$.

Consider the positive binary quadratic forms q and the integers s such that every positive integer p is a sum of s values of q. The case $p=1$ requires that q shall represent 1. Hence we may take $q=x^2+axy+by^2$, $a=0$ or 1. Then each p is a sum of four values of q with $y=0$. Thus the cases $s=2$ and $s=3$ alone are interesting. Whether a is 0 or 1, every p is a sum of two values of q if and only if $b=1$, 2, or 3, and a sum of three values of q if and only if $b=1, \cdots, 7$.

ALGEBRAIC NUMBERS

Failure of Expected Laws.—The roots of an equation $ax^n+bx^{n-1}+\cdots=0$ having integral coefficients are called algebraic numbers. If $a=1$, the roots are *integral algebraic numbers*; examples are $\sqrt{5}$, $\sqrt[3]{5}$. Prior to a lengthy controversy in 1847, it was regarded as self-evident that the laws of divisibility which hold for whole numbers continue to hold also for integral algebraic numbers. Fundamental for mathematics was the recognition of the falsity of this intuition and the invention of "ideals" serving to restore those laws of divisibility.

A typical example is the set S of all quadratic integers $a+b\theta$, where $\theta=\sqrt{-5}$, while a and b are whole numbers. By an indecomposable number n of this set S we mean one having no factor in S other than n, $-n$, 1, -1. If $2+\theta=(x+y\theta)(z+w\theta)$, where x, y, z, w are whole numbers, we multiply by the like equation having $-\theta$ in place of θ, and get $9=(x^2+5y^2)(z^2+5w^2)$. But $x^2+5y^2=3$ is evidently impossible in whole numbers. Hence we may take $x^2+5y^2=1$, whence $x+y\theta=\pm 1$. The same discussion applies also if we replace $2+\theta$ by $2-\theta$ or 3. Hence $9=3\cdot 3$ and $9=(2+\theta)(2-\theta)$ give two factorizations of 9 into indecomposable numbers of S. The law of unique factorization of whole numbers into primes therefore fails for numbers of S. Since the indecomposable number 3 divides the product 9 of $2+\theta$ and $2-\theta$ without dividing either of them, we have a second failure in S of laws of ordinary primes. A third more astonishing failure in S of the laws of arithmetic is the absence in S of a greatest common divisor of 9 and $t=3-6\theta$; their only common divisors are ± 1, ± 3 and $\pm(2-\theta)$, no one of which is divisible by the remaining five.

Ideals.—These laws are restored by the introduction of ideals, first defined intangibly in special cases by Kummer in 1847, and later in complete generality and clearness by Dedekind. To any number μ of our set S corresponds uniquely the totality $\rho\mu$ of its multiples, where ρ ranges over all numbers of S. This totality is called the *principal ideal* (μ) and evidently has the following two properties: (a) The sum and difference of any two numbers of an ideal are themselves numbers of the ideal. (b) Every product of a number of an ideal by a number of S is a number of the ideal. Any set of numbers of S is called an *ideal* if it has these two properties and is not composed exclusively of the number zero.

When x and y range independently over all whole numbers, the totality $x\xi+y\eta$ is denoted by $[\xi, \eta]$. It evidently has property (a). To show that $\beta=[3, 1+\theta]$ is an ideal, it remains to verify that it has property (b). This will follow if we show that 3ρ and $(1+\theta)\rho$ belong to β for every ρ in S. But $\rho=a+b\theta$, where a and b are whole numbers, and

$$3\rho=3(a-b)+3b(1+\theta), \quad (1+\theta)\rho=-6b+(a+b)(1+\theta)$$

are numbers in β. Since we may replace θ by $-\theta$ in this proof, we conclude that also $\alpha=[3, 1-\theta]$ is an ideal.

If L ranges over the numbers of an ideal λ and if M ranges over those of an ideal μ, then the set composed of the products LM and all their sums and differences is seen to have properties (a) and (b) and hence is an ideal, called the product of λ and μ, and denoted by either $\lambda\mu$ or $\mu\lambda$. In particular,

$$\alpha\beta=[9, 3+3\theta, 3-3\theta, 1-\theta^2=6]=[3, 3\theta]=(3).$$

Similarly, $\beta^2=(2-\theta)$ and hence $\alpha^2=(2+\theta)$.

To remove the above difficulties concerning numbers 9, $3, \cdots, t=3-6\theta$ of S, we pass to the uniquely corresponding principal ideals $(9), (3), \cdots, (t)$. Now

$$(9)=(3)\,(3)=\alpha^2\beta^2=(2+\theta)\cdot(2-\theta),$$

and we have the single factorization $(9)=\alpha^2\beta^2$ instead of the former two factorizations of 9. Finally, $\gamma=[7, 3+\theta]$ is an ideal such that $\beta\gamma=(1-2\theta)$, so that (9) and $(t)=(3)\beta\gamma=\alpha\beta^2\gamma$ have the greatest common ideal divisor $\alpha\beta^2$.

If an ideal is different from the principal ideal (1) and if it is divisible by no ideal other than itself and (1), it is called a *prime ideal*. It is readily proved that every ideal which is not a prime can be expressed in one and but one way as a product of (a finite number of) prime ideals. Hence the laws of factorization in

arithmetic hold for our ideals. Since α, β, γ are prime ideals, the above three difficulties have been completely removed.

Classes of Ideals.—Two ideals ρ and σ are called equivalent if there exist principal ideals (r) and (s) such that $\rho(r)=\sigma(s)$. If also ρ is equivalent to τ, with $\rho(q)=\tau(t)$, then σ is equivalent to τ since $\sigma(sq)=\rho(r)(q)=\tau(tr)$. Hence all ideals equivalent to a given one are equivalent to each other and are said to form a *class* of ideals.

Evidently any two principal ideals are equivalent. If σ is equivalent to the principal ideal (1), so that $\sigma(s)=(r)$, the number r of the product $\sigma(s)$ is in (s), whence r is divisible by s and $\sigma=(r/s)$. Hence the principal class contains all the principal ideals and no others.

For the above set S determined by $\theta=\sqrt{-5}$, we readily specify the classes of ideals. If (α) is any principal ideal, we have $\alpha=m(x+y\theta)$, where x and y are relatively prime integers. We can choose integers r and s such that

$$\begin{vmatrix} x & -y \\ s & -r \end{vmatrix} = sy-rx = 1.$$

Hence we can solve $x\alpha-y\alpha\theta=u$, $s\alpha-r\alpha\theta=v$, and express α and $\alpha\theta$ as linear functions of u and v with integral coefficients. This proves that $(\alpha)=[\alpha,\ \alpha\theta]$ is identical with $[u, v]$. But $u=ma$, $a=x^2+5y^2$, $v=m(b+\theta)$, $b=sx+5ry$. Also

$$b^2+5=b^2+5(sy-rx)^2=a(s^2+5r^2).$$

Hence all principal ideals are given by

$$[ma,\ m(b+\theta)],\quad (b^2+5)/a=\text{integer}, \qquad \text{(I.)}$$

in which a is properly represented by x^2+5y^2.

Since 2 is not such a value of a, $\rho=[2,\ 1+\theta]$ is not a principal ideal. Hence the system S was actually enlarged by the introduction of ideals. In some other systems Σ, every ideal is a principal ideal and then the laws of divisibility of whole numbers hold for Σ since they hold for the essentially equivalent set of all ideals. This happens for systems Σ of numbers involving $\sqrt{-k}$ when $k=1, 2, 3, 7, 11, 19, 43, 67, 163$, but for no further positive values $<1{,}500{,}000$ of k lacking square factors, and holds for many negative values of k.

For S all ideals equivalent to ρ are readily shown to be of type (I.) where now a is properly represented by $f=2x^2+2xy+3y^2$. Moreover, all ideals are given by (I.). Consider any such ideal and write l for the final integer in (I.). Then $ax^2+2bxy+ly^2$ is of discriminant $4(b^2-al)=-20$ and hence is equivalent to one of the two reduced forms x^2+5y^2 or f of discriminant -20. Thus a is represented by one of them. Hence there are exactly two classes of ideals.

This example illustrates the identity of the problems to find the number of classes of binary quadratic forms of negative discriminant d and the number of classes of ideals for the system of quadratic integers determined by $\sqrt{d}$. For a positive d, a similar result holds if in our criterion $\rho(r)=\sigma(s)$ for the equivalence of ideals ρ and σ, we impose the restriction that the norm of r/s is positive (narrow equivalence of ideals).

Arithmetics of Algebras.—We shall now discuss an important generalization of algebraic numbers. A quaternion $q=a+bi+cj+dk$ was called integral by Lipschitz in his *Untersuchungen über die Summen von Quadraten* (Bonn, 1886) if and only if a, b, c, d are integers. This natural definition led to serious difficulties and has been discarded. More fortunate was A. Hurwitz in his important book, *Zahlentheorie der Quaternionen* (1919), who called q *integral* not only when a, b, c, d are integers, but also when all four are halves of odd integers. Two such integral quaternions have a greatest common right (or left) divisor. The resulting perfect arithmetic of quaternions leads to simple proofs, as well as interpretations, of the main facts about the number of representations of integers as sums of four squares. Du Pasquier applied Hurwitz's definition unchanged to many further linear algebras and found that they usually do not possess integral numbers.

The latter unfortunate conclusion is avoided by the new definition given by Dickson in his *Algebras and their Arithmetics* (Chicago, 1923), where general theorems were obtained for the first time. In his *Algebren und ihre Zahlentheorie* (Zürich, 1927), he gave the following simpler, but equivalent, definition: Let A be any rational associative algebra containing 1. Consider a set S of numbers in A each satisfying an algebraic equation with integral coefficients and having 1 as leading coefficient, and such that the sum, difference and product of any two numbers of S are all numbers of S. Let S contain 1. Then if S is not contained in a larger such set, its numbers are called the *integral numbers* of algebra A. In case A is an algebraic field, our integral numbers become the classic integral algebraic numbers of A. Again, if A is the algebra of quaternions, our integral numbers become the integral quaternions of Hurwitz (*see* QUATERNIONS).

The applications include a complete theory of the number of (all or only proper) representations by $x^2+y^2+tz^2+tu^2$ for $t=1$, 3, -3, or 7, and by various forms having cross-products; and the complete solution in integers $x, \cdots, u, \delta_1, \cdots, \delta_k$ of $Q=\delta_1\delta_2\cdots\delta_k$, where Q is any one of the mentioned quadratic forms. For example, $q=a+bi+cj+dk$ is said to have the co-ordinates a, b, c, d and norm $N(q)=a^2+b^2+c^2+d^2$. Then all integral solutions of $x^2+y^2+z^2+u^2=\delta_1\cdots\delta_k$ are derived from

$$x+yi+zj+wk=d_1\cdots d_k,\quad \delta_1=N(d_1),\ \cdots,\ \delta_k=N(d_k)$$

if we take $d_1, \cdots, d_k$ to be arbitrary quaternions with integral co-ordinates. If we take $k=2$ and express w^2-v^2 as a product $\delta_1\delta_2$ of two integers in all ways, we obtain all integral solutions of $x^2+y^2+z^2+u^2+v^2=w^2$ by means of quaternions.

Let M be an n-rowed square matrix whose n^2 elements x_{ij} are variables. Denote its determinant by D. Then all integral solutions $x_{ij}, \delta_1, \cdots, \delta_k$ of $D=\delta_1\delta_2\cdots\delta_k$ are derived from

$$M=d_1 d_2\cdots d_k, \qquad \delta_1=|d_1|,\ \cdots,\ \delta_k=|d_k|$$

if we take $d_1, \cdots, d_k$ to be n-rowed matrices whose elements are arbitrary integers. For $n=k=2$, this yields all integral solutions of $x^2+y^2+z^2=u^2+v^2+w^2$. Instead of integers we may employ integral algebraic numbers.

MISCELLANEOUS TOPICS

Perfect Numbers.—A number is called perfect if it is equal to the sum of its divisors smaller than itself. For example, $6=1+2+3$ is the first perfect number. No odd perfect number is known, but it has not been proved that none exist. It is easily proved that every even perfect number is of the form $2^{p-1}(2^p-1)$. Euclid (*Elem.*, ix. 36) proved that the latter is a perfect number if 2^p-1 is a prime. Without justification, Mersenne stated in 1644 that the first 11 values of p for which 2^p-1 is a prime are 2, 3, 5, 7, 13, 17, 19, 31, 67, 127, 257. It is now known that 67 should be omitted, and 61, 89, 107 included; while the only cases in doubt are 137, 139, 149, 157, 167, 193, 199, 227, 229, 241, 257.

Galois Imaginaries.—Under the topic quadratic residues, we found that there is no integer x such that x^2-3 is divisible by 7. Nevertheless, in 1830 Galois invented imaginaries x having this property. Their use was later justified by employing the 49 residues $ax+b$ ($a, b=0, 1, \cdots, 6$) obtained from all polynomials in x with integral coefficients by suppressing polynomial multiples of both x^2-3 and 7. The theory is given completely in Dickson's *Linear Groups* (Leipzig, 1901). An account in French occurs in Serret's *Algèbre*.

Modular Invariants.—For example, consider

$$l=\begin{vmatrix} x^{p^2} & y^{p^2} & z^{p^2} \\ x^p & y^p & z^p \\ x & y & z \end{vmatrix}, \qquad L=\begin{vmatrix} X^{p^2} & Y^{p^2} & Z^{p^2} \\ X^p & Y^p & Z^p \\ X & Y & Z \end{vmatrix},$$

where p is a prime. If x, y, z are linear functions of X, Y, Z with integral coefficients whose determinant is d, then $l-dL$ is divisible by p. We therefore call l a *modular invariant*. But l has the factor x. It follows that l differs by a multiple of p from the product of all linear functions of x, y, z whose coefficients are chosen from $0, 1, \cdots, p-1$ such that the first coefficient >0 is 1. These facts hold also when l is replaced by the like deter-

minant of order n. For $n=2$, the last theorem implies Fermat's theorem.

All algebraic invariants (*see* ALGEBRAIC FORMS) with integral coefficients are modular invariants; but the converse is not true. The simplest theory of modular invariants is based on the modular classes of forms. For an exposition with bibliography, *see* Dickson's *Invariants in the Theory of Numbers* (American Mathematical Society Colloquium Lectures, 1914).

Distribution of Primes.—The number of primes is infinite (Euclid, *Elem.*, ix. 20). Any arithmetical progression $mx+n$ contains an infinitude of primes if m and n are relatively prime. The first proof is due to Dirichlet (1837), who extended the theorem to numbers $a+bi$ such that a and b are integers. He proved that $q=ax^2+2bxy+cy^2$ represents infinitely many primes if a, $2b$, c have no common factor. Also an infinitude are represented simultaneously by f and $mx+n$ provided the two can represent the same number and m and n are relatively prime.

For any $\epsilon>0$ and any relatively prime integers m and n, the number of primes $mx+n$ which lie between z and $(1+\epsilon)z$ increases to infinity with z. Take $\epsilon=1$. Hence if the integer y exceeds a certain limit (6, in fact), there exists at least one prime p such that $\frac{1}{2}y<p\leqq y-2$; this is known as Bertrand's postulate (1845).

In 1742 Goldbach conjectured that every positive even integer is a sum of two primes. This has been verified to 10,000, but not yet proved. Subject to assumptions about the roots of Dirichlet's function L, Hardy and Littlewood recently proved that all sufficiently large even integers e are sums of three odd primes; also if N of the first m even positive integers are not sums of two odd primes, N/m approaches zero as m increases indefinitely. By developing their first proof, Lucke showed that every $e>(3\cdot6)10^{32}$ is a sum of three odd primes.

Tchebychef proved in 1852 that, if x is sufficiently large, the number $\pi(x)$ of primes $\leqq x$ is between $0\cdot92129Q$ and $1\cdot10555Q$, where $Q=x/\log x$. By use of Riemann's function $\zeta(s)=\Sigma n^{-s}$, Hadamard and de la Vallée-Poussin proved independently in 1896 that the sum of the natural logarithms of all primes $\leqq x$ is equal to x asymptotically. This implies the important result that $\pi(x)$ is asymptotic to Q. If we integrate $du/\log u$ first from 0 to $1-\delta$ and second from $1+\delta$ to x, add the results, and take the limit of the sum for $\delta=0$, we get the integral logarithm of x, denoted by $Li(x)$. It is asymptotic to Q and hence to $\pi(x)$. But $Li(x)$ represents $\pi(x)$ more exactly than does Q or $Q+x/\log x$, etc.

All these subjects are treated exhaustively in Landau's *Handbuch der Lehre von der Verteilung der Primzahlen* (1909).

Partitions.—There are just two partitions $1+5$ and $2+4$ of 6 into two parts chosen from $1, 2, 3, \cdots$ without repetition; there is the third partition $3+3$ if repetition is allowed. If we exhibit the partition $2+4$ as $\left\{\begin{smallmatrix}1&1\\1&1&1&1\end{smallmatrix}\right\}$ and then sum the columns instead of the lines, we get the partition $2+2+1+1$. If we repeat the process on the latter, we return to $4+2$. This proves that the number of partitions of n into m parts is equal to the number of partitions of n in which m is the largest part. Taking $m=1, \cdots, k$, we conclude that the number of partitions of n into not more than k parts is equal to the number of partitions of n with no part greater than k.

The number of partitions of n into m parts chosen without repetition from the distinct positive integers $c_1, c_2, \cdots, c_r$ is the coefficient of $x^n z^m$ in the expansion of the product $(1+x^{c_1}z)\cdots(1+x^{c_r}z)$. Next, the coefficient of $x^n z^m$ in the series giving the expansion of $(1-x^{c_1}z)^{-1}\cdots(1-x^{c_r}z)^{-1}$ is the number of partitions of n into m parts chosen from $c_1, \cdots, c_r$, repetitions allowed.

For $D=(1-x)(1-x^2)\cdots(1-x^m)$, the coefficient of x^n in $1/D$ is the number (n, m) of partitions of n into parts $\leqq m$ not necessarily distinct. The relation $(n, m)=(n, m-1)+(n-m, m)$ serves to compute (n, m).

There are important applications of Sylvester's theorem (1855) concerning the number Q of partitions of n into distinct positive integers $c_1, \cdots, c_r$ repetitions allowed, whence Q is the number of sets of integral solutions $\geqq 0$ of $c_1x_1+\cdots+c_rx_r=n$. Then $Q=\Sigma W_q$, where W_q is the coefficient of $1/t$ in the development in ascending powers of t of

$$\Sigma\rho^{-n}e^{nt}\prod_{s=1}^{r}(1-\rho^{c_s}e^{-tc_s})^{-1},$$

in which the summation extends over the various primitive qth roots ρ of unity. Thus $W_q=0$ unless q divides some c_s.

Binary Quadratic Forms.—The form $f=(a, b, c)$ of positive discriminant d is called reduced if the roots of $aw^2+bw+c=0$ are of opposite signs, if one root ω_1 is numerically <1, and if the other root is numerically >1. Although every form is equivalent to a reduced form and the number of reduced forms of discriminant d is finite, usually each reduced form is equivalent to several other reduced forms, and the number of the latter depends upon the periodicity of the continued fraction for ω_1. There is also another reason why the theory is more complicated than that for negative discriminants (*see* the topic positive binary quadratic forms). When $d>0$, the number of linear transformations with integral coefficients which leave f unaltered (called automorphs of f) is infinite, in fact one for each set of integral solutions t, u of the Pellian equation

$$t^2-du^2=4\sigma^2, \tag{1}$$

where σ is the divisor of f. The difficult point is to prove the existence of solutions T, U in least positive integers such that if t, u be any further solution in positive integers then $t>T$, $u>U$. It is then easily proved that all sets t, u of integral solutions are given by

$$\frac{t+u\sqrt{d}}{2\sigma}=\pm\left(\frac{T+U\sqrt{d}}{2\sigma}\right)^k \quad (k=0, \pm1, \pm2, \cdots).$$

Gauss and various later writers restricted attention to forms $f=(a, b, c)$ in which b is even, $b=2B$. Its discriminant is the quadruple of the *determinant* $D=B^2-ac$ of f. In (1), t is now even, $t=2\tau$, and we obtain the new Pellian equation $\tau^2-Du^2=\sigma^2$.

Many writers have obtained formulas for the number $h(D)$ of classes of forms $(a, 2B, c)$ of determinant D and divisor $\sigma=1$. To give only samples, let p be a prime of the form $4n+3$. Then

$$h(-p)=\Sigma\alpha-\Sigma\beta,\ h(p)\log(T+U\sqrt{p})=\log\Pi\tan\frac{k\pi}{4p},$$

where $\Sigma\alpha$ is the sum of the quadratic residues $\leqq\frac{1}{2}(p-1)$ of p and $\Sigma\beta$ is that of the non-residues, while T, U give the solution of $T^2-pU^2=1$ in least positive integers, and k takes those values from $1, 3, 5, \cdots, 4p-1$ of which p is a non-residue.

Let N be the number of proper representations of m by $x^2+y^2+z^2$. Kronecker proved in 1860 by use of series for elliptic functions that $N=24F(m)-12G(m)$, where $G(m)$ is the number of classes of binary forms of determinant $-m$, while $F(m)$ is that of the forms in which at least one of a and c is odd. This is equivalent to a result due to Gauss (1801). Others found that

$$N=24\sum_{s=1}^{k}\left(\frac{s}{m}\right) \text{ if } m=4k+1,\quad N=8\sum_{s=1}^{2k+1}\left(\frac{s}{m}\right) \text{ if } m=4k+3,$$

where (s/m) is Jacobi's symbol and is zero if s and m have a common factor. (*See* FORMS, ALGEBRAIC.)

Positive Quadratic Forms in k Variables.—Let $N(n, k)$ denote the number of representations of n as a sum of k squares. Then $N(4r+1, 6)=12s$, $N(4r+3)=-20s$, with $s=\Sigma(d_1^2-d_3^2)$, where d_1 ranges over the divisors of type $4k+1$, and d_3 over the divisors $4k+3$. For m odd, $N(m, 8)=16\Sigma d^3$, where d ranges over all divisors of m, and $N(2^rm, 8)=\frac{1}{7}16(8^{r+1}-15)\Sigma d^3$. While $N(4r+3, 10)=12\Sigma(d_3^4-d_1^4)$, the expressions for $N(n, 10)$ are complicated if $n\neq4r+3$. For m odd and $r>0$,

$$N(2^rm, 12)=\tfrac{2}{3}\tfrac{4}{1}(21+2^{5r+1}\cdot5)\Sigma d^5.$$

The numbers $N(n, 5)$ and $N(n, 7)$ have been expressed as sums involving Jacobi's symbol (s/n), and in various other ways.

In a series of 18 papers in his journal for 1858–65, Liouville stated without proof many formulae and applications to the present topic. For example, he employed any function $f(x, y)$

which remains unaltered by the change of the sign of x or of y, and a given odd integer M, and a given positive integer α. Then

$$2\Sigma[f(d'-2^\alpha d,\ \delta'+\delta)-f(d'+2^\alpha d,\ \delta'-\delta)]$$
$$=\Sigma[2f(D,2)+2f(D,4)+\cdots+2f(D,\Delta-1)-(D-1)f(D,0)],$$

where the second summation extends over all factorizations $M=D\Delta$ of M, and the first summation extends over all sets of odd integers d', δ', d, δ for which $M=d'\delta'+2^\alpha d\delta$. Let $m'=d'\delta'$, $m=d\delta$, and let $\zeta_k(t)$ denote the sum of the kth powers of the divisors of t. When $f(x, y)$ is y^2, this gives

$$2^{1-\alpha}[\zeta_3(M)-\zeta_1(M)]=\Sigma\zeta_1(m')\zeta_1(m),$$

which is therefore the number of decompositions of $4M$ into $s+2^\alpha\sigma$, where s and σ are sums of four odd squares. Next, the choice $(-1)^{\frac{1}{2}\nu}$ for $f(x, y)$ yields the number of decompositions of $2M$ into $s+2^\alpha\sigma$, where s and σ are now sums of two odd squares. He found also the number of representations by various forms involving six squares with coefficients chosen from 1, 2, 3, 4; arithmetical proofs were given by Humbert in 1921.

Uspenskij employed any function $F(x, y, z)=F(x, -y, -z)$ such that $F(-x, y, z)=-F(x, y, z)$. He proved that

$$2\Sigma F(\delta-2i,\ d+i,\ 2d+2i-\delta)-\Sigma F(d+\delta,\ i,\ d-\delta)=T,$$

where the summation extends over all integral solutions of $m=i^2+d\delta$, $d>0$, $\delta>0$. Here $T=0$ if m is not a square, while if $m=s^2$,

$$T=2\Sigma F(2s-j,\ s,\ 2s-j)-\Sigma F(2s,\ s-j,\ 2s-2j),$$

summed for $j=1, \cdots, 2s-1$. In a memoir of 1916 in Russian, he used this formula to deduce the number of representations by x^2+ay^2 for $a=1, 2, 3$; $x^2+y^2+z^2+bu^2$ for $b=1, 2, 3, 4, 5, 12$; $x^2+y^2+cz^2+cu^2$ for $c=3, 4, 5$; $x^2+2y^2+3z^2+6u^2$; many quaternary forms whose coefficients are all powers of 2;

$$x^2+y^2+z^2+u^2+v^2+dw^2 \text{ for } d=1, 2, 3;$$
$$x^2+y^2+z^2+e(u^2+v^2+w^2) \text{ for } e=2, 3;$$
$$x^2+4y^2+2z^2+2u^2+2v^2+2w^2;$$
$$x^2+4(y^2+z^2+u^2+v^2+w^2).$$

In his papers of 1925 in French, he applied the same formula to find the number of representations as a sum 2, 4, 6, 8, 10 squares, and to deduce all known and certain new relations between the numbers of classes of positive binary quadratic forms of various determinants.

The number of representations as a sum of any even number of squares was found by elliptic functions by Boulyguine in 1914–15 and by elliptic modular functions by Mordell in 1920. The same year, Hardy applied his powerful analytic methods to sums of k squares, $k\leqq 8$. In 1924 Kloosterman gave exact and asymptotic formulas for the number of representations as a sum of r squares. In 1922 Siegel found an asymptotic expression for the number of representations as a sum of 5 or more squares of integers of a real quadratic field. *See* EQUATIONS; DETERMINANT; NUMBER; ALGEBRAIC FORMS.

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(L. E. D.)

NUMBER SEQUENCES. A set of numbers is said to form an ordered set if, in addition to the definition of the elements in the set, there is also given a means by which relative rank may be assigned to any two numbers of the set so that of two such numbers A and B one may say either that A precedes (is of lower rank than) B or that A follows (is of higher rank than) B. For example, the set 1, 2, 3, 4 is an ordered set. The order relation so defined is analogous to that of points on a directed line and hence the order itself may be characterized as linear. By a part of a sequence we mean an ordered subset of its elements such that every two elements in the subset have the same relative rank in it as they have in the whole set. Various types of ordered sets are known as *sequences*. Any ordered set containing only a finite number of elements is called a *finite sequence*. In this case the order may be defined by a law, as when we speak of the even positive integers less than 100 taken in order of magnitude; or it may be given by an exhibition of the objects in a given order, as when one writes the sequence 9, 7, 3, 6, 1, 8, 10. A *simply infinite sequence*, or a *simple sequence*, is an ordered set which contains no element of higher rank than all the others, while every part of it which contains an element of higher rank than all the other elements in that part is a finite sequence. Thus the positive integers in the order of their magnitude form a simply infinite sequence. But if they are taken in the order

$$1, 3, 5, 7, \ldots, 2, 4, 6, 8, \ldots,$$

they form not a simply infinite sequence but a combination of two such sequences. In a simply infinite sequence the elements are arranged in a countable order, that is, so that there is a first element, a second, a third, and so on. Thus a simply infinite sequence may be denoted by the symbols $u_1, u_2, u_3, \ldots, u_n, \ldots$, where it is understood that there is no last element in the sequence. The rational numbers between 0 and 1, taken in order of magnitude, afford an example of an ordered set which cannot be denoted by such a sequence of symbols; in fact, there is no element in this set which has a next following element in the set. This set may, however, be re-ordered so as to afford an example of a simple sequence. It is necessary that the order relation in an infinite sequence be prescribed by some norm or rule; it cannot be exhibited explicitly by a given arrangement as in the case of a finite sequence. In the course of the article other types of infinite sequences will appear.

The principle of mathematical induction may be given its most characteristic formulation with respect to simply infinite sequences. If in the case of a given simply infinite sequence it be true (1) that, if an element of the sequence possesses a given property P, the next following element also possesses the property P; (2) that the first element in the sequence possesses this property P; then it is true that every element in the sequence possesses the property P. For instance, if we wish to show that the numbers in the sequence $1, 1+3, 1+3+5, 1+3+5+7, \ldots$ are the square numbers $1^2, 2^2, 3^2, 4^2, \ldots$ in order, we observe that the first term in the sequence has the required property and we prove that if one term has the property the next one also has it, and then we conclude to the truth of the general proposition by aid of the principle as formulated.

Examples of Sequences.—A finite or a simply infinite sequence of numbers is said to form an *arithmetic progression* if for every pair of consecutive elements A and B of the sequence (A preceding B) the difference $B-A$ is one and the same fixed number d. If the first term is a, then the numbers of the sequence are

$$a, a+d, a+2d, a+3d, \ldots.$$

The nth term of the sequence and the sum of the first n terms are respectively

$$a+(n-1)d \quad \text{and} \quad \tfrac{1}{2}n[2a+(n-1)d].$$

A sequence of numbers is said to form a *harmonic progression* if the reciprocals of its terms in order constitute an arithmetic pro-

gression. A finite or a simply infinite sequence of numbers is said to form a *geometric progression* if for every pair of consecutive elements A and B (A preceding B) the quotient B/A is one and the same fixed number r. If the first term is a then the numbers of the sequence are

$$a,\ ar,\ ar^2,\ ar^3,\ \ldots .$$

The nth term and the sum of the first n terms are respectively

$$ar^{n-1} \text{ and } \frac{a(1-r^n)}{1-r}.$$

Simple Infinite Sequences.—A simply infinite sequence $a_1, a_2, a_3, \ldots$ of numbers is said to be *convergent* and to form a *regular sequence* if for every positive number ϵ, however small, there exists a positive integer n such that the numerical value of $a_n - a_m$ is less than ϵ for every integer m greater than n. Regular sequences play a fundamental rôle in the development of mathematical analysis. To begin with, they furnish one of the means by which the number system may be extended from the rational domain to the domain of real numbers, and thus serve to lay the foundations on which an adequate theory of functions may be built. If, having developed the system of rational numbers (*see* NUMBERS), we proceed to form simply infinite sequences of rational numbers, it will be found that some such sequences have rational numbers as limits (*see* LIMIT), and that all such sequences having rational numbers as limits are regular in accordance with the foregoing definition, the number ϵ in the definition being taken rational in this case. It becomes desirable to extend the number system so that every regular sequence of rational numbers shall have a limit in the extended number system. This is done by taking the regular sequence of rational numbers itself to represent a definite number defined by the sequence, in accordance with a method introduced by G. Cantor (*Math. Annalen*, vol. v., 1872, and vol. xxi., 1883).

Before presenting the method of Cantor it is convenient to note some properties of regular sequences of rational numbers. Let $\{a_n\}$ be a symbol to denote the sequence $a_1, a_2, a_3, \ldots$. If $\{a_n\}$ and $\{b_n\}$ are two regular sequences of rational numbers, then it may be shown that the sequences

$$\{a_n+b_n\},\ \{a_n-b_n\},\ \{a_n\, b_n\},\ \left\{\frac{a_n}{b_n}\right\}$$

are also regular sequences, with suitable restrictions in the last case—for instance, that all the elements of $\{b_n\}$ shall be greater than some given positive number. It is natural to take as the sum, difference, product, and quotient, of two sequences $\{a_n\}$ and $\{b_n\}$ the sequences

$$\{a_n+b_n\},\ \{a_n-b_n\},\ \{a_n\, b_n\},\ \left\{\frac{a_n}{b_n}\right\}$$

respectively. Then from the foregoing theorem it follows that the processes of addition, subtraction, multiplication and division may be carried out on regular sequences of rational numbers (with suitable restrictions in the case of division) and that the sequences which result from any finite number of applications of these operations are themselves regular sequences of rational numbers. Furthermore, it may be shown that the ordinary fundamental laws of algebra hold for operations with sequences, namely, the associative and commutative laws of addition and multiplication and the distributive law of multiplication (*qq.v.*) with respect to addition. (*See* ALGEBRA.)

Since these regular sequences of rational numbers combine according to the same formal laws as rational numbers themselves, it is natural to take regular sequences of rational numbers as themselves defining a new sort of number; and this is what Cantor does. The new numbers are called *real numbers*. A rational number a may then be denoted by the sequence $a, a, a, \ldots$ each element of which is the rational number a. But this is not a unique representation of a. In fact, any sequence of rational numbers $a_1, a_2, a_3, \ldots$ having the rational limit a may be used to denote the number a. In general, the real numbers a and b defined by two regular sequences $\{a_n\}$ and $\{b_n\}$, respectively, are said to be equal if for every positive rational number ϵ however small, a number n exists such that the numerical value of $a_{n+m}-b_{n+m}$ is less than ϵ for every positive integer m. The real number represented by $\{a_n\}$ is said to be of higher rank than the real number represented by $\{b_n\}$ if a value of n exists such that $a_{n+m}-b_{n+m}$ is numerically greater than some given positive number δ for all positive integers m. These definitions are sufficient to establish the relations of order among the real numbers.

The real numbers thus postulated satisfy the usual laws of algebra and possess an order relation analogous to that of rational numbers. In the domain of real numbers every regular sequence of rational numbers has a limit; namely, the real number defined by the sequence itself. The question naturally arises, whether every regular sequence of real numbers has a limit in the domain of real numbers. The answer is affirmative; that is, if definitions are introduced in connection with sequences of real numbers, in all respects analogous to those already given for sequences of rational numbers, then every regular sequence of real numbers has a limit in the domain of real numbers. Therefore regular sequences of real numbers lead to no further extension of the system of numbers. The fact that a regular sequence of real numbers always has a limit in the domain of real numbers renders the set of real numbers suitable to be the field of the real variable in a general theory of functions of real variables.

Any given simply infinite sequence $a_1, a_2, a_3, \ldots$ may be employed to define a new sequence $s_1, s_2, s_3, \ldots$ by writing

$$s_n = a_1 + a_2 + a_3 + \ldots + a_n$$

The problems connected with the convergence of the sequence $\{s_n\}$ are then identical with the problems of the convergence of the infinite series

$$a_1 + a_2 + a_3 + \ldots .$$

Therefore a part of the theory of limits (*see* LIMIT) and the whole of the general theory of simply infinite series (*see* SERIES) are aspects of the theory of simply infinite number sequences. In a similar way the definition of a definite integral as the limit of a sum presents the theory of integration as another one of the fundamental applications of the theory of simply infinite sequences.

Other Types of Infinite Sequences.—A simply infinite sequence is said to be of type ω; the distinguishing qualities of these sequences lie in their possessing a first term, a term following any given term but no last term, while the terms preceding any given term constitute a finite sequence. The symbol $^*\omega$ is used to denote what may be called a reversed simply infinite sequence. It has no first term but does have a last term, while every term but the last one is followed by a next term and all the terms following a given term constitute a finite sequence. A sequence of type ω is called an ascending sequence while one of type $^*\omega$ is called a descending sequence. As the positive integers 1, 2, 3, . . . in order of magnitude form a typical ascending sequence so the negative integers in order of magnitude . . . , −3, −2, −1 form a typical descending sequence. The sequence

$$\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots$$

of positive and negative numbers and 0, taken in order of magnitude, form a sequence of type $^*\omega+\omega$, characterized by its possession of the following properties: there is no first term and no last term, there is a term next following any given term, and the elements following one and preceding another given element form a finite sequence.

In the development of the general theory of functions it has become necessary to consider many other types of sequences as well as order types of a more general character than those for which the term sequence is usually employed; on this account a general theory of sequences and order types has sprung up—usually developed both in treatises on functions of a real variable and in those on the theory of sets of points (*see* POINT SETS). A few of those usually called sequences may be briefly described. A sequence of type ω followed by another of type ω is said to form a sequence of type $\omega \cdot 2$. A typical instance is the following:

$$1, 3, 5, 7, \ldots, 2, 4, 6, 8, \ldots .$$

If n such simple sequences are taken in a given order the resulting

sequence is said to be of type $\omega \cdot n$. A single sequence of type ω will then be noted by $\omega \cdot 1$. If any sequence of type $\omega \cdot n$ is followed by a finite sequence containing m elements, the sequence so formed is said to be of type $\omega \cdot n + m$.

Let $S_1, S_2, S_3, \ldots$ denote a simply infinite sequence each element of which is itself a simply infinite sequence. The sequence thus formed is said to be of type ω^2. This process of forming sequences of sequences may be continued; it has given rise to a certain class of so-called transfinite numbers. The theory of these transfinite numbers, and of the sequences which underlie them, has been extensively developed; and it has given rise to important analyses of the logical processes involved in defining them and reasoning about them, processes usually investigated in the theory of sets of points, since these sequences may be represented to the mind by means of sets of points on a line.

Let us illustrate the last remark by exhibiting a set of points of type ω^2. First define any simply infinite sequence of non-overlapping intervals on a given line, as, for instance, the intervals from 0 to 1, from 1 to $1\frac{1}{2}$, from $1\frac{1}{2}$ to $1\frac{3}{4}$, and so on without end, each interval after the first having half the length of the preceding one. On each of the intervals a set of points forming a sequence of type ω is to be defined. We might, for instance, define the points on a given interval I as follows. Let the first one be the midpoint P_1 of I, the second be the midpoint of the part of I to the right of P_1 and in general let the ith one P_i be the midpoint of the part of I to the right of P_{i-1}. Then on I we have a sequence $P_1, P_2, P_3, \ldots$ of points of type ω. When this is done for each interval I of the set of intervals and the resulting points are contemplated in their order from left to right on the line, we have a sequence of points of type ω^2.

A typical arrangement of a sequence of type ω^2 is the following:

$$\begin{aligned} &a_{11}, a_{12}, a_{13}, \ldots, \\ &a_{21}, a_{22}, a_{23}, \ldots, \\ &a_{31}, a_{32}, a_{33}, \ldots, \\ &\ldots\ldots\ldots, \end{aligned}$$

the elements in each line forming a simply infinite sequence and the elements in any line preceding all the elements in each following line. Such a sequence is often called a *double sequence*. It is the type which underlies the general theory of double series. A fundamental problem concerning double sequences is that of the existence and equality of the limits

$$\lim_{m=\infty,\, n=\infty} a_{mn}, \quad \lim_{m=\infty} \lim_{n=\infty} a_{mn}, \quad \lim_{n=\infty} \lim_{m=\infty} a_{mn},$$

the last two denoting limits of limiting values while the first denotes the limit as m and n become infinite independently. If the first limit exists and is a then each of the other limits exists and is a. But one or both of the latter limits may exist while the first does not, nor is it necessary that the two latter limits (when they exist) shall be equal.

That the same set of objects may be contemplated in sequences of various types may be indicated by observing that the elements in a double sequence, or sequence of type ω^2, are capable of an arrangement into a sequence of type ω. Thus, in the case of the foregoing array we may arrange the elements in the order of the finite diagonal sets and obtain the following sequence of type ω:

$$a_{11}, a_{12}, a_{21}, a_{13}, a_{22}, a_{31}, a_{14}, a_{23}, \ldots.$$

Recurrent Sequences of Integers.—In the theory of ordinary integral numbers certain simply infinite sequences of integers have been found to play an important rôle (*Quart. Journ. Math.*, 48 [1920]: 342–372). These integers satisfy recurrence relations of the form

$$u_{n+\kappa} + \alpha_1 u_{n+\kappa-1} + \ldots + \alpha_\kappa u_n = 0, \quad n = 0, 1, 2, \ldots,$$

where $\alpha_1, \alpha_2, \ldots, \alpha_\kappa, u_0, u_1, \ldots, u_{\kappa-1}$ are given integers. If to take a simple case, the polynomial

$$\rho^\kappa + \alpha_1 \rho^{\kappa-1} + \ldots + \alpha_\kappa$$

is irreducible modulo p, where p is a prime, then the sequence of residues $\{r_n\}$, where $u_n \equiv r_n \bmod p$ and r_n is a number of the set $0, 1, 2, \ldots, p-1$, is periodic and (when certain exceptional cases are removed) the period is a factor of $p^\kappa - 1$. This theorem may be extended to the case of a general modulus m. In this connection several criteria have been obtained for recognizing certain large prime numbers as prime, the following being one of the simplest. A necessary and sufficient condition that $2^n - 1$ shall be a prime is that

$$(a + b\sqrt{-1})^{2^n} + (a - b\sqrt{-1})^{2^n}$$

shall be divisible by $2^n - 1$, where a and b are any integers such that $a^2 + b^2$ is a prime number of which $2^n - 1$ is a quadratic non-residue. By means of such theorems several large numbers have been shown to be prime, including the following:

$$2^{61} - 1, \quad 2^{89} - 1, \quad 2^{107} - 1, \quad 2^{127} - 1, \quad 5 \cdot 2^{75} + 1.$$

See E. W. Hobson, *Theory of Functions of a Real Variable*, vol. i. (3rd ed., 1927); and *Encyclopédie des Sciences Mathématiques*, tome i., vol. i. (R. D. Ca.)

NUMENIUS, a Greek philosopher, of Apamea in Syria, Neo-Pythagorean and forerunner of the Neo-Platonists, flourished during the latter half of the 2nd century A.D. His chief divergence from Plato is the distinction between the "first god" and the "demiurge." This is probably due to the influence of the Valentinian Gnostics and the Jewish-Alexandrian philosophers (especially Philo and his theory of the Logos). His works were valued by the Neoplatonists, and it is said Amelius wrote about 100 books of commentaries upon them. Fragments of his treatises on the points of divergence between the Academicians and Plato, on the Good (in which according to Origen, *Contra Celsum*, iv. 51, he makes allusion to Christ), and on the mystical sayings in Plato, are preserved in the *Praeparatio Evangelica* of Eusebius.

The fragments are collected in F. G. Mullach, *Frag. phil. Graec.* iii.; *see* also F. Thedinga, *De Numenio philosopho Platonico* (Bonn, 1875); Ritter and Preller, *Hist. Phil. Graecae* (ed. E. Wellmann, 1898), T. Whittaker, *The Neo-Platonists* (1901; 2nd ed. 1918) and Überweg, *Grundriss der Gesch. der Philosophie* Bd. I. (1926).

NUMERALS. Just as the first attempts at writing came long after the development of speech, so the first efforts at the graphical representation of numbers came long after people had learned to count. Judging by the habits of primitive tribes of the present as well as by the oldest trace that we have of written or sculptured records, the earliest numerals were simple notches in a stick, scratches on a stone, marks on a piece of pottery, or the like. Having no fixed units of measure, no coins, no commerce beyond the rudest barter, no system of taxation, and no needs beyond those of a savage, there was no necessity for written numerals until about the beginning of what we call historical times.

Early Forms.—The earliest numerals of which we have definite record were simply straight marks for the small numbers, with some special form for ten. These symbols appear in Egypt as early as the 1st dynasty (*c.* 3400 B.C.), and in Mesopotamia as early as *c.* 3000 B.C. These dates long precede the first known inscriptions containing numerals in India (*c.* 3rd century B.C.), in China (3rd century B.C.), and in Crete (*c.* 1200 B.C.).

Egyptian hieroglyphic, *c.* 3400 B.C. . . . . 

Egyptian hieratic, *c.* 3400 B.C. . . . . 

Cretan inscriptions, *c.* 1200 B.C. . . . . 

Sumerian and later, *c.* 3000 B.C. . . . . 

Somewhat later it is not uncommon to find a group mark before 10 is reached. For example, four has a special symbol in certain Hindu types, as here shown:

Aśoka's time, 3rd century B.C. . . . . 

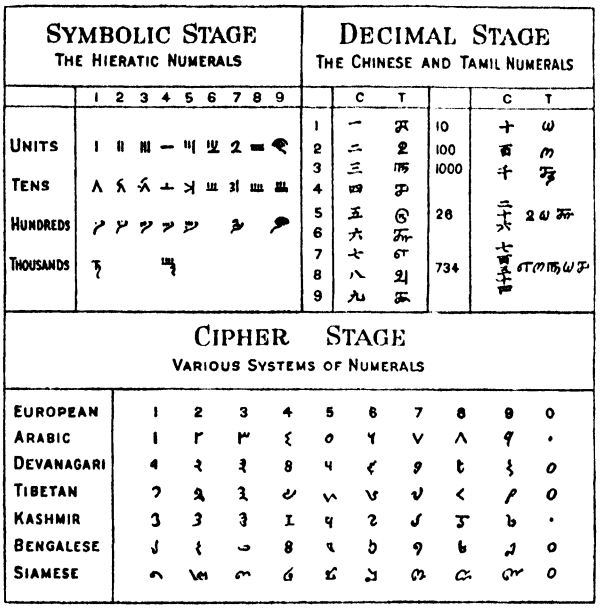
Nānā Ghāt, 2nd century B.C. . . . . 

Śaka, *c.* 1st century B.C. . . . .

Nasik, 1st or 2nd century . . . . . 𑁒 —

Kuṣana, *c.* 150 . . . . . 𑁒 𑁑

Early Hindu Symbols for 1 and 4.—Even to-day a Chinese merchant may write one and four in the forms 𝍠 and 𝍡 respectively, instead of using the classical symbol. This use of a symbol for four may, in fact, have preceded the Western habit of taking



THE DEVELOPMENT OF NUMERALS THROUGH THE SYMBOLIC, DECIMAL AND CIPHER STAGES

ten as the first group number, and the Etruscan and Roman use of 𝍢 or 𝍣 for five may have been a hand symbol in use before the 𝍤 was taken for ten.

The vertical marks, 𝍠, 𝍠𝍠, 𝍠𝍠𝍠, etc., may possibly be representations of the fingers held as used in counting and computing, a linguistic trace of which is found in the word *digit*. The horizontal marks may be representations of computing rods as they lie on a table. The vertical symbols were preferred in Mesopotamia and the Mediterranean region, and the horizontal ones in the Far East, where —, 𝍦, and 𝍧 were commonly used for one, two, and three, 𝍦 and 𝍧 being cursively written to give us our present 2 and 3.

It therefore appears that the primitive numerals were 𝍠, 𝍠𝍠, 𝍠𝍠𝍠, 𝍠𝍠𝍠𝍠, and so on, as we find in Egypt and the Grecian lands, or —, 𝍦, 𝍧, and probably so on as we usually find in the East, each going as far as the simple needs of people required. The idea of a group figure would naturally have occurred to merchants as soon as there developed a need for numbers beyond 10 or 12 (as was the case in Egypt and Babylon). Once the idea was suggested, probably influenced by the ten fingers, symbols were invented for smaller units, as in the case of those used for four and five as stated above. These naturally suggested special symbols for each of the numbers from one to ten or even farther, and the use of the additive principle to build up larger numbers, as in the Roman XXII. The idea of special symbols for larger groups, as for 20, 30, and so on, was a natural extension.

Cuneiform Numerals.—Around Babylon, clay was abundant; and in the damp clay tablets they impressed their symbols, then baking these tablets in the sun or in a kiln, thus forming historical documents that were practically as permanent as stone. Since the pressure of the stylus gave a wedge-shaped symbol, the writings are known as cuneiform (Lat. *cuneus*, a wedge, +*forma*, a shape) inscriptions.

For our purposes some leading principles will suffice. The symbol for 1 served also for 60, 3,600, and in general for 1×60^n; similarly the symbol for 10 served for 10×60^n, the context telling what particular value was indicated. The symbols could be made either with the pointed or the circular end of the stylus, as follows:

𒁹 or 𒐕 one 𒌋 or 𒁲 ten

There was also a symbol for 100, but in general the scribe preferred to make use of the symbol for 60, thus:

𒐕𒌋 = 100 𒐕𒐕𒐖𒌋𒐕𒐖 = 60+60+10+10+10+10+10+1+½ = 171½,

𒐕𒐕𒐖𒁲𒁲 = 60+60+10+½ = 130½.

Following the general custom of the race to use small numbers instead of large ones, the Babylonians employed a subtractive principle, as we do in saying "a quarter to three" instead of "three quarters past two," and "three minutes to six" instead of "57 minutes after five." This appears in such numerals as

𒌋𒌋𒐖𒁹 10+10−1=19, and 𒁲𒁲𒐖𒁹 = 20−3=17.

A similar custom is seen in Hebrew number names, in the occasional use of IV. for four and IX. for nine in the Roman inscriptions. The Romans also used *unus de viginti* for 19, and *duo de viginti* for 18, occasionally writing these numbers as XIX. (or IXX.) and IIXX., respectively. On the whole, however, the subtractive principle was little used in the numerals of the classical period.



FROM SMITH, "HISTORY OF MATHEMATICS"

THIRTEENTH CENTURY FINGER SYMBOLISM

From the *Codex Alcobatiensis*, in the Biblioteca Nacional, Madrid

Egyptian Hieroglyphics.—The Egyptian numerals in hieroglyphic writing differed somewhat from those in the hieratic and demotic, but the last two were degenerate forms of the first, with certain additions. It will suffice to call attention to the principles of the first and second. In doing so, however, it should be observed that the Egyptians generally wrote from right to left, as in the Semitic script, but the hieroglyphics were occasionally written from left to right or (as also the Hieratic) from top to bottom. The numerals from 1 to 10 were as follows:

Hieroglyphic 𓏺 𓎆 𓎇 𓎈 𓎉 𓎊 𓎋 𓎌 𓎍 𓎐

Hieratic 𓏺 𓎆 𓎇 𓎈 𓎉 𓎊 𓎋 𓎌 𓎍 𓎐

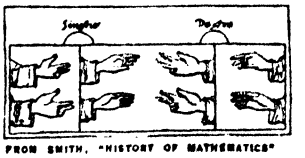
The hieroglyphic symbols for certain larger numbers were as follows:

𓎐𓏺 𓎐𓎐 𓎐𓎐𓎐 𓎐𓎐𓎐𓎐 𓎐𓎐𓎐𓎐𓎐𓎐𓎐 𓆐 𓆑 𓆼 𓍢

11 12 20 40 70 100 200 1000 10,000

It will therefore be seen that the general plan of the hieroglyphic notation was to have special symbols for powers of 10, and to repeat these as necessary. The Hieratic had special symbols for 5, 7, 8, and 9—a step towards the later Hindu system. The Hieroglyphic was similar in principle to the Etrusco-Roman, except that the latter introduced special numerals for 5, 50, and 500.

Greek Numerals.—The Greeks had two important systems of numerals, besides the primitive plan of repeating single strokes, as in 𝍠𝍠𝍠 for six. Their predecessors in culture—the Babylonians, Egyptians, and Phoenicians—had generally repeated the units up to nine, with a special symbol for ten, and so on. The early Greeks also repeated the units to nine, and probably had various symbols for ten. In Crete, whose early civilization was so much influenced by that of Phoenicia and Egypt, the symbol for ten was —, a circle was used for 100, and a rhombus for 1,000. Cyprus also used the horizontal bar for ten, but the precise forms



FROM SMITH, "HISTORY OF MATHEMATICS"

FIFTEENTH CENTURY FINGER SYMBOLISM

From *Summa* of Paciolli, Venice, 1494

are not of so much significance as that the grouping by tens, with special symbols for certain powers of ten, was characteristic of the early systems of the Near East.

The Greeks, entering the field much later, and influenced as to their alphabet by the Phoenicians, based their first elaborate system chiefly on the initial letters of the numeral names. This was a natural thing for all early civilizations, since the custom of writing out the names for large numbers was at first quite general, and the use of an initial by way of abbreviation of a word is universal. These initial numerals, in modern characters, were

Π, *pi*, for ΠΕΝΤΕ (*pente*), five;
Δ, *delta*, for ΔΕΚΑ (*deká*), ten; often written like O;
Η, an old Attic breathing, like our *h*, later represented by a special symbol like ', for ΗΕΚΑΤΟΝ (*hekaton*), hundred;
Χ, chi, for ΧΙΛΙΟΙ (*chil'ioi*), thousand;
Μ, *mu*, for ΜΤΡΙΟΙ (*myr'ioi, mur'ioi*), ten thousand.

These numerals were frequently combined, thus:

ΠΔ or ΠΔ, *pente-deka*, for 5×10, or 50;

ΠΗ, *pente-hekaton*, for 5×100, or 500;

ΠΜ, *pente-murioi*, for 5×10,000 or 50,000.

This system appears in records of the 3rd century B.C. but was probably used much earlier. In the 2nd century of our era it was described by the grammarian Herodianus, and hence characters are often spoken of as Herodianic numerals. They are more properly called Attic numerals, being the ones always found in the Attic inscriptions.

As early as the 3rd century B.C. another system came into use, running parallel to the initial-letter one, being better adapted to the theory of numbers, and being more difficult of comprehension by the trading class. It consisted in assigning nine letters of the alphabet to the numbers 1–9, nine letters to the numbers 10, 20, 30, ..., 90, and nine letters to the numbers 100, 200, 300, ..., 900. Since, however, there were only 24 letters in the Greek alphabet, three were added, namely the Phoenician *vau* (shaped like our letter **F**), *koph* or *qoph* (shaped somewhat like our letter **Q**, which indeed is derived from the same source, and represented below as **Ϙ**), and a character known in modern times as *sampi* (and then shaped somewhat like the Greek π, but tipped about 45° to the right and represented below as **ϡ**). An earlier form of this last symbol was Ϻ. The numerical values of the letters were therefore as follows:

Units	Α	Β	Γ	Δ	Ε	[F]	Ζ	Η	Θ
	1	2	3	4	5	6	7	8	9
Tens	Ι	Κ	Λ	Μ	Ν	Ξ	Ο	Π	[Ϙ]
	10	20	30	40	50	60	70	80	90
Hundreds	Ρ	Σ	Τ	Υ	Φ	Χ	Ψ	Ω	[ϡ]
	100	200	300	400	500	600	700	800	900

The thousands were often indicated by placing a bar to the left of the numeral, thus:

/Α = 1,000 /Β = 2,000 /Ι = 10,000 /Σ = 200,000

The myriads (ΜΤΡΙΟΙ, *myrioi*, ten thousands) were represented by such symbols as

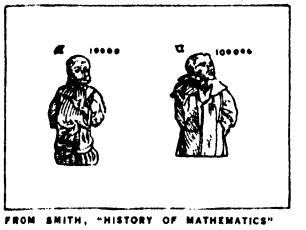
$\overset{\Gamma}{\underset{|}{\mathrm{M}}}$ or $\overset{\Gamma}{\mathrm{M}}$, for 10,000, $\overset{\Delta}{\mathrm{M}}$ for 4×10,000, or 40,000, etc.

Such numeral forms were not particularly difficult for computing purposes, once the operator was able automatically to recall the meaning of each. To be able to express 10,407 by MTZ would have seemed to a Greek considerably simpler than by our system. The capital letters were used by the Greeks, the small letters being a relatively modern invention.

Hebrew Numerals.—By the 2nd century B.C. at the latest, the Hebrews had established a system of alphabetic numerals similar to the one used by the Greeks. The alphabet being exhausted when the symbol for 400 was reached, the letters for 400 and 100 were combined by early writers to represent 500, and similarly up to 900. Later scholars used the final forms of the letters for 20, 40, 50, 80 and 90 (that is, the form of the letter that would be used at the end of a word) to represent 500, 600, ..., 900. The scheme then appeared as follows:

Units	א	ב	ג	ד	ה	ו	ז	ח	ט
	1	2	3	4	5	6	7	8	9
Tens	י	כ	ל	מ	נ	ס	ע	פ	צ
	10	20	30	40	50	60	70	80	90
Hundreds	ק	ר	ש	ת	ך	ם	ן	ף	ץ
	100	200	300	400	500	600	700	800	900

Roman Numerals.—The direct influence of Rome for such a long period, the superiority of her numeral system over any other simple one that had been known in Europe before about the 10th century, and the compelling force of tradition explain the strong position that the system maintained for nearly 2,000 years in commerce, in scientific and theological literature, and in *belles lettres*. It had the great advantage that, for the mass of users, the memorizing of the values of only four letters was necessary—V, X, L, and C. Moreover, it was easier to see three in **III** than in 3, and to see nine in **VIIII** than in 9, and correspondingly easier to add numbers—the simplest of all the operations.



FROM SMITH, "HISTORY OF MATHEMATICS"

SIXTEENTH CENTURY FINGER SYMBOLISM

From the *Abacvs* of Johannes Aventinus, Nürnberg, 1522

As in all such matters, the origin of these numerals is obscure, although the changes in their forms since the 3rd century B.C. are well known. Of the various theories that of Mommsen (1850) has had the widest acceptance. This was that the use of **V** for 5 is due to the fact that it is a kind of hieroglyphic representing the open hand with its five fingers. Two of these gave the **X** for ten. Three of the other symbols, he asserted, were modifications of Greek letters not needed in the Etruscan and early Latin alphabet. These were *chi*, which appears in inscriptions not only as **X** but also in such forms as ⊥, ↓, and which later became the **L** that was arbitrarily chosen for 50; *theta*, Θ, which was selected for 100, being finally changed to C under the influence of the word *centum* (hundred); and *phi*, Φ, to which was assigned the value 1,000, and which finally took the forms (**I**), and **M**, the last being chosen because of the word *mille* (thousand). There is considerable epigraphical evidence in support of these contentions made by Mommsen. (*See* the bibliography for other theories.)

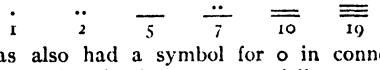
The oldest noteworthy inscription containing numerals representing very large numbers is on the *columna rostrata*, a monument erected in the Roman forum to commemorate the victory of 260 B.C. over the Carthaginians. In this a symbol for 100,000, which was an early form of (((**I**))), was repeated 23 times, making 2,300,000. This illustrates not only the early Roman use of repeated symbols, but also a custom which extended to modern times—that of using (**I**) for 1,000, ((**I**)) for 10,000, (((**I**))) for 100,000, and ((((**I**)))) for 1,000,000. The symbol (**I**) for 1,000 frequently appears in various other forms, including the cursive ∞. All these symbols persisted until long after printing became common. In the middle ages a bar (*vinculum*, *titulus*) was placed over a number to multiply it by 1,000, but this use is not found in the Roman inscriptions. When the bar appears in early manuscripts it was merely for the purpose of distinguishing numerals from nouns, as in the case IIVIR for *duumviri*. We also find in the middle ages such forms as **X̄I** or **IX̄I** for ten hundred thousand and **M̄** for one thousand hundred thousand.

Of the later use of the numerals, a few of the special types are as follows:

(1) $\bar{c} \cdot \overline{\text{lxiiij}} \cdot \text{ccc} \cdot \text{l} \cdot \text{i}$, for 164,351, Adelard of Bath (*c.* 1120).
(2) II.DCC.XIIII, for 2,814, Jordanus Nemorarius (*c.* 1125).
(3) MDCLVI, for 1,656, in San Marco, Venice.
(4) ɔIↃ.IↃ.IↃ, for 1,599, Leyden ed. of Capella, 1599.
(5) IIIIxxet huit, for 88, a Paris treaty of 1388.
(6) four Cli.M, for 451,000, Baker's arithmetic (1568).
(7) vj.C for 600 and CCC.M for 3,000, Recorde (*c.* 1542).

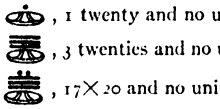
The first represents the use of the vinculum; (2) represents the place value as it occasionally appears in Roman numerals; (3) illustrates the not infrequent use of ↀ (like ↁ, originally half of (I), the symbol for 1,000); (4) illustrates the persistence of the old Roman form for 1,000 and 500, and the subtractive principle so rarely used by the Romans for a number like 99; (5) shows the use of *quatre vingt* for 80, commonly found in French manuscripts until the 17th century, and occasionally later, the numbers often being written like iiij^{xx}, vij^{xx}, and so on; (6) represents the coefficient method, "four C" meaning 400, a method often leading to forms like ijM or **IIM** for 2,000, as shown in (7).

The Maya Use of Place Value.—Evidence of some appreciation of place value is found in various systems of notation. For example, the cuneiform inscriptions contain frequent examples like ıttı (using ı to represent the vertical wedge and *t* to represent the tens symbol), in which the first ı stands for 60 and the last ı for one, the number being 81. Similarly the later Roman forms occasionally contain cases like II · CX for 2,110, although these are not examples of the systematic use of place value as we understand it. In Yucatan, however, the highly developed Maya civilization used, for calendar purposes, a system of numerals based upon a scale which has elements of both 5 and 20, the horizontal bar (—) representing 5 and the dot (·) representing unity. The following are examples:



1 2 5 7 10 19

The Mayas also had a symbol for o in connection with which the place value clearly appears, as follows:

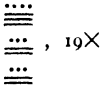


, 1 twenty and no units

, 3 twenties and no units

, 17×20 and no units (our 340)

The next number after 17×20+19 is 360, which then became a kind of super-radix, as follows:



, 19×360+13×20+13=7,113.

The Maya numerals seem to have been used for writing numbers rather than for calculation.

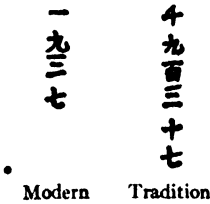
Chinese Numerals.—The Chinese have three general systems of numerals—the ancient national, the modern national, and the mercantile. These are respectively as follows:

一 二 三 四 五 六 七 八 九 十 百 千

一 二 三 四 五 六 七 八 九 〇 百 千

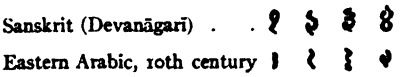
丨 ㇒ 川 乂 𠂇 一 二 三 文 十 百 千

The second differs from the first in that the place value is used, the circle ○ being used for our zero. The date 1937 is here shown in the two systems, the numbers being written downwards, as usual.



Modern Traditional

Sanskrit and Arabic Numerals.—By way of comparison of the modern Sanskrit and Arabic forms, the two are here shown:

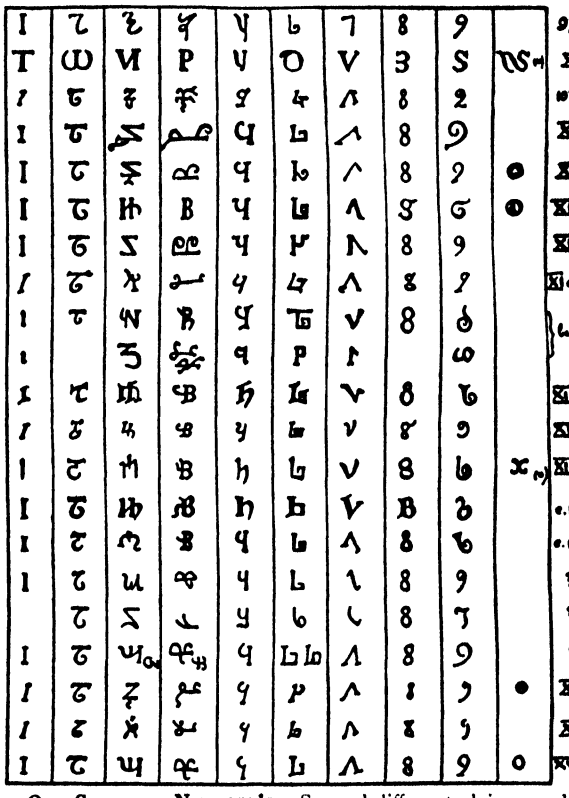


Sanskrit (Devanāgarī) . . ? ? ? ? ? ? ? ? ? ०

Eastern Arabic, 10th century ١ ٢ ٣ ٤ ٥ ٦ ٧ ٨ ٩ ٠

Modern Arabic . . . ١ ٢ ٣ ٤ ٥ ٦ ٧ ٨ ٩ ٠

TABLE OF CHANGES OF THE HINDU-ARABIC NUMERALS IN EUROPE
From G. F. Hill's *The Development of Numerals in Europe*, Oxford, 1915
Reproduced by permission of the author and the Oxford University Press



Our Common Numerals.—Several different claims, each having a certain amount of justification, have been made with respect to the origin of our present numerals, commonly spoken of as Arabic but preferably as Hindu-Arabic. These include the assertion that the origin is to be found among the Arabs, the Persians, the Egyptians, and the Hindus. It is not improbable that the intercourse between traders served to carry such symbols from country to country, so that our numerals may be a conglomeration from different sources. The country, however, which first used, so far as we know, the largest number of our numeral forms is India. The 1, 4, and 6 are found in the Aśoka inscriptions (3rd century B.C.); the 2, 4, 6, 7, and 9 appear in the Nānā Ghāt inscriptions about a century later; and the 2, 3, 4, 5, 6, 7, and 9, in the Nasik caves of the 1st or 2nd century of our era—all in forms that have considerable resemblance to our own, our 2 and 3 being well-recognized cursive derivations from the ancient = and ≡. None of these early Indian inscriptions gives any evidence of place value, or of a zero that would make our place value possible. Hindu literature gives some evidence that the zero may have been known before our era, but we have no actual inscription containing such a symbol before the 9th century.

The first definite external reference to the Hindu numerals is in a note by Severus Sebokht, a bishop who lived in Mesopotamia *c.* 650. Since he speaks of "nine signs," the zero seems not to have been known to him. By the close of the 8th century, however, some astronomical tables of India are said to have been translated into Arabic at Baghdad, and in any case the numerals became known to Arabic scholars about this time. About 825 al-Khowârizmî (*q.v.*) wrote a small book upon the subject, and this was translated into Latin by Adelard of Bath (*c.* 1120) under the title of *Liber Algorismi de numero Indorum*. There is some reason for believing that the numerals found their way into Europe even earlier than into Baghdad, but the earliest European

manuscript that is known to contain them was written in Spain in 976. The table on preceding page shows their subsequent development until the time of printing.

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NUMERAL SYSTEMS. There is no language without some numerals; the notion of unity and plurality is expressed at least in the formation of "one" and "two," though "two" is often equal to "much," thus concluding a numeration that has just only started. It is doubtful whether even systemless numeration really exists, as it is mostly reported of peoples who are but vaguely known. The eastern languages of Australia, in spite of the occurrence of numerals for "three" and even "four," and in a less degree the western languages, Yuin-Kuri, Wiradhuri, Kamilaroi, and the southern central languages have been suspected of it. It remains doubtful whether Tasmania practised systemless or pair numeration. The Pygmies of the Andaman islands and Malacca form numerals for "one" and "two," yet sum up only with units, not with pairs. So with the Chiquito in South America.

The Pair System.—The pair system has numerals for "one" and "two" and forms the following numerals by addition to the "pair": $3=2+1$, $4=2+2$, $5=2+2+1$, etc. It is found in Australia among tribes ethnologically the oldest—the Kulin-Kurnai of the south-east, the Narrinyeri of the south; several of them count up to "ten" in this manner. A pure pair system still occurs in many Papuan languages of Torres straits and the adjacent coast of New Guinea. In Africa it is practised by the Bushmen. In South America it is found among the ethnologically oldest tribes—the Fuegian tribes: Yamana and Halakwulup, the Guayaki and Shipaya, and the Ges-Tapuya tribes.

The pair system starts from the parts of the human body that exist in pairs, like eyes, ears, hands, feet. The pair system is also found in various associations with later numeration systems. The formation of a dual with the personal pronoun (and substantive) can be traced back to those times.

The Quaternary System.—The quaternary system forms the numerals above "four" by composition: $5=4+1$, $7=4+3$, $8=4+4$ (or 2×4), $9=(2\times4)+1$, $16=4\times4$. In this consequent type, however, it is but seldom met, *e.g.*, in California with the Salina and traces of it with the Chumash. In California the four quarters of the sky play an important part in religion, mythology and custom.

The Hexad System (Senary System).—When further developed to a duodecimal system this is the most useful of all as it permits of more divisions without fractional numbers than any other system, and in later stages it has been repeatedly introduced especially for astronomy or in metrical or monetary systems. In primitive numeration it has a rather limited dispersion in north-west Africa, *e.g.*, in the Huka, the Bulanda, the Apko; traces of it are to be met with among the Bube on Fernando Po.

The Quinary System.—The quinary system in its pure form, where for instance $10=2$ hands, $25=5$ hands, is found only in Saraweka, a South American Arowak language. Everywhere else it is combined either with the decimal or the vigesimal system.

The Vigesimal System.—The vigesimal system takes 20 as a basis, so as to make 20×20 the numeral next in height, if the numeration goes as far as that. It may combine either with the quinary system forming a quinary vigesimal system or more rarely and only in younger forms with the decimal system, and then becomes a decimal vigesimal system. The quinary vigesimal system is frequently combined with the pair system, so that the numbers 3 and 4, often also 6, 7, 8, 9, and further 12 and 13, are formed according to the pair system.

These systems start with the fingers and the toes. Therefore "five" often means "hand," "ten" means "the two hands," 11 "one at the foot." 20 "both the feet (and hands)" or "the whole man."

The quinary vigesimal system is found sporadically in almost all the Australian linguistic groups; in nearly all the Papuan languages of the (north) east coast and exterior of New Guinea, in the oldest Melanesian languages of New Caledonia, the Loyalty islands, etc. In Asia-Europe it occurs in the border languages: Ainu, Chukchi, Koryak, in Burushaski (*q.v.*), and in the Himalaya group of the Tibeto-Burman languages.

The decimal vigesimal system is found in the Munda languages of India and in Tibeto-Chinese groups of the Himalayas, in Nicobarese, in the north (and south) Caucasian languages. With the Indo-European and the Semitic languages the dual form for 20 seems to point to a former vigesimal system. The Sumerian, too, shows traces of it. Basque practises a full (decimal) vigesimal system, so that forms like soixante-dix, quatre-vingt, quatre-vingt-dix in French are to be explained.

In Africa the vigesimal system occurs in upper Guinea, and its hinterland, from the Senegal to the Cross river, in a series of Bantu, Mande, Togo and Niger languages, and in some east Bantu languages, in the Hamitic Kunama (and Barea) and in the Bantu languages Konde and Sango.

In North America it is found in Eskimo and in the north-west in Bellacoola and Haida and several languages of California, together with Pawnee (Caddo). This system mostly as decimal vigesimal is dominant in Mexico, Central America, even in the languages of the high civilization of the Aztecs and Maya. In South America the vigesimal system is found both in the progressive civilization of the Chibchas and with a great many primitive tribes belonging to nearly every linguistic group save the Gez-Tapuya and the tribes south of the Gran Chaco.

The quinary vigesimal system, especially its older form combined with the pair system, appears to have originated in the culture cycle (*Kulturkreis*, culture area) of the totemistic-patriarchal progressive hunters; a culture type in which the human body in art (sculpture), clothing and adornment has gained greatest importance and is most cared for. According to that the vigesimal system, too, agrees up to 20 with the parts of the body.

In north-western Africa on the coast of upper Guinea a quadragesimal system has developed, derived from a vigesimal system. Its origin is due to commercial reasons, as the monetary standard in this region is a set of 40 cowries.

The Decimal Systems.—The decimal systems are superior to the vigesimal systems in taking as a basis a smaller numeric unity more easily applied, and render possible shorter forms of the numbers. Two forms are known, the quinary decimal system and the pure decimal system. In the quinary decimal system the numbers of the second pentad are formed by composition with "five" ($6=5+1$, $7=5+2$, etc.) or by the pair system (especially $6=3\times2$, $8=4\times2$) or by subtraction (especially $9=10-1$). It seems to have originated in the matriarchal soil-tilling culture. The great quantity of agricultural products which had to be counted, arranged, stored, and brought to market required to be frequently repeated and counted quickly, and thus led to this system. In the languages of this culture numeral unities have developed which spring from the special grouping of certain products: a dozen, a brace, score (three score), etc.

In Australia and in the Papuan languages it is found isolated and in rudimentary form; with the Melanesians it is fully displayed. In Asia it originally dominated the two great families of the Austroasiatic and the Tibeto-Chinese languages. Whether a quinary or a pure decimal system was the original numeration in the Ural-Altaic languages cannot be ascertained. In Africa the great majority of the languages show originally a quinary decimal system, especially the Bantu and the semi-Bantu languages and the majority of the Nilotic, Wule, Ngo-Nke and Manfu languages. So too, in North America; but neither in Mexico, Central America, nor in South America has the system spread widely.

With the pure decimal system there is no partition of the decad into two pentads and therefore the compound character of the numerals from five to ten is not met with. The whole system

becomes simpler and its forms are better fitted for general application. The pure decimal system seems to have originated in the culture-cycle of the nomadic herders, who, in counting their large flocks of horses, cows, camels, sheep, etc., needed to employ high numbers with more facility. From the aristocracies of the nomadic herders it has spread everywhere, and it is now found in all nations of high culture on the whole globe, except those of Mexico and Central America, where the number 20 was used in astronomy, and thus was safe from competition. (P. W. S.)

NUMERATION: *see* NUMERALS; ARITHMETIC.

NUMIDIA, the classical name of a territory in the northern part of Africa. When the Romans first came into conflict with Carthage in the 3rd century B.C., the name was applied to the whole country from the river Mulucha (now the Muluya), to the frontier of the Carthaginian territory. Numidians were divided into two great tribes, the Massyli on the east, and the Massaesyli on the west, the limit between the two being the river Ampsaga. At the time of the second Punic war, the eastern tribe was governed by Massinissa, who took the side of the Romans, while Syphax, king of the Massaesyli, led the Carthaginians. At the end of the war, the Romans confiscated the dominions of Syphax, and gave them to Massinissa, whose sway extended from the frontier of Mauretania to the boundary of the Carthaginian territory, also south and east to the Cyrenaica, so that the Numidian kingdom surrounded Carthage except towards the sea. Massinissa, who reached a great age, retained the whole of these dominions till his death in 148 B.C. and was succeeded in them by his son Micipsa, who died in 118. For the war with Rome which followed the death of Micipsa, *see* JUGURTHA.

After the death of Jugurtha, the western part of his dominions was added to those of Bocchus, king of Mauretania, while the remainder continued to be governed by native princes until the civil war between Caesar and Pompey, in which Juba I. was defeated by Caesar. Numidia in the more restricted sense became for a short time a Roman province under the title of Africa Nova, but after the battle of Actium it was restored to Juba II., who had acquired the favour of Augustus. In 25 B.C., Juba was transferred to the throne of Mauretania, including the whole western portion of the ancient Numidian monarchy as far as the river Ampsaga, while Africa Nova was rejoined to the province of Africa; together with Africa Vetus it was governed by a proconsul, and was the only senatorial province in which a legion was permanently stationed. In A.D. 37 the Emperor Gaius sent a legatus of his own to take over the command of the legion (*see* AFRICA, ROMAN). Under Septimius Severus (A.D. 193–211) Numidia was separated from Africa Vetus and governed by an imperial procurator (*procurator per Numidiam*); finally, under Diocletian, Numidia became one of the seven provinces of the diocese of Africa, being known as Numidia Cirtensis, and after Constantine as Numidia Constantina. During this period it reached a high degree of civilization, and was studded with numerous towns, the importance of which is attested by inscriptions and by the massive remains of public buildings. The invasion of the Vandals in A.D. 428 reduced it to a condition of decay; and the invasion of the Arabs in the 8th century again brought desolation on the land, which was aggravated by misgovernment till the conquest of Algeria by the French in 1833.

Chief towns of Numidia under the Romans were: in the north, Cirta, the capital, which still retains the name Constantine given by Constantine, and Hippo Regius, the see of St. Augustine; to the south, Theveste (Tebessa) and Lambaesis (Lambessa), connected by military roads with Cirta and Hippo respectively. Lambaesis was the seat of the legion III. Augusta, and the most important strategic centre.

For bibliography. and account of Roman remains, *see* AFRICA, ROMAN.

NUMIDINAE: *see* GUINEA-FOWL.

NUMISMATICS (from the Latin *numisma*, a coin) is the study of coins and medals. Coins were first issued in east and west in the eighth century B.C., and since then their use has spread over the whole civilised world. Unlike many objects in every-day use, they have always been highly prized by their owners, and were therefore frequently hoarded. As is still the custom in the east, it was usual to bury treasure for safety, with the result that the contents of such ancient and mediaeval savings banks are frequently turned up by the spade to-day. Coins are themselves the most imperishable of antiquities. The result is that they still exist in vast numbers of forgotten generations out of all proportion to other remains of the culture with which they were contemporary. The study of coins may therefore be expected to yield a considerable amount of information about the past, although we must be careful not to exaggerate their importance. Coins give us some idea of the wealth and importance of ancient states and cities. A study of the find-spots of coins gives an idea of their circulation in ancient times, and it is sometimes possible to make deductions about the extent of the dominion of a particular state from this; chronological analyses of finds, by reasoning from known dates to pieces of which the dates are hitherto unknown, has often given valuable results. The argument from find-spots has to be used with care, as commercial reasons frequently explain the finding of coins far from their original mints. Thus, the frequent finds of Roman gold of the early empire in India do not show that the Romans ruled there, but corroborate Pliny's reference to the tremendous drain on Rome for gold to pay for Indian luxuries; to go to the other end of the world, the huge finds of Arab silver coins in Scandinavia were brought there to pay for furs for the wealthy Abbasids and Samanids. At all times certain currencies have acquired especial popularity and have wandered far; such were in ancient times the tetradrachms of Athens and the staters of Philip II.; in mediaeval times, the dinars of the early caliphs and the ducats of Venice, and in modern times the Mexican and Maria Theresa dollar and the English sovereign.

Commercial and economic history can thus learn much from coins; their depreciation reveals times of economic stress; the base Roman antoniniani of the third century tell their tale as readily as the inflated paper currency of Germany in 1919. The imitation of the Edward I. penny on the Continent shows how welcome a really good coin was in those days of base deniers.

Coins and medals have preserved a series of portraits which throw light on the characters of their issuers. Of particular value is the light thrown by coins on ancient religion and mythology.

As datable objects they are above all valuable as the grammar of art. Not only do they throw light on local forgotten schools and preserve representations of long-lost masterpieces, but it is from them that the chronology of ancient art has been fixed. A long series of coins of a Greek town, ranging from the archaic period to the decline of art, sets a standard of comparison which enables sculpture and other objects to be dated.

The principal metals in which coins are struck are electrum, gold, silver, copper and bronze.

Electrum is a natural mixture of gold and silver which was used for the earliest Greek coins struck in Asia Minor (Lydia) until Croesus replaced it by pure gold. Electrum was the metal of the great 5th century coinage of Cyzicus. An artificial electrum was used in the 5th and 4th centuries in Carthage and Sicily.

Gold was the great currency of Asia, of the later Lydian kings, of the Achaemenids, of the Kushans and most Indian dynasties till the 12th, and again in the 17th century. In Europe it is not found till the great coinages of Philip II., Alexander III. and Lysimachus of Macedon; in Europe we find it in the Roman and Byzantine empires and their successors till the 8th century; it was revived in the 12th century with the great commercial currencies of the Italian republics and from the middle of the 14th century became the standard of the northern countries of Europe also.

In the ancient world silver was the currency of early Greece and of Republican Rome, and of the 9th to the 14th century in Europe generally; it was the currency of the Parthians, and on the whole of the Sassanians, and of the Asiatic state of the middle ages.

Bronze or copper was the early currency of Rome and Northern Italy and of China till modern times: it first appears in Greece towards the end of the fifth century, and here as usual in its later numismatic history throughout the world was used only for small change.

Lead has only been occasionally used for coins; the only lead currencies of any note are that of the Andhras of ancient India and the modern coinages of the Malay States. Iron was occasionally used in the ancient world and during the World War in Germany. Nickel was used in Bactria, 3rd century B.C., and has been extensively used in modern currencies since the middle of the nineteenth century. The only pre-war aluminium coinage was that for British East Africa in 1908, but it was not a success. Aluminium and aluminium-bronze have recently been used for a number of the post-war currencies of modern Europe.

GREEK COINS

A coin may be defined as a piece of precious metal stamped with some mark or type or inscription showing that it is issued by some authority which guarantees its weight and purity. Coins as we know them are not older than the 8th century B.C. Traces of more primitive currencies which preceded them survived into historic times. Passing over the stage of barter, when a superfluity of one necessity of life was exchanged by its owner for another necessity of which he was in want but could not so easily supply, we find that certain things, notably oxen and instruments of husbandry, early became standards of value and were used as mediums of exchange. Among the Romans for example we find fines exacted in cattle down to the end of the 5th century B.C. and the etymology of *pecunia* from *pecus* shows that coined money took the place of cattle. With the passing of a pastoral civilization and the transition to an agricultural community with its multiplicity of products a demand for some more convenient medium and for small change was felt. We have abundant evidence of the use of agricultural implements and household utensils as currency in the ancient world. In China for example the earliest coins of the 8th century B.C. are models of the spades and billhooks which preceded them, with the addition of a proper coin-inscription showing they were issued by authority. In prehistoric Europe we have in Gaul hoards of small bronze celts which seem to have been used for currency. The most certain survival of this coin in the Mediterranean world is the iron or bronze spit (*obeliskos*—whence the name *obol* for a small coin); hoards of these spits have actually been found in circumstances which show that they were currency; the most remarkable of these hoards of spits is that found in the Heraeum in Argos, dedicated by Pheidon himself—whether as specimens of demonetised currency or as standards set up in connection with Pheidon's reforms or simply dedicated specimens of the usual currency is disputed; similar bundles of spits in bronze and iron have been found in Etruria. In Homer we find basins, tripods and axes used as gifts and prizes in a way which shows that they were a recognised standard of wealth. With the invention of the scales these more or less clumsy currencies disappeared and we have the metal itself used; a definite weight takes the place of a particular shape. In all countries from the 10th to the 5th centuries B.C. we find hoards of broken bronze or silver, sometimes shapeless, sometimes cast in the form of bricks or plates; later it is regularly in the form of bars which could be broken and weighed. We have finds of silver of this kind from Assyria of the 8th century B.C. and from Egypt and South Italy of a little later. The Egyptian finds frequently contain Greek silver coins chopped in a way which shows they were considered only as bullion. In Italy in particular rude chunks of copper (*aes rude*) were regular currency from early times to the 3rd century B.C. as we know from literary references and from finds. Caesar tells us that the ancient Britons used iron bars of a definite weight and specimens still survive; excavations have also confirmed the accuracy of Plutarch's reference to the iron money of the Spartans.

The large oblong Roman bronze pieces with a type on either side form a kind of transition from metal bars to coins although they are not earlier than some Roman coins—in any case it is a short step from the use of metal by weight to its use in pieces of definite weights with a stamp of some kind guaranteeing it is what it professes to be, so that it can be paid without weighing; at this stage it becomes a coin; it is in this form that coinage first meets us in Greece and India.

Period I. 750–480 B.C.—Ancient tradition—Xenophanes in the 6th and Herodotus in the 5th century—ascribes the invention of coinage to the Lydians; the latter says they were the first to strike coins of gold and silver. This definite statement probably refers to a period after the beginnings of coinage when Croesus of Lydia struck coins of pure gold and pure silver. We have, however, evidence of an earlier coinage of Lydia and Ionia of electrum, a natural mixture of gold and silver, the "white" gold of the Greeks; these early pieces, as the finds at Ephesus show, belong to the 8th century B.C. (Pl. I.-1). They are little globules with a variety of stamps which suggests that they are private issues and not issues of a state authority; this early coinage is irregular in weight and quality and unsystematic in character and it is not till the issues of Croesus that we have in Asia Minor an undoubted coinage by a state authority. The types on his gold and silver coins are the same, the heads of lion and bull facing one another and reverse a double incuse square caused by the anvil in striking (Pl. I.-3).

In contrast to this early electrum coinage, irregular, alike in quality, types and shape, is the almost contemporary earliest coinage of Greece proper, even the oldest specimens of which, unlike the electrum, are at once recognisable as coins to the least trained eye. This is of silver and capable of definite attribution. The oldest are those of Aegina and if the not early but persistent ancient tradition which says that coinage was invented by Pheidon king of Argos is correct, these would be his coins. The type of Aegina is a turtle—an animal associated with Aphrodite—on the obverse, an incuse square on the reverse. That the coins of Aegina are the earliest is supported by the fact that the Aeginetic standard is the commonest on the earlier coins of the islands, the Peloponnese and Greece proper; it was later supplanted by the Euboic-Attic standard, the adoption of which by Solon for Athens led to its wide dissemination. By the end of the 6th century the practice of striking coins was well established in many centres. Corinth with its *pegasi* (Pl. I.-9)—from their type of a pegasus—struck staters on its own standard, a variant of the Attic and began to strike not long after Aegina; it is not improbable that Periander was the institutor of the Corinthian coinage which became one of the great commercial currencies of the Greek world. The date of origin of the coinage of Athens is still uncertain; the well known types of the head of Athena on the obverse and her attribute the owl on the reverse date from the middle 6th century and are the earliest coins with a type on both sides and the earliest to bear a human head (Pl. I.-8). The exact attribution to Athens of its Solonian and pre-Solonian coins is still disputed. By the institution the "owls," a type of coin, obv. deity and reverse an attribute of the deity, was developed which had a far-reaching effect on the development of coin-types; the head of the king on an English penny goes back to the head of Athena through the deified head of Alexander and the Britannia on the reverse similarly can be traced back to the owl. Other important towns like Thebes and trading centres like Corcyra began to issue coins about this time but a number of important towns seem to have still been content to use the currency of their neighbours. In the 6th century also we have the earliest coins of Africa in the issues of the Spartan colony of Cyrene with its badge the silphium plant, the cultivation of which was its great source of revenue. Coinage was also begun by the Greek colonies in South Italy and Sicily; these latter are of a characteristic fabric. Instead of the thick dumpy piece with a type on the obverse only and an incuse square on the reverse which are common to the cities and islands of Greece, we have broad thin pieces with the type struck on both sides, in relief on the obverse, incuse on the reverse (Pl. I.-5). We possess many coins of this type of Tarentum, Metapontum, Croton, Rhegium, Zankle (Messana), etc. By the time of the Persian Wars coinage was a familiar feature of everyday life in the cities of the Greek world. Traders and colonists had carried the art to Cyrene in North Africa from Sparta to south Italy from Corinth, and to Sicily from Athens and the Peloponnese. In Asia Minor also coinage spread southwards and had reached Cyprus but not yet Crete. The Phoenicians and Egyptians were already familiar with Greek coins but did not

attempt to copy the invention; in the north however the silver mints of Thrace and Macedon were beginning to be worked vigorously and not only the Greek cities but the barbarian tribes, also, who employed Greek legends on their coins, were actively striking.

The various coinages of this early period (down to 480 B.C.) have a number of features in common. One of the most remarkable to the modern eye is the absence of inscriptions; these are either non-existent or consist only of the initial letter or letters of the town issuing the coin. The device of the town was originally sufficient for local circulation but as coins began to go further afield it became necessary to add some indication of its name. The earliest coin legends are therefore very brief: a *koppa* for the initial of Corinth, a Φ (*phi*) for Phocaea, Σ Γ (*Su*) for Sybaris, ΑΘΕ for Athens, and so on. The earliest inscriptions of any length are still written from right to left. Long inscriptions like "I am the badge of Phanes" above a stag on an archaic coin of Ephesus or "the stamp of Gortyna" on an early coin of the Cretan mint of Gortyna are remarkable exceptions and important as showing the original nature of inscriptions and of the types themselves. They show that the genitive, which is the usual form of the name when written in full, although nominatives are not very rare, is explanatory of the type.

Types.—The types in the early period are mainly taken from the animal world; they include domestic—particularly the bull—wild animals, birds and insects (the bee at Ephesus); fabulous creatures are also common like the griffin at Abdera, the pegasus at Corinth, the Chimaera, etc.; the vegetable world is also represented, notably by the silphium plant at Cyrene. Representations of the human figure are rarer and later than other types to appear, but once the human head became established as a coin-type, its use spread rapidly and widely and with the disappearance of the incuse square and coming of the double typed coin a head began to be regularly used as one of the types. Complete human figures are rare and are represented either kneeling or standing, both very stiffly like the Poseidon at Poseidonia; the nymph and satyr or centaur common in Thrace (Pl. I.-7) hardly deserves the name of a group; elaborate compositions like the Hercules and Hesperides at Cyrene and the flight of Aeneas at Aeneia are quite unique.

With the coming of legends on coins it was no longer necessary that the main type should be the badge of the town, which is frequently relegated to the reverse or becomes merely a symbol or disappears altogether to give the artist a subject more worthy of his talents. Except in the doubtful case of the earliest electrum, coinage was always a matter for the ruling authority whether civic or regal and the earliest types are chosen to show who these are. That coinage was early recognised as too important a right for private ownership is seen from the traditions which associate all the great law-givers, Pheidon, Solon and Lycurgus, with the institution or improvement of coinage. The sanctity of the republic's right of coinage is seen in the coinage of cities ruled by tyrants, who never put their name or other indication of their existence on the coins, although they occasionally made alterations in the types, as when Peisistratos added the head of Athena to the Athenian coins or when Anaxilos of Rhegium introduced the mule-chariot type in memory of his Olympic victory.

The early types are generally chosen from simple motives. Many of them are a punning allusion to the name of the town like the lion at Leontini, the seal at Phocaea, the goat at Aegae or the quince at Melos, or the sickle-shaped harbour at Zancle. Sometimes it is chosen from the history of a town like the figure of the mythical founder Taras at Tarentum or the Minotaur and Labyrinth at Cnossos (Pl. I.-6). Types like the ear of corn at Metapontum allude to the fertility of the country about. Thrace and Macedon are notable for their huge silver octodrachms with the type of a local hero in a chariot drawn by two bulls. In Italy, Croton takes as its type the tripod of Apollo like its mother city Zacynthus. Poseidonia has a statue of Poseidon brandishing his trident. Naxos in Sicily, whose founders came from Naxos in the Aegean, has a head of Dionysos who was born in the Aegean island. Himera has a cock, a punning allusion to the name of their town for the cock proclaims the dawning of day (*hēmera*). Selinus has another punning type, the wild parsley leaf (*selinon*). Towards the end of the 6th century B.C., Syracuse introduces the celebrated type of the head of Arethusa, the nymph of a spring in Ortygia, which was in the next century to become the most famous of Greek coin-types. The reverse, a victorious chariot, became a popular one in other towns. The finest specimen of this type of late archaic style is the *Demareteion* (Pl. I.-14) commemorating the victory over Carthage in 480. The head of Arethusa on the obverse wears the laurel wreath of the victorious and beneath the chariot on the reverse is a lion, the emblem of conquered Africa. This type of obverse spread throughout Sicily; the main types of Sicilian towns in the 5th century are local nymphs and river gods. At Catana we have the river god Amenanos; Gela has a manheaded bull swimming, a personification of the river Gelas.

Period II. 480–336 B.C.—The finest period in Greek coinage begins after the Persian Wars and runs to the accession of Alexander the Great in 336 B.C. The first half of this period is transitional and is marked by a great advance in technical skill, an increased delicacy in the treatment of details and greater freedom of movement in the treatment of the human figure. In the last eighty years of this period the art of engraving coins reached the highest standard it has ever attained: the head of a divinity is now established as the obverse type and is usually represented in very high relief—many of the finest are shown facing; the engravers sign their coins which show that they were artists of note and not mere artificers: the names of great artists otherwise unknown have been thus preserved. The types are very varied and almost entirely based on local mythology, although latterly the fine bigae and quadrigae types became popular in allusion to Olympic victories. The type first introduced in Athens—obverse head of a deity and reverse badge of the city—grows increasingly popular and towards the end of the period is almost regular. Inscriptions become general although still frequently contracted. The period is marked by a geographical extension of coining and an increase in its quantity; with the decline of the Persian empire, the cities of Asia Minor, Phoenicia and Syria show an increasing activity; the opening of the mints of Emporiae in Spain and Messalia in Gaul bring the art of coinage to the other end of the known world. Towards the end of the period the rise of Macedon under Philip II. led to the closing of many mints in northern Greece, and his coinage foreshadows the great imperial coinages of Alexander the Great. The second half of the 5th century witnesses a great expansion of the monetary influence of Athens at the expense of her allies.

The coinage of the period is mainly silver; the Aeginetic standard gradually yields to the Attic: electrum disappears except at Lampsacus and Cyzicus and sporadically at Syracuse and Carthage. Gold is continued in the darics of the Persian kings in the east and in the fine series of Lampsacene staters (Pl. I.-10); with the decline of Persian power the Great King's monopoly of gold was usurped by various rulers in Cyprus and Caria. The late 5th and 4th century gold coinages of Syracuse, Tarentum and Cyrene are extensive. Towards the end of the period we have the institution of Philip II.'s gold stater, the first great gold coinage of the world. In the latter part of the 5th century the first copper coins were issued and soon drove out the infinitesimal small silver coins which had hitherto served as small change.

The greatest commercial currency of the 5th century was the silver coinage of Athens, as contemporary references and the huge finds still made all around the Mediterranean show. It was imitated in Central Asia and Arabia which shows the extent of its penetration. The Corinthian stater continued to be an important coinage although its circulation was more limited. The same is true of Cyzicene staters: these great currencies remain more conservative than their contemporaries which are not affected by the same commercial considerations; care is taken to avoid the slightest change, hence the long survival of the now obsolete *koppa* on the coins of Corinth or the archaic use of E for H at Athens.

The feature of the period is the development of the general type—head of a deity on obverse and reverse, the badge of the city—which usually has some reference to the deity also. We find

the latter prevailing in time so that when the old type has no reference to the deity chosen, it is dropped. The gradual abandonment of these old types gave a freer choice to the artist and the simple figures of animals, plants, fabulous animals, etc., give way to mythological groups. Symbols begin to appear on coins and are usually the marks of magistrates or otherwise mark the issues and change constantly. Occasionally we find the old badge of the town relegated to a subordinate position, like the tunny fish at Cyzicus. Names of towns and magistrates are written at greater length and those of artists begin to appear. Types are occasionally labelled like the Zeus at Locri Epizephyrii or the Ajax at Locri Opuntii.

Predominance of Athens.—The causes of the predominance of Athenian currency were firstly the development of rich silver mines in Laurium in the beginning of the 6th century, which provided the money to build the ships which defeated the Persians at Salamis in 480 and secondly the prosecution of her policy of prohibiting silver issues by any city or state that came within her power, whether as tributary or as a member of the alliance in which she was the predominant partner. The members of the Confederacy of Delos while nominally retaining their monetary rights bowed to the practical advantages of a common coinage—which was that of Athens. The fine quality of its silver, the accuracy of its weights and its numerous subdivisions made the Athenian tetradrachm welcome everywhere so that Athens gained the monetary hegemony in addition to the political. In 453 Aegina became tributary to Athens, which at once put a stop to the issue of the "tortoises" and the stater of Aegina practically disappeared from the international market where it had so long competed with the "owls." Eretrea on its conquest in 445 lost its right of coinage as did its neighbour Carystus. Tenos, Naxos and other Aegean islands also ceased coining. In Asia Minor, Miletus, Cnidos and other tributaries of the Confederacy issued only small change.

One notable exception is that of Melos, which had refused to enter the League and therefore could still continue its staters. Samos and Lesbos kept up their issues but they were allies of equal status to Athens; Ephesus which entered the Confederacy in 469 continued to coin silver till 460, but there was seemingly some special arrangement in this case. Aeolis, Mysia, and Troas only struck small change. Several towns of the south coast of Thrace, like Abdera, continued their coins but these with their different standards did not compete with those of Athens in the markets of the Aegean. Phocaea, Mytilene and Cyzicus continued their electrum in the 5th century but their silver ceases. The Athenian tetradrachms thus became predominant in the Aegean and beyond, completely ousting local currencies. If we occasionally find autonomous staters, it is a sign of rebellion or shows that the town in question entered the League with special reservations. With the first news of the disasters in Sicily a general defection began and the days of the economic supremacy of Athens were soon over. The Spartans seized the mines of Laurium in 413 and cut off the supply of silver. In 407 Athens was reduced to such financial straits that the gold statues of Victory from the Parthenon were melted down for an emergency coinage; in the next year she had to have recourse to a coinage of bronze which had an unfavourable reception as it could not, like the infinitesimal silver pieces, be carried in the mouth. After being almost extinct, Athenian coinage revived after Conon's successes in 394. On the formation of the second League against Sparta, her allies however struck coins on equality with Athens and used a common type of the infant Hercules with their own reverses and their own standards. Such staters are known of Ephesus, Cnidus, Rhodes, Samos, Cyzicus and other islands and towns of Asia. This diversity of standard in the League shows that there was no monetary convention. Among the rising coinages of this period one of the chief was that of Rhodes (Pl. I.-15) founded in 408. Its silver and gold coins have the punning type of the rose and head of Helios. Rhodes had its own standard and its rapidly increasing commerce spread its coinage and standard quickly in the Mediterranean. In 376 Athens regained her hegemony over the islands but for a generation only. Her coinage again became abundant but never regained a predominance over the numerous local coinages which had sprung up since the end of the 5th century. In addition to Rhodes the important mints of Amphipolis and Larissa begin to issue their beautiful coins and many smaller towns open their numismatic history. The ancient coinages of Samos and Chios disappear before Athenian vengeance in the middle of the 4th century but other towns of Asia and the islands, Cnidos, Ephesus, Tenedos, and notably Cyzicus, testify in their coins to the great prosperity which their autonomy brought them. Corinth and its colonies continued to issue their staters of the old types uninterruptedly up to their conquest by Philip II. and even then did not lose the right of coinage. With this exception however the great revival of autonomous coinage in the early 4th century was short-lived. Philip II. (Pl. I.-12) became politically supreme, and economically his gold and silver mines enabled him to drive the gold of Cyzicus and the silver of Athens from the market, but the Attic standard was to survive in the tetradrachm of Alexander. In 404 the people of Aegina after half a century of exile returned to their homes to resume the issue of their celebrated staters but replaced the turtle of the obverse by a tortoise.

The 5th century saw the beginning of one of the finest and most interesting series of silver coins, that of Elis. From about 471 when Elis became a city to its conquest by Macedon in 322 the staters form a continuous series. The whole land was sacred to the Olympian Zeus and his symbols, the thunderbolt or eagle clutching its prey, are usual types along with a Victory in various attitudes—running to crown a victor, standing or seated with outspread wings—the latter type was copied by Pistrucci for the Waterloo medal in 1815. At a later period the head of Zeus appears as does that of Hera and also the fine head of the nymph Olympia. The legend is always FA for (F)*aleion* and the long obsolete digamma survived to the end of the coinage in the middle of the 1st century B.C. The types and the additional legend *Olympikon* occasionally found show a close connection with the Olympic games which the Eleians claimed to control. There is an interesting numismatic record at Pisa of the successful effort on the occasion of the 104th Olympiad by the Pisatans to regain their ancient right of controlling the games which they had lost when the Eleians destroyed their city in 572 B.C.

Italy and Sicily.—It is in the west in Italy and Sicily that work of the finest period is seen in greatest profusion. In Italy, Tarentum, the capital of Calabria, continued its type of Taras on a dolphin on its silver. In the middle of the 5th century the agonistic type of a horseman appears and Taras is relegated to the reverse; the celebrated Tarentine cavalry are thus commemorated down to the middle of the 4th century. About 340 Tarentum issued a series of very beautiful gold coins with a head of Persephone and, reverse, the infant Taras appealing to Zeus enthroned. These gold coins, like sudden issues of gold elsewhere, were really a money of necessity.

In Lucania, Heraclea, founded in the middle of the 5th century, issues fine staters with a helmeted Athena and Heracles seated, strangling, or wrestling with a lion. Metapontum interrupts the monotony of its ear of corn type with a most striking head of its founder Leucippus. Other mints of the time are Neapolis, with its types the siren Parthenope and her father, the manheaded bull Archelous; Velia, with its head of a nymph and reverse the eastern type of a lion attacking a bull; Thurium, with its unusually fine head of Athena and the powerful bull on the reverse, and Terina, remarkable for its beautiful treatment of the Victory type.

It is in Sicily, particularly in Syracuse, that the engraver's art reaches a perfection never attained elsewhere before or since; from the middle of the 5th to the middle of the 4th century every coin is the work of an artist. In the 5th century Syracuse began to dominate the politics of Sicily as Athens was doing in the Aegean, and her artists spread the influence of her coin-types everywhere. The coins of Syracuse showed many varieties of the heads of Arethusa and Persephone and the chariot of the reverse was found capable of very varied treatment. After the middle of the 5th century her artists began to sign their work and we



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ANCIENT GREEK COINS

1. Electrum stater of Lydia. 2. Electrum stater of Ephesus. 3. Gold stater of Croesus. 4. Dario of Persia. 5. Alliance of Siris and Pyxus. 6. Knossos with Minotaur and Labyrinth. 7. Stater of Thasos. 8. Tetradrachm of Athens. 9. Stater of Corinth. 10. Gold stater of Lampsacus. 11. Stater of Aegina. 12. Stater of Philip II. 13. Stater of Alexander the Great. 14. Decadrachm of Syracuse. 15. Stater of Rhodes. 16. Stater of Lysimachus. 17. Tetradrachm of Alexander the Great. 18. Tetradrachm of Antiochus Hierax. 19. Late tetradrachm of Athens. 20. Tetradrachm of Ptolemy II. 21. Tetradrachm of Cleopatra. 22. Gold 100 litrae of Syracuse

NUMISMATICS



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

ANCIENT GREEK AND ROMAN COINS

1. Tetradrachm of Smyrna. 2. "Noe" coin of Apamea. 3. Cistophorus. 4. Jewish shekel. 5–9. Roman Republican. 10. Denarius of Caesar and Antony. 11. Denarius of Brutus and Casca. 12–13. Aureus and denarius of Augustus. 14. Sestertius of Nero. 15. Sestertius of Vespasian. 16. Aureus of Hadrian. 17. Aureus of Carausius. 18. Antoninianus of Diocletian. 19. Solidus of Constantine I. 20. Solidus of Theodosius. 21. Solidus of Justinian. 22. Solidus of Justinian II.

can thus prove, what is frequently obvious, that other towns borrowed engravers from Syracuse. The Syracusan coinage is mainly silver. During the siege by the Athenians, beautiful little gold coins were struck with reverse Hercules strangling a lion (Pl. I.-22). With the prosperity following the enemy's defeat, Syracusan art reaches its zenith. As the *Demaretcion* commemorates the defeat of the Carthaginians so the great series of decadrachms perpetuates the victory of 412. The agonistic types and word *athla* on some of them show that they were distributed at the games held to celebrate the victory; their types were widely copied and their engravers Kimon and Euainetos—otherwise quite unknown—have gained a place among the world's greatest artists. In the 4th century the coinage becomes somewhat stereotyped and has no longer any originality. We may note the issues of electrum by Dion in 357–353 and of gold by Timoleon who introduced the Pegasus type from Corinth on his coinage.

Among other cities of Sicily we may note the fine series of Agrigentum of the 5th century with its beautiful double eagle type and the Camarina type of the river god Hipparis and the nymph Camarina on a swan; Himera before its destruction in 408 issued some very interesting types such as the nymph Himera sacrificing while Silenus beside her bathes at the thermal spring for which Himera was noted,—or Pelops in his chariot, referring to a victory of a Himeran at the Olympic games which Pelops is said to have founded. Segesta, Eryx and other cities already Carthaginian, use Greek types and artists but have Punic legends. The nymph Segesta and the river god Crimissos are the best types of Segesta while Selinus abandons its parsley leaf and issues a number of very remarkable types, notably that of Apollo and Artemis in their quadriga with reverse the god Silenus sacrificing at an altar, a type which refers to the cessation of the plague as a result of appeals to Apollo as healer. In conclusion we may mention the wonderfully realistic Silenus with his wine-cup at Naxos.

Period III. c. 336–c. 100 B.C.—Alexander's conquest considerably extended the sphere of Greek influence and in this period there is a further extension of coinage. Egypt, hitherto coinless, now produces the richest series of the Hellenistic period. Bactria and Parthia too strike Greek coins. Spain and Mauretania begin to issue coins; in the north the Gauls, Britons and Germans begin early in the 2nd century to imitate Greek coins and soon learn to strike more independent issues. The influence of Alexander's coins (Pl. I.-13, 17) is decisive in the coinages of his successors in their different kingdoms. Only a few free towns strike their own silver and even they tend to use Alexandrian types. The period produced a number of coins of alliances like the Achaean and Thessalian Leagues. In the west the gradual advance of Rome is reflected in the coinages; local silver ceases earlier in Italy and Sicily than in Greece and Asia.

The accession of Alexander the Great in 336 inaugurates a new epoch in coin-types. The main feature of the period from his accession to the conquest of Greece by Rome is the final establishment of the portrait coin as the regular type of a currency and the great preponderance of regal issues.

The portrait of a living monarch took nearly a century to establish itself on a coin. Philip II. and Alexander the Great issued vast coinages throughout the ancient world but were content to put their name alone on the coin—latterly Alexander added the title *Basileus*. After his death his deified portrait appeared on the coins of Lysimachus in Thrace and on the early coins of Ptolemy I. in Egypt. It is not till 306 that we have a portrait of a living king on his coins when Ptolemy I. appears, still as god with the aegis of Zeus. Seleucus I. similarly puts himself on his coins as Dionysos; in time the divine attribute is dropped and the ruler appears as a mortal wearing only the royal diadem. In Macedon Arrhidaeus, Cassander and Antigonos still follow the types of Alexander and the early coins of Demetrius Poliorcetes (306–283) are without a portrait. Soon however his own portrait appears, still with the horns that deify him. His successors only have types of deities. Pyrrhus does not appear on any of his extensive coinages but the last two kings of Macedon, Perseus and Philip V. have left very fine portraits. The kings of Pontus notably Mithridates VI. have a magnificent series of portraits. The kings of Pergamon use the same portrait throughout, that of the founder of the dynasty, Philetairos I., and the Ptolemies in Egypt throughout their long series use only the head and legend of Ptolemy I. (Pl. I.-20), except on certain special issues (Pl. I.-21). Among the early Seleucids Antiochus I. was reluctant to drop the portrait of Seleucus I., but the portrait of the reigning monarch becomes the rule in this series (Pl. I.-18); farther east we have the long series of portraits of the Arsacids and the unparalleled series of Bactrian and Indian kings (Pl. V.-1). The smaller series of Persis give some portraits, but they rapidly become stereotyped as do the coins of Elymais and Oman. The Jews (Pl. II.-4) with that strict interpretation of the second commandment as is later the case among the Arabs have no portraits, but the Nabathaean kings have.

The reverse types also show the influence of Alexander; seated deities become common and go back to the Zeus on the tetradrachms of Alexander (Pl. I.-17), or standing deities which go back to the Nike on his gold (Pl. I.-13). The Seleucids have commonly a seated Zeus or Apollo. The Parthian series is unusual—the reverse shows the king seated, (perhaps) Arsakes I. the founder of the dynasty, treated with the respect due to a deity. The king's name remains on the reverse in keeping with its development as the successor to a town name and does not yet appear alongside of the portrait. The ancient world did not know the custom of numbering kings of the same name; they are as a rule sufficiently distinguished by their epithets.

After the vast issues of gold by Philip II., Alexander and Lysimachus, gold is but rarely struck, except in Egypt. Silver is the general metal of coinage and the Attic standard, which Alexander had adopted for his tetradrachms, became the monetary standard of the world, except in Egypt; there is a great increase in the bronze coinage, the local issue of which does not seem to have been seriously restricted by sovereigns and suzerains.

As the greater part of the Greek world was now ruled by the Diadochi, their various coinages naturally formed the main currencies of commerce. A number of civic and other coinages still survived however. Third century Athenian coinages are scarce except in bronze; occasionally as in 296 the issue of gold shows the straits to which the once wealthy city was come. In 229 when Macedon lost its supremacy over Athens and friendly relations were established with Rome a new era begins with the abundant issue of tetradrachms of the "new style" (Pl. I.-19) which went on for two centuries. The Athena of these coins is not the old one but a copy of the head of the Parthenos of Phidias and the owl on the reverse is now perched on a Panathenaic amphora. The ΑΘΕ still remains but a number of new legends and symbols are added to the reverse chronicling a long series of magistrates. Much light is thrown on the organisation of the Greek civic mints from these names and symbols. The other great coin issuing city, Corinth, went on striking its stater till 229 when by its surrender to Dosion the long series came to an end.

Rise of Rome.—The Roman conquest of Greece is reflected in the coinages. When the Romans overthrew Philip V. in 197 or Perseus in 168 they professed to be restoring the liberties of the Greeks and it is clear from the resumed activity of the mints that the Greek cities were autonomous in one respect at least. After the defeat of Philip V. the Thessalians formed a confederation with silver coins of the type of Zeus and Athena and the legend *Thessalōn;* a similar coinage was issued by the Boeotians. With the final overthrow of Macedon at Pydra in 168 begins the extensive issue of tetradrachms of Maronea and Thasos which became a great commercial currency for trade with the Barbarians across the Danube who continued to imitate them. Macedon itself as a Roman province issued tetradrachms bearing the names of Roman governors. In Asia after the defeat of Antiochus III. at Magnesia we have an outburst of tetradrachms of Attic weight and local types at towns like Lampsacus, Smyrna (Pl. II.-1), Magnesia and many others. Other cities similarly resumed the issue of Alexander tetradrachms, adding a small symbol to mark the town of issue—Miletus, Samos, Rhodes and many other Asiatic cities. These Alexander types continued down

to the middle of the 2nd century when the Roman province of Asia was set up and the *cistophori* replaced them. The first *cistophori*, so called from the Dionysiac chest which formed the principal type, were first struck at Ephesus at the end of the 3rd century; the reverse is a bow in quiver between two serpents (Pl. II.-3). The Pergamene kings popularised them and the Romans thus found it easy to substitute them for the Alexandrine tetradrachms with their undesirable associations. *Cistophori* were now struck in many Asiatic mints and bear the monogram of the town of issue. The last stage in the Roman conquest of the east was the defeat of Mithridates and those towns that had assisted him had their coins replaced by *cistophori* with the exception of Athens which obtained favoured treatment. The fact that Rhodes resisted Mithridates and assisted Sulla enabled its autonomous silver coinage to survive down to the Civil War:—it was the last autonomous coinage of Greece.

In the west the rise of Rome in the 3rd century introduced a new factor into the history of Greek coinage. The first coinage to disappear was the Etrurian after a life of two centuries. Rome's early intercourse with the Greek cities of Italy is reflected in the Romano-Campanian coinage. In the south the Italian campaign of Pyrrhus left its mark on various coinages, notably at Tarentum which also has some exceptional numismatic records of Hannibal's occupation. The towns of Magna Graecia gradually lost their silver coinage under Roman influence although their bronze lasted till the 1st century.

In Sicily in the 3rd century Syracuse began to dominate the whole island in coinage as well as politically; the types are mainly imitations of those of the 5th and 4th centuries; the coins of the other towns have little claim to originality. The Punic Wars brought the Romans to Sicily where the Carthaginians had been established since the end of the 5th century and had struck coins of Syracusan and other Sicilian types with Punic legends and later with their own types. When Syracuse fell to Rome in 210, Sicily became a Roman province; henceforth only bronze was struck in it; these local coins continued into the first century, when the last trace of Greek coinage in the west disappears.

Period IV. c. 100 B.C.–A.D. 268.—Under the Romans many Greek cities and districts continued to issue their own bronze coins but the geographical area over which this was done became considerably restricted under the empire. In the west—Italy, Gaul, Spain and North Africa—the right of coinage was abolished quite early in the empire, the latest local issue of these regions being a coin of Babba in Mauretania of the reign of Galba. In the east, particularly in Asia, these local bronze coinages went on down to the time of Gallienus in 268, when the complete depreciation of the Imperial silver coinage, now bronze washed with silver, made the issue of bronze for small change pointless. The language of the inscriptions is Latin in the west and Greek in the east—with a few exceptions in the latter case. The Imperial gold (solidus) and silver (denarius) became the main currencies throughout the Roman empire.

Before dealing in general with the bronze of the Greek cities, we may note one or two local subsidiary silver coinages issued by the Roman emperors in continuation of important pre-conquest coinages. The largest series of these was the Egyptian or Alexandrian series which runs from Augustus to Diocletian. In addition to bronze, this series at first included tetradrachms of billon of gradually decreasing fineness, which continued the tetradachms of the Ptolemies; later it is of bronze only. The legends are always in Greek; the coins bear the emperor's head on the obverse and the reverse types are at first usual Roman types but after the end of the first century begin to include native Egyptian types in increasing numbers, often of peculiar interest. The reverses are dated in regnal years in Greek numerals. From the reign of Claudius II. there is only one denomination, a small thick bronze piece originally coated with silver, which is probably still the commonest of all ancient coins. The earlier bronze which occasionally, although not generally, rival the work of the Roman mint have in the 2nd century a characteristic bevelled edge.

In Syria silver tetradrachms continued to be struck, mainly at Antioch but also at Tyre and a few other mints. These gradually became baser in the course of the early third century. Copper was also struck by the Romans at these mints and frequently bears the letters S C showing that this issue, as in Rome, was the prerogative of the Senate. Of several other local silver coinages the large series of drachms struck at Caesarea in Cappadocia from Tiberius to Commodus is the most important. The usual type is a local one of Mount Argaeus but common denarii reverses are also found.

A number of vassal states and protectorates continued to issue their own coinages in the precious metals until they became Roman provinces. The only gold coinage of this kind is that of the kings of the Bosporus who struck coins from the time of Augustus to the beginning of the 4th century with the Roman Emperor's head on one side and the local dynast's on the other. This coinage becomes gradually debased, passing from gold to electrum then to silver and billon and ultimately to copper in the 3rd century A.D. At the other end of the world, the kings of Mauretania continued to strike their own gold and silver until it became a Roman province in A.D. 40.

Bronze Coinage.—We now come to the regular series of Imperial Greek bronze coins which close the thousand years of Greece's numismatic history. They have no claim to artistic merit and are of local workmanship; therein they form a contrast to the regular Roman coins of the time which frequently attain a very high level. If they are devoid of artistic interest they have a very high historical and archaeological value.

The right of coinage is sometimes continuous and sometimes intermittently permitted by the Emperor or governor. Sometimes the right is held alternately by pairs of towns as in Moesia by Marcianopolis and Nicopolis. Coins are struck not only by single towns but jointly by alliances of towns (*homonoia*).

The general type is everywhere the same; obverse a bust and reverse a type of local interest. Under the Republic the Greek cities usually placed on the obverses of their coins an allegorical bust,—that of some local hero or of the "people" the "Senate" or the local city-goddess. The People (*Demos*) in Asia Minor is usually personified as a young male bust; the municipal council (*Boule*) and the Senate (*Sunkletos*) appear as young veiled females. The Tyche of the city appears as a female bust wearing a mural crown. The goddess Roma is found as a helmeted female, *e.g.*, at Smyrna. Pergamon and other towns of Asia Minor have Poseidon. Athena, Apollo and other well-known divinities are also found on the obverses.

Under the empire the usual obverse type is the head of the Emperor as on the regular Roman series. There are some notable exceptions. Macedonia for example had the head of Alexander the Great. Athens was privileged by Hadrian to use the head of Athena in place of the Emperor's. These are exceptions; the usual type is the bust of the Emperor and the obverse legend gives his name and titles in Greek, usually transcriptions or translations of his Latin titles, with occasionally some local allusion. The reverse type is reserved for the town of issue and the date when given is in a local era. The name of the town is in the genitive plural of the ethnic, very frequently with the addition of some proud epithet, of more or less significance. These epithets are of various kinds; many refer to the emperor either to flatter him or in memory of some benefit received. Some recall the origin of the inhabitants; Blaundus in Lydia, for example, calls itself Macedonian because it was originally a colony of Macedonian soldiers. Very favourite adjectives are "autonomous" and "free" but the most highly prized is that of *Neokoros*, which in Imperial times signified that the town had built a temple in honour of the Emperor. Ephesus for example proclaims in the reign of Caracalla that it had built 3 imperial temples. Capitals of provinces call themselves *Metropolis;* the title "first city" of the province is also highly prized and occasionally disputed, as we see from the coin-legends of Nicomedia and Nicaea in Bithynia or of Smyrna and Ephesus in the province of Asia. Towns in Phoenicia and Syria which had a temple with the right of asylum call themselves *ἱερὰ καὶ ἄσυλος*; a number of maritime towns bear the title *ναυαρχὶς* officially granted them by the emperor in recognition

of their naval importance. Damascus calls itself "illustrious," Syedra "brilliant," Nicaea "greatest and best" and there are many such empty titles.

Besides the ethnic these coins very often bear the names of magistrates and other officials; in the early years of the empire these include a few governors and other officials sent from Rome, some of whom even have their portraits on their coins, like the younger Cicero at Magnesia. But throughout the series the names and titles of local magistrates are vastly more common. These throw a good deal of light on local life and administration.

It is the reverse types of this series of coins that give them their importance. The coins of Athens preserve representations of many statues famous in antiquity which have long since perished such as the Athena Parthenos of Phidias, the great Athena Promachos on the Acropolis visible far out at sea, or the Dionysos of Alcamenes. A coin of Elis preserves for us the Olympian Zeus of Phidias and Lacedaemon the Apollo of Amyclees. Local cults are everywhere illustrated and incidents in the lives of all the divinities of Greek mythology are common types. Not only do we have gods and goddesses but also all kinds of local deities like river gods and nymphs. Local celebrities are also recorded; thus we have Homer at several of the various towns that claimed him as a native notably Smyrna, Anacreon at Teos, Sappho at Eresos in Lesbos, Herodotus at Halicarnassus, Alcaeus at Mytilene which records on its coins a whole series of its famous men, the majority of whom are not otherwise known. Not only are famous Greeks commemorated; the travels of Hadrian in the provinces led to the issue of many specially fine coins, some of which bear the portrait of his favourite Antinous.

Agonistic types are very numerous on account of the great part played by games and festivals in the life of the time. Their celebration is frequently recorded on coins; sometimes we learn that the town was not able to bear the expense and that officials or private individuals were ready to bear the expense in return for the honour of presiding and this is duly chronicled. In addition to the four great Hellenic Games we find many of more recent origin instituted in honour of the Emperor, like the Actian games in honour of the victory of Augustus at Actium, celebrated at Tyre and other towns, the Philadelphian in honour of Caracalla and Geta at Nicaea, etc., or in honour of local deities like the Panathenaic at Athens, or the Heraclean at Perinthus commemorated by a series giving the labours of Hercules. When two or more cities combined to have a joint festival, this is commemorated by a joint issue of coins. In conclusion we may mention a notable example of the preservation of a local tradition on a Greek imperial coin. On a coin of Septimius at Apameia in Phrygia we have as reverse type a man and woman in a chest or ark floating on water with a raven on the top and a dove flying above with a branch in her beak; to remove any doubt as to what scene is represented the ark is labelled ΝΩε and the coin is evidence of the local tradition that the ark rested on the mountain behind Apameia (Pl. II.-2).

ROMAN COINS

It was comparatively late in her history that Rome emerged from obscurity and became a great city. The adoption of a coinage was one of the most significant signs of the change. In very early times Rome had reckoned values in oxen and sheep, hence the word *pecunia* (money), from the same root as *pecus* (head of cattle). Later she began to use bronze as a means of payment,—but as yet only in rough, unstamped lumps (*Aes rude*), not as coins. The later tradition represents her as ridiculously poor in the precious metals, and the little that we know confirms it.

The exact date at which Rome passed on to the use of metallic currency is subject to some doubt. It is certainly not earlier than 338 B.C. (the date proposed by E. J. Haeberlin), and a strong case can be made for a date rather later. The Roman authors, who attributed the innovation to the king Servius Tullius, had no real knowledge of the facts. The first pieces issued were heavy cast coins of bronze (*Aes Grave*) representing the As, the unit, a pound of bronze and its subdivisions—semis, (½), triens (⅓), quadrans (¼), sextans (⅙), uncia ($\frac{1}{12}$)—a cumbrous coinage that needed wagons to transport it. It seems to be a clumsy attempt to apply the Greek institution of coinage to the bronze system of Italy. But very soon afterwards silver also was issued in the Roman name; its superior convenience was soon felt and, after the First Punic War at latest, it ranked as the chief metal in the Roman market.

The earliest Roman silver coins were didrachms struck on a standard familiar in Campania and issued in part at least in that district. They are coins of a normal Greek pattern and with the small token bronze that accompanies them, were clearly meant to circulate in districts accustomed to Greek coins—that is to say in Campania and its neighbourhood, Lucania and Bruttium and to some extent Samnium and Apulia. The coinage, whether we regard it as primarily military or commercial, certainly arose in the course of the great wars, which ended in making Rome supreme in Italy by about 270 B.C. It represents one result of the closer contact of Rome with the Greek south.

The *Aes Grave*, to a large extent, runs in series parallel to the silver, but can hardly have circulated in the same districts. It is simplest to regard it as the counterpart of the silver coinage, issued for Rome and her Italian allies, in North Italy, Latium, the Sabine country and, to some extent, Samnium and Apulia. As Haeberlin has demonstrated, Rome's first system of coinage is a dual one: it is only unified, when the more cumbrous Italic system yields to the Greek. Our knowledge of details is as yet very imperfect. There are variations in the weight of the *As* or pound, which do not answer to any obvious explanation; there is a reduction in the weight of the didrachm, which may or may not be due to inflation in the Pyrrhic War. We do not know how the didrachm and the As were related. Fortunately, the historical meaning of the coinage is clear. Rome began to open her doors to Greek ways and she was soon followed by her colonies in the South—Cales, Suessa, Teanum, which struck didrachms like hers—and by other colonies, in districts less Greek, which cast *Aes Grave*—Hatria in Picenum, for example, and Luceria in Apulia, or by independent cities such as Iguvium and Tuder in Umbria.

It was under the strain of the Punic Wars that Roman Republican coinage assumed the form in which we know it best. The denarius, traditionally assigned to 269–268 B.C., replaced the didrachm as the main Roman silver piece; it was equal in value to 10 asses, while its half, the quinarius, equalled 5, its fourth, the sestertius 2½. The As, originally a pound in weight, was reduced to about 5 oz.; then by slow descent to little more than 3 oz., again to 2 oz. and finally to 1 oz. Gold was issued on two separate occasions, as an emergency coinage—once in 217 B.C., once perhaps earlier. One fact, which has been obscured by modern writers, is the issue of *Aes Grave*, with the reverse type, in great masses during the First Punic War; Rome was short of silver and fell back upon her native Italian bronze and the strain of the war led to inflation, expressed in the reduction of the weight of the bronze unit, the As.

By the end of the Second Punic War Roman coinage had assumed its lasting form. The denarius was without question the master coin. Second to it in importance came a second silver piece, three-fourths of it in weight, the "Victoriate" or "Victory coin," struck for foreign trade in the Western Mediterranean, South Italy and the Adriatic. It may only have been introduced just before or during, the Second Punic War. The As, now reduced to one ounce, was a tenth of the denarius in value. Pliny has recorded a change of tariff to sixteen to the denarius in the Second Punic War, while admitting that the value of ten to one still held in the pay of the soldiers. As the coins themselves only show the new value much later, we are uncertain how far Pliny can be trusted. There was no gold coinage except in case of emergency.

The political supremacy of Rome in Italy afterward found expression in the supersession of all other Italian coinages, except a few of token copper in the South, by the Romans. This change did not take place very early or all at once—and favoured allies, such as Naples or Velia, probably coined in their own name longer than the Latin allies, with their closer bond with Rome: it was

probably hardly complete before the end of the Second Punic War.

In the great period of expansion after 200 B.C., denarius and victoriate went out to conquer the markets of the world. In the West progress was rapid, but the East, with its abundance of coinage, offered a successful resistance. Rome in her Eastern wars learned to use Eastern currencies, gold staters of Macedon and silver tetradrachms of Athens or Asia, and brought them into her own service: it was thus that she could dispense with any gold coinage and be content with a silver piece of less value than a shilling. About 135–130 B.C. the value of the denarius was raised to 16 asses, in place of 10, and, after a period in which the two values conflicted, that of 16 won the day (*c.* 100 B.C.). The great Social War of 91–89 B.C., when the Italian allies almost overthrew Rome in their eagerness to share her citizenship, led to confusion and inflation. The policy of the Gracchi, with its demands for land settlement and foreign colonies, had necessitated great issues of money, and, as early as 122 B.C. the senate had begun to inflate, by issuing base, plated denarii among the good ones. This policy was now vastly extended: the silver became so mixed and impure, that no one could tell what he really possessed. To add to the confusion the As was reduced from 1 oz. to ½ oz.; and, finally, in 87 B.C., the state declared itself bankrupt by ordering that all debts should be cleared at five shillings in the pound (*quadrans* for *As*). A praetor, M. Marius Gratidianus, attempted to find a remedy by sorting out the good denarii from the bad: at the same time, a new coinage of pure silver (theoretically pure, at least) was issued. Sulla, however, on his return and triumph, butchered M. Marius and annulled his policy, insisting that the money of the state must be accepted at its issue value: but, in future, the senate used its powers with strict moderation. The bronze coinage was allowed to sink into the background. The only further development of the Republic was the introduction of a permanent gold coinage by Julius Caesar, after previous experiments by Sulla.

The control of the coinage was in the hands of the senate, acting for the sovereign people; major changes had to be sanctioned by the passing of special laws. The responsibility for the striking of coins was normally entrusted to a special commission of three, "tresviri aere argento auro flando feriundo," but also, if less commonly, to other officials, such as quaestors or curule aediles. Roman coins were issued not only at Rome, but also at other mints in Italy and, later, in the provinces. But it is probable that these outside coinages were not at first administered in any way differently from the home and that issues outside Italy occur but rarely until the time of Sulla. In the period after Sulla these provincial issues became more and more important and less and less dependent on the senate. The generals abroad assumed the right to issue money to their troops in their own name and the senate raised no objection. In the end this military coinage of the provinces gave birth to the imperial coinage.

Roman coinage was historical in a sense in which modern coinage is not, but it is only late in the Republic that this element becomes strong. Rome began by placing on the obverse of her denarius the helmeted head of Roma, the protectress of the city and on the reverse, the Heavenly Twins, Castor and Pollux, who "fought so well for Rome" at the battle of Lake Regillus in 494 B.C. These types, with their somewhat general reference to Rome's divine protectors, remained in vogue for more than a hundred years. Variety first began in the reverse types, when figures of deities driving chariots began to replace the Dioscuri—Diana or Victory driving a biga or Jupiter or Apollo driving a quadriga. From about the time of the Gracchi an even greater freedom begins to prevail, and, extends to the obverse as well. In the succeeding period the types vary from issue to issue, with rare and passing revivals of traditional types. The choice is dictated by two considerations (1) the family pride of the moneyer, who selected incidents of interest from his family history (2) a natural interest in current politics, which leads the moneyer to select such types as can be brought into relation with current events.

A few examples will illustrate these tendencies. Sex. Pompeius Fostlus strikes a reverse, showing his ancestor Faustulus, the shepherd, finding the twins, Romulus and Remus, with the she-wolf; he probably strikes in the days of Tiberius Gracchus, when the thought of Roma Renascens, the "re-birth of Rome" was in men's minds—hence an appropriateness in the reference to her origins.

A group of moneyers of the year 118 B.C. issuing coins for the new colony of Narbo in Gaul, put on their reverses a Gallic warrior, probably Bituitus, king of the Arverni, in his war-chariot: in this case the public interest in Gaul has displaced any personal references. L. Tiburius Sabinus, striking *c.* 87 B.C., refers to the legendary Sabine king, Talicus, and to the rape of the Sabine women: the parallel between Rome's troubles with her neighbours in the past and in the present was obvious to all. Sulla, in the East, struck gold coins, with obverse types of Venus, whose favourite he claimed to be: later, in Rome itself, he commemorates his own triumph. Pompey the Great, perhaps in 61 B.C., struck a similar coin in honour of his Eastern victories, with a glance too at Africa, where his career of triumph had begun. The twenty years from 70 to 50 B.C. yield a host of references to history. M. Lepidus, probably the man who was afterwards triumvir with Octavian and Antony, has a gallery of family types, celebrating an earlier Lepidus, who at the age of 15 killed an enemy and saved a fellow-countryman in battle; the Marius Lepidus, who was sent to Alexandria to be tutor to King Ptolemy V. of Egypt in 200; the vestal virgin Aemilia, for whom Vesta miraculously rekindled the sacred fire; the Lepidus who restored the Basilica Aemilia and hung it with shields in 78 B.C. A. P. Hypsicus goes back still further to Neptune and his daughter, Leucronoe, the origin of his line.

With the outbreak of the great Civil War, the personal element burst out into full prominence. The coinage of Julius Caesar from the first bears the stamp of his personality and in the last year of his life the senate authorized him to place his portrait on the coins. Hitherto, the obverse of the coins had been considered the prerogative of a god or goddess: at the most, room might be made there for a hero of early days, such as Scipio Africanus. Caesar's own generation had begun to engrave the portraits of its fathers and now, at last, the portrait of the living man appears. Rome had come back to the monarchy, by whatever name she might call it. From this point to the end of the Republic, we have no true Republican coinage but only the preparations for the Imperial. Even the murderers of the tyrant Caesar in their last struggle for the Republic in the East, placed their own portraits on their coins. Brutus, on one famous reverse, set the daggers that had stabbed Caesar, with the comment EID. MAR. (the fatal Ides of March). Antony strikes in the East associating with himself first his wife in Rome, Octavia, later his Egyptian enchantress, Cleopatra. For his army and navy before the battle of Actium, he strikes denarii with the eagle and standards and prow on the reverse. Sextus Pompey, the pirate son of Pompey the Great, celebrates his chief naval victory over Octavian by a coin showing him as "son of Neptune"—proud title of a successful admiral.

The Roman bronze coinage never outgrew its conventional types. It grew to importance in the First Punic War, when the reverse represented the prow, the sign of sea power, the obverses the great gods of the state. These types it kept throughout: the ordinary Latin word for the "tail" of a coin is "navis" (ship).

Augustus.—The Empire, founded by Augustus, has a dual aspect; on the one side it is a monarchy, based on the support of the troops; on the other it is simply an exalted magistracy of the Roman Republic, created with special powers to deal with special problems. The imperial coinage faithfully mirrors this duality. The Emperor, as paymaster of the soldiers, keeps in his own hands the issue of the precious metals; but he leaves to the senate, now the one representative of the Roman people, the right of issuing the token coinage of brass and copper. The mint of the senate is naturally in Rome itself. The imperial mint is early centralised in the same place, but it is important to note that Augustus began by striking his money for the troops in the provinces, continuing the practice of the generals of the late Republic. His mint was not the successor of the senatorial, but

a new creation of his own. It was probably Caligula who opened the first mint in the capital. Henceforth gold and silver was normally struck in Rome. Provincial issues occur freely in times of civil war, but hardly to any extent otherwise. It was only in the 3rd century that a number of provincial mints came into being, to meet the needs of the chief armies. Antioch in Syria among the first. The example once given soon spread. By the time of Gallienus, imperial coins were struck in Viminacium, Siscia, Lugdunum, Mediolanum—perhaps at other mints too—as well as at Rome and Antioch; and from Aurelian on, the principle of the local issue of imperial coins is dominant. The senate struck mainly in Rome—at first only for Rome and Italy. The mark S.C., "senatus consulto," attests its authority. Antioch in the East and Lugdunum in Gaul also issue coins with this mark, which we must regard as also issued under senatorial authority. After the first two Emperors this coinage was probably current over the whole Empire; but it never played any large part in the East.

The commission of "tresviri" of the mint continued to exist as late as the 3rd century; but the names of these magistrates cease to appear on the coins before the death of Augustus. They may still have played a part in the senatorial issues; the imperial coinage fell within the range of the chief imperial officer of finance, the "a rationibus," and, under him, were administered by imperial procurators. The actual striking was entrusted to a staff of imperial freedmen and slaves. From an early date the Emperor began to exercise a controlling influence over the bronze token coinage also. The two mints may after a time even have been housed in the same building; at any rate the authority of the senate came to be more and more an empty form.

The Roman Republic had only known gold as an emergency or as a foreign coinage. Augustus from the first made his standard gold piece, the "aureus," the head of his system. The denarius however continued to be struck pure and of unimpaired weight; the coinage rested on a bi-metallic basis. The aureus weighed the forty-second part of a pound, the denarius the eighty-fourth; twenty denarii went to the aureus. The token coinage consisted of the sestertius and the dupondius, struck in brass, the fourth and the eighth part of the denarius respectively. The as, the fourth of the sestertius, and the quadrans, the fourth of the as, were struck in copper. Gold and silver were both struck almost pure. Base, plated denarii were not uncommon, but were the work of forgers. Under Caligula and Claudius, however, there is reason to think that the government abandoned its sound principles and condescended to make an unlawful profit by this device itself.

Later Imperial Changes.—Nero reformed the coinage, reducing the weight of the aureus to the forty-fifth part, that of the denarius to the ninety-sixth part of a pound. More important still, he added ten per cent of alloy to the hitherto pure silver. The relations of the coins to one another remained unchanged. Various more or less respectable motives for this reform have been suggested; and, so far as concerns the reduction of weight, there may have been justification for this measure of inflation. It is impossible to judge the debasement of the silver so charitably. It can be nothing but a device of a spendthrift government for meeting its obligations cheaply.

The evil consequences of Nero's debasement were slow to make themselves felt; but they were nevertheless disastrous. Again and again under stress of circumstances the government resorted to the same expedient. The percentage of alloy in the silver rose to as much as forty per cent under Septimius Severus.

Caracalla took the next step. He reduced the weight of the aureus to a fiftieth part of the pound and issued a new silver coin, the "antoninianus" or double denarius at the weight of about a denarius and a half. In the following period the aureus continued to decline in weight and the denarius, after a struggle, succumbed to the less honest double piece.

A final debasement of the silver by Gallienus at the crisis of his reign, when Valerian was a Persian captive and the West cut loose under an Emperor of its own, overtaxed the patience of a long-enduring public. The Antoninianus was no longer taken at its nominal value; confusion reigned and prices rose to absurd heights.

It was Aurelian, the "restorer of the world," who stabilized the coinage. The details of his work are obscure; what is certain is that his stabilization was so unpopular that it led to a riot, on the scale of a miniature civil war in Rome. A coin like the antoninianus was struck, but its value was reduced far below par. Gold was not restored on a reliable basis and the process of inflation began again. Diocletian had no choice but to deal summarily with this problem, before he could restore a coinage that deserved confidence.

Non-imperial Coinages.—In the West, local coinage in South Italy, Sicily, Gaul, Spain and Africa is found commonly under Augustus and Tiberius and sporadically, down to Galba. When this local coinage ceased, the duty of supplying the whole of the West fell on the mints of Rome, sometimes assisted by branches at Lugdunum (Lyons). In the East the case was very different. Coinage had been known there for so long, that the Romans found it expedient to leave a large part of the issues to local mints. Provincial silver or billon was struck in Asia, at Caesarea in Cappadocia, at Antioch in Syria, and at Alexandria in Egypt. Small change was issued freely not only in a number of provincial issues, but also at a vast number of city mints. It may fairly be said that the right to issue such small change was freely granted to almost every urban community. Under these circumstances the part assigned to imperial coinage was a restricted one. The aureus, indeed, had hardly a rival, the denarius circulated beside the provincial silver; but the token coinage in use was almost exclusively of local make. Not till late in the 3rd century did this local coinage succumb before the debasement of the imperial silver and the opening of provincial mints for imperial coin. The provincial coinage was, in its degree, a concern of the imperial government; the local coinage, however, was in theory independent. Its types are largely taken up with local interests; and, although reference to the Emperor or senate or people of Rome, is common, it is by no means universal and expresses a compliment rather than a definite acknowledgment of sovereignty.

Portraiture.—We have seen how under Julius Caesar interest in the living individual found expression on the coins in the form of portraiture. This tendency was developed to an immense degree under the Empire; but, as was only natural, interest was now focussed on the Emperor himself and the members of his family. Beside them there was no room for individual distinction. The Emperor, as head of the state, enjoys the right of portraiture on the obverse—a right which extended, at first sparingly, later more freely, to living Empresses or princes or to deceased members of the line. The reverse types, too, are full of his personality and his prowess. His victories, his triumphs, his distributions to the poor of Rome, his public shows, his measures for the welfare of Italy or the provinces, his arrivals and departures, his marriages, the birth of his heirs, his provision for the succession—these and many more, find constant reference on the coins. It is significant of the growth of imperial influence over the senatorial coinages, that, after a time, such reference is found as freely on the bronze coinage as on the gold and silver.

Religion still plays a large part. But even the great gods of the state are freely brought into connection with the Emperor and his protectors or as types of his qualities; and what is true of them is even more true of the minor deities, or virtues, who were so widely worshipped by the Romans. The virtues of the Emperor provide a symbolism fit to cover the whole of the imperial administration; his valour and victorious power, his care for the corn-supply of Rome, his spirit of constitutionalism, his liberality, his justice and his mercy. The coinage has throughout a strongly propagandist character. It serves to make known the achievements and to advertise the policies of the government.

The imperial system produced its own cult, the worship of those Emperors who, after death, were adjudged worthy of the honour of consecration. The worship of the "divi," as these deified Emperors were called, bulks large on the coins. They wear the radiate crown of the Sun-god as the symbol of their divinity;

while on the reverses appears the eagle, the symbol of the soul flown heavenwards, the pyre, the temple, or types of "Aeternitas," that world beyond time, conceived of as in the starry heavens, to which the soul of the good depart.

Diocletian.—Diocletian refounded the Roman Empire, but in a form that Augustus would hardly have recognized. The Emperor is now a monarch of the Eastern pattern, even in his lifetime receiving something like divine worship.

The mints formed a section of the department of the chancellor of the exchequer and, under him, were administered by "rationales." The moneyers, like so many other professions of the age of Diocletian, were organized as a rigid caste, from which escape was barely possible. They were subject to severe discipline and terrible penalties for abuses: but, despite this, false coinage was immensely prevalent and flourished in the face of repression.

Diocletian in A.D. 296 completed the task which Aurelian had begun. He finally cleared away the depreciated coinages of the 3rd century and issued a new coinage, based on sound gold and silver coins. His gold piece was struck at sixty to the pound of gold, his silver at ninety-six to the pound of silver. His successors continued his policy in the main lines unchanged. Constantine substituted the *solidus*, a piece of $\frac{1}{72}$nd of the pound, for Diocletian's sixtieth; this standard found general acceptance and passed on to the famous "besant" of the Byzantine Empire. In the first thirty-five years of the 4th century silver was very sparingly struck. When its free issue was resumed, new denominations, the *miliarense* ($\frac{1}{1,000}$ of the gold pound) and *siliqua* ($\frac{1}{1,728}$ of the gold pound) soon replaced Diocletian's ninety-sixth. The silver came more and more to be struck below standard weight—that is to say, to become a subordinate token coinage. The basis of the system was the steady supply of a standard gold coin.

Whether Diocletian and his successors issued a regular coinage in bronze or copper is very doubtful. They certainly continued to issue the very base billon, which represented the last stage of the debasement of the double denarius.

Diocletian's reform must have brought some improvement on the chaos of the great anarchy of the third century. But one great evil persisted—the cost of living remained high and would not come down. Diocletian's edict of A.D. 301 fixing maximum prices, was undoubtedly only one of a series of blows aimed at a recurrent social evil.

Influence of Christianity.—The spirit of the coinage undergoes a change, similar to that of its form. The divine Emperor dominates the entire coinage: even the gods hardly appear except as patrons of the new dynasty—Jupiter for Diocletian, Hercules for Maximian, Mars for Galerius, Sol for Constantius I. When Christianity, surviving the great persecution, received full tolerance and increasingly marked favours from Constantine, the pagan element in the coinage declined. Little of Christianity, however, took its place. For many years types and legends of a neutral character were preferred, though Christian signs and emblems—cross, monogram of Jesus Christ, *labarum* (Christian standard) begin to appear. There was in fact an unavowed truce between old and new. After Julian—who revived pagan types on his coins—notably the Apis bull of Egypt—the Christian element becomes stronger. The Emperor appears more and more as the defender of the faith, the imperial Victory shades off into the Christian angel. But the full development of the Christian tradition in coinage was reserved for Byzantium.

The Roman coinage of the East passes on without interruption into that of Byzantium. In the West, the Empire, succumbing to the barbarians in the late 5th century, left them its coinage as part of its legacy.

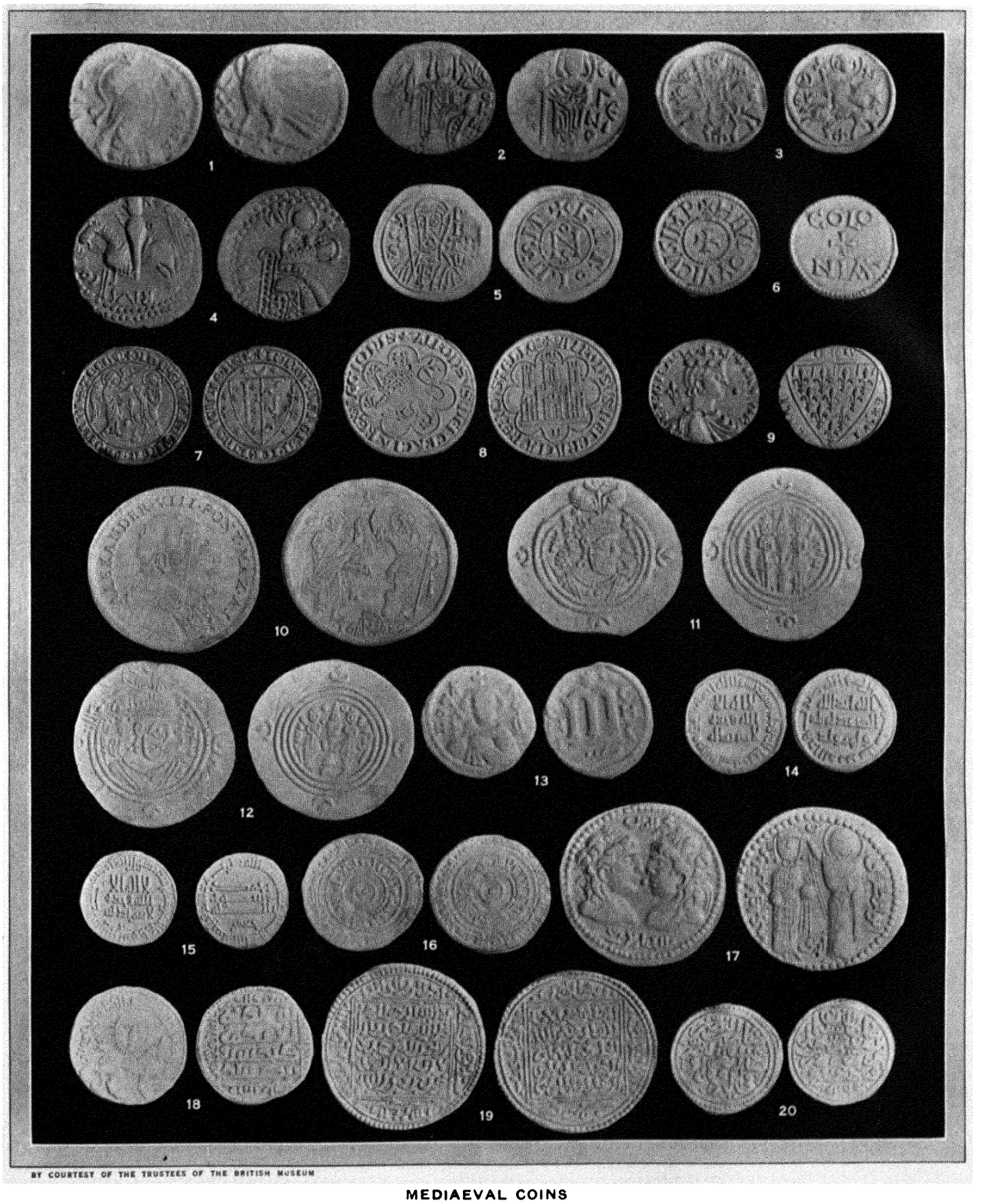
MEDIAEVAL AND LATER EUROPEAN COINS

With the fall of the Western empire, the coinage of the Byzantine empire became the great influence in European currency. The Byzantine period in coinage may be considered to begin in the reign of Anastasius. The coins are in the three metals, but the silver is rare, and was probably struck in small quantities. At first the gold and silver are fine, but, towards the close of the empire, much alloyed. The gold coin is the solidus of Constantine (Pl. II.-19), with its half and its third (semissis and tremissis). The Byzantine solidus (besant) (Pl. II.-21) throughout the middle ages was the gold coin of European trade until the introduction of Italian gold in the 13th century. The chief silver coin was the miliarision, and a smaller coin, the siliqua or keration.

In 498 Anastasius introduced a new copper coinage, bearing on the reverse, the following marks of value in place of a type: M, K, I and E, 40 nummi, 20, 10 and 5. These coins bear beneath the values the abbreviated name of the place of issue. Justinian I. added the regnal year in A.D. 538, his twelfth year; this is the first appearance of annual dating on European coinage. The money of this class shows extraordinary variations of weight, which reflect the state of the imperial finances. Under Basil I. the bronze money to all appearances was reformed, but the absence of marks of value makes the whole later history of the coinage in this metal very difficult. There was one curious change in the shape of the money. Early in the eleventh century the solidus begins to assume a cup-shaped form, and this subsequently became the shape of the whole coinage except the smaller bronze pieces. These coins are called *nummi scyphati*. The types, except when they refer simply to the sovereign, are of a religious and Christian character.

On the reverse of the oldest coins we have such types as a Victory holding a cross (other personifications all but disappear), but on those of later ones a representation of Christ or the Virgin Mary. Christ first appears on a coin of about A.D. 450, where He is represented marrying Pulcheria to Marcian. He does not appear again until the end of the 7th century, when His bust is introduced by Justinian II. From the 9th century Christ appears in various forms on the coins; about 900 we find the Virgin; a few years later saints, St. George, St. Michael, St. Theodore, etc., begin to appear. A remarkable type was introduced by Michael VIII. Palaeologus, who recovered Constantinople from the Latins in 1261, and issued coins with the Virgin standing in the midst of the walls of the city. Another notable type is the adoration of the Magi. The principal inscriptions for a long period almost invariably relate to the sovereign, and give his name and titles. The secondary inscriptions of the earlier coins indicate the town at which the piece was struck, and in the case of the larger bronze pieces, the year of the Emperor's reign is given. From about the 10th century there are generally two principal inscriptions, the one relating to the emperor and the other to the sacred figure of the reverse, in the form of a prayer. The secondary inscriptions at the same time are descriptive, and are merely abbreviations of the names or titles of the sacred personages beside the representations of whom they are placed. From the time of Alexius I. (Comnenus) the principal inscriptions practically disappear, and descriptive ones alone are given. These are nearly always abbreviations, like the secondary ones of the earlier period. The language of the inscriptions was at first Latin with a partial use of Greek; about the time of Heraclius Greek began to take its place on a rude class of coins, probably local; in the 8th century *Basileus* and *despotes* replace *Augustus;* by the 9th century Greek inscriptions occur in the regular coinage; and by the time of Alexius I. Latin has wholly disappeared. The Greek inscriptions are remarkable for their orthography, which indicates the changes of the language. In the 11th century we have a few metrical inscriptions, a practice commoner in Asia than in Europe. From the time of Justinian (6th century) onwards the profile which has been usual for centuries practically disappears from the coinage, and is replaced by a facing bust. The last Byzantine gold coin (a piece of John V., 1341–91) shows a figure of John the Baptist imitated from the Florentine coinage.

Cognate Groups.—Besides the regular series of the Byzantine empire, there are several groups connected with it, either because of their similarity, or because the sovereigns were of the imperial houses. These are the coinages of various barbarians, and the money of the emperors of Nicaea, of Thessalonica, and of Trebizond (Pl. III.-2, 3). The last groups consist of small silver pieces, which were prized for their purity; they were called Comnenian white-money (*ἄσπρα κομνήνατα*), the princes of Trebizond hav-



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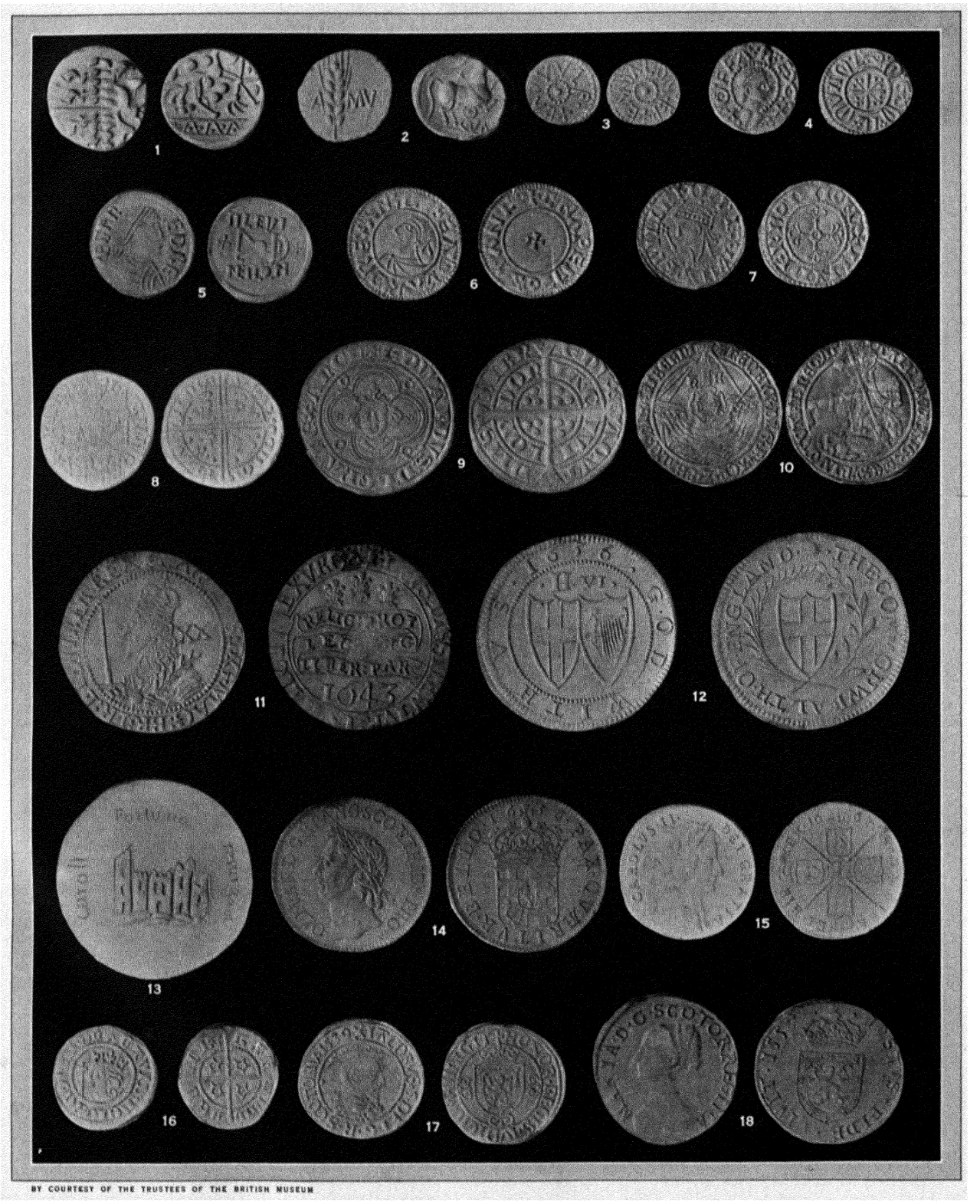
MEDIAEVAL COINS

1. Vandal. 5th and 6th century, Africa. 2–3. Trebizond, Aspers. 4. Roger II. of Sicily (copper). 5. Pope John VIII. and Charlemagne. 6. Denier of Louis I. 7. Ducat of Charles II. of Sicily. 8. Ducat of Alfonso XI. of Spain. 9. Ducat of Charles I. of Sicily. 10. Scudo of Pope Alexander VIII. 11. Dirhem of Khusru II. 12–14. Early Arab. 15. Dinar of Harun al-Rashid (A.D. 786–809). 16. Dinar of the Fatimids, Arab. 17. Copper Seljuk coin with reverse of Virgin crowning a Byzantine emperor (1152–76). 18. Silver Seljuk coin of the Lion and Sun type (1236–45). 19. Moroccan dinar. 20. Turkish sequin

NUMISMATICS



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BRITISH COINS

1. Ancient British stater. 2. Stater of Cunobelinus (Cymbeline) 1st century A.D. 3. Northumbrian styca (copper). 7th century A.D. 4. Penny of Offa. 8th century. 5. Penny of Alfred. 6. Penny of Edward the Martyr. 7. Penny of William I. 8. Gold penny of Henry III. 9. Groat (fourpenny piece) of Edward I. 10. George noble (6s.8d.) of Henry VIII. 11. Unite or sovereign (gold) of Charles I. 12. Half-crown of the Commonwealth. 13. Colchester siege-piece. 14. Broad of Oliver Cromwell. 15. Guinea of Charles II. 16. Penny of David II. of Scotland. 17. Bonnet-piece of James V. of Scotland. 18. Ryal of Mary Queen of Scots

ing sprung from the illustrious family of the Comneni.

The coinage of the other states of the West falls into well-defined periods which have been distinguished as (1) transitional period, from Roman to true mediaeval coinage, *i.e.*, from the fall of Rome (476) to the accession of Charlemagne (768); (2) true mediaeval period, during which Carolingian money was the currency of Western Europe; this covers the period from Charlemagne to the end of the Swabian house in 1286; (3) early Renaissance from the first issue of the florin at Florence in 1252 to the beginning of the classical Renaissance in the middle of the 15th century; (4) the Renaissance and (5) modern period.

Mediaeval.—The main feature of the mediaeval period is the disappearance of gold and rise of silver and the return of gold from the 15th century onwards. The inconvenience of gold money when it represents a very large value in the necessaries of life must have caused its abandonment and the substitution of silver by the Carlovingians. The denier (denarius) or penny of about 24 grains was at first practically the sole coin. The solidus in gold was struck but very rarely, perhaps as a kind of proof of the right of coining. The Byzantine solidus or bezant was used and probably the equivalent Arab gold. The new coinage spread from France, where it was first royal and then royal and feudal, to Germany, Italy, where the Byzantine types did not wholly disappear, England, Scandinavia, Castile and Aragon. In Germany and France feudal money was soon issued, and in Italy towns and ecclesiastical foundations largely acquired from the empire the right of coinage, which was elsewhere rare. The consequence of the extended right of coinage was a depreciation in weight, and in the middle of the 12th century the one-sided deniers called bracteates appeared in Germany, which were so thin that they could only be stamped on one side. The types of this whole second coinage are new, except when the bust of the emperor is engraved. The most usual are the cross; and the church as a temple also appears, ultimately taking the form of a Gothic building. There are also sacred figures, and more rarely busts in the later age.

The great precursor of the Renaissance was the emperor Frederick II. (1215–50). In his restoration of the gold coinage he had already been preceded by the Norman Duke of Apulia, who for the convenience of these Arab subjects and for commercial reasons also had continued the gold coinage of the Fatimids, the great currency at that time of all the western Muslims. Roger II. (1130–54) also struck Latin coins of his own as DVX APVLIAE, the first ducats. Frederick II., continuing the gold standard, also struck his own Roman gold money, solidi and half solidi, with his bust as emperor of the Romans, Caesar Augustus, and on the reverse the imperial eagle, in keeping with the obverse title. In workmanship these were the finest coins produced in the middle ages. It is not till the great Swabian that we get the final establishment of a worthy coinage, a necessity of their large commercial schemes. The famous gold florin was first issued in 1252 and at once became popular. The obverse type is the standing figure of St. John the Baptist, the reverse bears the lily of Florence. The weight was about 54 grains, but the breadth of the coin and the beauty of the work gave it dignity. The commercial greatness of Florence and the purity of the florin caused the issue of smaller coins in almost all parts of Europe. Venice was not long in striking (in 1248) a gold coin of the same weight as the florin, but with the types of a standing figure of Christ, and the doge receiving the gonfalon at the hands of St. Mark, a type suggested by Byzantium. It was first called the ducat, the name it always bears in its inscription; later it is known as the zecchino or sequin. Though not so largely imitated in type as the florin, the extreme purity of the sequin made it a world currency down to the 19th century. Genoa likewise had a great gold currency, and the other Italian states struck in this metal. Many varieties of gold money appear in course of time in France, England and to a less extent in other countries. The need for heavier silver coinage caused the issue of the large denier (grossus denarius, gros or groat). This coin appears early in the 14th century. The types from the 14th century onwards are many and distinctly worthy of the art of the time, which as yet is purely decorative and conventional, so that portraits are not possible. The religious intention also is gradually giving way to the desire to produce a beautiful result, and the symbol of the cross is varied to suit the decorative needs of the coin. Heraldic subjects also appear, and in the shield, which is frequently a reverse type, we see the origin of the usual modern reverse of the most important coins.

With the classical Renaissance we find ourselves in the presence of modern ideas. It is a period of innumerable small states and kingdoms with no uniformity of coinage yet most modern series can be traced back to it. Its most remarkable characteristic is the revival of portraiture and from the 16th century with the opening of the new world the enormous increase in output of coins in gold and silver. With the institution of the German thaler in 1518, it speedily became the chief European piece in its metal, and to its popularity is no doubt due the large silver pieces of other countries—crowns, ecus and scudos.

In the west a number of coins carry on the Roman tradition. They cover the period from the 5th to the 8th centuries, and are of considerable historical significance. The types throughout are monotonous: the bust of a Roman emperor or local ruler, a cross of some kind, a Victory, etc. The style is quite barbarous. The classification of the earliest servile imitations of Roman and Byzantine money rests only on origin and is uncertain. The following general series are distinguished: (A) The Vandals (Pl III.-1) (Africa, 428–534) issued gold (?), silver and bronze from Hunneric (477–84) to Gelamir (530–34); the gold is anonymous. (B) The Suevians (Spain, 409–585) had little but imitations of Byzantine gold; but Richiar (448–456) issued a denarius in his own name. (C) The Ostrogoths (Italy, 489–553) were preceded by the Herulian Odoacer (476–94), who coined silver and bronze; their kings (including Theodoric, 493–526, and Totila or Badulla, 541–52) issued gold, silver and bronze in their own names, from Rome, Ravenna, Milan, etc. (D) The Lombards (Italy, 568–774) had no coins in their own names before Grimoald, duke of Beneventum (662–71); later there are gold solidi and thirds and silver from many mints. Gold was issued for the duchy of Beneventum in the 8th century. (E) The Burgundians (Gaul, to 534) first issued recognizable coins under Gondebald (473–516). (F) The Visigoths (South Gaul and Spain) had imitative gold thirds in the 5th and 6th centuries; the kings' names appear from Leovigild (573–586) to Roderic (710–11). Sixty-one mints were in operation. (G) The Meroving Franks first issued under Clovis I. (481–511) coins recognizably Frankish (solidi and thirds). Royal names first appear on silver and copper under Theoderic of Austrasia (511–34) and Childebert I. of Paris (511–58). The chief Frankish inscribed coinage is, however, of gold solidi and thirds, from Theodebert I. (534–48), who broke down the Roman imperial prerogative and issued gold with his own name in full, to the beginning of the 8th century. The last Merovingians issued no coins in their own names, being mere puppets. From the middle of the 6th century the coins with kings' names are far less numerous than those bearing the names only of mints and moneyers; some 800 places (not only in what is now France, but in Germany, the Low Countries and Switzerland) are thus named. This coinage seems to have been intimately connected with the fiscal organization, though the generally accepted theory that the taxes collected in each place were there and then converted into money is by no means proved. Certain religious establishments also possessed the right of coining in their own name. The close of the Merovingian dynasty saw a revival of silver in the *saiga*, which heralded the introduction of the denier. (H) In England the Anglo-Saxons began with an imitative coinage similar to the Merovingian, viz., gold, *solidi* and *thirds*, and silver *sceattas* of about 20 grains troy, and *stycas*, first of silver, then of copper. The gold is rare and confined to the south; only two *solidi* are known, imitations of Honorius, with Runic legends on the reverse.

Portugal.—The coinages of the various countries of Europe from the end of Roman coinage and its imitations can be briefly mentioned in geographical order from west to east. The money of Portugal begins, after the expulsion of the Moors, with Alphonso I. (1112); it is exclusively regal, and not of great interest except as affording indications of the wealth and commercial activity of the state in the early part of the 18th century.

The early golds are of interest as by the arrangement of their type and inscription they try to look as like Moorish coins as possible.

Spain.—The coinage of Spain, after the reconquest from the Moors, is almost without exception regal. The Kingdom of Navarre had a coinage from the time of Sancho III. (1000–35). The series of Castile and Leon begins with Alphonso VI. (1053) with deniers and obols. Aragon first has coins under Sancho Ramirez I. (1063). Gold (as in Portugal imitated from Moorish money) is introduced in the middle of the 12th century. A plentiful coinage was issued after the union of the crowns in 1479. The Spanish dollar of the 17th and 18th centuries was one of the most widely circulating currencies in the West.

France.—In France in 755 Pepin the Short abolished the gold coinage of his Merovingian predecessors and introduced the silver denier (denarius = penny); the coinage became a royal prerogative once more and confined to a few mints. The denier (Pl. III.-6), which at first weighed *c.* 1·28 gramme (19¾ grains), was for centuries the chief of European silver coins. Under Charlemagne the weight was slightly raised; the Caroline monogram appears and there are other modifications in the types. Charlemagne also issued money from various Italian, German and Spanish mints. He also introduced the obol, and struck gold (chiefly at Italian mints). Among his types must be noted the temple with the inscription XPISTIANA RELIGIO. Louis le Debonnaire (814–840) was the last Carolingian to strike gold. In the 9th century are perceptible the first traces of the movement which led to the extensive feudal coinage. The advent of the house of Capet made no great change in the system, but the feudal issues now become important. The most widespread denier was that of the abbey of St. Martin at Tours (*denier tournois*); the royal coinage was known as the *monnaie parisis*. Louis IX. (1226–70) effected a great reform late in his reign, making the sou (hitherto a money of account) into a real coin as the *gros* and introducing a gold coinage. Henceforward the coinage increases in complexity; in the 14th century it has great artistic merit, especially the gold; from the end of the 16th century it becomes conventional.

Belgium.—Passing on to Belgium, its coinage, which, except for the few mints operating under the Merovingians and Carolingians, does not begin until the 11th century, comprises many pieces struck by foreign rulers, and has little of an independent character in either the regal or the seignorial class. The most important coinages are those of the house of Burgundy and Charles V. and his son, and of the bishops of Liége. The coinage of Belgium approaches the French on the one side, the German on the other.

Switzerland.—The multitudinous coinage of Switzerland illustrates the varying fortunes of this central state, and its gradual growth and consolidation. First we have the gold money of the Frankish kings, among whose mints Basel, Lausanne, St. Maurice-en-Valais and Sitten (Sion) already appear. The silver deniers, which Charlemagne made the coinage of the empire, are issued by fewer mints; the dukes of Swabia began to strike at Zürich in the 10th century, and the empire granted during the 10th and down to the 13th century the right of coinage to various ecclesiastical foundations, bishoprics and abbeys. Bern was allowed a mint by the emperor Frederick II. in 1218, and other towns and seigneurs subsequently gained the same right.. The demi-bracteate appears about the middle of the 11th century, and about 1125 is superseded by the true bracteate, which lasts until about 1300. The 14th century witnessed the rise of the Swiss confederation, and by degrees the cantons struck their own money. These, together with the coins of some few sees and abbacies, form the bulk of Swiss money of the mediaeval and modern periods. The separate cantonal coinage, interrupted by the French occupation, was finally suppressed in 1848, when a uniform currency was adopted.

Italy.—Italy, with Sicily, has special features. Here the barbaric coinages were mixed with the Byzantine issues which marked the recovery of the Eastern empire, and left a lasting influence in the north at Venice, and in the south at Beneventum. Later the Arab occupation of Sicily and the predominance of Arab coins left their mark in the curious Oriental coinages with Arabic inscriptions of the Normans of Sicily and of the Emperor Frederick II., mixed after his fashion with Latin coinage. The earliest money is that of the barbarian Ostrogoths and Lombards, and local Byzantine issues in Sicily. This is followed by the deniers of Charlemagne and his successors, succeeded by the gold currencies of the Normans and Frederick II. The age of the free cities is marked by the great coinages of Florence, Venice and Genoa, while the Angevin and Aragonese princes coined in the south, and the popes began to issue a regular currency of their own at Rome. The Italian princes of the next period coined in Savoy, and at Florence, Modena, Mantua and other cities, while Rome and the foreign rulers of the south continued their mintages, Venice and Genoa of the republics alone surviving.

The money of Florence, as may be observed, is disappointing in its art, for the great commercial currencies have to be conservative. The silver florin was first struck in 1189. It is heavier than the denier, weighing about 27 grains, and bears the lily of Florence and the bust of St. John the Baptist. These are thenceforward the leading types, the flower never changing, but the representation of the saint being varied. On the gold florin, first issued in 1252, the Baptist is represented standing, while in the contemporary silver florins he is seated. The latter have a rhyming legend, "Det tibi florere Christus, Florentia vere."

Venice as a mint rivals Florence in conservatism, and the early style is distinctly Byzantine; commercial reasons had to prevail in keeping coin types unchanged even in a great artistic city. The famous Venetian zechino or sequin, the rival of the florin of Florence, appears to have been first issued under Giovanni Dandolo (1284). On the obverse St. Mark gives the gonfalon to the kneeling doge, and on the reverse is a standing figure of the Saviour within an oval nimbus and a rhyming legend, "Sit tibi, Christe, datus Quem tu regis, iste ductus."

The series of the coins of Rome is rather of historical than of artistic merit. The popes begin to strike money under Adrian I. (A.D. 772–795), whose deniers are in a Byzantino-Lombard style. The coins of his successors, excepting few, down to Leo IX. (1049) associate the names of pope and emperor (Pl. III.-5). From Leo IX. to Urban V. (1362) there is no papal coinage. The Roman senate strikes from 1188 onwards. We then see on the silver the style of the senate and Roman people, and ROMA CAPUT MUNDI. Some coins have the figures of St. Paul and St. Peter, others Rome seated and a lion. Charles of Anjou, King of Sicily (1263–85), strikes as a senator, and Cola di' Rienzo (1347–48) as tribune. The gold ducat of about 1300 imitates the types of the Venetian sequin. St. Peter here gives the gonfalon to a kneeling senator. The arms of the moneying senator next appear in the field. The papal coinage is resumed at Avignon; and Urban V., on his return to Rome, takes the sole right of the mint. From Martin V. (1417) to Pius IX. there is a continuous papal coinage. The later coins, though they have an interest from their bearing on the history of art, are disappointing in style (Pl. III.-10). We have beautiful gold coins of Giovanni Bentivoglio, lord of Bologna, who employed Francia at his mint, and we know that the artist remained at his post after Julius II. had taken the city. There are also pieces of Clement VII. by Cellini, vigorous in design but careless in execution. There were papal mints at Ancona, Bologna, Piacenza, Parma, Ferrara and other Italian towns; and coins were also struck at Avignon from 1342 to 1700. When the City of the Vatican state was created in 1929 it was accorded the right of issuing its own coinage.

The coinage of Sicily, afterwards that of the Two Sicilies, or Naples and Sicily, begins with the Normans. Theirs is a curiously mixed series. It begins with Robert Guiscard as duke of Apulia (1075) and Roger I. of Sicily (1072). The gold money is almost wholly Arabic though Roger II. struck the Latin ducat, the earliest of its class; the silver is Arabic, except the great Latin scyphati of Roger II. with Roger III.; the copper is Latin (Pl. III.-4) and Arabic. The gold series (*Augustales*) of the emperor Frederick II. (1198–1250) shows the first sentiment of reviving classical art, its work far in advance of the age. These are Latin coins; he also struck small Arabic pieces in gold. Under Conrad and Manfred there is little coinage, copper only, but with Charles I. (Pl. III.-9) of Anjou (1266–85) the gold money in purely mediaeval style is beautiful, quite equal to that of his brother, St. Louis of France.

After this time there is a great issue of gigliati, silver coins with, for reverse, a cross fleurdelisée cantoned with fleur-de-lis (Pl. III.-7).

Germany.—The money of Germany, with which we include Austria and Hungary is, like that of Italy, far too varied for it to be possible here to do more than sketch some of its main features. In the Frankish period mints were in operation at cities in the west, such as Mainz, Strassburg, Speyer, Treves, Worms, Cologne. Pepin issued denarii from Strassburg and Mainz; under his successors denarii and obols were also coined at other mints, as Bonn, Cologne, Spires, Treves. After the reign of Louis the Child (910–11) the Carolingian system was continued until the advent of the Swabians with Conrad III. (1138–52). In the succeeding period which ends with the introduction of the grossus and the gold coinage under Louis of Bavaria (1314–47), the uniformity of the currency disappears. In the west (in Lotharingia, including the southern Low Countries, the Moselle and Rhine-lands, in Frisia, Bavaria, parts of Franconia and Swabia) the denier continues; but elsewhere we find the bracteate. The right of coinage is acquired in an increasing measure by the feudatories of the empire. With the introduction of the regular gold coinage (consisting for the most part of florins) and the grossus in the 14th century, Germany enters on the modern period. From the 16th century the thaler (so called from Joachimsthal in Bohemia, where the counts of Schlick first struck the coin in 1518) dominates the silver currency. The thalers and other large coins of the 16th and 17th centuries are often good and always vigorous in workmanship. By the convention of 1857 the thaler was recognized as the unit for Berlin and the north, the florin of 100 kreuzers for Austria, the florin of 60 kr. for the south. A uniform system, based on the gold reichsmark of 100 pfennigs, was established all over the German empire in 1876. Of particular currencies in Germany we must be content with the mention of some of the more important. Among the great rulers we note the dukes of Bavaria, who coined from Henry I. (948–55), and issued fine thalers in the 16th century. The Counts Palatine of the Rhine coined from 1294, their mints being at Heidelberg, Frankfort, etc. The Saxon coinage begins with Duke Bernard (973) and includes a large series of bracteates and thalers, the latter being especially famous. The Brunswick coinage begins in the 11th century; besides its bracteates we note the large mining-thalers of the 16th and 17th centuries (up to ten thaler-pieces). There are good bracteates and thalers of the margraves of Brandenburg; from 1701 they coin as kings of Prussia. In Austria there is a ducal coinage from the 12th century; the gold florin of Florentine character appears under Albert II. (1330–1358). The marriage-coin of Maximilian and Maria of Burgundy (a 16th-century reproduction of a medal made by the Italian, Candida in 1479) is a striking piece, and in the 16th century there is a large series of fine thalers. The thalers of Maria Theresa became popular on either side of the Red Sea, and those of the date 1780 are still recoined for trade there. In Bohemia there is a ducal coinage from the early 10th century to 1192; then came the regal bracteates. Wenceslas II. (1278–1305) struck the first German grossus at Prague. The gold florin made its appearance under John of Luxemburg (1310–47). In Hungary the regal coinage begins with St. Stephen (1000). Charles I. of Anjou (1310–42) introduced the florin and grossus. Of historical interest is the money of John Hunyadi as regent (1441–52). The abundance of gold about this time and later shows the metallic wealth of the land. The same is true of the rich gold coinage of the Transylvanian princes in the 16th and 17th centuries. Of ecclesiastical coinages the most important are at Münster, Cologne, Mainz, Treves, Augsburg, Magdeburg, Spires, Würzburg, Salzburg. The Cologne series of coins is almost continuous from the Frankish period; the archbishops first received the right from Otto I., Brune (953–65) being the first to coin; from Pilgrim (1021–36) the series, issued at various mints in the Rhineland, is very complete down to 1802. The series of Treves ranges from Theodoric I. (965–75) to Clement Wenceslas (1794). The archiepiscopal coinage of Mainz begins with Willigis (975) and lasts until 1802; its mints included Erfurt, Bingen and many other places. The Salzburg series (beginning 996) is remarkable for its fine thalers (especially of Mathias Lang, 1519–1540). The patriarchs of Aquileia, who may be mentioned here, acquired the right of coinage from Louis II. in the 9th century, but the first who can be identified on the coins is Godfrey (1184); thence onwards there is an interesting series of denarii and smaller coins down to the early 15th century. Of cities with large coinages it is sufficient to mention Aix-la-Chapelle (from the time of Frederick I. to 1795), Frankfort-on-the-Main, Hamburg (with great gold pieces of the 16th and 17th centuries, up to 10 ducats) and Nuremburg.

Scandinavian Countries.—The origin of the coinage of the Scandinavian states: Norway, Denmark and Sweden, is clearly English and due to the Danish conquest of England. The Runic alphabet is employed, though not by any means exclusively, on many of the early coins of Denmark and Norway. The Norwegian series begins with Hakon Jarl (989–96), who copies the pennies of Aethelred II. In the second half of the 11th century begins a coinage of small, thin pennies, which develop into bracteates. Magnus IV. (1263–80) restores the coinage, more or less imitating the English sterlings of the time. Norway and Denmark were united under Eric of Pomerania in 1396. The money of Denmark begins with pennies of Sweyn (985–1014) which are copied from the coinage of Aethelred II.; the coins of Canute the Great (1014–1035) and Hardicanute (1036–42) are mainly English in character. With Magnus (1042–47) other influences, especially Byzantine, appear, and the latter is very strong under Sweyn Aestrithson (1047–76). Bracteates come in in the second half of the 12th century. The coinage is very difficult of classification until the time of Eric of Pomerania (1396). There are important episcopal coinages at Roskilde and Lund in the 12th and 13th centuries. Sweden has very few early coins, beginning with imitations of Olaf Skötkonug (995) of English pennies and showing the usual bracteate coinage. The money was restored by Albert of Mecklenburg (1363–87). The thaler is introduced by Sten Sture the younger (1512–20). The money of Gustavus Adolphus is historically interesting. Under Charles XII. there is highly curious money of necessity. The daler is struck as a small copper coin, sometimes plated. The types include the Roman divinities. At the same time and later there was a large issue of enormous plates of copper, stamped with their full value in silver money as a countermark.

Russia.—The earliest Russian coinage begins with the princes of Kiev as early as the end of the 10th century; it shows strong Byzantine influence. The grand princes from the early 15th century struck curious little silver pieces. The coinage was modernized by Peter the Great, who introduced a regular gold coinage. The large silver and copper coins of his successors are very plentiful. Nicholas I. (1825–55) introduced a platinum coinage of about two-fifths the value of gold.

Other Countries.—The Christian coinages of the northern Balkan States are of great morphological interest. They are chiefly silver grossi, showing a mixture of Byzantine and Venetian influences. The Bulgarians had a regular silver coinage from Asien I. (1186–96) to John Sismana (1371–95). The Serbian coinage lasts from Vladislas I. (1234–40) to the middle of the 15th century. There is also a coinage of the Bans of Bosnia (late 13th to 15th century). The modern coinages of the Balkan States are of the 19th century only. The independent city of Ragusa is remarkable for the bold style of its early copper (13th century, inspired by Roman models of the 4th century) and the richness and variety of its later issues.

BRITISH COINS

The earliest coins struck in Britain were rude uninscribed imitations of the stater of Philip II. of Macedon (359–336 B.C.), one of the great currencies of the ancient world; they reached Britain through Gaul where they had been imitated by the various tribes there (Pl. IV.-1). The exact distribution of the earliest coins of this type found in Britain between British and Gaulish mints is still uncertain. These coins are of gold of gradually diminishing purity and are at first uninscribed. Under Roman influence we have the introduction of silver and copper coins towards the end

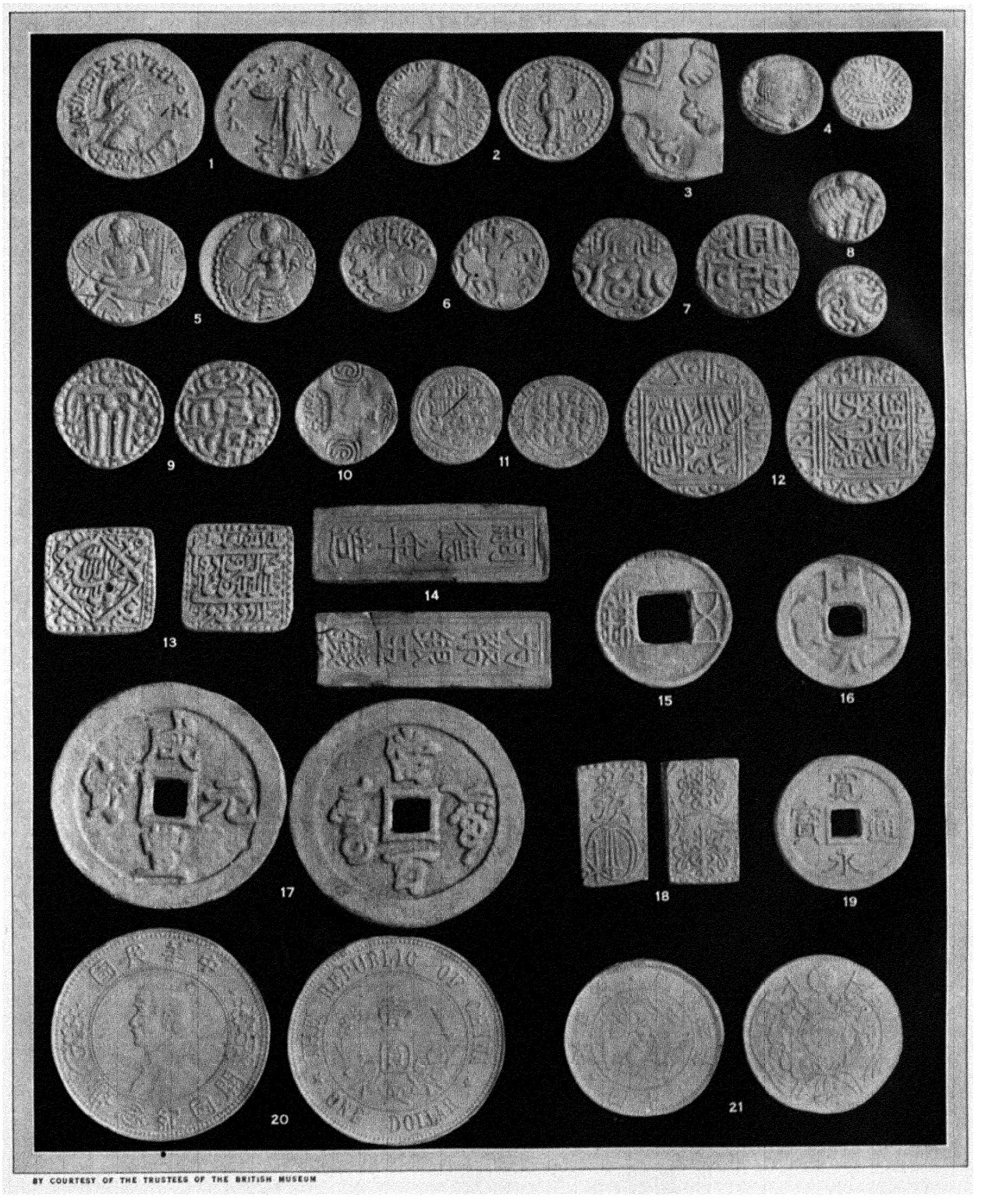
of the last century B.C.; inscriptions also now appear on the coins so that we can identify the coinage of Tincommius and Cunobelinus (Cymbeline) (Pl. IV.-2) and others known and unknown to history. With the Roman conquest native coinage disappears and if we except the Roman coins from the mint of London in the 3rd and 4th centuries A.D., we have no British coinage again till the departure of the Romans. Gradually degenerating copies of Roman types formed the currency of Britain from the 5th to the 7th century, when we are once more able to attribute the coins to definite rulers. In the 7th century we have the extensive coinage of little silver pieces known as "sceats" with a considerable variety of types and legends in Runic letters, which enable some to be attributed, for example to Peada, king of Mercia, (655–57 A.D.). About the same time in the kingdom of Northumbria we have the small copper coins known as "stycas" (Pl. IV.-3), which record a long series of kings from Ecgfrith (670–85) onwards. But it is from the reign of Offa (757–96) who introduced the silver "penny" that English coinage may be said to date. In its broad flat fabric, contrasted with the thick fabric of its predecessors, it shows the influence of its Carolingian prototype but the designs are thoroughly Anglo-Saxon and the portrait of Offa (Pl. IV.-4), a remarkable piece of work, reaches a level not equalled again in English coinage till the reign of Henry VII. The inscriptions, obverse name of the king and reverse that of the moneyer, were to remain unchanged in form till the reign of Edward I.; for the same period also the silver penny was the only English coin. A remarkable coin struck by Offa is his imitation of an Arab dinar of the Caliph al-Manṣûr with the additional legend OFFA REX, one of the few and exceptional gold coins of the Anglo-Saxon period. About the same time we find the Archbishops of Canterbury beginning to issue coins, the earliest being those of Jaenberht (766–90) bearing the names of the suzerain Offa also. The kings of Kent and the kings of East Anglia also began to strike pennies: the rise of Wessex after the battle of Ellandune in 825 can be traced in the coinage; the earliest coins of Wessex were those struck at Canterbury by Ecgberht and his conquest of Kent, and the mints of Alfred's reign (Pl. IV.-5) reveal how West Saxon power had expanded. The Danish invaders have also left extensive numismatic records, some of exceptional historical interest like the London coinage of Halfdan. The troubled state of the country is reflected in the many barbarous and hurriedly struck coins of this period. The peace and prosperity which returned after the peace of Wedmore (878) is seen in the improved workmanship of the coinage, with a more careful treatment of the portrait and a great variety of original work in the reverse types, a feature which was not long maintained. In the 10th century it became the regular practice to add the name of the mint as well as that of the moneyer on the reverse. In the edicts of the Council of Greatley (928) we have the earliest surviving mint ordinances. Coins were only to be struck at certain towns and each town was to have only one moneyer with certain specified exceptions (*e.g.*, 8 for London). The number of mints increased till in the reign of Aethelred II. we have over seventy; from about his time also the king's portrait, which had only been occasionally used, became the regular obverse type on the coinage, while the reverse type also became stereotyped to some form of cross (Pl. IV.-6).

The Norman conquest made no change in the coinage or mint system and we even find that pre-conquest moneyers stayed in office and struck coins for William I. (Pl. IV.-7). But the coin-types were now regularly changed partly as a source of revenue, for the moneyers had to make a payment when new dies were issued, partly as a check on forgery. The dies were made in London and sent to the country mints. The pennies of William II. have nothing in their legend to distinguish them from his father's issues but students have been able to allot eight types to William I. and five to his son. Forgers gave Henry I. much trouble and one step he took to prevent it was to issue his later coins with a snick in the edge to show that the silver was good. The civil wars of Stephen's reign produced many interesting coins such as those struck in Matilda's name and the pennies of Eustace Fitzjohn and other barons.

Henry II. ceased the practice of regularly changing the types which had been the custom since William I.'s reign and struck one type till 1180. In this type the work of the English mints reached its lowest level; the coins frequently have only a letter or two of the legends and fragments of the type. His second type the "short-cross," so called from its reverse design, first issued in 1180, remained unchanged—including the name Henricus—not only by Henry II. but also by Richard and John and Henry III. till 1247. In 1247 Henry III. coined the "long-cross" penny with the arms of the cross extended to the edge of the coin with a view to preventing clipping. He also reduced considerably the number of mints. In 1279 Edward I. introduced a new type of penny obv.: bust of the king and reverse: long cross with three pellets in each angle, a type which was much imitated abroad and persisted in the silver coinage till the reign of Henry VII. The moneyer's name disappeared from the reverse legend and its place was taken by the name of the mint CIVITAS LONDON, etc. He also struck halfpennies and farthings to replace the cut pennies which had hitherto done duty for small change. He also introduced a groat or fourpenny piece (Pl. IV.-9) (groat = gros = *grossus*, large *denarius*-penny) but the time was not yet ripe for this larger coin and it did not establish itself till Edward III.'s reign. The coins of Edward I., II., III. cannot be distinguished by their legends; a minute study of them has, however, enabled them to be attributed satisfactorily.

Henry III. had attempted to issue a gold coinage by striking the gold penny (Pl. IV.-8) of the value of 20 pence silver, later raised to 24, but the difficulty of rating gold to silver proved insuperable and the coinage was withdrawn. In 1344 Edward III. with the issue of his fine series, the florin, leopard, and helm (½ and ¼ florin) again attempted without success to introduce a gold currency: the attempt was renewed with the noble and after various experiments with its weights a gold coinage was finally established in currency in 1351 with a noble of 120 grains of gold and its subdivision the half and quarter noble. The silver penny was reduced to 18 grains and the groat first issued in the same year. The noble (Pl. VII.-4) was valued at 6s. 8d. The obverse type of the noble, the king in a ship, is supposed to allude to the naval victory of Sluys. The reverse type is a floreate cross with considerable ornamentation. Edward IV. distinguished his noble by a rose on the ship (rose-noble or ryal) and raised its value to 10s., while a new gold coin, the "angel," was introduced to replace the old value of the noble at 6s. 8d.; the penny was reduced to 12 gr.

The angel (Pl. VII.-8) is so called from its type of St. Michael and Lucifer. The reverse is a ship with a cross in front of the mast. The angel in the 16th century became the piece given to those touched for king's evil; it was struck for this purpose down to the reign of Charles I.; it was not again issued as legal tender but small copies of it were struck by the later Stuarts and pretenders for presentation at the ceremony of touching for king's evil. The next important change in the coinage was not till the reign of Henry VII. This was the introduction of the sovereign (Pl. VII.-11), a large gold coin of 240 grains current for 20s.; the obverse type was the king seated in an elaborate throne and the reverse a Tudor rose with a shield of arms in the centre. The same ruler also issued the first English shilling or testoon, a handsome coin with a fine portrait, in 1583, but this did not attain much currency. Henry VIII. altered the types of the smaller silver coins by replacing the three centuries old cross and pellets by a long cross and shield while the inscription POSUI DEUM ADJUTOREM MEUM took the place of the mint legend; the stereotyped bust was replaced by an excellent profile portrait on the groat and the seated king on the penny: Henry VIII. debased the gold and reduced the weight of the sovereign, the reverse type of which was now the royal arms supported by a lion and dragon. He introduced the gold crown of 5s. and half-crown and raised the angel to 7s. 6d., introducing the George noble to take its old value of 6s. 8d.—so called from its type of St. George and Dragon (Pl. IV.-10). In 1544 he issued the base shilling or testoon of 12 pence and debased the silver coinage. It was in his reign that the archiepiscopal mints of Canterbury, York and Dur-



ANCIENT AND MODERN ORIENTAL COINS

1–13. INDIAN. 1. Tetradrachm of Menander. Graeco-Indian, *c.* 2nd–1st century B.C. 2. Stater of Kanishka. 3. Punch-marked, *c.* 3rd century B.C. 4. Western satrap. Silver, 1st century B.C.–4th century A.D. 5. Samudragupta, 4th century. 6. Samantadeva. 7. Govindechandra. 8. Chera, mediaeval. 9. Massa of Ceylon, *c.* 1200. 10, 11. Mahmud of Chazna, 11th and 12th century. 12. Sher Shah rupee. 13. Mohur (gold) of Akbar. 14. ANNAM. Tu Duc, 1847–83. 15–17, 20. CHINESE. 15. Five-chu piece (copper), *c.* A.D. 500–550. 16. Kai Yuan, A.D. 618–627. 17. Hsien Feng, struck for Chinese Turkistan. 20. Republic. 18–19, 21. JAPANESE. 18. 2 *bu* piece (gold). 19. Sen. 21. Modern gold 10-yen piece

ham were abolished, the former having exercised its privilege for nearly eight centuries. When Edward VI. again restored a coinage of fine silver he introduced the silver crown of five shillings, which took the name of the gold piece of the same value introduced a few years earlier. The reign of Mary is notable for the appearance of her husband Philip II. of Spain on the shilling.

Elizabeth continued her father's denominations and restored the purity of the silver coinage. By introducing the sixpence and threepence of silver she gave the groat its deathblow, although it and the twopence continued to be struck. She also introduced coinage by machinery (mill and screw) although it was not really established until after the Restoration. James I. introduced a number of new gold coins, the most important being the "unite" or sovereign (20s.), so called from its legend (*Faciam eos in gentem unam*) alluding to the union of the crowns. In his reign the number of denominations in use reached its maximum. Charles I. (Pl. IV.-2) made no changes in the coinage of the last years of his father, but the Civil War and the king's financial difficulties added many new coins to the English series. These were 20s. and 10s. pieces in silver and the large gold pieces, *e.g.*, £3 pieces of Oxford and Shrewsbury, the fine Oxford silver crown by Rawlins with a view of Oxford behind the usual type of the king on horseback; the siege pieces rudely struck on pieces of silver plate at various Royalist strongholds show to what straits the king's party was reduced (Pl. IV.-13). Under James I. and Charles I. we have the first English copper coins, the "Harrington" farthings; they were not struck by the king but by contract. The coinage of the Commonwealth is remarkable for the simplicity of its types and this is the only period of English coinage when the legends have been in English (Pl. IV.-12). A series of coins were struck with Cromwell's bust and superscription but, although not uncommon, they never seem to have been put into currency (Pl. IV.-14).

The modern coinage dates from the reign of Charles II. After issuing the old denomination of hammered money in the first two years of his reign, he replaced the unite or broad in 1662 by the guinea (Pl. IV.-15), so called from the provenance of its gold, still a 20s. piece. It was not till 1717 after various oscillations that its value was fixed at 21s. His silver coins were the crown, half crown, shilling, etc., all regularly and beautifully struck by Jan Roettier with the new mill which was then established at the mint. In 1672 he introduced the bronze halfpenny and farthing with the Britannia type. The finest coin of his reign is not a regular issue. It was the "Petition" crown (Pl. VII.-14) made by Thomas Simon, engraver at the mint under the Commonwealth, and bears on the edge a petition to the king that he might be given the same office under the new régime. The coinage of the 18th century calls for no remark; one may just mention the practice of recording the provenance of the metal of particular issues as in the VIGO issues of Anne struck from captured Spanish bullion in 1702, the Welsh Copper Company shillings of George I. and LIMA coinage of George II. made of bullion brought by Anson from his voyage round the world. Towards the end of the century the scarcity of government silver was largely made good by Spanish dollars, with or without a bust of George III. countermarked upon them, and by tokens issued by the Bank of England while the deficiency in copper was made up by the private issue of vast numbers of tokens. In 1816 the great recoinage took place with the introduction of the sovereign and silver coins each with Pistrucci's design, St. George and the Dragon. In 1848 in the reign of Queen Victoria the 2s. piece (florin) was issued and proved a most popular coin; the double florin which was first issued in 1887 did not take the public fancy and the practical disappearance of the crown piece also from circulation reflects the public prejudice against large coins. The gold sovereign was last struck in 1917 but it had disappeared from currency in 1914 soon after the outbreak of war, after a career of three hundred years as sovereign, unite, guinea, and again sovereign.

Wales has never had a regular coinage but there exist two unique coins of Welsh kings, a penny of Howel Dda (*c.* 910–40) and another of Llewellyn (1075–79).

Scotland.—The coinage of Scotland followed similar lines to that of England as regards types and weights: the earliest coins are silver pennies (Pl. IV.-16) resembling the contemporary coins of England. The silver coins are baser and of inferior work but the rarer gold coins present several remarkably fine pieces of workmanship (Pl. IV.-17); the Scots coinage decreased in quantity after the union of the crowns in 1603 and ceased in 1709 after the union of the parliaments. The only extensive and varied coinage is that of Mary Queen of Scots.

Ireland.—Ireland had an extensive silver coinage in the 10th century, mainly copies by Danish kings, Sihtric III. and his successors, of the Anglo-Saxon coinage. The Anglo-Irish coinage began in 1177 with pennies and halfpennies of John, the only coins to bear his name which does not occur on the English coins. The quality of the coinage became more and more debased, reaching its final degradation under the Tudors. Gold was never struck by the government but copper was introduced quite early. The Civil War as in England produced a number of siege-pieces, notably the Inchiquin and Ormonde money. James II. in his campaign in Ireland issued vast numbers of gun-metal coins ranging from the 2/6 downwards. These were to be cashed for silver when he regained the throne. They are unusual as bearing the date in months. Irish coinage under the British régime did not actually come to an end until the reign of George IV., the last issue being in 1822. In 1928 coinage by the Irish Free State was introduced.

We may note that the Isle of Man had its own coinage from 1709 under the Earls of Derby to 1864 under Victoria and that the Channel Islands of Jersey and Guernsey have had their own bronze coinage for over a century

ASIATIC COINS

Achaemenids.—The ancient kingdoms of the nearer East, Sumerian, Assyrian, Babylonian and Hittite, had no coined money, nor had the earlier Achaemenids of Persia. Not till after Cyrus conquered Lydia in 546 B.C. did the Persians learn the art of coinage. It is not certain which Achaemenid ruler first struck coins but it was likely Darius Hystaspes (521–486) as Herodotus suggests. The coins of the dynasty were the daric (Pl. I.-4) (*i.e.*, the coin of Darius) of gold of very pure quality and the siglos in silver. Thus early we have the relationship of sovereign and shilling anticipated, for 20 sigloi (shekels) made a daric which weighed a little more than an English sovereign. The types of both coins were the same: obverse the Persian king in a kneeling position holding a bow in his left hand and a spear in his right; the reverse bears no type but only a rough irregular incuse caused in the striking. In shape they are roughly oval being struck from round or rather egg shaped globules of metal. These pieces were uninscribed and remained in issue unaltered in type till the fall of the empire. The issue of gold was the royal prerogative, but the conquered Greek and other cities and states were allowed to issue silver and copper while a number of Persian satraps struck silver in their own names; to this latter class we owe a number of the earliest and finest portraits on coins. On the fall of the empire, various satraps, like Mazaeus who ruled Babylon for his new master Alexander the Great, struck silver coins of their own.

Parthians.—In the middle of the 3rd century the Parthians rebelled and cast off the Greek (Seleucid) yoke and soon became a great power in Persia. They had an extensive but monotonous coinage in silver (tetradrachms and drachms) and copper. The tetrodrachms and drachms bear the bust of the king and Arsakes, the founder of the dynasty, seated holding the Parthian bow on the reverse of the drachms. The usual reverse on the tetradrachms is the king seated receiving a wreath from a Victory or a city goddess. The coins do not bear the name of the issuer but that of Arsakes, the founder of the dynasty, and the inscriptions range in length from the simple (coin of) "king Arsakes" to legends like (coin of) "the great king of kings, Arsakes, the just, the illustrious, the divine, the friend of the Greeks." After Phraates IV. the coins are dated in the Seleucid era; on the later coins the Greek becomes corrupt and broken and is joined by an inscription in Pehlevi, a language now more intelligible to those who used the coins.

The kings of Persis, who became independent about the same

time as Parthia, began their series with very fine portrait tetradrachms but the coins rapidly degenerated; their reverse type a fire-altar with or without attendant priests was revived by the Sassanians so that it had a life of nearly a thousand years; numerous debased silver, almost copper, tetradrachms of the rulers of Characene and of the Omani on the lower Tigris down to the sea still exist to record the names of forgotten rulers.

Sassanians.—In the beginning of the 3rd century A.D. Ardashir, a native Persian prince, overthrew the last remnants of Parthian power and founded the great Sassanian empire which ruled all western Asia. The Sassanian coinage was very extensive in silver and the early emperors regularly coined gold although the latter was rare. The copper coinage also seems to have been small. The coin-types throughout the dynasty are the same for all metals; on the obverse is a bust of the king with a long legend of the form (Ardashir, etc.) "worshipper of Ahura Mazda, divine king of kings of Iran," and on the reverse a fire-altar usually with two attendant priests and the legend "the fire of (Ardashir or other emperor)"; from the time of Kobad the reverse legend gives the mint and the regnal year of issue. The standard of the gold coins is derived from that of the Roman solidi; the silver coins are drachms following the Parthian standard and are remarkable for their broad thin fabric which was copied by the Arabs from their silver coins (Pl. III.-11). The execution of the portraits especially in the 3rd and 4th centuries is remarkably fine.

Caliphates.—The early Arabs were unacquainted with the art of coinage which had died out in Arabia with the extinction of the Himyarite kingdom in the south; it was not till the conquering armies of Islam had wrested Syria from the Byzantines in the east and overthrown the Sassanian empire of Persia in the west that they became acquainted with regular currencies and with the sudden accession of wealth found the need of one. At first they issued gold and bronze pieces imitated from contemporary Byzantine coins, modifying the cross on the reverse of the latter somewhat to suit Muslim susceptibilities; the earliest silver coins were copies of late Sassanian coins with the addition of *bismillah* (in the name of God) on the margin (Pl. III.-12). The need for a purely Arab coinage worthy of the now vast Arab empire was soon felt and towards the end of the 7th century the fifth Omayyad Caliph 'Abd al-Malik (A.D. 685–705) instituted a coinage more in keeping with the principles of Islam. This coinage was of gold, silver and copper and the names *dinar* (denarius aureus), *dirhem* (drachm) and *falus* (follis) were borrowed from the Byzantines, as also the weights of the gold and bronze. It is interesting that the gold and bronze (Pl. III.-13) kept the thick fabric of the Byzantine originals while the silver retained the thin fabric of the Sassanian drachms; it was some centuries before this distinction of fabric disappeared. The strict interpretation of some sayings of Mohammed on image-making had removed a vast field of activity from the Muslim mint-engraver by limiting him to legends instead of types. This however gave Arab coins a historical value which the coinage of no other race possesses. From the earliest times they bear the mint and date and in time the ruler's name and title often with valuable genealogical data and titles of historical interest. Every Muslim claimant to sovereign power took the earliest opportunity of striking coins and we possess coins of rulers and pretenders known to have had the briefest reigns and in some cases their coins still testify to the existence of rulers unrecorded by history.

The dirhem of 'Abd al-Malik bears on the obverse the Muslim profession of faith. "There is no god but God: he has no associate" and around is the marginal legend. "In the name of God this dinar was struck at —— in the year ——." The reverse area has a quotation from Koran CXII. "God is alone; God is eternal: He begets not and is not begotten nor is there any one like unto Him." Around is Koran IX. 33. "Mohammed is the Prophet of God sent with guidance and the religion of truth to make it prevail over all other religions averse though the idolators may be." This type of coin (Pl. III.-14, 15), issued from Spain and Morocco to the borders of China, gave Muslim coinage the character which it held for centuries. In mid 8th century the 'Abbāsids overthrew the Omayyad Caliphate but at first made little change in the coinage. The long reverse formula was replaced by the simple statement "Mohammed is the Prophet of God" and in time the caliph's name was added and at the provincial mints that of the local governor and in the 9th century a second marginal inscription was added: "To God belongs the order before and after and in that day believers shall rejoice in the help of God" (Koran XXXI. 3–4). Among the more remarkable coins of this series are those of Hārūn al-Rashid (786–809) which bear the name of his vizier and boon companion the ill-fated Barmecide Ja 'afar (Pl. III.-15), whose fame, like that of his master, has been spread by the *Arabian Nights*. The extensive gold coinage of the 'Abbāsids became one of the great currencies of the mediaeval world and Offa in his efforts to found an English coinage imitates a dinar of al-Manṣūr (A.D. 754–775).

The 'Abbāsid caliphate broke up in the 9th and 10th centuries and the succeeding independent governors regularly put their own names on the coins although they retained that of the caliph of Baghdad whose spiritual authority was still recognised. Among such dynasties were the Omayyads of Spain, who issued an extensive coinage mainly in silver from the middle of the 8th till the end of the 11th century, the Idrīsids, Tūlūnids, 'Aghlabids and Ibhshīdids, all short-lived dynasties in North Africa and Egypt, coining mainly in gold. In Central Asia we have the extensive coinage of the Sāmānids of the days when Samarkand and Bukhārā were great centres of culture and poured their wealth into northern Europe to buy costly furs as the great finds of Arab coins around the Baltic show. The 'Abbāsid coinage continued down to the 13th century but Baghdad was almost its only mint in its latter days; its last coins are very handsome large gold pieces. Minor dynasties mainly of Persian origin were the Ṭāhirids, Saffarids and Būyids whose silver coins are still valuable historical documents. In the 10th century the Fāṭimid caliphate, of Shī'a origin, arose in western Africa and in time conquered Egypt. Its extensive currency of gold introduced a new type of dinar with legends of the usual type but arranged in three concentric circles (Pl. III.-16); they held Sicily for a time and the coins struck were imitated by their Norman successors. A little later the Turks arose in the West, swept before them the smaller dynasties and ultimately ruled all western Asia. As the Ghaznawids, they ruled in Afghanistan and part of India; Mahmud of Ghazna struck coins with inscriptions in Arabic and Sanskrit, the latter for his Indian dominions (Pl. V.-11). His regular gold coinage and those of the great Seljuk Tughril Bey are among the last issues of the old type and in the 13th century we have a series of remarkable innovations. The descendants of the original Seljuk conquerors divided their conquests in western Asia into numerous small states. Their scarce gold coinage follows orthodox lines, while giving a wealth of historical information, but the most remarkable of their issues was an extensive series of large copper coins bearing a remarkable number of different types borrowed from all sources, ancient Greek and Roman and Byzantine. They seem to have taken a childish delight in reproducing any coin-type or even picture that took their fancy. Such are the coins of Karā Arslān (1168–1174) with reverse the familiar Byzantine type of Christ seated or of Alpī (1152–1176) with the virgin crowning a Byzantine emperor (Pl. III.-17). Their silver coins were directly influenced by the aspers of the Byzantine emperors and more particularly by those of the empire of Trebizond. From the latter comes the type of a horseman with a mace over his shoulder (Pl. III.-3), popular with the Seljuks of Asia Minor. Notable among the silver coins of this period are those of Kai Khusru II. (1236–1245) with the Lion and Sun type (Pl. III.-18). the horoscope of his beautiful Georgian wife whose portrait he even wished to put on his coins. It is these Turks, Seljuk, Ortukid and Ayyubid who were the "Saracen" opponents of the Crusaders. the best known of them being Saladin, the Ayyubid sultan of Egypt and Syria; his silver coins and those of his family give their titles at great length to the exclusion of religious legends. During this period and a little later some of the most beautiful coins the Muslim world has produced were being struck by the Almohads and Almoravids in western Africa. These large thin pieces of fine gold (Pl. III.-19) bear very long genealogical and

religious legends written in a beautiful and often elaborate script. Ibn Baṭṭūṭa, the famous Moorish traveller, remarks that nowhere were the dinars so large and beautiful as in his native land.

In the 13th century we note that the Mongols swept through all Asia except India until checked on the Egyptian frontiers. Of the Mongol lines, the Khans of the Golden Horde in the north issued an extensive series of small silver coins; the greater and wealthier line of the Ilkhans of Persia struck large and handsome coins in all three metals, with the Khan's titles in Mongol on the reverse and the Mohammedan creed in the Shī'a form on the obverse. In Egypt the Bahrī and later the Burjī Mamluks struck a series of large gold coins down to the 16th century; their silver coins are rarer. In the 14th century the great Tamerlane (A.D. 1369–1404), a distant descendant of Jenghiz Khan, revived the power of the Mongols; the majority of his coins (silver and copper) bear the name of his nominal sovereigns Suyurghatmish and Mahmud on the reverse and the kalima on the obverse. His son and ultimate successor Shāh Rukh introduced a new type of dirhem, obverse kalima with the names of the first four caliphs on the margin and his titles on the reverse, which remained popular throughout the 15th, 16th and early 18th centuries; gold was not struck in Asia during this period. In the meanwhile the eastern half of the Muslim world was passing to the Ottoman Turks. Their coinage of gold and silver, which became gradually baser and baser, and bronze, is monotonous in its legends of stereotyped titles and mints only. Their wealth of mints gives their coins a certain historical interest as they trace the expansion and decline of Ottoman power in Europe, Asia and North Africa. A notable feature of the Turkish coinage is the tughra, an elaborate monogram formed of the sultan's name and titles which occupies one side of the coin from the 16th century onwards. Latterly Constantinople and Egypt were the only Turkish mints of importance. The coinage of Morocco rapidly degenerated in every way from the 16th century onwards, though its most recent issues struck in Paris, Berlin and Birmingham show an improvement.

Persia.—The earlier coins of the shahs of Persia are descended through the Shaibanids from those of Shāh Rukh; at first they are large thin silver pieces of Central Asian style but in the 18th century the fabric changes and the coins become smaller and thicker as in India. The coins, especially the larger pieces, are remarkable for their fine calligraphy; the legends are usually in the form of rhyming couplets; gold is not common till the 18th century. Copper was not a regal but a local issue and each city issued its own which are remarkable from the fact that each has some type, usually an animal. Some of the products of the Persian mint are of huge size; these are pieces struck for presentation to distinguished officials, for example a gold piece of 80 tumans weighing over a pound. In the latter part of the 19th century Nasir al-Din (1868–1896) abolished the provincial mints and instituted a coinage from a central mint in Tehran with European machinery. Henceforth the coins of Persia bear the portrait of the shah on the obverse and the "lion and sun" on the reverse.

Afghanistan.—The emirs of Afghanistan who became independent of Persia in the 18th century and carved out a kingdom at the expense of their neighbours in Persia, Central Asia and India, struck coins in gold and silver on the standards of the Moghul emperors whose poetical legends they also copied. At the end of the last century a mint on European lines was established in Kabul and the high flown distichs were replaced by a representation of a durbar hall. The Afghan coinage of the 19th century has been mainly silver although in its early days gold also was common.

Of the various smaller modern dynasties who ruled Central Asia till the Russian conquest, the emirs of Bukhara and of Khokand are notable for their extensive issues of gold pieces, to the practical exclusion of other metals.

India.—There is no reason to doubt the independent origin of coinage in India although it was soon so much modified by Greek influence that the question was long disputed. The earliest coins are pieces of silver (Pl. V.-3), very commonly square, and of copper punched with various symbols on both sides; of about the same date are the square and round cast copper pieces with similar but less varied symbols. These pieces circulated all over India and belong to at least the 4th century B.C. although they circulated after this date and may be somewhat earlier. Contemporaneously from the 3rd century onwards are the copper coinages of numerous states and dynasties which show increasing Greek influence and whose few silver coins are directly influenced by the hemidrachms of the Greek rulers of N.W. India of the 2nd century B.C. The types of these are of considerable mythological and religious interest. Technically they are interesting as showing the evolution of a type from a series of separate punches to the grouping of the punches on a die.

Early in the 2nd century B.C. the Greeks of Bactria began to invade India and their coinage is remarkable for its fine series of portraits and for the number of names it records of rulers otherwise unknown (Pl. V.-1). Prakrit legends begin to appear alongside of corrupt Greek; the Greek in time becomes more and more corrupt as the Greek rulers were replaced by Scythian and Kushan invaders who copied their types. The Greek deities gradually give place to Indian ones on the coins. In the middle of the 1st century A.D. the Kushans founded a great empire in N.W. India; they have left a wealth of gold and copper coins with legends in an Iranian language in a corrupt Greek character;—at this period Roman gold in enormous sums went to India every year and was recoined there. The Kushan coins (Pl. V.-2) bear on the obverse the king sacrificing and on the reverse deities of all the religions of the time, Greek, Roman, Zoroastrian, Hindu and Buddhist. This type of king on obverse and deity on reverse became the general type of North Indian coinage for the next thousand years; the Kushan coinage continued, rapidly degenerating till the fourth or fifth century, over a much more limited area; the type was continued by the kings of Kashmir down to the 10th century and adopted and modified by the great Gupta emperors in the 4th century. The latter struck an extensive gold coinage with long legends in poetical Sanskrit and many interesting types, often medallic (Pl. V.-5) in nature, but, on their coins for general currency at least, always betraying the Kushan prototype. Among the more notable Gupta coins are those that commemorate Sandragupta's horse-sacrifice, or those that record his skill as a lyrist, to which he also testifies in his inscriptions. The art and correct Sanskrit legends of these coins are in keeping with the great Hindu revival of the period. In Western India a dynasty of Western Satraps of Persian origin had been ruling since the 1st century B.C. Their extensive coinage of silver only is dated and therefore of a historical value unusual in Indian or any early coinage (Pl. V.-4). They look modern in that they bear on the obverse a bust of the ruler; they resemble Roman denarii and may have been influenced by them but their prototype is rather to be sought in the hemidrachms of the later Greek kings of India. This kingdom was overthrown by the Guptas at the end of the 4th century and they at once began to imitate this silver coinage not only locally but also in their own territory which seems to have had hitherto no silver coins. The barbarian Huns who destroyed the Gupta and other civilisations in the 6th century have left numerous coins, imitated from Sassanian, Gupta or Kushan prototypes. Degenerate copies of these seem to have been the coinages of Northern India till the revival of various Hindu dynasties from the 10th century onwards. A notable innovation was the neat silver coinage of the Shahis of Gandhara of the "bull and horseman" type in the 9th and 10th centuries (Pl. V.-6), extensively imitated by the Mohammedan conquerors of India and the contemporary minor Hindu dynasties. The other type favoured by the mediaeval Hindu dynasties for their gold coinage was that of a seated goddess—going back to a Gupta reverse—and an inscription with the king's name on the other side (Pl. V.-7).

The coinages of Southern India form a class by themselves. In the later centuries B.C. and early A.D. the Andras ruled a great kingdom in central South India; their coinage is mainly of lead and has types of the usual indigenous character. The later mediaeval dynasties of South India struck coinages mainly of gold, the type of which is usually the badge of the dynasty; the Cheras (Pl. V.-8) of Malabar for example had an elephant and the Chalukyas of the Deccan a boar (Pl. V.-10), the Pandyas a fish and the

cup-shaped pieces of the Kadambas bear a lotus. The Chola dynasty introduced under northern influence the type of a king standing on obverse and on the reverse the king seated, which spread through South India and was taken to Ceylon by the Chola conquest and adopted by the local rajas there (Pl. V.-11). The great Hindu kingdom of Vijayanagar (Mysore) has left a large series of small gold and copper coins with the types of various deities which had considerable influence on the modern coinages of Southern India including those of the various foreign companies.

The earliest Arab invaders had reached India in the 8th century and founded a dynasty in Sind which has left numerous very small silver coins of the Omayyad type. Not till the 11th century was India seriously affected by Muslim invasions when Mahmud of Ghazna (Pl. V.-11) conquered the Punjab. His empire was short-lived. In 1193 the Ghorid Mohammed bin Sam defeated the allied Hindu forces and became lord of India. His descendants ruled Northern India from Delhi till the Mogul conquest. Their coinage is varied and extensive, mainly gold and silver tankas (or rupees) of 178 grains. They are large thick pieces with the profession of faith on one side and the name of the king, mint and date on the other. A feature of this coinage is the unsuccessful attempt made by Mohammed III. b. Tughlak (A.D. 1324–1357) to replace gold and silver coinage by brass tokens. Gold was hardly issued at all in the 15th and 16th centuries and for a time the coinage was mainly billon. Sher Shah (1539–45) (Pl. V.-12), one of the ablest of the line, issued a large silver currency of a type, kalima and names of the four caliphs, which was imitated by the Mogul successor of the Suris. During the latter half of the period of the sultans of Delhi, various dynasties made themselves independent; such were the rulers of Bengal, Gujarat, Jaunpur, Malwa, etc., whose coins all follow the standards of the central power. Those of Bengal are mainly silver rupees with rare gold; the currency of Jaunpur, gold and billon; Malwa and Kashmir gold and silver coins were square.

The coinage of Bāber and Humāyūn, the first two of the Mogul conquerors of India, are not extensive and are of Central Asian types. With the next two, the Great Moguls Akbar (Pl. V.-13) and Jahāngīr, we have a series unrivalled for variety and within their limitations beauty:—the gold coins of Jahāngīr are noble examples of Muslim calligraphy, an art evidently cultivated as much as painting at his court (Pl. VII.-13). The mints of the Mogul coins reflect dynastic fortune—even Shāh Jahān's brief occupation of Balkh is at once recorded on a gold mohur. The close association in the Muslim mind between sovereignty and the right of the coinage is exemplified in the existence of the coins of many pretenders to the imperial throne, some of whom we know from history to have had the briefest spell of power. The general type throughout is the same. In the 16th century the type that goes back to Sher Shah prevails, the Kalima with the names of the first four caliphs and the emperor's titles on the other side; Aurangzib replaced the confession of faith by the mint and date and this remained the usual type till the end of the dynasty. The emperor's name is usually enshrined in a Persian couplet to the effect that the metal of the coins acquires added lustre from bearing the emperor's name. Nearly fifty such verses are found on Jahāngīr's coins. The latter's reign is also remarkable for the series of coins bearing the sign of the zodiac and the set of portrait mohurs, one of which represents him holding a wine-cup. He also allowed his wife Nūr Jahān to strike coins in her own name, and she is also said to have inspired the issue of the zodiacal series. From the beginning of the 18th century the coins become stereotyped and the epigraphy loses its beauty; numerous native states began to arise and throw off the Mogul yoke, but right down to the middle of the 19th century they continued to coin on Mogul lines. The English and French East India Companies for years copied the native types from the coinages and did not strike on European lines till the 19th century. The right of native states to mint their own coinage has been gradually curtailed by the British government and there are now very few independent coinages. The most important native state mint at present is Hyderabad, which a few years ago instituted a mint with European machinery. Before leaving India we may just mention the extensive coinage in gold and silver with Sanskrit legends of Nepal, which is still being issued, the long series of octagonal gold and silver of Assam struck down to the British conquest, and the brief coinage of Burma in the 19th century.

Chinese.—In spite of the very early references to money in Chinese literature, there is no reason to believe that the earliest coins are much older than the seventh century B.C.; that is to say that coinage originated in the Far East about the same time as it did in the west and independently. The earliest Chinese coins are small bronze spades and knives, copies of the spades and billhooks and other small articles of husbandry that had been used for barter. The knives are about six inches long and bear the value and name of authority issuing it; *pu* money, a modified form of the spades circulated widely in the 5th and 4th centuries B.C. Small change was supplied by cowrie shells in this period, as it had been long before the invention of a coinage. There was an issue of bronze cowries in the 7th century B.C. Round money with a hole in the centre was issued as early as the 4th century but it was not till 221 B.C. that the reforming Shah Huang Ti (221–210 B.C.) superseded all other currencies by the issue of round coins of half an ounce (*pan-liang*), which were continued by the Han dynasty. This coin became gradually reduced and debased and was replaced in 118 B.C. by the Emperor Wu Ti's five-chu piece which remained the coin of China for the next eight centuries; a break in the monotony of the regular coinage is formed by the archaistic innovations of the usurper Wang Mang (A.D. 9–22) who issued a modified form of the *pu* and knife currency and a new round coin (*ho tsien*). The history of Chinese coins is the history of a series of gradual debasement of the government currency until it is overwhelmed by the increasing activity of forgers and a new coin is instituted. On one occasion at least the most skilful of the forgers were given work at the government mints. The five-chu piece lasted till the rise of the T'ang dynasty when the emperor Kau Tsu in 618 issued the *Kai-yuan* coin (Pl. V.-16) which gave the coinage of all the Far East its form till the end of the 19th century—a round coin with a square hole and a four character legend of the form "current money of (regnal period)." The Southern Sung dynasty (A.D. 1137–1278) dated their coins on the reverse in regnal years and the Ming dynasty (A.D. 1368–1628) put the mint name on the reverse as did the Ching dynasty (A.D. 1628–1911), the latter giving it in Manchu characters. Paper money has been in use in China since the 9th century and was current almost to the exclusion of regular coins under certain of the Mongol emperors, for example Kublai Khan, whose paper money is described by Marco Polo. For over 2,000 years the copper cash with occasional multiples of it was the only coinage of China; gold and silver were current by weight only, the latter in the form of boat shaped ingots. The monotony of the series is only rarely broken as for example by the nail-mark of the emperor Wen-Teh on the Kai-yuan pieces, an issue of lead coins in the 12th century and the issue of large token pieces (Pl. V.-17) going up to 1,000 cash in value during the Tai Ping rebellion when the rebels held the copper mines. With the increasing popularity of Spanish Colonial and Mexican dollars as a silver currency in China, several attempts were made to institute a silver coinage in the 19th century; not till the very end of the 19th century were mints established to strike silver and copper coins of European style in all the provinces. One of the last of these, a rupee of Sze-Chuan, was the only coin of the Chinese empire to bear the head of an emperor. This was because it was intended to compete for Tibetan trade with the Indian rupee. Under the Republic, coins were at once struck with the portraits of Sun Yat Sen and Yuan Shih Kai and the various generals who have since been fighting for China have issued their own coins with their portraits. A feature of the issues of the latter has been the number of gold coins they have issued, for the first time in Chinese history. The very extensive series of talismans, coin-like in shape but usually larger should be noted. Many are Taoist and Buddhist in their legends and types; others are simply lucky pieces.

Japan.—The art of coinage was borrowed from China by Japan whose first bronze coins were issued in A.D. 708. Twelve



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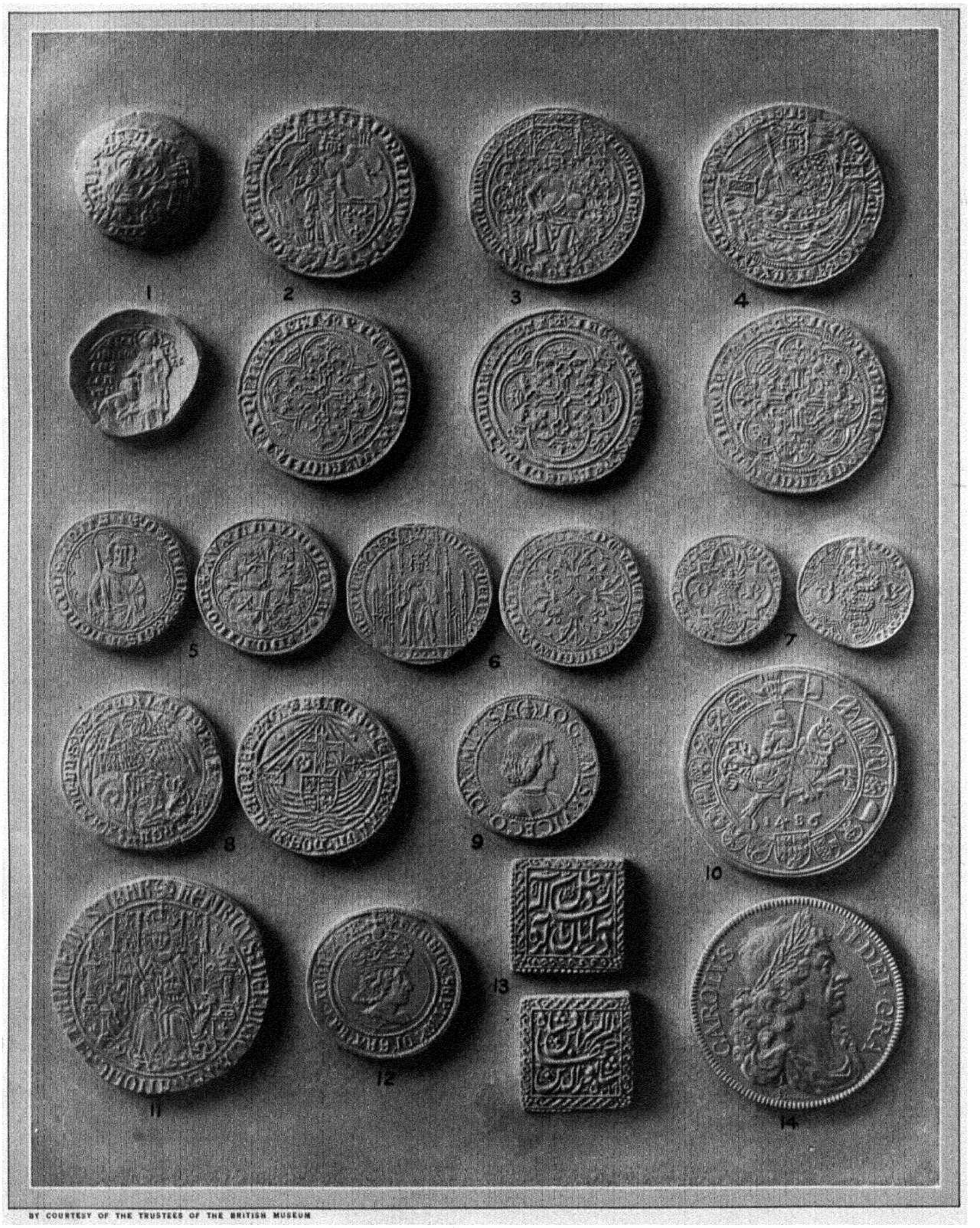
GREEK, ROMAN AND EARLY MEDIAEVAL COINS

1. Delphi, c. 480 B.C. 2. Istrus, 4th century B.C. 3. Syracuse, c. 410 B.C. 4. Egypt, 271–46 B.C. 5. Magnesia, c. 190 B.C. 6. Nero and Agrippina, A.D. 54–55. 7. Constantine Jun., 317–37. 8. Constans, 337–50. 9. Honorius, 395–423. 10. Tiberius Constantine, 578–582. 11. Offa of Britain, 757–796. 12. Coenwulf of Britain, 796–822. 13. Conrad II., 1024–39. 14. Edward the Confessor, 1042–66. 15. Thuringia (Germany), 1190–1200. 16. Frederick II., 1226–50. 17. Florin (gold) of Florence, 1252–1300. 18. Ducat (gold) of Venice, 1280–89. 19. Henry III. of England, 1257. 20, 21. Louis IX. of France, 1226. 22. Philip II. of France, 1270–85

NUMISMATICS



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MEDIAEVAL AND LATER EUROPEAN AND ASIATIC COINS

1. Byzantine cup-shaped coin of Andronicus II. (1282–1328). Byzantine. 2. Philip VI. of France (1328–50). 3. Florin (gold) of Edward III. of England (1344). 4. Noble (gold) of Edward III. 5. The Black Prince (1368). 6. John II. (The Good) of France (1350–64). 7. Visconti family of Milan (1354–85). 8. Edward IV. of England (before 1471). 9. Milan (1479–94). 10. Austria (1486). 11, 12. Henry VII. of England. 13. The Great Mogul Jahangir (1610) India. 14. Charles II. "Petition" crown made by Thomas Simon

different issues were made down to the middle of the 10th century, each of a different reign. For the next six hundred years, however, no government coins were issued and the currency was supplied by imitations of contemporary Chinese coins made by the great nobles. In the 17th century the copper *kwan-ei* (Pl. V.-20) was first issued in 1624 and remained in vast variety the usual issue for over two centuries. The *ei-raku* and *bun-kyu* sen of the 19th century were the only other regular copper coins. Unlike China, Japan has had a gold and silver currency since the 16th century. The gold coins are large flat pieces in the shape of rectangles with circular corners the largest size being *obans* and the smaller *kobans*; these bear various small official stamps and a large signature in ink of a mint official. They range in length from 6 inches to ½ inch. Other gold pieces are the small rectangular pieces of 1 and 2 *bu* (Pl. V.-18) issued from time to time; round gold is rare and usually of provincial mints. There have not been many issues of silver, usually in small rectangular pieces; the so-called bean money with the figure of Daikoku is not a currency but was made to add to the large, long silver presentation pieces to bring them up to a certain weight. A notable Japanese coin is the oblong silver piece struck in 1765 out of confiscated silver ornaments by an official named Taruna.

In 1869 a mint on European lines was established in Tokio and gold, silver (yen or dollar) and copper have since been regularly issued from it. The *e* sen of Japan are not coins but amulets and bear figures of Daikoku, the god of wealth, Itsibu fishing, etc.

Korea.—Korea has had a bronze coinage of the Chinese style since the 12th century, but it is only with the institution of *Shang Ping* cash at numerous mints, with an elaborate system of dating or rather numbering the issues between 1790 and 1881, that its coinage becomes common. Attempts were made to establish a silver currency during the last years of its independence. Annam began by imitating Chinese coins and had a regular bronze coinage of its own on the Chinese model from the 10th to the 19th century. Silver became common in the 19th century in the form of narrow oblong bars (Pl. V.-14). Annam also has its amulets or rather presentation pieces. These are in gold, silver, and copper with a variety of designs bearing auspicious inscriptions, quotations from the Chinese classics, etc., in addition to the king's name. The native coinage ceased when it became a French possession.

Siam.—Siam down to the middle of the 19th century struck gold and silver in the form of balls formed by doubling in the ends of a short thick bar of silver, and bearing the stamp of the reigning monarch. Since 1850 it has had a coinage on European lines with portraits and issues in gold, silver and copper and more recently in nickel.

The native kingdoms of the Malay Straits used lead for their coinage, these are usually round with Malay or rarely with Chinese inscriptions; an exception is found in the "hat money" of Pahang in the form of a hollow square with truncated pyramids and a Malay inscription along the bottom. The spear money of the Nagas, the canoe-shaped and willow leaf money of the Shan States and the "snail shells" in silver of the more primitive parts of Burma can only be mentioned here.

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TECHNIQUE AND ART

The technique of production of coins and medals has remained in principle the same from the earliest period of coinage to the present day; the gradual introduction of more complicated machinery, while lessening the part played by human hand and eye in the later stages of the process, has never, unless the so-called photosculpture be acknowledged as an art, eliminated the part of the artist in producing in one form or other the actual relief of the coin or medal type.

Casting and Striking are the two sharply distinguished methods of production. The former, although it was little employed in antiquity save for large coins, may be described first, since it was the method that metal-workers used on a larger scale for the solid casting of statues, statuettes and decorative work, etc. A model was first built up in wax or clay. The process of carving the model out of a mass of wax was occasionally employed, sometimes partly combined with the building up process. but there is no evidence of this before the days of the Renaissance. Another method of producing the model, that of carving it in boxwood or pearwood or in fine stone, such as Solnhofen stone or slate, was brought to a high degree of perfection by the Germans of the Renaissance; it was almost unknown in Italy. The model once made was impressed in a mould of fine sand or other material. and a cast was made. Some of the German medallists of the Renaissance seem to have carved the design in reverse in clay (just as if they were carving a matrix in hard material) which was then baked and used as mould. In the case of small coins a number of moulds were often combined, with channels leading from one to the other. Tree-like sets of coins produced in the Far East by such casting *en chapelet* are still extant.

The coins produced by this process are seldom of precious metals and almost entirely negligible as works of art, being of the roughest kind. But the method was employed by all the greatest medallists, from the founder Pisanello, in the 15th century, onwards, in preference to the more mechanical process of striking. Casting was carried to a high degree of excellence (especially by the Germans), the ideal being to reproduce the wax model without subsequent chasing. The Italian medallists were sometimes content with the roughest representation of their work. Others depended on chasing with the burin or graver to remove the irregularities of the cast; and often the chasing was by an alien hand. Any coin or medal could be used as a model, for impressing

in moulding material, so that a new cast could be made. The vast majority of the extant medals supposed to be of the 15th or 16th century are after-casts to the nth degree. Detail has disappeared and the actual diameter has decreased since metal contracts in cooling.

The Repousse Process (*q.v.*) can of course also be used in making medals, in shells, of which the two halves are worked separately. This process was especially favoured in Holland in the 17th century. The process of pressure-casting has also, it is said, been used in recent times. Plaquettes (which are small metallic reliefs, differing from medals in being primarily decorative, not commemorative, usually one-sided and more frequently rectangular than circular) are produced like medals.

Striking of coins or medals is done by means of dies, engraved in intaglio, and impressed on the metal by blows or pressure. It is the method of impressing a signet on wax applied to a hard material, the type of a coin being, indeed, in origin and principle the signet of the issuing authority. The die had first to be engraved in a hard material. Not until Roman times was iron and occasionally steel used for this purpose. The Greeks used bronze, and analysis of two of the extremely few Greek dies that have survived shows a proportion of from 18 to 22% of tin, the rest being copper with negligible impurities. Such proportions mean a very hard quality of bronze. Modern dies are all of steel.

Hubbing and Cutting.—The die can be cut direct in reverse as an intaglio gem is cut. Or a positive punch or hub can be carved in relief in hard metal, and hammered into a piece of softer metal, which can then be hardened for use as a die. Details which cannot be produced by hubbing in this way can be finished by direct cutting. Both methods were known to the ancients; though no ancient hubs, and very few ancient dies are preserved, examination of the struck coins reveals certain details which can only be due to hubbing. The amount of time and labour saved by hubbing is immense; with one hub many dies can be made, whereas if the design is represented by a die alone, when that breaks or wears out all the work has to be done again. The instruments used in antiquity by die-engravers were the graver or scauper and the dotting-punch. There is no evidence that they used the drill, although that instrument was in the hands of every gem-engraver. The fineness of the work, the almost microscopic detail, must have necessitated the use of magnifying glasses, and there is evidence, literary and material, that these were known to the ancients. (*See* ENGRAVING.)

The Reducing Machine.—The second way of obtaining a die was invented in the 19th century and, greatly to the detriment of the art, ousted the method of cutting by hand. It involves the use of the reducing machine, which dates in origin from about 1839 (*see* MINT). The artist first makes a model in wax or plaster at least four times the size of the piece to be produced. This, reproduced in a nickel-faced copper electrotype, is placed in the machine, which works on the familiar principle of the pantograph. A tracer at one end of the proportional arm moves over the whole surface of the model. At the other end a cutting point, revolving rapidly, cuts an exact, mathematically reduced reproduction of the model. Thus is produced a punch which, when driven into another piece of soft steel, afterwards hardened, gives the die which can be used to strike the coin or medal. It is obvious that the die so produced is at least three stages removed from the artist's original model which may not be suitable for a small scale relief, however exact.

The result of the introduction of this machine has been that artists have ceased to trouble themselves about the final metallic product. Not having to cut the metal themselves, they have lost the sense of material. They model in wax or plaster, and the coins or medals which are struck from the dies produced without their intervention appear as if they were made of wax or plaster coloured to look like metal.

Preparing the Blanks.—In ancient times dies were cast, sometimes actually in globular form, more usually in a form approximating to that of the final product, with sufficient convexity to allow the metal to penetrate to the deepest recesses of the die. They could also be cut from bars. The thin blanks of the middle ages were clipped out of a sheet of metal; in modern times they are punched out of a rolled bar. In antiquity, the lower die, which produced the obverse, was let into an anvil. The upper (for the reverse) was on the end of a cylindrical bar. The blank being placed on the anvil die, the reverse die was placed above it, and a sledge-hammer brought down on the upper end of the bar. How far the blank was heated before being struck we do not know. Such a primitive method of striking, without a collar to keep the blank in shape, produced great irregularities, splitting of the edge, double-striking and the like. The Greeks were indifferent to such things. The methodical Roman was more careful, and his coins are less irregular in shape. The sledge-hammer blows of course placed great strain on the dies. The first invention to obviate that disadvantage consisted in placing the dies in a frame and hammering wedges in between frame and dies, thus forcing the latter on to the blank between them. In the reign of Julius II. (1503–17) Bramante began experimenting with a press for papal leaden seals; and Leonardo da Vinci also made experiments with a coining press, and more particularly in the process of drawing strips of metal to the right thickness and punching out blanks. Out of such experiments grew the screw-press, the essential advantage of which was that the upper die was brought down on the blank not with a blow, but with a gradual pressure.

Relief and Lettering.—Those qualities which make a coin most serviceable as currency are not necessarily favourable to its beauty as a work in relief. The Greeks, for instance, being pre-eminently sculptors, made their coins in high relief. They thus suffered in circulation. It was only in the 4th century of our era that the relief of coins began to become flat, making way for the flat pattern-like treatment which is characteristic of the middle ages. That was not due to a recognition of the suitability of such treatment so much as to the decay of technique. In the use of lettering the Byzantines made an effort at decoration (Pl. VII.-1), but the finest development of lettering as an art on coins was left to the Muslims (Pl. VII.-13). In the 16th century printing wrought disaster on medal lettering.

The 13th Century.—Frederick II. attempted to revive the older Roman style; his gold augustale (Pl. VI.-16) has a head in medium relief, inspired by the Roman gold of the Constantinian period. But this was a false start. The beautiful Gothic coinages of the 14th century in France, England, the Low Countries, Italy, etc. (Pl. VII.-2-7), show the high-water mark of the flat pattern style, which is by far the most suitable for a coinage which has to be packed in rouleaux and circulates widely. The facing head ousted the profile under the Lower empire (Pl. VI.-9). In obedience to a Roman principle, the frontal pose was alone proper to the imperial majesty.

Towards the end of the 15th century the influence of the medal, for which the profile was alone suitable, made itself felt on the coinage and the facing head thus practically disappeared. The early testoons of the Sforzas (Pl. VII.-9) at Milan are the supreme example of profile treatment in very low relief, the finest combination of portraiture with decorative treatment that coinage can show. So far as mere engraving was concerned the highest excellence was probably reached in the 17th century by artists like Briot and Thomas Simon (Pl. VII.-14); and, so far as mere finish is concerned, a Pistrucci, a Wyon or an Andrieu leaves nothing to be desired.

The problem of composing within a circular field was solved by the ancients. The posing of a head, the combining of two or more heads in a group, whether they are jugate or addorsed or opposed, were the main problems of the obverse. The jugate or accollate position was not attempted until the 3rd century B.C. (Pl. VI.-4), and does not become common until Roman times. The confronted pose offers no difficulty, and pleased the Roman taste for symmetry (Pl. VI.-6); but the Greeks disliked it and it is not found on their coins before Roman times. The Greeks liked symmetry, but it had to be dynamic and full of movement; while they knew all that need be known about what is called heraldic opposition (Pl. VI.-1, 2), and occasionally used it, it never played much part in their designs.

The remarkable outburst of artistic effort in England in the

middle of the 8th century, when a real profile portrait head of Offa appears on his coins (Pl. VI.-11) at a time when the designs of all other parts of Europe were entirely without merit, had no duration or repercussion. Not even the excellent ornamental designs on the Anglo-Saxon coinage of this time (Pl. VI.-12), due perhaps to Irish influence, inspired Continental contemporaries to efforts for better coins. Equally without effect was such an innovation as the type of the sovereign seated in majesty on Edward the Confessor's penny (Pl. VI.-14), as on the Great Seal. France had to wait two centuries until Philip III. (1270–85) ventured to introduce the majesty-type (Pl. VI.-22). The Norman Conquest caused a definite set-back in English art.

Germany.—In the next period we must turn to German lands to find the first signs of relief from the degradation of the engraver's art. About 1125 the curious pieces known as bracteates (Pl. VI.-15), extremely thin and bearing on one side only a type which shows through on the reverse, began to be produced in Thuringia and Lower Saxony. The designs—the figure of the king seated facing, the half-figures of king and queen side by side, the emperor on horseback, the figures of saints, often in an architectural setting, and the like—are a not unworthy reflection of the greater art of the Romanesque period. The style reaches its zenith in the second half of the 12th century under Frederick Barbarossa and Henry VI., when the coins sometimes attain a diameter of 50 millimetres. It was, however, in the middle of the 13th century that the real revival began.

A similar effort was made by the little republic of Ragusa in the same century. But other States, though they wisely did not attempt to attain high relief, did begin to play with the idea of making their coins interesting or significant. Florence placed on the gold coins, which were to become world-famous as florins, its graceful lily and the figure of St. John the Baptist (in 1252). Venice started its equally famous gold sequins or ducats in 1280 with the interesting types of the figure of Christ blessing in a border of stars, and of the doge receiving the gonfalon from St. Mark (Pl. VI.-18). These types were not entirely new; they had been already used in a less elaborate form on silver.

It must have been the florin that suggested to Henry III., that enlightened patron of art, the introduction of his beautiful gold "penny" in 1257 (Pl. VI.-19). His example was followed by St. Louis in his *denier d'or* in 1266—an admirably executed coin of heraldic design (Pl. VI.-20). St. Louis must also be credited with a far-reaching innovation in the shape of the large silver piece or gros (Pl. VI.-21) of 12 deniers, the forerunner of the English groat or fourpence, though that coin did not come into regular use until 1351. The enlarged size eventually made possible the introduction of more interesting designs, though France continued to cling to conventional patterns, and England to the conventional facing head and cross. In the grossi of Wenceslas II. of Bohemia (1278–1305) the opportunity afforded by the larger flan was seized for a fine heraldic design.

The 14th Century.—But the time of Edward III. and his contemporaries is the golden age of European coinage. There is no distinction in style between the Anglo-French coins and those of the French kings, and foreign workmen were employed at the English mint. At this period there is no evidence of an independent English art. The fine period of the Anglo-French coinage closes about 1368; the gold coin of the Black Prince issued at that time is a distinct attempt at portraiture on a small scale (Pl. VII.-5). In England we have the beautiful, but abortive first issue by Edward III. in 1343 of the gold florin (Pl. VII.-3) and smaller denominations: the most beautiful coins in the whole English series, but demonstrably the work of two Florentines, Giorgio Chierichino and Lotto Nicolini. These coins are followed by the gold noble, the obverse bearing the king in his ship as type (Pl. VII.-4). In 1465 Edward IV. introduced a type of rude strength, the angel (Pl. VII.-8), in which there is something peculiarly English, especially in contrast with the St. Michael on the French coins of a century and a quarter earlier (Philip VI., Pl. VII.-2) and the angelot of Louis XI.

Towards the end of the 15th century the Tudor coinage makes its appearance with a flourish; the sumptuous "sovereign" of Henry VII., first struck in 1489, is still Gothic, but effete: it mistakes restlessness and over-decoration for strength (Pl. VII.-11). As in England, the art of coinage in the Low Countries in the 14th and 15th centuries presents no essential difference from what is to be seen in France; Germany during the same period lags far behind the West, its coinage being monotonous and crude.

Italian Influence.—It was from Italy that the new revival was to come; and the splendour of its coinage in the last quarter of the 15th century was directly due to the sister art of the medal. The portrait-medal founded by Pisanello, with his incomparable series of portraits made between 1438 and 1449, showed the possibilities of the profile relief. After a few artists, like Enzola of Parma, had in the '60s and '70s made groping experiments in die-cut portraits on small medals, others, notably in Milan—though the attribution of the Sforza series to the Milanese Caradosso may be baseless—succeeded towards the end of the century in producing pieces which, as we have said, reached the high-water mark of portraiture in coinage. Early in the 16th century the influence made itself felt outside Italy. It was a German, Alexander of Bruchsal in Baden, who was employed by Henry VII. from 1494 to 1509, but the beautiful profile portraits by which, from 1503 onwards, he left his mark on the English coinage are obviously inspired by the Italian fashion (Pl. VII.-12). His work sealed the doom of the facing-head on English coins although examples lingered on to the reign of Edward VI.

The Thaler.—Meanwhile Germany had taken an important step in the invention of the thaler, again the size giving greater scope to the designer (Pl. VII.-10). The Tyrolese guldengroschen of 1484—the earliest of the class afterwards generally known as thalers—is evidently inspired, clumsy though it be, by an Italian model. It is the ancestor of all the large silver coins, thalers, dalers, dollars, scudi, crowns, of the 16th and 17th centuries. It did not add greatly to the art of coinage, which attains its highest perfection on a field of not more than an inch and a quarter. For a larger field, the medallic art, unrestricted in relief by its nonuse as currency, is proper.

Portraiture.—The development of portraiture on coins, as seen in the second half of the 15th century, must be traced to the Italian medal (Pl. VIII.-1, 2). Pisanello's first medal, representing the Emperor John VIII. Palaeologus, was made in 1438 (Pl. VIII.-1). It revealed the possibilities of profile portraiture on a small scale, suitable for coinage. What the medallists showed was that modern portraits, and not mere imitations of the antique, could find a place on modern coinage. In the '60s and '70s engravers in Milan, Parma and Venice were producing both small medals and portrait-coins from dies. By the beginning of the 16th century the technical difficulties had been overcome (Pl. VIII.-3); and soon the facility afforded by striking for the mass production of medals began to have a reaction on the medallic art. The art of coinage had reached its culmination; all future developments added nothing to its artistic content, and were due merely to increased technical dexterity.

But the medal had still a course to run. The best medallists continued throughout the 16th century to use the casting process for their most important work, even when they were also die-engravers by profession. But official patronage favoured the struck medal, satisfied with number rather than quality. The technical dexterity of the modeller continued nevertheless to increase. In Germany especially, where the art of the medal culminated in the period from 1520 to 1540, a series of portraits was produced unsurpassed in the realism of their presentation and technique of casting (Pl. VIII.-2). In Italy after about 1530 the cast medal continued to develop as an art that had lost its inspiration; facile, graceful but superficial, the elegant portraits of Pastorino of Siena (Pl. VIII.-5) are typical of the school. The modeller begins to lose the sense of material; the original wax-model is all that he cares about and the final product in metal is merely a means of perpetuating it. By the end of the 16th century the Italian vein was worked out. Italian influence, however, had passed across the Alps. German lands, especially Austria, France and Flanders, had all felt it, though none of them in the 16th century produced medallists who marked an epoch. It

remained for France in the first half of the 17th century to do for the art of the medal what Italy through Bernini did for sculpture. As masters of the baroque portrait Guillaume Dupré (Pl. VIII.-6), Jean and Claude Warin should be mentioned beside Bernini, though they too had his excessive virtuosity, as well as his brilliance. In England Thomas and Abraham Simon (Pl. VIII.-7) are almost on the same level. In Holland a native school is distinguished by hardy vigour. These developments are the last flowering of the medallic art before the dead period of the 18th century.

The 19th Century.—In the last quarter of the 19th century the monotonous academic tradition which had reigned for nearly two centuries began to break down. The French revival took its rise in Ponscarme (1827–1903). By the study of character in portraiture, the search for a dignified realism, and for a harmonious relation of type to background, and by such external reforms as the abolition of the raised border which had so long been the fashion, he inaugurated a return to the true principles of the art (Pl. IX.-1). The French school reached its zenith under Chaplain (1839–1909), but unfortunately, thanks to modern machinery, exploited with immense skill by Oscar Roty and his school (Pl. IX.-4), the medal in French hands became a merely pretty art, lacking virility and sincerity. In Germany native vigour interposed, and the portraiture by such artists as the Viennese Anton Scharff (1845–1903) is of a fine seriousness. In England Alphonse Legros (1837–1911), with a true instinct rejecting the machine-made medal, produced a remarkable series of cast portraits (Pl. IX.-2); but he found no successor.

Later developments are not sufficiently important to require detailed mention. We are still in the age of experiment. The immense output of medals, especially in Germany, during the World War should have revealed original artists if there were any, but the only one to rise above a journalistic level was Ludwig Gies (Pl. IX.-3) and he often trespassed beyond the limits of his art. There is at the present moment no lack of fine and accomplished portraiture, and although for the purposes of mass production the use of machinery is unavoidable, the better medallists, such as Theodore Spicer-Simpson, are content to produce their works by the nobler method of casting in limited editions of two or three specimens. (*See* METAL WORKS; SEALS; GREEK ART; ROMAN ART.)

BIBLIOGRAPHY.—On the technique of making coins and medals *see* G. F. Hill, "Ancient Methods of Coining," *Numismatic Chronicle* (1922) and *Medals of the Renaissance* (1920). On the place of coins in art, the literature is confined to ancient coins: B. V. Head, *Guide to the Coins of the Ancients* (4th ed., 1895); P. Gardner, *Types of Greek Coins* (1882); K. Regling, *Die Antike Münze als Kunststwerk* (1924); G. F. Hill, *Select Greek Coins* (1927). (G. F. H.)

TOKENS FOR WAR SERVICE

From the earliest times service of all kinds has been rewarded by honours and distinctions. We learn from Josephus ("Antiquities of the Jews") that in the 3rd century B.C. Jonathan, the high priest, successfully led the Jews in battle thereby aiding Alexander, who "sent to Jonathan, and gave testimony of his worth, and gave him *honorary rewards*, as a *golden button*, which it is the custom to give King's kinsmen." Later Jonathan received another golden button for similar service. These honorary rewards of golden buttons are the earliest form of medal to commemorate war service.

BRITISH MEDALS

War Medals.—The earliest medal in existence struck for an Englishman for war service is that awarded to John Kendal in 1480. Kendal was prior of the English Knights of St. John of Jerusalem and in 1480, relieved Rhodes. His medal is now in the British Museum.

Although decorative medals were common before her reign, Queen Elizabeth appears to have been the first sovereign to bestow a medal for particular military service to the Crown, this being the "ark in flood" medal (so called from its design) to commemorate the victory over the Armada in 1588. James I. (1603–1625) issued a medal "in reward for naval achievements" on which the design was repeated.

Under a royal warrant, dated May 18, 1643, Charles I. authorized the issue of "Badges of silver, containing our Royal image and that of our dearest son, to be achieved to wear on the breast of *every man* who shall be certified under the hands of their Commander-in-Chief to have done us faithful service in the Forlorn-Hope" (*i.e.*, the tactical advanced guard of those days and not a hopeless adventure).

During the Commonwealth, statutory provision was made for the bestowal of medals as naval awards under a minute of the council of State, Nov. 15, 1649. There was also a "Medal of the Parliament" for land service, one being awarded to Col. Mackworth, governor of Shrewsbury, as a mark of the parliament's favour. This medal was given with "a chain of gold to the value of one hundred pounds." The first English campaign medal is that issued by the Commonwealth to commemorate Dunbar, Sept. 3, 1650. A week after the battle the House of Commons authorized the medal "both for officers and men." Cromwell protested against his effigy appearing on the medal, but this was overruled, and his effigy placed thereon. The finest medals of this period are those granted to Blake, Monk, Penn and Lawson for their victory over Van Tromp, July 31, 1653. The medals are in gold, with gold chains.

One interesting medal granted by James II. was to Bishop Mew, for his services as commander of the king's artillery at Sedgemoor, 1685. Before entering the church Mew had been an able soldier, and his ecclesiastical duties had not interfered with his continued study of the military art. Almost all writers on the subject classify the "Cumberland" medal (sometimes called the "Culloden" medal) as a commemorative war medal. This is incorrect. The battle was fought on April 16, 1746, the English being commanded by the young duke of Cumberland. To commemorate his success a number of admirers formed the Cumberland Society, a rule of which was that each member on joining was to be presented with a medal. No evidence has been found to show that the victory was *officially* commemorated by the grant of a medal.

Only one medal was issued for the American War of Independence, this being awarded to a Captain Ewing who distinguished himself at Bunker Hill.

Credit is due to the Honourable East India Company for instituting the regular practice of making the grant of medals a "general distribution" and not solely to officers. Some of their early grants include the "Deccan" medal for service during 1778–84, the "Mysore" medal (1791–92) and the "Seringapatam" medal (1799), and they continued this practice until the Crown assumed the Government of India after the Indian Mutiny. The lack of medallic recognition to the rank and file prompted Davison, Nelson's prize agent, to present a medal to every man who took part in the battle of the Nile (1798). His example was followed in 1805 by Boulton, of the Soho Mint, Birmingham, who presented medals to all ranks who had taken part in the battle of Trafalgar (1805). But, it is stated, that as the medals for the men were only made of pewter they deemed them of no value and the majority threw them away. These are the only instances of medals being awarded to service men by private individuals.

British war medals enter upon a new era with those awarded to admirals and captains for Lord Howe's victory over the French on "the Glorious 1st of June" (1794), generally known as the *Navy Gold Medals*, in that the first official reference is made to *medal ribbon* in connection with them.

The Peninsula Campaign was two years old before any medals were authorized to commemorate the successful major operations therein. The battles of *Roleia* (Roliça), *Vimiera, Corunna* and *Talavera* had all been fought before the *Army Gold Medals* were instituted under general order, Sept. 9, 1810. In addition to the foregoing the *Army Gold Medal* was authorized for officers, not below the rank of battalion commander, for the following operations: *Sahagun, Benevente, Busaco, Barossa, Fuentes d'Onor, Albuhera, Ciudad Rodrigo, Badajoz, Salamanca, Vittoria, Pyrenees, St. Sebastian, Nivelle, Nive, Orthes* and *Toulouse*. Originally a separate medal was awarded for each separate operation and many officers became entitled to several medals. This,

however, caused inconvenience to the recipients and a new system was instituted in 1813 under which only one medal was to be borne by each officer entitled thereto. For the second and third occasions gold clasps, the first ever sanctioned, were added to the medal ribbon, and on becoming entitled to a fourth mark of distinction the medal was surrendered and a *Gold Cross* issued in its place, on the four arms of which were inscribed the four battles for which marks of distinction had been awarded. On becoming entitled to a fifth or further marks of distinction, gold bars inscribed with the name of each battle were added to the *Gold Cross* ribbon. The substitution of a cross for a medal was never repeated.

Of the 20 operations in the Peninsula Campaign for which medals, crosses and clasps were awarded, the Duke of Wellington had distinctions for 14, viz. (*a*) inscribed on the *Gold Cross:*— *Roleia* and ***Vimiera, Talavera, Busaco, Fuentes d'Onor,*** (*b*) clasps to the ***Gold Cross: Ciudad Rodrigo, Badajoz, Salamanca, Vittoria, Pyrenees, Nivelle, Nive, Orthes*** and ***Toulouse.***

The first war medal to be issued to all ranks, alike in all respects, was the *Waterloo Medal*—this, at the suggestion of the Duke of Wellington.

The fact that the *Waterloo Medal,* the *China Medal* (1840–42) and the *Jellalabad Medal* (1842) were given to all ranks alike without discrimination, appears to have started an agitation amongst those who had taken part in operations for which the *Army Gold Medal* and *Gold Cross* had been awarded but for which they were not eligible, owing to their rank. In this case, the Duke of Wellington opposed granting such a medal but it was adopted as the *Army General Service Medal.* The *Military Ribband* was worn with the medal. It was usually referred to as the *Peninsula Medal,* colour being lent to the idea by Wellington's figure appearing thereon, but it included campaigns in which Wellington had no military concern. Clasps were added.

The grant of the Army G.S.M. naturally led to a similar medal being authorized for the Navy, the *Navy General Service Medal* which covered operations from 1793 to those off the coast of Syria in 1840. Clasps included: *Howe's Victory* (June 1, 1794), *Camperdown* (Oct. 11, 1797), *Nile* (Aug. 1, 1798), *Copenhagen* (April 2, 1801), *Trafalgar* (Oct. 21, 1805), *Navarino* (Oct. 20, 1827).

Later medals commemorate service in the Crimea, the Indian Mutiny, New Zealand campaigns and those in Egypt.

The Honourable East India Company followed the example of the home Government and instituted the "India 1851" medal. Four further India general service medals have been granted to cover operations from 1849–95, 1895–98, 1901–02, and from 1908 to 1928. For the late Lord Roberts' march from Kabul to Kandahar in 1880 there is a bronze, known as *Roberts' Star.* For minor campaigns, the *General Service Medal* is granted.

Gallantry Medals, Crosses or Orders.—The most famous of this class is the *Victoria Cross* instituted in 1856. All ranks and civilians are eligible for the award, to qualify for which the recipient must have performed some conspicuous act of bravery in the presence of the enemy. The ribbon now is red (claret) for all recipients, but was previously blue for the Royal Navy. Recipients who are granted a second distinction are awarded a bar. The award carries a pension. The V.C. takes precedence of all other orders and medals (*i.e.,* it is worn nearest the buttons of the tunic).

Other awards of lesser degree in this class are: *Distinguished Service Order,* instituted in 1886 and the *Military Cross* (1915); only officers are eligible for the award. *Distinguished Conduct Medal* instituted in 1854, also the *Military Medal* (1916); only "other ranks" are eligible for the award. *Meritorious Service Medal,* instituted in 1845, awarded to sergeants as a reward for distinguished or meritorious service; it carries a gratuity. *Conspicuous Galantry Medal,* originally sanctioned for Crimean War only, reinstituted 1874 and now available for any war; only "other ranks" of Royal Navy and Royal Marines are eligible for the award. *Indian Distinguished Service Medal,* instituted 1907, only Indian officers and "other ranks" are eligible. The Royal Air Force has medals, etc., comparable to the foregoing.

Good Conduct Medals.—There are a number of medals granted for good conduct combined with a prescribed number of years' service, the conditions of eligibility varying according to the service, and whether Regular, Auxiliary, Colonial, etc. The first of these medals was the *Long Service and Good Conduct Medal* instituted in 1830.

UNITED STATES MEDALS

The premier decoration of the United States is the *Medal of Honour* which is comparable to the *Victoria Cross.* It was instituted in 1862 as a reward for conspicuous acts of bravery during the Civil War. In the course of time the details of the design have changed; the present description of the Army medal is a five-pointed star superimposed on a wreath, in the centre of the star the head of *Minerva,* surrounding which is a circle inscribed "UNITED STATES OF AMERICA." The star is suspended from a bar attached to the two top points, and on the bar is inscribed "VALOUR," above which is the American Eagle. Attached to the eagle's head is a ring through which passes the ribbon. The ribbon is light blue with stars embroidered thereon, and the medal is worn round the neck. The Navy medal differs in a few details from the Army pattern. This medal takes precedence of all other United States decorations. "Medal of Honour" lapel buttons are optional for wear in civilian clothes; they are hexagonal rosettes made of light blue silk with 13 white stars. There was a *Merit Medal,* awarded with the "Certificate of Merit" for which only enlisted men were eligible, but this was abolished in 1918.

War commemorative medals follow the British practice. An interesting example is the *Civil War Medal,* on the obverse of which is a portrait of Lincoln, surrounded by an inscription taken from his famous Second Inaugural: "WITH MALICE TOWARDS NONE, WITH CHARITY FOR ALL." On the reverse is inscribed "THE CIVIL WAR, 1861–1865." The "Indian Wars" Medal is also interesting from the fact that the reverse was copied for reverses of many other campaign medals.

MEDALS OF OTHER COUNTRIES

France.—Before 1802 gallantry in the field was awarded by grants of swords of honour, muskets of honour and other weapons but in that year Napoleon instituted the *Legion d'Honour.* The original cross of the Legion of Honour was a white enamel gold badge, with five rays of double points, each point tipped with a silver ball, the whole on a wreath of oak and laurel: in the centre of the obverse, Napoleon's effigy with "NAPOLEON" inscribed around it. The present badge is much the same in appearance but instead of Napoleon's effigy on the obverse there is a female head, and inscribed round it, "REPUBLIQUE FRANÇAISE, 1870." The order is divided into five grades: Grands Croix, Grands Officiers, Commandeurs, Officiers and Chevaliers. The Legion of Honour is the premier order of France and is only conferred for gallantry in action or for 20 years' distinguished military or civil service in peace. The *Médaille Militaire,* instituted in 1852, is comparable with the British D.C.M. It is only conferred upon general officers in command of armies and to N.C.Os. and men of the Navy and Army for distinguished service in action. It was awarded to the late Field-Marshal Lord French. As regards commemorative war medals the first is interesting, viz., *St. Helena Medal,* instituted in 1857 for operations between 1792 and 1815. The medal is bronze and bears on one side the effigy of Napoleon, and on the other, in French, "Campaigns of 1792 to 1815. To his comrades in glory, his last thought. St. Helena, May 5, 1821." Another interesting war medal is the *Pontifical Cross,* instituted in 1867, by Pope Pius IX., and granted to all members of the French forces who took part in the defence of Rome in 1867.

Germany.—A renowned German decoration was the *Iron Cross,* instituted in 1813, as a reward for distinguished service in the War of Liberation. It was revived for the Franco-Prussian War of 1870 and was again issued for service in the World War. The cross is a Maltese Cross of cast iron edged with silver. On the upper link is a crown, on the lower link the date of the campaign, that for the World War being "1914," in the centre the initial or initials of the sovereign at the date of issue. There are three classes of the Order of the *Iron Cross,* viz., the Grand Cross, dou-



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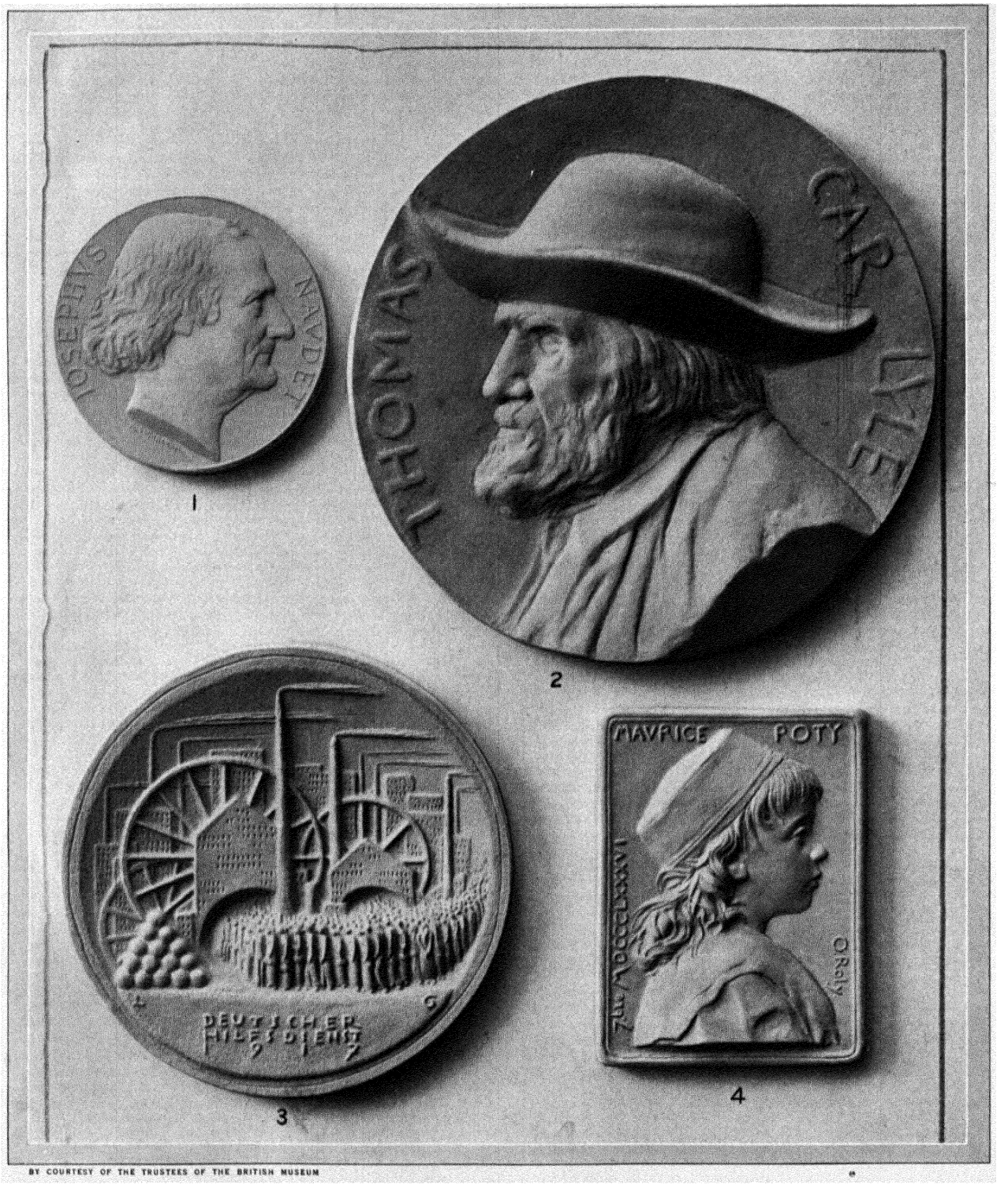
FIFTEENTH, SIXTEENTH AND SEVENTEENTH CENTURY MEDALS

1. John VIII., by Pisanello, 1438
2. Christoph Tetzel, by M. Gebel, 1528
3. Vittorio Gambello, by himself, 1508
4. Giovanni Toscani, by Lysippus
5. Edward Courtney, by Pastorino, 1556
6. Marie de Médicis, by G. Dupré
7. George Monck, by Thomas Simon, 1660

NUMISMATICS



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MEDALS OF THE 19TH AND 20TH CENTURIES

1. Joseph Naudet by Ponscarme (1827–1903)
2. Thomas Carlyle by Alphonse Legros (1837–1911)
3. German Auxiliary Service medal by Ludwig Gies, 1917
4. Maurice Roty by Oscar Roty; 1886

ble the size of the ordinary cross, is worn round the neck, and is awarded solely for the winning of an important battle, or equivalent exploit. With the rank and file the cross carries with it a gratuity. *The Order of Military Merit* (*Prussia*), founded in 1665, was bestowed for conspicuous war service.

Belgium.—The *Order of Leopold II.* was instituted in 1900. There are six classes. It is awarded to N.C.Os. and men and "ranker" officers for exemplary service after a number of years (20–30). The *Ordre de la Couronne*, instituted in 1897, was originally the premier order of the Independent Congo State but was transferred to the Ministry of Foreign Affairs in 1910. It is awarded to officers after a number of years' exemplary service (20–32) and to N.C.Os. after 38 years' exemplary service. The *Military Medal*, instituted in 1902, is comparable with the British Military Medal.

Japan.—The *Order of the Rising Sun*, instituted in 1875, is awarded to all ranks of Army and Navy for gallant service in war or distinguished service in peace. The *Order of the Sacred Treasure*, instituted in 1888, is awarded to both military and naval officers for meritorious service. The *Order of the Golden Kite* was instituted in 1891. There are several classes, the higher for officers and the lower for N.C.Os. and men. It therefore corresponds approximately to the British D.S.O., D.S.C., M.C. and D.C.M. The medal to commemorate the Russo-Japanese War of 1904–05 is made of light bronze.

Italy.—The *Order of Saint Maurice and Saint Lazarus* was founded in 1434, and revised in 1831, 1837 and 1855. The *Military Order of Savoy*, founded in 1815, is awarded for special distinguished war service. Medals for military valour are awarded for acts of bravery in much the same manner as British gallantry medals. The *Messina Medal* was awarded by the King of Italy to officers and men of the British men-of-war and to certain others who assisted in succouring the injured after the terrible earthquake at Messina and Reggio in Dec. 1908. The ribbon is green with white edges.

Serbia.—The *Order of the White Eagle*, instituted in 1883, consists of five classes. The badge consists of a double-headed eagle in gold, ensigned with a crown. The *Star of Kara George*, instituted in 1904, consists of four classes.

WORLD WAR MEDALS AND DECORATIONS

By resolutions passed by a committee of the Peace Conference in Paris in March 1919, it was decided that the victorious Allies and associated Powers (*i.e.*, Great Britain and her dominions, France, Belgium, Italy, Spain, United States of America, Japan, etc.) should have a medal common to the Powers in general design. The medal was to be called the *Victory Medal* and was to be round, made in bronze (36mm. wide), the colour, surface, thickness and attachment to be similar to the French Medal of the 1870 war, on the obverse a winged figure of Victory full length in the middle, on reverse the inscription, "The Great War for Civilization," in the language of the country granting the medal, the rim plain. The ribbon to be identical for all countries and to consist of two rainbows joined by the red in the centre.

One of the objects of issuing a medal similar in design in all countries was to obviate the interchange of Allied commemorative war medals. No clasps have been issued with the medal except in the U.S. The exact conditions under which the medal was awarded varied in each country, but generally it was issued to all who went into a theatre of war in any capacity between the first declaration of war in 1914 and the date of the Armistice, Nov. 11, 1918. In the British service it was also granted for post-Armistice operations in North Russia and Siberia, ending on Oct. 12, 1919, and in Trans-Caspia, concluding on April 17, 1919. Also in the British service an emblem in the form of an oak leaf in bronze was placed on the Victory Medal to indicate that the recipient had been mentioned in despatches during the World War.

OTHER MEDALS AND DECORATIONS

Great Britain.—(*a*) *1914 Star* (commonly known as the Mons Star), instituted in 1917, and awarded to all ranks, including nursing staffs, who actually served in France or Belgium on the establishment of a unit between Aug. 5, 1914, and Nov. 22–23, 1914. (*b*) *1914–15 Star*, instituted in 1918, similar in design to the *1914 Star* except that the date in the centre is 1914–15. (*c*) *British War Medal*, instituted in 1919. In general terms it was granted to all personnel of the Army who served overseas in a theatre of operations in any capacity during the war, and to the Navy for one month's service during the war. (*d*) *Mercantile Marine War Medal*, granted to members of the Mercantile Marine for service during the World War; (*e*) *Territorial Force War Medal*, instituted in 1920, granted to members of the T.F. and T.F. nursing service for service outside the United Kingdom during the war subject to certain conditions (those awarded the *1914 Star* or *1914–15 Star* were ineligible for the T.F.W.M.); (*f*) *Military Cross*, instituted in 1914, an army decoration for which only captains, junior officers and warrant officers are eligible; (*g*) *Distinguished Service Medal*, instituted in Oct. 1914 for other ranks of Royal Navy and Royal Marines; (*h*) *Order of the British Empire*, instituted in June 1917, as a reward for war service in any capacity; (*i*) *Military Medal*, instituted in 1916; all other ranks are eligible for the award; (*j*) *Silver War Badge*, instituted in 1916, issued to all ranks who served at home or abroad during the World War and who on account of age, or physical infirmity arising from wounds or sickness caused by military service, had been compelled to leave the forces; (*k*) *Royal Air Force*. The following decorations were instituted under a royal warrant dated June 3, 1919, and have been awarded for post-Armistice operations and peace service: *Distinguished Flying Cross, Air Force Cross, Distinguished Flying Medal* and *Air Force Medal*.

No "battle clasps" have yet (1928) been issued for the World War, although "battle honours" have been granted.

United States of America.—(*a*) *Distinguished Service Cross, Army*, instituted Jan. 12, 1918, awarded to those who since April 6, 1917, have distinguished themselves in connection with military operations in circumstances which do not justify the award of the Medal of Honour. (*b*) *Distinguished Service Medal, Army and Navy*, instituted Jan. 12, 1918, awarded for exceptionally meritorious service. (*c*) *Navy Cross*, terms of award similar to *Distinguished Service Cross, Army*. The United States *Victory Medal* has battle clasps.

France.—*Médaille de la Reconnaissance Française*, instituted in 1917, is awarded to persons who performed acts of devotion in the public service. The following war medals were also issued: *Médaille Commémorative d'Orient* and *Médaille Commémorative Française de la Grande Guerre*.

Turkey.—For the Gallipoli campaign Turkey issued a white metal five-pointed star, in the centre of which is the Sultan's cypher, and the characters representing "El Ghazi" (The Victorious), below the date "333" (*i.e.*, 1915). The ribbon is scarlet moire with a white stripe towards the edges.

Japan.—This medal is similar to that granted for the Russo-Japanese War. The ribbon is dark blue with a broad white stripe.

Egypt.—*The Military Star of the Sultan Fouad* was instituted in 1919 for officers of the Egyptian Army who are mentioned in despatches for post-Armistice operations.

Belgium.—*Croix de Guerre*, instituted in 1915, awarded for exceptional acts of bravery. Medal *De la Reine Elisabeth*, instituted in 1916, and awarded to ladies, without distinction of rank, who assisted Belgians during the war. Other medals are *Médaille du Roi Albert; Croix Militaire; Décoration Militaire; Médaille de l'Yser*. Three medals for the general campaigns on the Continent and in Africa were also struck: *Médaille Commémorative de la Campagne 1914–1918, Médaille Commémorative de la Campagne d'Afrique 1914–18*, and *Étoile de Service du Congo*.

Rumania.—*Order of St. Michael The Brave*, instituted in 1916, solely for service in the field.

Portugal.—*Victory Medal* and *Medalha commemorativa das campanhas do Exercito Portugues* (to which were added clasps) were issued for the general campaign.

Germany.—Several medals were issued in Germany of which the following are the most important: (*a*) a silver medal was struck for the *March on Paris*. On the obverse is the bust of Gen. von Kluck and "1914–1915"; reverse, a naked fury on horse-

back carrying two blazing torches and "Nach Paris, 1914"; (*b*) a bronze medal was struck for the anticipated German entry into Paris. Obverse the Arc de Triomphe; among rays spreading from the top "1871–1914"; in the background the Eiffel Tower, and inscribed round the whole, "Entry of the German Troops into Paris." Reverse, the 1914 Iron Cross and "Nach aussen entschlossen. Nach innen geschlossen" (Resolute in the face of the enemy, united on the home front). An attempt was made to suppress it when the German hopes were not realized, but a few specimens are in existence, one being in the British Museum; (*c*) the Failure Before Paris is commemorated by a cast-iron medal. Von Kluck's bust with "1914–1915" on the obverse, with an eagle perched on a gun-emplacement, gazing at distant "Paris" on the reverse; (*d*) the new Triple Alliance is commemorated by a bronze medal, bearing on the obverse the busts of Kaiser Wilhelm II., Kaiser Franz Josef and the sultan of Turkey, and the inscription "Glory to God alone." Reverse, eagle perched on an oak branch, with the inscription "Brotherhood in arms, 1915, Germany, Austria-Hungary, Turkey"; (*e*) Russian defeat at Tannenberg: medal cast in iron and bronze. Obverse, bust of Hindenburg; reverse, "Tannenberg–Ortelsburg 1914" and "Queller of the Russians, liberator of East Prussia"; (*f*) the battle of the Falkland isles, Dec. 8, 1914, is commemorated by a bronze medal; (*g*) the Submarine War medal is cast in bronze. Obverse, bust of Admiral von Tirpitz. Reverse, Neptune with trident, seated on conning-tower of a submarine, shaking his fist at the distance where are two British sailing ships, one sinking; in middle distance, another submarine, inscription, "Gott strafe England, 18 Februar, 1915"; (*h*) the sinking of the "Lusitania." Obverse, ticket office of the Cunard company in New York, with Death issuing tickets to a crowd of passengers, motto "Business First." Reverse, the Lusitania (showing guns, aeroplanes, etc., on board) sinking. Inscription, "No contraband" and "The liner Lusitania sunk by a German Submarine, May 5, 1915." The liner was sunk on May 7 not May 5. "The authenticity of this medal has sometimes been denied, but the fact that it was issued has been frequently admitted by responsible German authorities as well as by the artist (K. Goetz) himself" (vide *Historical Medals in the British Museum*); (*i*) the Zeppelin attack on London on the night Aug. 17–18, 1915, was commemorated by a medal cast in iron; (*j*) the failure of the Allies Dardanelles Expedition was commemorated by a satirical medal in bronze. (T. J. E.)

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NUMMULITE: *see* PROTOZOA.

NUN, a member of a community of women, living under vows a life of religious observance (*see* MONASTICISM; MONK).

NUNATAK, a name applied in Greenland to a hill or mountain peak appearing above the surface of a glacier. Greenland is for the most part covered by an ice-cap of a certain thickness which moves slowly downwards to the sea. It will rise upwards and pass over a barrier if there is no outlet, but it will flow between and around mountain peaks leaving them standing as hills (nunataks) above the general surface of the ice-cap.

NUNCIO, a representative of the pope sent on diplomatic mission, sometimes called *Nuntius apostolicus*. The nuncios are of lower rank than the *legati a latere*, but have practically superseded them as ambassadors of the papacy. Nuncios were permanently established during the 16th century.

NUNCOMAR or NANDA KUMAR (d. 1775), Indian official, best known for his connection with Warren Hastings (*q.v.*), was governor of Hugli in 1756, and in 1764 he was appointed collector of Burdwan in place of Hastings, which resulted in a long-standing enmity. In 1775, when Hastings was governor-general, Nuncomar brought accusations of peculation against him, which were entertained by Francis and the other members of council inimical to Hastings. While the matter was still pending Nuncomar was indicted for forgery, condemned and executed. Warren Hastings and Sir Elijah Impey, the chief justice, were both impeached, and were accused by Burke and afterwards by Macaulay of committing a judicial murder; but Sir James Stephen, after investigation, reached an opposite conclusion.

See Sir James Stephen, *The Story of Nuncomar* (2 vols., 1885); and H. Beveridge, *The Trial of Nanda Kumar* (Calcutta, 1886).

NUNEATON, a town in Warwickshire, England, on the river Anker, and on the Coventry canal. It is an important junction of the L.M.S.R. and is 97 m. N.W. from London. Pop. (1901) 24,996; (1921) 41,875. The prefix of the name of the town is derived from a priory of nuns founded here in 1150. In the reign of Henry III. a weekly market was granted to the prioress. Nuneaton was incorporated in 1907. The church of St. Nicholas consists of nave, chancel and aisles, with a square embattled tower having pinnacles at the angles. A free grammar school was founded in the reign of Edward VI., and an English free school by Richard Smith in 1712. The ribbon industry is of less importance than formerly, but there are ironworks, cotton, hat, elastic hosiery, silk goods, and worsted factories; drain-pipes, tiles and bricks are manufactured and coal is mined.

NUNEZ, PEDRO (PETRUS NONIUS) (1492–1577), Portuguese mathematician and geographer, was born at Alcacer do Sal, and died at Coimbra, where he was professor of mathematics. He published a translation of portions of Ptolemy (1537), and a treatise in two books, *De arte atque ratione navigandi* (1546). His clear statement of the scientific equipment of the early Portuguese explorers has become famous. A complete edition of all his writings appeared at Basel in 1592.

See F. de B. Garcão-Stockler, *Ensaio historico sobre a origem e progressos das mathematicas em Portugal* (Paris, 1819); R. H. Major, *Prince Henry the Navigator* (London, 1868, p. 55).

NUÑEZ CABEZA DE VACA, ALVARO (*c.* 1490–*c.* 1564), Spanish explorer, was the lieutenant of Pamfilo de Narvaez in the expedition which sailed from Spain in 1527; when Narvaez was lost in the Gulf of Mexico, Cabeza de Vaca succeeded in reaching the mainland to the west of the Mississippi, and, striking inland with three companions, reached the city of Mexico in 1536. Returning to Spain in 1537, he was appointed "adelantado" or administrator of the province of Rio de la Plata in 1540. Sailing from Cadiz in the end of that year, after touching at Cananea (Brazil), he landed at the island of St. Catharine in March 1541. Leaving his ships to proceed to Buenos Aires, he set out in November with about 150 men to find his way overland and reached Ascension (Asunción) for the relief of his countrymen there the next year. Though successful, he was sent home under arrest in 1544, and in 1551 was banished to Africa by the council of the Indies for eight years. He was recalled and appointed judge in Seville, where he died not later than 1564.

The *Naufragios* ("Shipwrecks") of Cabeza de Vaca, which relate to the Florida expedition and his journey to the city of Mexico, appeared at Zamora in 1542; the work has frequently been reprinted, and an annotated English translation was published by T. Buckingham Smith in 1851. His *Comentarios* (1555) chronicle the events of the South American expedition. *See* Fanny Bandelier, *Journey of A. Nuñez Cabeza de Vaca* (ed. A. F. Bandelier, New York, 1905).

NUÑEZ DE ARCE, GASPAR (1832–1903), Spanish poet, dramatist and statesman. Deputy for Valladolid in 1865, he was imprisoned at Cáceres for his violent attacks on the reactionary ministry of Narvaez, acted as secretary to the revolutionary Junta of Catalonia, and wrote the "Manifesto to the Nation" (Oct. 26, 1868). He served under Sagasta as minister for the colonies, the interior, the exchequer and education; but ill-health compelled him to resign in 1890.

Nuñez de Arce first came into notice as a dramatist with such plays as *La Cuenta del Zapatero* (1859), and *El haz de leña* (1872). But his talent was more lyrical than dramatic, and his celebrity dates from the appearance of *Gritos del combate* (1875), a collection of poems exhorting Spaniards to save the country from anarchy and lay aside domestic controversies. He was maintained in popular esteem as the only possible rival of Campoamor by a series of philosophic, elegiac and symbolic poems: *Raimundo Lulio, Ultima lamentación de Lord Byron* (1879), *Un Idilio y una Elegía* (1879), *La Selva oscura* (1879) and *La Visión de Fray Martín* (1880). The old brilliance sets off the naturalistic observa-



BY COURTESY OF (1-3, 5, 6) THE GERMAN TOURIST INFORMATION; PHOTOGRAPH, (4) DONALD MCLEISH

• SCENES OF HISTORIC INTEREST IN THE OLD CITY OF NÜRNBERG

1. Entrance to the Fleischbrücke (meat bridge) one of the oldest stone bridges in the city, built 1596–98
2. Aerial view of Nürnberg looking down on Castle Hill (centre left) and its mediaeval fortifications around which the town developed. At the left is the imperial castle, and in the centre the Vestner-Turn (round tower), built 1561. Behind it in a diagonal line is the Five-Cornered Tower, in which was the torture device known as the "Iron Maiden"
3. Looking across the roofs of Nürnberg to Castle Hill. St. Sebald's church (1230–73), with twin towers, is on the left
4. House (centre) of Albrecht Dürer. It has been owned by the city since 1826, and has been restored
5. Hauptmarkt, the principal market on the Sebald side. In the centre of the square is a modern replica of the Neptune fountain, made in 1661–69 and sold by the city to the tsar of Russia. Behind it stands the church of Our Lady (1355–61) with a curious clock on which figures of the electors move around that of the emperor Charles IV.
6. The children's playground on the Pegnitz river, with the turrets and dome of the Jewish synagogue seen in the background

tion of *La Pesca* (1884) and *La Maruja* (1886). The list of his works is completed by *Poemas cortos* (1895) and *¡Sursum corda!* (1900); *Hernán el lobo*, published in *El Liberal* (Jan. 23, 1881), and *Luzbel* remain unfinished. Gracious in his vision, sincere and patriotic, his weakness was sentiment and rhetorical sympathies. (J. F.-K.)

NÜRNBERG [NUREMBERG], the second town in Bavaria in size, and the first in commercial importance. It lies in the district of Middle Franconia in a sandy, well-cultivated plain, 124 m. by rail N.N.W. from Munich. The city stands on the Pegnitz, which is here crossed by 14 bridges.

History.—The first authentic mention of Nürnberg, which seems to have been called into existence by the foundation of the castle, occurs in a document of 1050; and about the same period it received from the emperor Henry III. permission to establish a mint and a market. It is said to have been destroyed by the emperor Henry V. in 1105, but in 1127 the emperor Lothair took it from the duke of Swabia and assigned it to the duke of Bavaria. An imperial officer, styled the burggrave of Nürnberg, became prominent in the 12th century. This office came into the hands of the counts of Hohenzollern at the beginning of the 13th century. The town was ruled by patrician families. German monarchs frequently resided and held diets here, and in 1219 Frederick II. conferred upon it the rights of a free imperial town.

Like Augsburg, Nürnberg attained great wealth as an intermediary between Italy and the East on the one hand, and northern Europe on the other. Its manufactures were well known. The town gradually extended its sway over a territory nearly 500 sq.m. in extent, and was able to furnish the emperor Maximilian with a contingent of 6,000 troops. But perhaps the great glory of Nürnberg lies in its claim to be the principal fount of German art. Adam Krafft, Veit Stoss and Peter Vischer are famed as sculptors. In painting Nürnberg claims Wohlgemuth and Dürer. A large proportion of the old German furniture, silver-plate, stoves and the like was made in Nürnberg workshops. Its place in literary history it owes to Hans Sachs and the other meistersänger. The inventions of its inhabitants include watches, the air-gun, gun-locks, the terrestrial and celestial globes and the art of wire-drawing.

Nürnberg was the first imperial town to embrace Protestantism (about 1525). The first blow to its prosperity was the discovery of the sea-route to India in 1497; and the second was inflicted by the Thirty Years' War, during which Gustavus Adolphus was besieged here for ten weeks by Wallenstein. The downfall of the town was accelerated by the illiberal policy of its patrician rulers. In 1803 Nürnberg was allowed to maintain its nominal position as a free city, but in 1806 it was annexed to Bavaria.

Population and Industries.—The population of Nürnberg was, in 1925, 392,494, more than two-thirds of whom are Protestant. The city is a garrison town. The manufactures are toys and fancy articles in metal, carved wood and ivory, which are collectively known as Nürnberg wares. It is also famous for pencils, needles, electric apparatus, chromo-lithography and motors. Nürnberg is the chief market in Europe for hops. It is an important junction for railways and is served by the Ludwig canal, connecting the Danube and the Main.

Buildings.—Considerable sections of the ancient walls and moat still remain; of the 365 bastions which formerly strengthened the walls, nearly 100 are still *in situ*, and a few of the old gateways have also been preserved. Most of the streets are narrow and crooked, and the majority of the houses have their gables turned towards the street. The general type of architecture is Gothic, but the rich details, which are lavished with especial freedom in the interior courts, are usually borrowed from the Renaissance. Most of the private dwellings date from the 16th century, and there are practically none of earlier date than the 15th century. The roofs are of red tile.

The old castle (Kaiserschloss), is placed on a rock on the north side of the town. This dates most probably from the early part of the 11th century, but it received its present form mainly during the reign of the emperor Frederick I. about 150 years later. It was restored in 1854–56. In the Heidenturm are two late Romanesque chapels, one above the other. Other parts of the castle are the pentagonal tower, the oldest building in the town, wherein are preserved the famous "iron virgin of Nürnberg," and other instruments of torture; the granary (Kornhaus), also called the Kaiserstallung; and the Vestnertor or Vestnerturm. The castle of Nürnberg was a favourite residence of the German sovereigns, in the later middle ages, and the imperial regalia were kept here from 1424 to 1796. Near it are the remains of the burg of the Hohenzollerns, the principal existing part of which is the chapel of St. Walpurgis, which was destroyed with the rest of the building in 1420, but was restored in 1892. Not far from these ruins stands the Luginsland, a stronghold with four corner turrets, said to have been built by the burghers in 1367 as a watch-tower against the burg of the Hohenzollerns.

Nürnberg contains several churches, the finest of which are those of St. Lorenz, of St. Sebald and of Our Lady. All three are Gothic edifices and are notable for their elaborately carved doorways, in which free play has been given to the exuberant fancy of the Gothic style. The church of St. Lorenz, the largest of the three, was built in the 13th and 14th centuries and has recently been restored. In it is the masterpiece of the sculptor, Adam Krafft, consisting of a ciborium, or receptacle for the host, in the form of a florid Gothic spire 65 ft. high; the carving of this work is exquisitely minute and delicate. The shrine of St. Sebald, consisting of a bronze sarcophagus and canopy, in the richest Gothic style, adorned with numerous statues and reliefs, is looked upon as one of the greatest achievements of German art. It was executed by Peter Vischer, the celebrated artist, in bronze, who was occupied on the work for 13 years (1506–19). The church of Our Lady possesses some fine old stained-glass windows and some paintings by Michael Wohlgemuth. The Tuchersche altar, with its winged picture, is one of the finest works of the Nürnberg school about the middle of the 15th century. Other noteworthy churches are those of St. Jacob, founded about 1200 and restored in 1824; and of St. Aegidius.

The town hall (Rathaus), erected in the Italian style in 1616–19, contains frescoes by Dürer, and a curious stucco relief of a tournament held at Nürnberg in 1446. The building incorporated an older one of the 14th century, of which the great hall, with its timber roof, is part. The most interesting secular buildings are the houses of the old patrician families. A special interest attaches to the dwellings of Albert Dürer and Hans Sachs, the cobbler-poet. The streets are embellished with several fountains, the most noteworthy of which are the Schöne Brunnen, 1385–96, in the form of a large Gothic pyramid, adorned with statues, and the Gänsemännchen or goose-mannikin.

The Germanic national museum, established in an old Carthusian monastery includes masterpieces by Holbein, Dürer, Wohlgemuth and others. The municipal library contains many thousands of manuscripts and books, some of which are of great rarity.

NURSERIES, NURSERY TREES: *see* ARBORICULTURE.

NURSERY EQUIPMENT. A baby should room alone, if possible, and must always sleep alone. Nursery equipment should be simple and all furniture and fittings of a type that may be readily washed. Painted walls are preferable but fresh clean wall paper is permissible. The best floors are well oiled or waxed hard wood or linoleum with a few small, washable, cotton rugs. Muslin curtains and dark window shades permit of good ventilation and subdued lighting. The necessary furniture consists of: A table of plain wood about two by three feet in size and low enough so that the mother may reach anything on it from her chair. Two low chairs without arms; one may be a rocker. A screen with removable washable panels to be used for protection from draughts and as a rack for airing the clothing. Two accessible shelves on the wall for the toilet articles. A closet with shelves or a bureau to hold the clothing. A wall thermometer and a covered pail to hold soiled diapers.

The Bed.—A crib or bassinet may be used. The latter is advised for the first two months; the best kind is the ordinary clothes basket with handles at either end. This affords free ventilation, is easily cleaned, may be placed upon two chairs or a bench and is moved about readily. For a mattress an ordinary hair pillow

is best; a feather pillow must not be used but one of felt or kapoc is a good substitute. Large pillow cases are preferable to sheets; one to hold the mattress and so serve as a lower sheet; the other to hold the blankets and serve as an upper sheet and bed spread. A small blanket rolled tightly may be placed at the foot of the bed before the upper sheet and blankets are tucked in; this will hold the upper bedding away from the baby's feet and permit free movement of the legs. A pillow for the head is not needed.

Care of the Nursery.—The bed should be placed in a corner of the room well protected from a direct draught and too strong a light. The wall thermometer should be placed on the wall above the head of the bed. The temperature of the nursery should not be above 68° F nor below 66° during the daytime. For the first three months the proper night temperature is from 62 to 64° and later this may be reduced to from 50 to 54 degrees. In winter the proper ventilation may be secured by the use of a window board and in summer the windows, thoroughly screened, may be left open during the cooler part of the day and at night. The room should be well cleaned and aired every day and the baby in his basket taken out of the room while this is done. Soap and hot water with sunshine are the best cleaners and disinfectants to use.

The Bath.—Tub baths may be given as soon as the umbilical cord drops off, usually about the tenth day after birth. Until that time sponge baths only are permitted. The equipment needed for the bath consists of: A portable bathtub of rubber or enamel ware. Rubber apron for the mother. Small soft blanket. Supply of soft and absorbent towels. Two wash cloths; one for the face and head and the other for the body. A tray holding a cake of castile or other pure white soap, a tube or jar of baby cream, plain unscented talcum powder, a few covered glass jars to hold small squares of sterile gauze, cotton pledgets and liquids needed, safety pins of assorted sizes, a bottle of boric acid solution and a bath thermometer. These articles should be replaced on the tray after use and covered with a clean towel until needed again. When all the equipment is in place, undress the baby and lay him on the bed wrapped in the soft blanket. Put on the rubber apron and pour the water into the tub. The temperature of the water must be tested with the bath thermometer at the last moment before the bath is given. For the first few weeks this should be 100° F. From the second to the sixth month the right temperature is 98 degrees. For the remainder of the first year, 95° is proper. During the second year the temperature of the bath water may be lowered to from 85 to 90° F. When the water is at the right temperature, take the baby in your lap and place the towel about him in place of the blanket. Before placing the baby in the tub use one of the wash cloths to bathe his face with plain water. Then soap the cloth well and gently wash the head, neck and back of the ears. Be careful not to get any of the soap in the baby's eyes. Rinse the wash cloth and wash off the soap from the head and neck. Now lift the baby by placing your right hand and arm under his buttocks and your left arm under his back with the forearm supporting his head. Set him gently in the tub keeping his back and head well supported, leaving your right arm and hand free for giving the bath. Soap the second wash cloth and rub the body, arms and legs all over, gently but thoroughly. Then rinse the cloth and wash off the soapy lather. The bath should not take more than a few moments during the first few weeks, later it may be given more leisurely. Now lift the baby from the tub and wrap him in the bath towel on your lap. The drying process consists of a series of gentle pattings; do not irritate the baby's delicate skin by rubbing. The head and face should be dried first and then the arms, legs and body. Do not wash out the baby's mouth, ears or nostrils unless so advised by your doctor. If the eyes need special care they may be wiped gently with a pledget of sterile cotton wet with sterile water or boric acid solution. When this is done, the baby should be turned on his right side while the right eye is washed and on the left side for the left eye; this turning is necessary to prevent the solution used for one eye from running into the other eye. After the baby is well dried it is a good plan to smear all of the folds of the skin in the groin, under the arms and about the neck with a little of the baby cream or with olive oil. Then comes a light dusting of the body with talcum powder and the baby is ready for his clothing, his feeding and his nap. Diapers must be changed as soon as soiled, placed in a pailful of cold water and once each day thoroughly scrubbed with soap and hot water, rinsed in hot water and then boiled for five minutes. If possible, dry the diapers in the sunlight.

Clothing.—Three points to remember about the baby's clothing are that it must be loose, light in weight and of materials that will not irritate the skin. The same weight clothing should be worn indoors both summer and winter. On very hot days the shirt, diaper and dress are sufficient. In cold weather, a light weight knitted shawl or blanket may be used for added warmth. For out of doors in cold weather, a warm cloak, hood and bootees are necessary. Socks or stockings may be worn if needed for warmth but their use is rarely desirable except in very cold weather. The list of articles needed for a layette is as follows: 6 dresses, 6 petticoats without sleeves, 4 shirts, 3 flannel abdominal bands for the first month, 4 nightgowns, 4 dozen diapers, 1 wrapper, 1 cloak, 1 hood, 4 pairs of socks or stockings, 1 light weight woollen shawl. The best materials for the dresses are; fine muslin, nainsook or lawn cloth. Do not use lace or embroidery around the neck or cuffs as it is apt to irritate the delicate skin. For the petticoats use a light weight flannel or cotton flannel. Knitted cotton goods is best for the undershirts; wool is needed only in the coldest climates. The dresses and petticoats should be made twenty inches long from neck to bottom of hem and should be opened all the length of either the back or the front. Both methods of opening have advantages. The full opening down the back permits the petticoat and dress to be drawn aside when the baby is put into his bed and so prevents soiling of the clothing. When the dress and petticoat open all the way down the front, the entire clothing may be put on as a unit. In this method, the dress is laid out flat on the bed or table with the wrong side up. The petticoat is laid over the dress with its armholes over the armholes of the dress. The sleeves of the undershirt are then drawn through the armholes of both petticoat and dress. The diaper is laid in place on top of the clothing and the abdominal band laid across the top of the diaper and the lower end of the shirt. The baby is then laid on the clothing, the band and diaper fastened in front, the arms drawn through the combined armholes of the shirt, petticoat and dress and the latter fastened in front. With this method of dressing, the baby is not turned at all and is handled only when the arms are being put through the armholes. It has many advantages as a method of dressing as the baby is disturbed so little that digestion is not interfered with, sleep comes more readily and consequently health is markedly improved. (*See* CHILDREN: CARE OF; INFANCY.)

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(S. J. B.)

NURSERY SCHOOLS. The nursery school is a comparatively modern section of education arising from the necessity of providing a suitable environment for the mental and physical development of children of pre-school age.

Great Britain.—The age of compulsory school attendance is five years, but education authorities have the option of admitting children at three years. In the 19th century the general opinion was that the children of the elementary school class were better in school than out of it, and there were large classes of "younger infants" (three to five years old), in most elementary schools in urban districts in England. In Scotland there was no general demand for the admission of children under five.

By the beginning of this century the conditions essential to the right physical and mental development of the young child were more fully understood, and the school education of the "under fives" was attacked both by doctors and educationists. The doctors asserted that epidemics were spread in crowded class rooms, and physical development retarded and impaired by lack of activity and fresh air; the educationists, that the formal instruc-

tion given in the three R's retarded intelligence.

In 1904 five women inspectors, appointed by the Board of Education to enquire into the education of children under five years of age in public elementary schools, reported in terms so adverse that in 1908 the board appointed a consultative committee to report on the school attendance of children below the age of five. The conclusions of the committee, based on a survey of the field in Great Britain and in France, Belgium, Switzerland and Germany, were that, where home conditions were satisfactory, the natural place for the child under five was the home; that "many homes now exist in which the mental and physical development of young children cannot be properly secured"; that the elementary schools were not providing the right sort of education for these children; that the children from "imperfect homes" should be sent to places specially intended for their training, the best place for this purpose being a nursery school as described in the report. The conditions there described were abundance of air and sunshine; open space; hygienic structures; opportunity for physical activity and sleep; education on kindergarten lines; training in right habits, and enlightened teachers. The board took no action, however, to establish such schools, and the local authorities increasingly excluded the "under fives."

Voluntary effort had already opened day nurseries for "under threes," and one or two free kindergartens on Froebelian lines for children from two to five. Nursery schools on these lines though in small numbers, became centres of light and healing in slum areas. The majority were held in adapted houses, seldom with more than a small garden attached, but all sought to provide conditions for healthy development of body and mind; formal lessons were replaced by training of the senses and of speech and movement; independence and self-control were encouraged; happy activity and comradeship in a friendly community fostered social virtues. The influence of Mme. Montessori was added to that of Froebel. Co-operation was established with infant welfare clinics and the public medical services. In 1914 a notable advance was made by Rachel and Margaret Macmillan, who in a riverside slum area in Deptford, London, established a large nursery school under completely open air conditions with remarkable results.

In 1918 the president of the Board of Education supported enlightened opinion by including in the Fisher Act regulations giving local authorities power to supply, or aid the supply, of nursery schools (or nursery classes) for children from two to five years of age. Again economy nipped the new growth. Few new schools were established, but grants helped to maintain those in existence. There are now 24 nursery schools in England and 12 in Scotland. Meanwhile the "under fives" have returned in large numbers to the elementary schools, the best of which are in sympathy with the new ideals.

Other European Countries.—Institutions analogous to nursery schools are, as already indicated, to be found on the continent of Europe. In Belgium they are called *écoles gardiennes* or *jardins d'enfants*, in Austria *Kindergarten* and in Germany and Switzerland *Kindergarten, Krippen* and *Kleinkinderbewahranstalten*. (For nursery schools in France *see* EDUCATION: *France;* INFANT SCHOOLS; KINDERGARTEN; MONTESSORI SYSTEM; and OPEN AIR SCHOOLS.)

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UNITED STATES

It is evident that development of science in the fields of biology, psychology and sociology had emphasized the importance of the years from two to five, and it was recognized that during the pre-school years the child gains control of his body; develops the beginnings of response to tone, rhythm, colour and form; and forms his speech habits and acquires a vocabulary. It was shown also that the physical habits of sleeping, feeding, elimination and exercise, the mental habits of concentration, self-control and self-reliance, or their opposites, and the social attitudes toward authority, reality and affection, whether good or bad, are developed in this period and are likely to be little changed in future years. These scientific developments led many parents to seek help in training children during the years when the child is ordinarily dependent upon the home for all his contacts. Study groups of mothers, magazine articles, and books assisted.

In 1919 the Bureau of Educational Experiments in New York city organized a nursery school to serve as a basis for studying the educational factors in the environment of pre-school children and for research. The State of Iowa in 1917 authorized the establishment of a child welfare research station at the State university which, in Oct. 1921, opened a play school to provide a laboratory in child psychology for experimental work with pre-school children. In 1916 a fund was left in Detroit, Mich., to finance a centre for teaching child care, and in Jan. 1922, the Merrill-Palmer Nursery school was established for the purpose of training pre-school children and their parents, as well as a group of prospective parents and teachers. Since that time a considerable number of institutions of college and university grade have established similar centres for training and research which have stamped the American nursery school as an agency for parental education as well as a centre for child development. Research schools also provide a laboratory for the scientific study of the pre-school child: the experimental type, organized to study and experiment with the educational factors in the environment of the pre-school child; the co-operative type, organized by the parents themselves and conducted with their active co-operation; the high-school or training school type, organized to give high-school girls training in child care; and the collegiate type, by far the largest group, organized in connection with colleges and universities for the purpose of providing a laboratory for the teaching of child care to pre-parental and parental groups. A number of nursery schools represent a combination of one or more of these types. The only outstanding American experiment comparable to the social type represented by the English nursery school is the Nursery Training school of Boston, formerly the Ruggles Street Nursery school, established in 1922.

In an educational programme for pre-school children, participation in living activities and play form the basis for physical and mental development. The essentials of the nursery school, therefore, include spacious rooms equipped for small children, with plenty of suitable play equipment, adequate bath and toilet facilities, sleeping space, a garden and outdoor equipment, and the supervision of skilled teachers. In order that the programme may be suitable for the individual child, and the parents furnished with accurate information, the services of specialists of various types must be available. On the physical side, a physician, nutritionist, physiotherapist, and dentist are essential if a complete picture is to be secured. Daily inspection of the children by a nurse is an essential service, since at these early ages they are especially susceptible to infections. A psychologist specially trained to determine the mental level and character traits of the pre-school child and a liaison officer between the school and the home are also essential. Experience has shown that the pre-school period of the child is also the most desirable time for training the parent whose ideas are then less crystallised.

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NURSING. The evolution of the sick-nurse is mainly due to three very diverse influences—religion, war and science—to name them in chronological order. It was religion which first induced ladies, in the earlier centuries of Christianity, to take up the care of the sick as a charitable duty. The names of the oldest foundations which still survive, such as the Hôtel Dieu in Paris, St. Thomas's and St. Bartholomew's in London, the order of St. Augustine, the order of St. Vincent de Paul, and (in the form of a modern revival) that of St. John of Jerusalem, sufficiently indicate the original religious connection.

The training of nurses, which was inaugurated in Germany in

1836 on a semi-religious basis, received great impetus from the Crimean War, which was further emphasized by the Civil War in America and the subsequent great conflicts in Europe. The despatch of Florence Nightingale with a staff of trained nurses, to superintend the administration of the military hospitals was the direct result of the publicity given to the details of the Crimean War by *The Times* newspaper. The work undertaken and accomplished by this lady was far more important than the mere nursing of sick and wounded soldiers. She had grasped the principles of hygiene, which were then beginning to be understood, and she applied them to the reform of the hospital administration. In civil life it had a marked effect in stimulating the training movement and raising the status of the nurse. It remained for the third influence to develop systematic nursing to its present dimensions. Since 1880 advances in medical knowledge, particularly in respect of bacteriology, antisepsis and asepsis, have revolutionized nursing in the home, the hospital and the Poor Law infirmary. The nurse is now looked upon as following a great vocation for which she has to be qualified by years of training.

GREAT BRITAIN

Training of Nurses.—In Great Britain the training of the nurse is regulated by the state through the Nurses' Registration Act of 1919. This act was only carried into law after years of controversy, ending with the War. There is a general nursing council for England and Wales and another for Scotland, and 16 of the 25 members of the English council must be registered nurses elected by persons registered under the act.

In addition to the ordinary registration of nurses with a general training (which occupies three or four years) there are five supplementary registers for male, mental, fever, mental defectives' and sick children's nurses. Nurses usually begin their general training in recognized training schools at an age not less than 21, though for certain kinds of training (such as those for nurses of fever or sick children) probationers are taken earlier. The nurses usually live in the hospital or in hostels near it; and as a rule, those who remain in hospital retire about the age of 50 or 55, when a pension is frequently provided with or without contribution. Post-graduate teaching is developed in the best schools, as is the system of providing tutor-nurses. There is not as yet much connection with the universities though the University of Leeds grants a diploma in nursing. The matron of a great hospital holds a very important position as regards her staff, which is divided into sisters, staff nurses and probationers. There are specialists in electric and other technical work, but these have usually first completed their general training. Strenuous efforts have been made to reduce the hours of service and to increase the salaries, which for many years have been extremely low.

In 1916 a college of nursing was established and in 1925 it had a membership of 24,000 with 42 branches and sub-branches throughout the United Kingdom. Connected with it are a student nurses' association for nurses in training, a section for sister tutors and a section for public health workers. It is recognized by the Ministry of Health as an approved centre for the training of health visitors.

Although a large number of nurses serve in hospitals, these are regarded mainly as training schools, where the young nurse is carrying on her studies as well as gaining practical experience. The difficulty with the present hours of duty is to provide the necessary time for her studies and for preparing for frequent examinations, state and hospital. In early days, the importance of the training was not fully recognized, and the nurse was regarded as one who simply performed certain useful functions. Now, the doctor or surgeon looks to the nurse for assistance in his work; he can only see the patient at intervals but she has him always under observation, and the accuracy of her report is of vital importance.

District Nurses. On completing her general training, usually of four years, a nurse may take her district training and be placed on the roll of the Queen's nurses, which are supervised from headquarters but supported locally. There are still "cottage nurses," with a short training, but those with a higher standard are rapidly increasing, more especially as they are eligible to do county health work under the medical officer of health. Those holding the certificate of the Central Midwives Board are often employed in infant and child-welfare work.

Public Health Work. In addition to child welfare work many nurses are employed under county, burgh or city schemes. The education authorities require a large staff for following up the cases of children inspected by their medical officers. Nurses are also required for fever and isolation hospitals. Poor Law infirmaries give excellent training and have certain advantages over hospitals, which are also schools for the medical profession.

Private Nursing. This form of nursing has expanded enormously and though some visiting nurses come in for the day they are mainly residential. Nurses who undertake this work are to be had either from a hospital which sends out its nurses after they gain their certificates, or from an institution, possibly a co-operative institution or home. Nurses are employed in many private nursing-homes for the well-to-do.

Mental Nurses. The training for mental nurses is usually conducted in a recognized institution for the treatment of mental disorders where the candidate serves for three years, and enters for the state examination for mental nurses. The nurses and attendants are of both sexes, but women are being increasingly employed even for male patients.

Midwives and Maternity Nurses. Midwifery is controlled by a Central Midwives Board, established in London, with jurisdiction in England and Wales, and there are separate boards for Scotland and Ireland. The number of midwives on the roll in England and Wales is approximately 78,000. These boards regulate the issue of certificates and the conditions of admission, and have also the power to remove names from the roll. In 1910 it was forbidden to any person to attend women in childbirth for gain (otherwise than under direction of a qualified medical practitioner) unless certified under the act. An incorporated Midwives Institute has done splendid work in promoting the interests of midwives. Many trained nurses take the midwives' certificate, for which a six months' special course is required while a twelve months' course of midwifery is necessary for those who are not trained nurses.

Masseurs and Masseuses. The Chartered Society of Massage and Medical Gymnastics grants a certificate to those who have taken a prescribed training at a recognized school and have passed an examination. After June 1927, examination on massage ceased as a single subject.

Various Services. A voluntary advisory nursing board was established in 1921 under the Prison Commission of the Home Office, and trained nurses are now appointed for the care of sick prisoners. A nursing service deals with hospitals under the Ministry of Pensions, and a matron-in-chief is at its head.

The Overseas Nursing Association sends trained nurses to the Crown Colonies and small British communities abroad. There is also an Indian nursing service for Europeans in India.

Queen Alexandra's Imperial Military Nursing Service originated in 1902. A nursing board advises the secretary of state on matters connected with the service. A matron-in-chief is at its head and principal matrons, matrons, sisters and staff nurses are subordinate to her.

In the first year of the World War there were 2,323 fully trained reserve nurses in addition to the regular service, and by 1918 the number reached 10,304. There is likewise a service called Queen Alexandra's Military Families Nursing Service. The Territorial Army Nursing Service, established in 1907–8 in connection with the Territorial Army, supplied the largest number of British nurses available on the outbreak of the World War. The probable number required is about 4,000, but the territorial nurses are only called up in case of necessity. Like the Territorial Army, they enroll with overseas obligations.

Queen Alexandra's Royal Naval Nursing Service is a small one, which also has a reserve. The Royal Air Force Nursing Service was established in 1921. (*See* MEDICAL SERVICE, ARMY.)

(E. S. H.)

UNITED STATES

Nursing in the United States under the Nightingale plan,

according to which student nurses are educated by nurses as well as by physicians, began in 1873 at the Bellevue Hospital, New York, the Connecticut Training School, New Haven, and the Massachusetts General Hospital, Boston. Mention of it, however, is made earlier in connection with care of the sick in the Pennsylvania Hospital, the charter of which was granted in 1751, the New York Hospital in 1798, the Philadelphia Dispensary in 1855 and the New England Hospital for Women and Children in 1859–60.

Training generally begins at 18, though in some hospitals the minimum entrance age is 19, 20 or 21. Under the apprenticeship system, making of a hospital and school of nursing not two separate institutions but one and the same, the nursing in the wards is done by these young students in most of the hospitals where they are trained. Of the 7,416 hospitals in 1927, 5,261 were very small or State institutions without schools and in 75% of the remaining 2,155 the nursing was done by students in most schools without the assistance of a single general-duty graduate nurse. After from one to four years training nurses pass out into professional life at the average yearly rate of approximately 18,000.

Each State has a board of nurse examiners with which properly accredited nurses may register after passing an examination. On Jan. 1, 1928, there were 200,000 registered nurses in the United States. Of the various branches of nursing 54% go into private duty, 19% into public health, and 23% into institutional work but they change from field to field, especially away from private duty with its uncertainty of employment and its demand for 24-hour duty arising from the fact that many families are unable to afford a night nurse as well as a day nurse in sickness.

A field for nurses developed generally in 1905 when the Massachusetts General Hospital, Boston, instituted hospital social service. The idea originated in 1879 when the Ethical Culture Society of New York employed a nurse with a visiting physician in connection with the dispensary. It means follow-up work among discharged patients and their families, carrying the treatment of the hospital into the home and utilizing the opportunity of education, systematizing and co-ordinating treatment with rehabilitation of the family through public and private agencies. Staffs of social workers and nurses are now employed for this purpose.

The usual yearly salary of the typical private duty nurse throughout her professional life was computed in 1928 to be $1,311 since the months of employment average but 7 out of 12; public health nurses begin at about $1,450, with the yearly average $1,720; and nurses in institutions begin at $1,750 plus maintenance, with the yearly average $2,079 plus maintenance. The superintendent of a hospital receives an average salary of $2,600 to $2,700; the superintendent of nurses of $2,500 to $2,600 plus maintenance; and the superintendent of hospital and nurses jointly an average of $2,400 to $2,500 plus maintenance. Nurses in the United States are recruited largely from the agricultural, manufacturing, trade and professional classes with proportionately more from the last group than from the first, considering the extent of agricultural pursuits in the country.

As a profession, nurses in the United States are organized into three national organizations for which they themselves are responsible, the American Nurses Association, the National Organization for Public Health Nursing and the National League of Nursing Education. Each organization has its individual staff of full-time workers engaged in promoting the various aspects of nursing interests. The remarkable progress made in the nursing field in the past 30 years is due to the distinctive service rendered by these national organizations because of their specialized knowledge and experience and steadfast insistence on the maintenance of the highest standards.

Government Nursing Services.—The Army Nursing Service was established by Act of Congress in 1901 and the Navy Nursing Service in 1908. The Army School of Nursing, Washington, D.C., was established on progressive lines in 1918 with hospital affiliations to give its students the experience necessary for complete training. The U.S. Public Health Service employs a staff of nurses under a woman superintendent to assist in carrying out its extensive public health programme in hospitals, in foreign and domestic quarantine and various sanitation projects. The U.S. Veterans' Bureau nursing service also has a woman superintendent who is a registered nurse. It is now (1928) the largest of the Government nursing services and is composed of two groups of nurses, those who care for the patients in the nation-wide chain of Veterans' Bureau hospitals and those who do welfare work among the ex-service men in their homes. The U.S. Government has a great nursing reserve upon which it can draw in time of need in the American Red Cross Nursing Service (*see* AMERICAN RED CROSS) which has been closely linked with the American Nurses Association throughout its history, and membership in this association is essential to enrollment, as an insurance of standards.

(X.)

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NUSKU, personification of the new-moon, the name of the light and fire-god in Sumer, Babylonia and Assyria, who is hardly to be distinguished from a god Gibil. Nusku-Gibil is the symbol of the heavenly as well as of the terrestrial fire. As the former he is the son of Anu, the god of heaven, but he is likewise associated with Enlil of Nippur, the earth god, and regarded as his messenger. A centre of his cult in Assyria was in Harran, where, because of the predominating character of the moon-cult, he is viewed as the son of the moon-god Sin (*q.v.*). He is often called upon to cleanse the sick and suffering in the magic fire rituals.

The fire-god is also viewed as the patron of the arts and the god of civilization in general, because of the natural association of all human progress with the discovery and use of fire, and as the protector of the family. He becomes the mediator between humanity and the gods, since it is through the fire on the altar that the offering is brought into the presence of the gods.

While temples and sanctuaries to Nusku-Gibil are found in Babylonia and Assyria, he is worshipped more in symbolism than the other gods. Nusku and Gibil are symbolized by the lamp.

See A. Deimel, *Pantheon Babylonicum*, Nos. 598 and 2367. H. Zimmern, *Keilinschriften und das Alte Testament*, 416–420.

NUT, a term applied to that class of fruit which consists generally of a single kernel enclosed in a hard shell. Botanically speaking, nuts are one-celled fruits with hardened pericarps, sometimes enveloped in a cupule or cup, formed by the aggregation of the bracts as in the hazel and the acorn. A great number of nuts enter into commerce for various purposes, principally as articles of food or sources of oil, and for several ornamental and useful purposes. The edible nuts are very rich in oil, with a small percentage of the other carbohydrates, starch, sugar, etc., and also a large proportion of nitrogenous constituents. Oleaginous nuts used for food are likewise employed more or less as sources of oil, but on the other hand there are many oil-nuts of commercial importance not embraced in the list of edible nuts.

On the following page is set out an alphabetical enumeration of the more important nuts, and of products passing under that name, used either as articles of food or as sources of oil.

There remain to be enumerated a number of nuts of commercial value for turnery and ornamental purposes, for medicinal use, and for several miscellaneous applications in the arts. *See* table at foot of p. 646.

The application of the term nut to many of these products is purely arbitrary, and it is obvious that numerous other bodies

Name	Source	Locality	Remarks
Almond	*Prunus Amygdalus*, var. *dulcis*	S. Europe	Food, oil.
Almond (bitter)	*Prunus Amygdalus*, var. *amara*		Oil.
Ar nut or earth nut	Tubers of *Bunium flexuosum* and other species	W. Europe (Britain)	Food.
Bambarra ground nut	*Voandzeia subterranea*	Tropics, especially Africa	Food.
Ben nut	*Moringa oleifera* (a winged seed)	India	Oil.
Bitter nut	*Carya cordiformis* (swamp hickory)	N. America	*See* HICKORY.
Brazil nut	*Bertholletia excelsa*	S. America	Food, oil.
Bread nut	*Brosimum Alicastrum*	W. Indies	Food.
Butter or Souari nut	*Caryocar nuciferum*	Guiana	Food.
Cahoun nut	*Attalea Cohune*	Honduras	Oil.
Candle nut	*Aleurites triloba*	S. Sea Islands	Oil.
Cashew nut	*Anacardium occidentale*	W. Indies and Tropical America	Food, oil.
Chestnut	*Castanea vesca*	S. Europe	Food.
Cob, filbert, or hazel	*Corylus avellana*	Europe (Britain), etc.	*See* HAZEL.
Cob nut of Jamaica	*Omphalea diandra*	W. Indies and Tropical America	Food.
Coco-nut	*Cocos nucifera*	Tropics	Food, oil.
Cola nut	*Cola vesa*	W. Africa	Food.
Dika nut	*Irvingia Barteri*	W. Africa	Food, oil.
Ginkgo nut	*Ginkgo biloba* (seed)	Japan, China	Food, oil.
Hickory nut	*Carya ovata*	N. America	*See* HICKORY.
Hog nut	*Carya glabra*	N. America	Eaten by animals.
Jesuit's nut	*Trapa natans*	S. Europe	Food.
Mocker nut	*Carya alba glabra*	N. America	*See* HICKORY.
Moreton Bay chestnut	*Castanospermum australe*	Australia	Food.
Nutmeg	*Myristica fragrans*	E. Indies	Spice. *See* NUTMEG.
Nutmeg (wild)	*Myristica fatua, M. tomentosa*, etc.	Tropics	Spice. *See* NUTMEG.
Olive nut	*Elaeocarpus Ganitrus*, etc.	E. Indies	Food.
Palm nut	*Elaeis guineensis*	W. Africa	Oil. *See* PALM.
Pea nut	*Arachis hypogaea*	Tropics	*See* PEA NUT.
Pecan nut	*Carya Pecan*	N. America	Food, oil. *See* HICKORY.
Pekea nut	*Caryocar butyrosum*	Guiana	Food.
Physic nut	*Jatropha Curcas*	Tropical America	Oil.
Pine nut	*Pinus Pinea*, etc.	Italy	Food.
Pistachio nut	*Pistacia vera*	S. Europe, etc.	Food.
Quandang nut	*Fusanus acuminatus*	Australia	Food.
Ravensara nut	*Ravensara aromatica*	Madagascar	Spice.
Rush nut	*Cyperus esculentus* (tubers)	S. Europe, etc.	Food.
Sapucaia nut	*Lecythis Ollaria*	Brazil	Food.
Tahiti chestnut	*Inocarpus edulis*	S. Sea Islands	Food.
Walnut	*Juglans regia*	Asia, Europe	Food, oil.
Water chestnut	Species of *Trapa*	S. Europe, India, etc.	Food.

not known commercially as nuts might with equal propriety be included in the list. Most of the nuts of real commercial importance receive separate notice, and here further allusion is only made to a few which form current articles of commerce, not otherwise treated of.

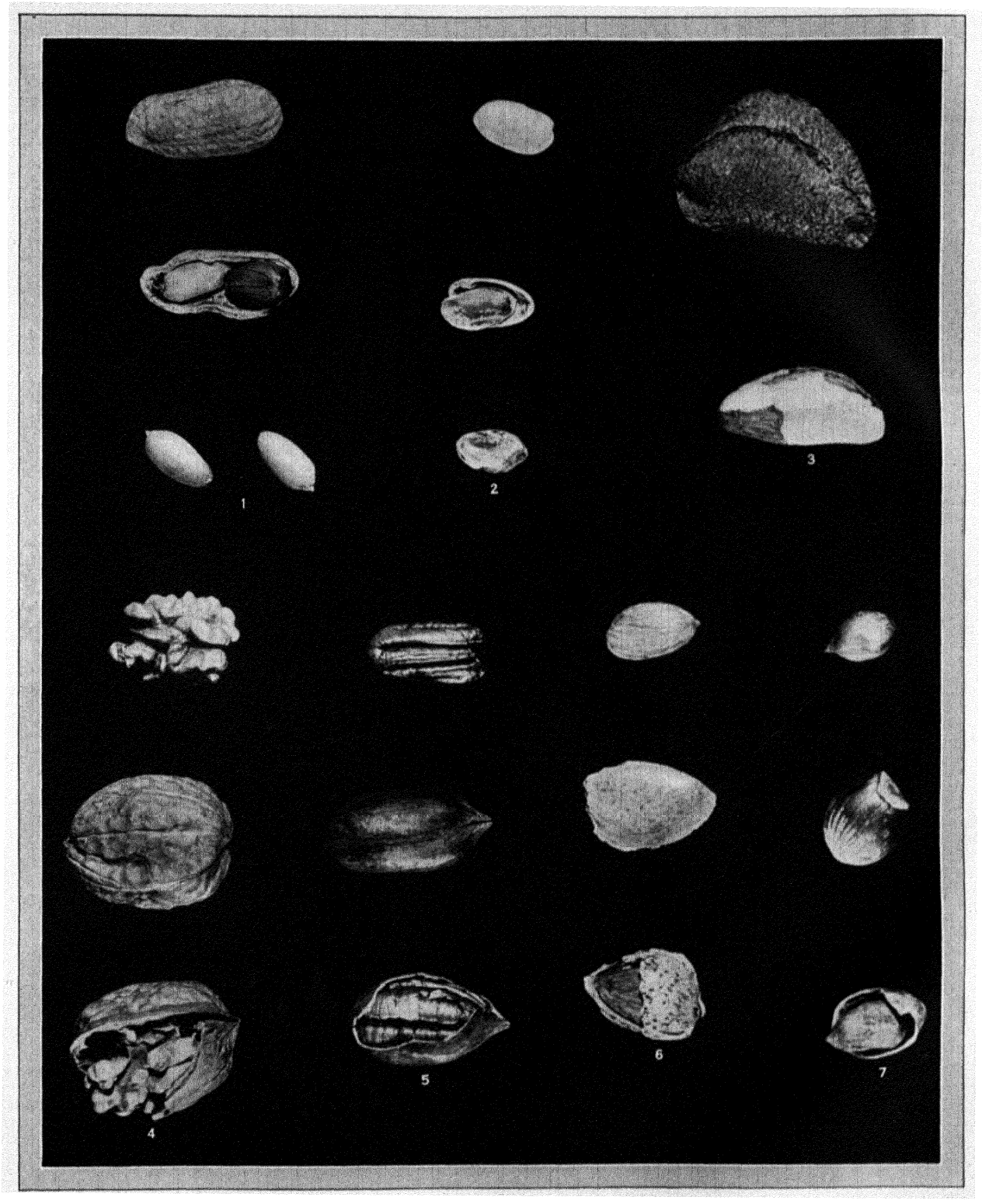
The bread nut of Jamaica is the fruit of a lofty tree, *Brosimum Alicastrum*. It is about an inch in diameter, and encloses a single seed, which, roasted or boiled, is a pleasant and nutritious article of food.

The souari or surahwa nut, called also the "butter nut of Demerara," and by fruiterers the "suwarrow nut," is the fruit of *Caryocar nuciferum*, a native of the forests of Guiana, growing 80 ft. in height. This is perhaps the finest of all the fruits called nuts. The kernel is large, soft, and even sweeter than the almond, which it somewhat resembles in taste. The few that are imported come from Demerara, and are about the size of an egg, somewhat kidney-shaped, of a rich reddish-brown colour, and covered with large rounded tubercles.

Cola, kola or goora nuts are the seeds of *Cola vera* (Sterculiaceae), a tree, native of tropical Africa, now introduced into the West Indies and South America. The nuts form an important article of commerce throughout central Africa, being used over a wide area as a kind of stimulant condiment. The nuts, of which there are numerous varieties, are found to contain a notable proportion of caffeine, as much as 2·13%, besides theobromine and other important food-constituents, to which their valuable properties are due.

Coquilla nuts, the hard inner portion ("stone") of the palm, *Attalea funifera*, the piassaba of Brazil, are highly valued for turnery purposes. They have an elongated oval form, 3 to 4 in. in length, and being intensely hard they take a fine polish, displaying a richly streaked brown colour.

Name	Source	Locality	Remarks
Betel nut	*Areca Catechu*	E. Indies	
Bladder nut	*Staphylea pinnata*	S. Europe	Necklaces.
Boomah nut	*Pycnocoma macrophylla*	Africa	Tanning.
Bonduc nut	*Caesolpinia Bonduc*	India	Medicine, beads.
Clearing nut	*Strychnos potatorum*	India	Clearing dirty water.
Coquilla nut	*Attalea funifera*	Brazil	Turnery.
Corozo nut or vegetable ivory	*Phytelephas macrocarpa*	Tropical S. America	*See* PALM.
Cumara nut (Tonka or Tonquin bean)	*Dipteryx odorata*	Tropical S. America	Perfume.
Grugru nut	*Acrocomia sclerocarpa*	S. America	Beads.
Horse chestnut	*Aesculus Hippocastanum*	S. Europe	Starch.
Marking nut	*Semecarpus Anacardium*	E. Indies	Marking ink and varnish.
"Nut" galls	*Quercus galls*	Levant	Dyeing and ink making. *See* GALLS.
Poison nut	*Strychnos Nux-Vomica*	E. Indies	Medicine. *See* NUX VOMICA.
Sassafras nut	*Nectandra Puchury*	S. America	Aromatic.
Snake nut	*Ophiocaryon paradoxum*	S. America	Curiosity.
Soap nut	*Sapindus Saponaria*	W. Indies	Washing; ornamental.



VARIOUS KINDS OF COMMERCIAL AND EDIBLE NUTS

READ FROM TOP TO BOTTOM

1. Peanut; half of shell removed exposing, left, kernel, and right, kernel enclosed in skin; two whole kernels
2. Pistachio nut; half of shell removed showing kernel; kernel removed from shell
3. Brazil nut; whole kernel
4. Walnut kernel; whole walnut; shell broken to expose part of kernel
5. Pecan kernel; whole pecan nut; shell broken showing kernel
6. Almond kernel; whole almond; shell broken showing part of kernel
7. Filbert kernel; whole filbert; part of shell removed to show kernel

The marking nut, *Semecarpus Anacardium*, is a fruit closely allied in its source and properties to the cashew nut (*q.v.*). The marking nut is a native of the East Indies, where the extremely acrid juice of the shell of the fruit in its unripe state is mixed with quicklime and used as a marking-ink. The juice when dry is the basis of a valuable caulking material and black varnish. The seeds are edible, and the source of a useful oil.

Physic nuts are the produce of the euphorbiaceous tree, *Jatropha Curcas*, whence a valuable oil, having similar purgative properties to castor oil, is obtained. The plant is a native of South America, but is found in all tropical countries.

Pine nuts are the seeds of several species of *Pinus*, eaten in the countries of their growth, and also serving to some extent as sources of oil. Of these the most important are the stone pine, *Pinus Pinea*, of Italy and the Mediterranean coasts, and the Russian stone pine, *Pinus Cembra*. *Pinus Sabiniana*, the digger pine of California; *P. edulis*, *P. monophylla*, *P. Parryana*, and *P. cembroides*, the "piñons" of the southwestern United States and northern Mexico; and also *P. Gerardiana* of the Himalayas similarly yield edible seeds. These seeds possess a pleasant, slightly resinous flavour.

Ravensara nuts, the fruit of *Ravensara aromatica* (Lauraceae), a native of Madagascar, is used as a spice under the name of the Madagascar clove nutmeg.

The Sapucaia nut is produced by a large tree, *Lecythis Ollaria*. Its specific name is taken from the large urn-shaped capsules, called "monkey-pots" by the inhabitants, which contain the nuts. The sapucaya nut has a sweet flavour, resembling the almond, and is of a rich amber-brown; not unlike the Brazil nut.

Soap nuts are the fruits of various species of *Sapindus*, especially *S. saponaria*, natives of tropical regions. They are so called because their rind or outer covering contains saponin, which lathers in water, and so is useful in washing.

NUT: For the nut in engineering, etc., *see* BOLT.

NUTATION [from Lat. *nutare*, to nod], a deviation of the celestial pole from its mean position, due to inequalities in the action of the sun and moon on the equatorial protuberance of the earth. The main part of the nutation is a motion of the pole in a circle of 9″ radius in a period of 18·6 years. *See* PRECESSION OF THE EQUINOXES.

The name is also used in reference to the phenomena of certain organs in plants which bend alternately in opposite directions. In some cases the apex of the stem will describe a spiral movement, inclining to all points of the compass in succession; this being termed *circumnutation*. *See* PLANTS.

NUTCRACKER (*Nucifraga caryocatactes*), an European bird of the crow family (*Corvidae*). The plumage is mottled and the tail feathers have conspicuous white tips. The beak is long and the flight undulating. The nutcracker feeds mainly on conifer seeds, but also takes fruits, insects and young birds. The nest is built on the bough of a tree, about 20 ft. from the ground, and is a large structure of sticks lined with grass. The eggs are of a very pale bluish-green, freckled with pale olive or ash colour. Another species (*N. columbiana*) is found in America.

The Siberian nutcracker migrates into western Europe in large flocks, at intervals of approximately 11 years. *See* also CROW.

NUT CULTURE IN THE UNITED STATES. The United States is especially rich in native nut-bearing trees, as the black walnut, butternut, chestnut, hazel and various hickories, and contains large districts in which the soil and climate are suitable for nut production. Recent experimental cultivation of numerous varieties of native as well as introduced species has yielded very promising results. As yet, however, the culture of only three kinds of nut-bearing trees has been established on a substantial commercial basis and attained rank as a horticultural industry. Of these, the pecan (*Carya Pecan*), a species of hickory (*q.v.*), is a native tree brought into extensive cultivation only since 1900, while the others, the Persian walnut (*Juglans regia*) and the almond (*Prunus Amygdalus*) are Old World trees that have been grown widely since ancient times.

Numerous varieties of the pecan are planted for commercial production in the Southern States. Hardy strains are producing successfully in Missouri, Illinois and Indiana, indicating the probable extension of pecan culture throughout the central Corn Belt (*q.v.*). In 1926, which was a maximum crop year, the total production was estimated by the U. S. Department of Agriculture at 64,046,000 lb., valued at $9,772,000. The yearly average for the four-year period 1924–27 inclusive was 33,854,500 lb., with an average annual value of $6,506,000.

The commercial production of almonds is restricted to various forms of the sweet variety (var. *dulcis*), with increasing preference for those having thinner walls in the stone, as in the paper-shell almonds. The climatically suitable districts are comparatively limited, being confined chiefly to the Pacific States. In California, which usually grows about 99% of the United States crop, the production of sweet almonds in 1926 was estimated at 16,000,000 lb., valued at $4,800,000.

The commercial production of the Old World or Persian walnut, in the United States often called English walnut, has attained its greatest development in specially selected and prepared soils under irrigation in California. However, hardy strains are grown locally with considerable success in the eastern States from Massachusetts westward and southward to Arkansas, especially in climatic situations similar to the Great Lakes region of western New York. In California, where about 98% of the American commercial crop is grown, the production of walnuts in 1927 was estimated at 84,000,000 lb., valued at $15,120,000.

NUTHATCH, a small bird, so called from its habit of hacking nuts, which it cleverly fixes in a crevice of the bark of a tree, and then hammers with the point of its bill till the shell is broken. This bird is known as *Sitta Caesia*. It is not normally found in Ireland or Scotland. Without being plentiful anywhere, it is generally distributed in localities which afford it a sufficient supply of food, consisting during the greater part of the year of insects, which it seeks on limbs of trees; but in autumn and winter it feeds on nuts, beech-mast, the stones of yew-berries and hard seeds.

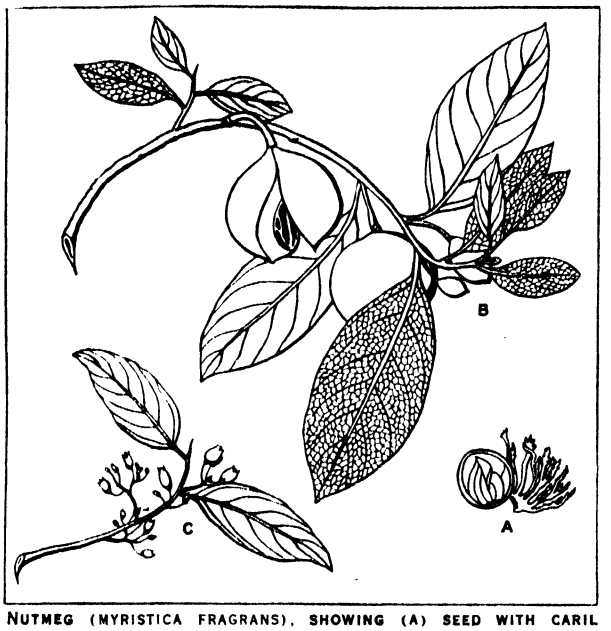
It generally makes its nest in a hollow branch, plastering up the opening with clay, leaving only a circular hole just large enough to afford entrance and exit; the interior is made of a bed of dry leaves or flakes of the inner bark of a fir, on which the eggs are laid. In the Levant another species (*S. syriaca*) haunts rocks rather than trees; and four or five arboreal species are found in North Asia. North America possesses four species; *S. canadensis* has the most northern range, while the white-bellied *S. carolinensis* inhabits more southern latitudes. Related genera, found in the Indian region, are remarkable for their beautiful blue plumage. Other genera occur in Madagascar, Australia and New Guinea. The nuthatches are placed in the passerine family *Sittidae*.

NUTKA. This people held the west coast of Vancouver island, and with the Makah of Cape Flattery form one branch of the Wakashan family, the Kwakiutl constituting the other. The speech relationship of Nutka and Kwakiutl is not close, and the two bodies must have been distinct a long time. Nutka culture is that of the North Pacific coast, with specializations, such as whale hunting, that reflect frontage on the open ocean. Their trade influence is shown by the considerable proportion of words they contributed to the composite Chinook jargon. (*See* G. M. Sproat, *Scenes of Savage Life*, 1868.)

NUTLEY, a town of Essex county, New Jersey, U.S.A., on the Passaic river, 7 m. N. of Newark, adjoining Belleville and Bloomfield. It is served by the Erie railroad and motor-coach lines. There are paper, silk, woollen mills and several other factories, but the town is primarily a suburban residential community. Pop. (1920) 9,421; 1928 local estimate 20,000.

NUTMEG, the commercial name of a spice representing the kernel of the seed of *Myristica fragrans*, a dioecious evergreen tree, about 50 to 60 ft. high, found wild in the Molucca islands and extending to New Guinea. Nutmeg and mace are mostly obtained from the Molucca islands, although the cultivation has been attempted with varying success in Singapore, Penang, Bengal, Réunion, Brazil, French Guiana and the West Indies. The trees yield fruit in eight years after sowing the seed, reach their prime in 25 years, and bear for 60 years or longer. Almost the whole surface of the Molucca islands is planted with nutmeg trees,

which thrive under the shade of the lofty *Canarium commune*. The ripe fruit is about 2 in. in diameter, of a rounded pear-shape, and when mature splits into two, exposing a crimson arillus surrounding a single seed. When the fruit is collected the pericarp is first removed; then the arillus is carefully stripped off and dried, in which state it forms the mace of commerce. The seed consists



NUTMEG (MYRISTICA FRAGRANS), SHOWING (A) SEED WITH CARIL (MACE) ROUND IT; (B) BRANCH SHOWING RIPE FRUITS, ONE OF WHICH IS SPLITTING AND SHOWS SEED INSIDE; (C) TWIG WITH FLOWERS

of a thin, hard shell, enclosing a wrinkled kernel, which, when dried, is the nutmeg.

To prepare the nutmegs for use, the seed enclosing the kernel is dried at a gentle heat in a drying-house over a smouldering fire, the seeds being turned every second or third day. When thoroughly dried the shells are broken and the nutmegs picked out and sorted, the smaller and inferior ones being reserved for the expression of the fixed oil which they contain, and which forms the so-called oil of mace.

"Oil of mace," or nutmeg butter, is a solid fatty substance of a reddish-brown colour, obtained by grinding the refuse nutmegs to a fine powder, steaming it and then compressing it while still warm. The brownish fluid which flows out being afterwards allowed to solidify. Nutmegs yield about one-fourth of their weight of this substance. It is partly dissolved by cold alcohol, the remainder being soluble in ether. The latter portion, about 10% of the weight of the nutmegs, consists chiefly of *myristin*, which is a compound of *myristic acid*, $C_{14}H_{28}O_2$, with glycerin.

The name nutmeg is also applied to other fruits or seeds in different countries. The Jamaica or calabash nutmeg is derived from *Monodora Myristica*, the Brazilian from *Cryptocarya moschata*, the Peruvian from *Laurelia sempervirens*, the Madagascar or clove nutmeg from *Agathophyllum aromaticum*, and the Californian or stinking nutmeg from *Torreya californica*.

NUTRITION. Despite the fact that life may be continued for many weeks without food and for several days without water, for the practical maintenance of life we must have a regular intake of food; nutrition must go on. Food is required for two main purposes: (1) to supply the necessary energy for the production of internal and external work and the maintenance of the body temperature and (2) to supply the necessary material to make good the wear and tear of the tissues in the adult and also, especially in the child, the material required for growth. The study of the problem of nutrition demands therefore the study of the methods by which the various foodstuffs are digested, absorbed and utilized in the body and further how the waste products formed during the various tissue activities are got rid of.

The evidence available would seem to point to the fact that the majority of mankind eat too much rather than too little. Excessive intake may prove to be, probably is, harmful. Certain experiments carried out for purely commercial purposes on the breeding of pelt-bearing animals go to show that such animals do best on a diet just slightly in excess of the bare maintenance ration. (*See* DIET AND DIETETICS.)

CHEMISTRY OF DIGESTION

The essential step which prepares the ordinary food for utilization in the body, for the change into living matter, is digestion, a process which the food undergoes under the influence of the ferments or enzymes present in the gastro-intestinal tract. By this process it is broken down into simpler substances, which can be utilized by the body tissues for conversion into protoplasm and as the supply of energy.

Enzyme Action in General.—The substances which bring about this change are known as ferments, enzymes or zymins. Formerly it was believed that there were two distinct classes of enzymes: those which were living or associated with living cells, and those which were non-living. In 1897, however, E. Buchner and M. Hahn showed that from living cells (yeast) a ferment could be obtained which acted quite as well extracellularly as when it was bound up within the cell. Subsequent work has shown that other organisms act by the enzymes they contain, so that it is now recognized that there is no essential difference between the living or organized ferment and the non-living or unorganized ferment. All ferments probably act as catalysts. Catalysis (*q.v.*) is the process by which reactions are either initiated or accelerated by the mere presence of certain substances which remain unchanged during the process. It has been shown that the action of ferments is specific; *i.e.*, the ferment only exerts its action on definite substances or substrates of definite structural arrangement. The relation of ferment to substrate has been compared to that of a key to its lock. Ferments which bring about the breakdown of proteins are without influence on fats and carbohydrates; those which decompose fats leave proteins and carbohydrates untouched, and so on.

The chemical composition of enzymes is unknown, but it would seem certain that all enzymes have not the same chemical structure. One of their most important physical properties is their colloidal nature, shown by the fact that they cannot, or only with extreme difficulty, pass through a parchment membrane.

Most of the ferments are soluble in water or saline solutions, and in glycerol and water. The ferments are found to have an optimum temperature of action. This temperature in most cases ranges from 37° to 40° C. All true ferments are thermolabile, being destroyed at about 70° C. The action of many of them is retarded when the products of their action are allowed to accumulate. Just as when a chemical reaction is set up its rate tends to decrease and finally comes to a standstill before the reaction is completed—an equilibrium being established—so the reactions set up by enzymes also tend to come to an equilibrium before the complete conversion of the original substance.

A number of the body ferments have now been shown to exist in the tissues in an inactive form. This condition is known as the proferment or zymogen state, and before any action can be exerted it must be activated, usually by some specific substance, as in the case of the activation of trypsinogen by means of enterokinase. The table on page 649 gives a list of the principal ferments concerned in the digestion and metabolism of food-stuffs.

Certain oxydases, catalases and de-aminizing enzymes are found in the tissues generally and play an important part in the various metabolic processes.

Digestion in the Mouth.—The first of the digestive secretions which food encounters is the saliva. It is produced by the three large salivary glands, the parotid, the sub-maxillary and the sub-lingual, is a colourless or slightly turbid viscous fluid with a faintly alkaline reaction and of low specific gravity, and exercises a twofold function. First, it has a mechanical action moistening the mouth and the food and thus aiding mastication and swallowing by securing the formation of a proper bolus

Material acted on	Enzyme	Where found
I. Protein	Pepsin	Gastric juice
	Trypsin	Pancreatic juice
	Erepsin	Small intestine
	Various autolytic enzymes	Tissues generally
II. Fats	Lipase	Pancreatic juice and certain tissues
III. Carbohydrates	Ptyalin (salivary diastase)	Saliva
	Pancreatic diastase	Pancreatic juice
	Maltase	Pancreatic juice
		Small intestine
	Invertase	Small intestine
	Lactase	Small intestine
	Various tissue diastases	Liver, muscle, etc.

of food; it also assists by binding the particles together, an action of special importance when the food is dry. Second, in man and in some of the lower animals the enzyme ptyalin exerts an action in digestion on part of the carbohydrates of the diet. The starches or polysaccharides are broken down, first of all to the simple dextrins and then to the still more simple disaccharide, maltose. The action of ptyalin on starches is thus very similar to that of acids, except that it stops at the formation of maltose. Ptyalin acts best at a temperature of about 40°C and in a neutral or faintly alkaline medium, its action being inhibited by the presence of even very dilute solutions of the mineral acids. If the acid be in sufficient amount the enzyme is destroyed. For this reason the action ceases in the stomach whenever the bolus is completely permeated by the gastric juice. As it takes time for the gastric juice thoroughly to permeate the food mass, which remains for a considerable period in the fundus of the stomach unmixed with the secretion, salivary digestion goes on for about half an hour after food is taken.

Gastric Digestion.—The stomach has two digestive functions: (i.) it acts as a store chamber permitting a full meal to be taken; (ii.) it acts as a digestive organ of importance in preparing the food for further attack in the intestinal canal. But the stomach cannot be regarded as an essential organ, since it has been removed in dogs and in man without apparent interference with health.

Gastric digestion is brought about by the action of the gastric juice, a clear watery, colourless and strongly acid fluid with a specific gravity of about 1003. The amount of hydrochloric acid present in the juice varies with the period of digestion. The acid exists in the stomach in two forms, as free hydrochloric acid and as combined hydrochloric acid. The amount of each depends on various factors: (i) the secretion itself; (ii.) the nature of the food; and (iii.) the rapidity with which the stomach empties itself, etc. For instance, after a protein-free meal the hydrochloric acid is for the most part free, whereas, when protein is present, it combines with it and, unless secreted in very large amount, most of the acid is in a fixed condition.

The hydrochloric acid is formed by the activities of certain gland cells in the middle region of the stomach, and the fact that it does not exist as such in the blood proves that it is formed within these cells. That the chlorine comes from the sodium chloride in the food has been shown by the fact that, when the tissues are deprived of this salt, and sodium bromide is given, hydrobromic acid may appear in the gastric secretion.

The hydrochloric acid is essential for the action of the gastric enzyme, pepsin, in splitting up the protein of the food. In addition to this, the acid has a slight action in splitting polysaccharides and disaccharides. Lastly, it acts as a bactericidal agent, preventing bacterial decomposition from taking place, and it may thus prevent certain noxious bacteria, taken in in the food, from gaining access to the intestinal tract, where there is a chance of their flourishing in the rich alkaline medium.

The quantity of juice secreted varies with the nature of the food consumed. Each separate food seems to give rise to a definite hourly secretion of the juice and to a characteristic alteration in its properties.

The principal ferment found in the gastric juice is pepsin, which acts only in the presence of a mineral acid. The action proceeds best at a temperature of about 37°C in an acid medium of 0·2% to 0·3%. Pepsin is elaborated in the so-called chief cells of the gastric glands as an inert precursor—propepsin. It is only when it comes into contact with the acid of the juice that it is activated into attacking the protein of the food.

As already mentioned, the main function of the gastric juice is to deal with the protein moiety of the food and to prepare it for further digestion in the intestine. The first result of the action of this secretion on protein matter is to render it soluble—a metaprotein or acid albumin being formed. This body may be regarded mainly as the product of the action of the hydrochloric acid independently of the pepsin.

The following steps of decomposition are the result of the action of pepsin. From the metaprotein primary and secondary proteoses are formed, and from these peptones are finally produced. The result of this process of digestion or hydrolysis induced by the pepsin is that complex insoluble protein substances of high molecular weight are converted into simpler soluble protein bodies of comparatively low molecular weight. The contents of the stomach—products of protein digestion—are passed on into the duodenum, chiefly as proteoses and peptones.

In addition to pepsin some workers hold that another enzyme is present in the gastric juice. This is the ferment rennet, rennin or chymosin, the sole action of which, so far as is known at present, is to bring about the curdling of milk, the curd formed being subsequently dealt with in the ordinary way by the pepsin. Clotting of milk under the action of rennin occurs at a suitable temperature with great rapidity. This process is said to take place in two stages: (1) the rennin converts the caseinogen of the milk into soluble casein, and (2) this soluble casein unites with the lime salts present in the milk and forms the curd or precipitate. That lime salts are absolutely essential for this process of clotting has been shown by the fact that, if they are removed by precipitation as by oxalates, no clotting will take place even after the addition of a large amount of active rennin. Immediate clotting takes place, however, when the necessary lime salts are restored.

The speed with which the stomach empties itself depends to a great extent on the nature of the food. Plain water leaves the stomach almost at once, salt and sugar solutions at a somewhat slower rate. On a mixed diet, emptying of the stomach in man proceeds very slowly, requiring about four hours. Cannon, by feeding with food impregnated with bismuth and using X-rays, showed that carbohydrates leave most rapidly, then mixtures of carbohydrates and proteins, then proteins, then fats and finally mixtures of fats and proteins. The diet which remains longest in the stomach is a mixture of fats and proteins—rich food, as it is popularly called. Here two factors enter to prevent rapid emptying: (1) the presence of much fat, and (2) the acid secretion engendered by the abundant protein.

There is no doubt that fats present in fine emulsion can be decomposed in the stomach. The action proceeds in a medium which is slightly acid or neutral, being entirely prevented by the presence of strong acids and alkalis. Many workers believe this gastrolipase to be of pancreatic or intestinal origin, and suppose that it gains entrance to the stomach by a reflux flow through the pylorus.

No specific enzyme for carbohydrates has been found in the stomach in man. Certainly a small amount of polysaccharide decomposition takes place, but this is dependent (1) on the ptyalin which comes from the mouth, and (2) on a certain amount of hydrolysis due to the action of the free hydrochloric acid.

Digestion in the Intestine.—The food so far digested in the stomach is known as chyme, and it is passed on to undergo intestinal digestion under the influence of (1) the enzymes of the pancreas, and (2) of other enzymes present in the different secretions of the intestine.

Pancreatic Digestion. The pancreatic juice is the secretion from the pancreas and is discharged into the duodenum. It is a clear, usually thin fluid with a specific gravity of about 1008, and with an alkaline reaction. The most important inorganic constit-

uent is sodium carbonate, which gives the alkaline reaction. This alkaline salt, along with that contained in the intestinal juice, plays an important part in neutralizing the acid chyme.

In the pancreatic secretion there are at least three important enzymes, each with a definite action: (*a*) trypsin, the proteolytic enzyme which brings about the further breakdown of the food proteins; (*b*) a diastase which deals with the carbohydrates, and (*c*) a lipase which acts on the fats.

(*a*) *Trypsin.* This ferment, in the form in which it is secreted—trypsinogen—is inert. Before it can exert its hydrolytic action it must be activated. This activation is brought about by another enzyme found in the intestinal tract—enterokinase. The conversion is brought about as soon as the trypsinogen comes into contact with the enterokinase, the merest trace of which suffices to activate a large amount of trypsinogen.

Trypsin acts on the protein just as pepsin does, by bringing about hydrolytic changes. It differs from the latter in acting best in an alkaline or neutral medium. Its effect is much more energetic than that of pepsin, so that the protein molecule is more completely decomposed.

The character and properties of the products formed in such digestion depend on the nature of the protein acted upon. As will be seen from the following table, proteins vary fairly widely in the proportion of amino acids which they contain.

Approximate Amino-Acid Percentage Composition of Several Proteins

	Gliadin (wheat)	Gelatin	Caseinogen (milk)	Albumin (milk)	Fish muscle (protein)	Ox muscle (protein)
Glycine	0·0	25·5	0·45	0·37	0·00	2·06
Alanine	2·0	8·7	1·85	2·41	+?	3·72
Valine	3·34	0·0	7·93	3·30	0·79	0·81
Leucine	6·62	7·1	9·7	14·03	10·33	11·65
Phenylalanine	2·35	1·4	3·88	1·25	3·04	3·15
Tyrosine	3·04	0·0	5·36	1·95	2·39	2·20
Serine	0·20	0·4	0·5	1·76	(?)	(?)
Cystine	2·40	0·16	0·25	4·1	..	..
Proline	13·22	9·5	8·7	3·76	3·17	5·82
Hydroxyproline	?	14·1	0·23	0·0	..	..
Aspartic acid	0·58	3·4	4·1	9·30	2·73	4·51
Glutamic acid	43·66	5·8	21·77	12·89	10·13	15·49
Hydroxyglutamic acid 0	2·40	..	10·5	10·00	..	..
Tryptphan	1·10	0·0	1·6	2·40	Present	Present
Arginine	3·2	8·22	3·81	3·47	6·34	7·47
Lysine	0·63	5·02	8·38	9·87	7·45	7·59
Histidine	1·49	2·94	2·5	2·61	2·55	1·76
Ammonia	5·22	0·49	1·61	1·31	1·33	1·07

(*b*) *Diastase.* This ferment is found in the pancreatic juice apparently secreted in an active form, although some observers hold that it also is secreted in a zymogen form. It is practically identical in its action with the ptyalin of the saliva, converting starch into maltose. It deals with all the starchy food which has escaped conversion into the simple sugars by the ptyalin.

(*c*) *Lipase.* Most of this ferment, if not all, is apparently secreted in the form of a zymogen. There is evidence that the bile salts are the activating agent here, just as the enterokinase acts in the case of trypsin. Lipase can act in any medium acid, neutral or alkaline, and both on emulsified and non-emulsified fats. It converts the fats by a process of hydrolysis into fatty acids and glycerol. It has been found that not only can this enzyme break up fats into their components, but that it also has the power to act in the reverse direction, and in this way bring about the union of fatty acids and glycerol so as to form fats, a process which occurs in the intestinal epithelial cells after absorption.

2 *Intestinal Digestion.* By this is meant the other digestive processes which go on in the intestine under the action of the secretion of Lieberkühn's follicles—the *succus entericus.* This is a yellowish, often opalescent, strongly alkaline fluid. The alkalinity is due to the presence of sodium carbonate. Most of the ferments are found in very small amount in the intestinal juice. They seem to be present actually within the epithelial cells lining the intestine, for extracts made from the intestinal mucous membrane are richer in ferments than the secretion.

The intestinal secretion contains no trace of a ferment acting on native protein, but a ferment—erepsin—is present in fair amount in the intestinal mucous membrane and in small amount in the secretion, which acts in an alkaline medium on proteoses, peptones, and on casein, converting them into amino acids. A lipase has also been detected which is very similar to pancreatic lipase; it, however, attacks only emulsified fats.

Several carbohydrate hydrolysing enzymes have been described in the small intestine. Invertase, the ferment which splits cane-sugar, is present in small amount in the secretion, more abundantly in the extract of mucous membrane. In all probability it deals with the saccharose after or in process of absorption. Maltase is also present in large amount, and here again in greater amount in the extract than in the secretion. The question of the presence of lactase has been much discussed, and it seems probable that suckling animals do possess this enzyme.

Bile.—This fluid, in all probability, has little direct action in ordinary digestion, although it contains substances which act indirectly. The bile salts act as solvents for fats and fatty acids, and as activators of pancreatic lipase. The salts also serve to keep cholesterol in solution. Bile is to be looked upon rather as an excretion, the result of the hepatic metabolism, than as a digestive juice. It has an orange-brown colour, but the colour varies according to the pigment present. It is more or less viscous (not so viscous as bile taken from the gall bladder) and has a specific gravity of about 1010. It has a slightly alkaline reaction, a bitter taste and a characteristic smell. On analysis it is found to have over 2% of solids, of which more than half are organic. It contains in addition to a nucleo-albumin, derived mainly from the bile passages and gall bladder, bile acids, bile pigments, cholesterol, lecithine, etc. The most abundant solids are the salts of the bile acids, of which in man the most important is sodium glycocholate, sodium taurocholate being present in small amount. The bile acids are formed in the liver cells, and when the duct is ligatured they tend to accumulate in the blood.

The pigments amount to only about 0·2%. In human bile the chief pigment is bilirubin, whilst in herbivores biliverdin is more abundant. They are derived from the haemoglobin of the blood, but the pigments are iron-free. They may be regarded as purely excretory products arising from the breakdown of the haemoglobin of effete blood corpuscles.

Cholesterol is a monatomic alcohol, and is probably a waste product. Fats and lecithine are both derived from the liver cells. Of the inorganic constituents calcium phosphate is the most abundant.

The secretion of bile is practically continuous, but it seems to enter the duodenum intermittently. The taking of food increases the flow of bile. The entry of the acid chyme into the duodenum is the stimulus which brings about the ejection of the bile.

Faeces.—The bulk of the waste matter arising from the foods along with the secretions from the alimentary canal form the faeces. On a diet giving little residue the faeces are almost purely intestinal in origin. As a channel of excretion of nitrogenous metabolic waste products they are not very important, although they do play a certain part. The nature of the excreted nitrogenous substances has not been fully examined. It is, however, very difficult to come to any definite conclusion as to what is unabsorbed material and what excreted.

ABSORPTION

Stomach.—No absorption of food-stuffs takes place in the mouth. Absorption from the stomach occurs only to a small extent. Water passes rapidly through the stomach and is practically unabsorbed. Salts are apparently absorbed in a limited amount from their watery solution, the extent of absorption depending to some extent on the concentration of the solution. Sugar is also absorbed to a small extent from its solutions. Alcohol is readily absorbed from the stomach. A small amount of the products of protein digestion may be absorbed. There is no evidence that fats are absorbed under any conditions.

Intestine.—The greatest absorption of the foods takes place in the intestines, especially in the small intestine. It has been shown that practically all the protein digest products have disappeared before the lower end of the small intestine is reached. There are two channels for the removal of the material from the intestine: (1) the blood capillaries spread in the villi, and (2) the lacteals also present in the villi. The foods may reach the blood direct or through the various lymph channels into the thoracic duct and finally into the blood. The lacteals of the villi are channels for the absorption of the fatty parts of the food. The products of the digestion of the proteins and carbohydrates reach the body directly through the capillaries via the portal system. Whether the nervous system plays any part in absorption is not yet determined.

Carbohydrates. These reach the body, as already mentioned, by way of the blood, and in the form of monosaccharides or simple sugars. It has been shown that if lactose be put into a lactase-free intestine, no absorption takes place, the lactose gradually disappearing under bacterial action, whereas when the ferment lactase is present, glucose and galactose, the products of its splitting, are absorbed as readily as cane-sugar and maltose. The body deals with its carbohydrate supply in the form of monosaccharides as if solutions of various sugars, mono- and disaccharides be injected, it is found that the simple sugars are retained, whereas the double sugars are excreted in the urine. The only disaccharide which can be dealt with in the body is maltose, as there is a maltase present in the blood which splits it. Carbohydrates which are not absorbed from the intestine are disposed of by bacterial action.

Fats. Fats are absorbed from the intestine in the form of fatty acids and glycerol, *i.e.*, in the form in which they exist after the action of the lipase. That a resynthesis takes place in the epithelium is shown by the fact that as fat absorption goes on fat droplets are seen to grow in the protoplasm away from the free margin of the cells. As already mentioned, the fat is removed by the lacteals from the cells to the thoracic duct, and then to the general circulation. A small amount of the fat may pass into the body via the blood, but this is practically all retained by the liver. The amount of fat absorbed depends largely on the nature of the fat, especially with reference to its melting-point, fats of low melting-point being most readily taken up.

Protein. It is unquestionable in the light of modern work that the great bulk of the digested protein is absorbed from the intestine via the portal blood stream in the form of amino acids. The work of Abel with his vivi-diffusion apparatus demonstrated very clearly that amino acids circulated in the blood and the work of Folin and van Slyke demonstrated that the amino acids were taken up by the various tissues.

In the large intestine, little absorption of nutrient matter takes place under normal conditions, mainly of course because most of the absorbable material is removed whilst the food is in the small intestine. The principal substance absorbed here is water; and thus the excreta become firm and formed.

METABOLISM

Within the living protoplasmic mass of the tissue-cells activity is ceaseless. The whole series of changes has been given the name of metabolism and within this title are recognized the two phases of building up, *anabolism*, and of breaking down, *catabolism*. There is a constant interplay between these two phases, sometimes rapid, sometimes slow, with a straining towards an equilibrium which is never reached whilst life goes on. When this metabolism is analysed further it is customary to divide it into two parts, the metabolism of energy and the metabolism of matter or material. But it must be made clear that within the living cell metabolism is one and indivisible. Further, although for descriptive purposes it is necessary to discuss the metabolism of the different proximate principles, *e.g.*, protein, carbohydrate, etc., individually the fact must be appreciated that the living protoplasmic mass which forms the content of the cell is not a mere conglomerate of protein, carbohydrate, fat, salts and water, where each constituent may be envisaged as a separate entity. Protoplasm, on the contrary, is a complex colloid—an intimate compound of its various constituents. No constituent can be metabolized without influencing the metabolism of the others.

Protein.—After absorption the amino acids are taken up by the cells of the various tissues and would seem for the most part to undergo sooner or later a disintegrative change, deaminization, in which the amino group (NH_2), is broken off. It is commonly believed that the freed amino group is converted into ammonia (NH_3), which of course does not remain in the free state but becomes neutralized mainly by carbon dioxide to form ammonium carbonate. This ammonium carbonate in its turn is conveyed eventually to the liver, where it is finally transformed into urea and eventually excreted in the urine as a waste product. The nitrogen-free remainder is utilized for energy purposes either directly or indirectly. The work of Lusk and others has shown that under certain circumstances about 58% of the protein molecule can be converted into sugar. Such would seem to be the history of the fate of the bulk of the protein ingested. Of course a certain amount of the ingested material is not broken down in the way above described but is utilized intact by the organism as building material for the repair of tissue waste and for the formation of new tissue as in growth. Despite the variation in composition of the ingested proteins of a mixed diet the fact that all in the course of digestion are reduced to their simple amino-acid components serves a useful purpose in that it permits the various tissues, which have, of course, varying needs, to exercise a selective action over what they will retain and what reject. It is the composition of the tissues which determines the type of retention.

Evidence of the importance of the chemical composition of the protein fed has been had from another aspect which has shown definitely that the organism must receive certain, probably the majority, of its amino acids in the preformed state. Feeding experiments on young growing animals have been carried out where the protein fed was abnormal in that certain amino acids were completely absent. One of the proteins used was zein (from maize), which lacks the amino acids tryptophan and lysine. When young animals were fed on a well selected diet with zein as the sole protein they rapidly went downhill and died. When to the diet as before the appropriate amount of tryptophan was added to make good the deficiency in this amino acid, the animals remained alive but did not grow; when as a further addition lysine was added the animals not merely lived but grew.

Carbohydrate.—Carbohydrate may be regarded as the foodstuff which most readily gives up its energy in the organism. The tendency of modern work is to accept carbohydrate as *the* fuel. After absorption into the blood stream any excess above immediate requirements would seem to be deposited in the liver and muscles in the form of animal starch or glycogen as a readily available form of reserve. If there is a persistent overingestion the excess carbohydrate would seem to be converted into fat and thus there is built up a more permanent reserve of energy. Finally if the organism is suddenly flooded with sugar as the result of the ingestion of excessive amounts, much of the sugar is excreted as such in the urine—alimentary glycosuria. Normally the sugar is completely burnt in the organism to form carbon dioxide and water. The complete utilization of the sugar is intimately related to a special secretion of the pancreas to which the name of insulin has been given by its discoverers, Banting, Best, Macleod and Collip. When there is a disturbance of this insulin formation as in the disease known as diabetes, sugar is excreted as such in the urine, the body having lost the power to utilize it. Just how insulin acts is unknown. There is very good reason also, due primarily to the interesting work of Harden and Young on fermentation, to believe, certainly as regards muscle, that before the carbohydrate can be broken down it first enters into combination with phosphorus to form a hexose diphosphate.

Fat.—Fat is not apparently readily metabolized in the body, but it is not probably so stable as one might deduce from the apparent readiness with which it is deposited. It is undoubtedly, so to speak, invested capital, whereas carbohydrate may be looked upon as capital in current account or at most on deposit receipt. When combustion is carried out normally it is complete, the end

products being carbon dioxide and water. For this complete combustion it is essential that a certain amount of carbohydrate be present as is evidenced by the fact that when carbohydrate is withheld from the diet or when it is not available as in diabetes a condition known as acidosis ensues. In acidosis the combustion of fat ceases before combustion is complete, with the result that there is formed in the body and excreted in the urine β-hydroxybutyric acid, aceto-acetic acid and acetone. These substances can be caused to disappear from the urine if a supply of carbohydrate is made available. It would seem that there are two chemical actions involved in the breakdown of the long fatty acid chain, a special process of oxidation known as β-oxidation, associated with desaturation which renders the chain unstable. Although the evidence for the conversion of carbohydrate to fat is plain, there is still lacking indubitable evidence of the conversion of fat to carbohydrate, although many workers accept the idea.

Salts.—Although the mineral salts do not directly contribute to the supply of energy to the body and although generally speaking, they themselves undergo no metabolic change in the body they play a very important part in the various tissue activities. Unless the salts be present in proper amount and in proper proportion, metabolism is impossible. The principal mineral elements found in the body are sodium, potassium, calcium, magnesium, iron, phosphorus, sulphur, chlorine and iodine, with in addition traces of many other elements. Of course these various elements do not exist in the tissues in their free state but as compounds which, in the majority of instances, would seem to be inorganic. As all these substances are continually being lost from the body in the various excretions, it is essential that a sufficient supply be always available in the food. These mineral constituents play the main rôle in the maintenance of the faintly alkaline reaction of the various tissue fluids. As the result of the different metabolic processes which take place in the tissues there is a constant production of acid, chiefly from sulphur and phosphorus, which requires to be neutralized by basic elements like sodium and potassium and probably also calcium and magnesium. The kidney for the most part regulates in a very selective fashion the output of these various inorganic constituents. It must not be imagined, however, that the body can completely protect itself from excessive salt loss, a loss so great that it may give rise to symptoms of a serious character. Thus it has been shown that men who are, in the course of their work, exposed to high environmental temperatures with consequently much sweating, are very liable to a form of cramp. Further it has been noted that the cramp is frequently exacerbated where the men drink freely of water to allay their thirst. Recently it has been found that the condition is due to an excessive loss of sodium chloride from the body carried away in the sweat and that the condition may be cured or prevented by giving the men saline fluid to drink.

Although five-sixths of the total mineral matter of the body is found in bone and in spite of the fact that bone has all the appearance of being firm and resistant the evidence available goes to show that the bony structures must be regarded as active storehouses of mineral matter. When the need arises the body as a whole can draw upon the bones for constituents like lime and phosphates. Under certain conditions the bones indeed may give up so much of their mineral matter that they become soft and can no longer function as an effective frame work.

The other one-sixth of the mineral constituents found in the body are not distributed uniformly throughout the remainder of the tissues. As regards this varying distribution of salts in the tissues and the blood Macallum, in his study of palaeochemistry, produced some most interesting evidence in favour of his view that the present composition of the blood plasma, in so far as its inorganic constituents are concerned, is probably identical with that of the sea water just before the Cambrian period and that the salt concentration in protoplasm represents conceivably the salt concentration of the primaeval ocean in which life first appeared. At any rate the curious ratio of potassium and calcium to sodium, which is characteristic of protoplasm, is reflected in the salt relationship in water drawn from pre-Cambrian formations.

The mineral constituents play an important part without doubt in digestion in that acid must be secreted for gastric digestion and alkali for intestinal digestion.

Water.—In so far as water forms about 60% of the bodyweight of man it is very obvious that the part it plays in metabolism must be an important one. It is indeed true that the whole series of chemical actions which are so intimately related to the life of the living organism, be it animal or vegetable, are ultimately referable to changes which take place in solution. It has been conclusively shown that the younger the animal the richer it is in water. It has also been found that the fatter the animal the smaller the percentage amount of water present.

So far as is known water undergoes no change in the body, but nevertheless all the water present in the organism does not come from some source external to the body but is in part formed in the tissues during the metabolism of the various foodstuffs and of the tissues themselves. According to one calculation this internal source of supply accounts for about 16% of the water excreted. It has been also maintained that this intracellularly formed water is of greater value to the living structure than the imbibed water as it presumably does not bring about drastic osmotic changes. It is impossible, however, with the information now available to decide whether the metabolic water in the cell differs in any way from the water received from external sources.

It is of interest to note that animals which live in arid regions, in contradistinction to those which live where water is abundant, excrete as their main nitrogenous waste product uric acid which is voided with the minimum waste of water instead of urea, which has to be excreted in solution.

Methods of Investigation.—Brief reference may here be made to the methods employed in investigating metabolism. No matter the line of attack selected, the investigator is handicapped by the fact that he can only deal with the end products of metabolic activity.

If the extent and degree of metabolic activity of a subject have to be determined we may do so by direct calorimetry. The subject is enclosed in a special chamber or calorimeter so devised that all the heat given off by the subject can be directly collected and measured (fig. 1). These calorimeters, which we owe mainly to the ingenuity and skill of Atwater, Rosa and Benedict, are very delicate and costly pieces of apparatus. In order that there be no escape of the body heat to the environment, the double copper walls of the chamber are fitted up with elaborate electrical equipment which permits of so delicate a balance that heat can neither pass out nor into the chamber. In order to measure the heat given off by the subject, a current of cold water is circulated within the box in continuous piping. If the temperature of the incoming and outgoing water is carefully measured and if the

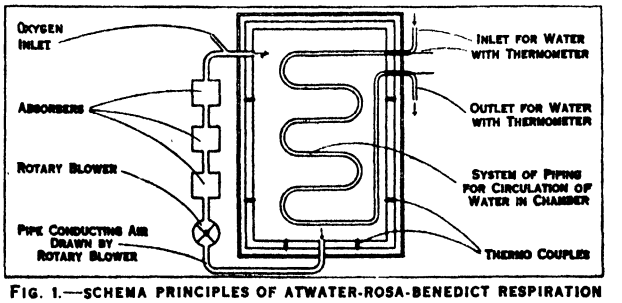
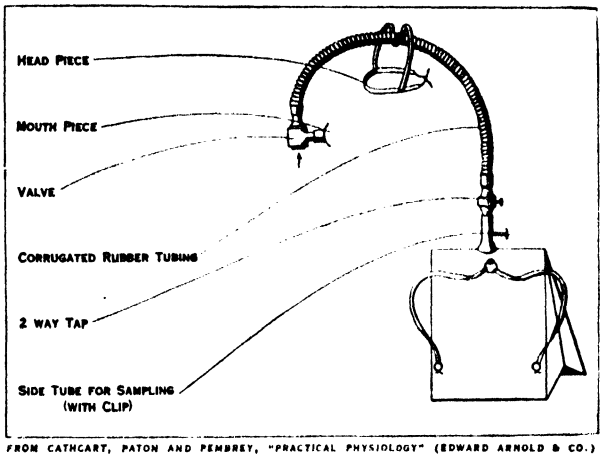


FIG. 1.—SCHEMA PRINCIPLES OF ATWATER-ROSA-BENEDICT RESPIRATION CALORIMETER

quantity of water passing through be also known the heat lost by radiation and conduction by the subject in a given time can be determined. As part of the heat lost, amounting to about one-fourth of the whole, is eliminated by the subject in the form of water vapour this must be and is also determined by absorbing the water lost in sulphuric acid and subsequent weighing of the acid container. This method of direct calorimetry is very accurate and reliable, but the method is difficult and the apparatus is very liable to get out of order. In addition to this direct measurement of the heat output, the metabolic activity of the subject

can be calculated from a determination of the amount of carbon dioxide given off and the amount of oxygen utilized by the subject in a given period. This method of Indirect Calorimetry can be carried out simultaneously with the direct method and serve as a check upon it. The calorimeter chamber in which the subject is enclosed is gas-tight and the air is circulated through a gas-tight absorbing system (fig. 1) by means of a rotary blower. The



FROM CATHCART, PATON AND PEMBREY, "PRACTICAL PHYSIOLOGY" (EDWARD ARNOLD & CO.)

FIG. 2.—INDIRECT CALORIMETRY: DOUGLAS BAG

carbon dioxide given off is absorbed by means of soda lime, the amount absorbed being determined by weighing the soda lime container at the beginning and the end of the experiment. The carbon dioxide free air is returned to the chamber after the deficiency in oxygen, which is approximately determined by reduction in volume, has been made good from a cylinder of pure oxygen. The amount of oxygen used during the experiment is determined either by measuring by a meter the amount of oxygen passed in or by weighing the cylinder before and after the experiment. The heat lost by the subject can be determined from the amount of oxygen used. The caloric value of a litre of oxygen used in the tissue combustion has been determined. This value varies with the carbon dioxide–oxygen ratio, called also the respiratory quotient (R.Q.), from 4·795 calories with an R.Q. of ·713 which is held to represent the combustion of fat alone to 5·058 calories with an R.Q. of 1·00, which is accepted as representing the combustion of pure carbohydrate by the tissues. The two methods of direct and indirect calorimetry have been found to give almost identical results.

It is obvious that the use of the chamber would act as a great handicap if the determination of energy expenditure were confined to it. To enable measurement of energy expenditure of subjects engaged in actual work a portable apparatus was first devised by Zuntz and later much simplified by Douglas (fig. 2). In this last form the subject wearing either a mask or special mouthpiece, with nose clip, fitted with two one-way valves breathes into a gas-tight bag carried on his back. The air collected in the bag at the end of the experiment is measured by passage through a meter, a sample of the expired air is analyzed in the Haldane gas analysis apparatus and the amount of carbon dioxide and oxygen present is determined. As the composition of the atmospheric air is known it is readily calculated how much carbon dioxide the subject excreted and how much oxygen is utilized in a given time and the caloric values can be determined as above. In order to relate the carbon dioxide output and oxygen utilization to the non-protein moiety of the food the protein metabolized during the period of the experiment is determined from the nitrogen output in the urine. For every gram of urinary nitrogen derived from protein 8·45g. of oxygen are required and 9·35g. of carbon dioxide are given off. Hence to determine the non-protein utilization the appropriate amounts of carbon dioxide and oxygen are deducted from the total amounts. As the amount of nitrogen excreted during the period of examination is minute, in practice it is usually ignored.

When the alterations of the gaseous metabolism are considered they are commonly referred to variations from the so-called Basal or Standard Metabolism. The basal metabolism may be defined as that of a subject lying comfortably at rest in a warm bed and in the post-absorptive condition, *i.e.*, about 12 to 15 hours after the last meal. With the subject in such a condition the metabolism reaches its lowest level. As it has been estimated that functional activities of the various organs may account for about 25% of the resting metabolism (thus the activity of the heart for about 3·6%, respiratory movements for about 10% and the kidney for about 5%) Krogh maintains that it is better to call this resting metabolism standard rather than basal. It, of course, could only be truly basal if all functional activities were in abeyance at the time of the determination.

It is obvious, in view of the fact that humanity is of varying sex and size, that if a universally applicable standard is to be obtained there must be some fundamental unit on which to base assessments. It has been shown that body-weight is not satisfactory. The modern unit selected is the surface-area of the body. A very useful formula for the determination of this area based on height × weight × a constant has been worked out by E. F. and D. Du Bois. As the result of their work it is common practice now to take as the fundamental unit the calorie output per square metre surface area.

This basal metabolism is shown to be high in childhood and that as adolescence is reached it falls to a level which is more or less uniformly maintained until about the age of fifty. Thereafter the decline is steady although small. The basal metabolism is also influenced by the sex of the subject, the nature of the food consumed, and environmental conditions like temperature, climate, etc. The most potent factor is, however, muscular work.

FACTORS WHICH INFLUENCE NORMAL METABOLISM

Fasting.—During fasting the body draws upon its own reserve of stored material for its requirements in the production of energy, and the rate of breakdown varies with the energy requirements. An individual kept warm in bed, therefore, stands fasting longer than one who is compelled to take exercise in a cold place. The breakdown of tissue during the early days of a fast is much greater than later, for as the fast progresses the body becomes more economical in its utilization of tissue. During a fast the tissues do not waste at an equal rate; those which are not essential are utilized at a much greater rate than those which are essential to the maintenance of the organism. For instance, it has been shown that during a fast the skeletal muscles may lose over 40% of their weight, whereas an essential organ like the heart loses only some 3%.

The essential tissues obtain their nourishment from the less essential by ferment action, a process which has been termed autodigestion or autolysis. The autolytic products of tissue digestion are practically identical with those which arise during the ordinary gastro-intestinal digestion.

Muscular Work.—The muscular tissue plays the most important part in general metabolism. Not only is muscle the most abundant tissue present, but it is constantly active and is the great energy-liberating machine of the body. Formerly it was believed on the authority of Liebig that muscular work was done at the expense of the protein material, but it has been conclusively shown that the real source of energy in moderate work is the non-protein material, carbohydrates and fats; of these the former plays the greater part in a man on ordinary diet. That there is some influence on protein is shown by the fact that there is a definite but small increase in the output of nitrogen in the urine as the result of muscular work, but it is in no sense proportionate to the work done; whereas the output of carbon dioxide produced by the combustion of the carbohydrates and of the fats is increased proportionately to the work done.

Internal Secretions.—Evidence is accumulating to show that the activities of the various tissues of the body are presided over and controlled not merely by the action of the nervous system but also by certain chemical substances elaborated in special glands known as endocrine glands or glands of internal secretion. The

active secretions of these glands are poured out into the blood stream. We have direct evidence that some of these secretions like thyroxin from the thyroid gland and insulin from the pancreas exercise a very active influence on metabolism. As regards the other secretions we know more about their action on various tissues than of their direct influence on metabolism.

EXCRETION

While we know comparatively little of the intermediate stages in the breakdown of the food constituents, and more particularly of the protein moiety, our knowledge of the final products of the metabolic changes excreted is fairly full. The urine is the main channel of excretion for the nitrogenous waste products. Water is excreted by the lungs, the kidneys and the skin.

The urine is a yellowish fluid which varies greatly in its depth of colour, from pale amber to a deep brown. It has a specific gravity of about 1020, varying with the percentage of solids in solution, and it usually has an acid reaction. Among the principal organic substances present are urea, ammonia, purins (uric acid and the so-called purin bases, xanthin, etc.), creatinine, conjugated sulphates, various aromatic bodies and many other substances in small amount, together with the water and inorganic salts.

The following table from Folin gives a good idea of the average composition of the urine as regards the nitrogen-containing constituents, and its variation according to the nature of the diet when this is free of creatin, creatinine and the precursors of the purins:—

	Nitrogen-rich diet	Nitrogen-poor diet
Total nitrogen	14·8–18·2g. per day	4·8–8·0g. per day
Urea nitrogen	86·3–89·4% of total	62·0–80·4% of total
Ammonia nitrogen	3·3–5·1% „ „	4·2–11·7% „ „
Creatinine nitrogen	3·2–4·5% „ „	5·5–11·1% „ „
Uric acid nitrogen	0·5–1·0% „ „	1·2–2·4% „ „
Undetermined nitrogen	2·7–5·3% „ „	4·8–14·6% „ „

Urea, which forms the chief nitrogenous constituent, amounting on an ordinary diet to about 30g. per diem, is for the most part formed in the liver, from ammonia obtained either directly from the blood after absorption from the intestine, or resulting from the deaminization of the amino acids. There is at present a controversy as to the true chemical nature of this substance.

Ammonia is present in the form of ammonium salts, and forms about 4% of the total urinary nitrogen. It may exceed this amount under certain conditions, for the most part pathological. The ammonia is utilized by the body to neutralize acids which arise during the various metabolic processes.

Purins (uric acid, xanthin, hypoxanthin, etc.) are all members of a series which have as their common nucleus a body which E. Fischer called purin. The most important member of this series is uric acid. It forms about 2% of the total urinary nitrogen. Recent work has shown that it has two quite definite sources of origin: (1) from ingested food containing the precursors, and (2) from the tissue metabolism. The first is known as the exogenous source, and the second as the endogenous. This acid is chemically known as trioxy-purin, and may be regarded as the union of two urea molecules with a three-carbon chain fatty acid. All the uric acid formed in the body is not excreted as such, part being, as already mentioned, converted into urea. The amount which is converted into urea varies with the species of animal. The other chief purin bodies present in urine are xanthin and hypoxanthin, purins less oxidized than uric acid; the first is a dioxy-purin, and the second is a monoxypurin. The main source of total purin supply would seem to be muscle metabolism. The mother substances from which all are derived in the body are the nucleo proteins. These complex bodies are apparently first broken down by enzyme action to aminopurins. These in their turn have their amino groups split off, and then, according to the degree of oxidation, the different purin bodies are formed.

Creatinine. The physiological significance of this substance is as yet unknown. The daily excretion varies little with the character of the diet, provided, of course, that the diet be creatinine-free. It would seem to be derived from the creatine of muscle, a substance which is very readily changed into creatinine outside the body. Whatever its source, after urea and ammonia it is one of the important nitrogenous substances excreted.

The *sulphur* excreted in the urine comes chiefly from the sulphur of the protein molecule. It is excreted in various forms: (1) as the ordinary preformed sulphates, *i.e.*, sulphur in the form of sulphuric acid combined with the ordinary bases; (2) as ethereal sulphates, *i.e.*, in combination with various aromatic substances like phenol, indol, etc.; (3) in the form of so-called neutral sulphur in such substances as cystin, which are intermediate products in the complete oxidation of sulphur.

Phosphorus appears linked to the alkalis and alkaline earths as phosphoric acid. A very small part of the phosphoric acid may be eliminated in organic combination such as the glycero-phosphates, etc.

Sodium (mostly as sodium chloride), potassium, calcium and magnesium are the common bases present in the urine.

The lungs are *the* important channel of excretion for the waste product of carbon metabolism, carbon dioxide or CO_2 (*see* RESPIRATORY SYSTEM); and also a very important channel for the excretion of water. As regards the skin, the sweat carries off a large amount of the water. It has been estimated that about 900c.c. is excreted per diem under normal resting conditions, rising to 7,000c.c. and over when hard work is done. Sweat contains salts, chiefly sodium chloride, and organic waste products. Of the organic solids excreted from this source urea forms the most important under normal conditions. Under pathological conditions, especially when there is interference with free renal action, the amount of nitrogenous waste excreted may become important.

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NUTTING, MARY ADELAIDE (1858–), American nurse educator, was born at Waterloo, Quebec, Canada, on Nov. 1, 1858. Educated in private schools, she became a member of the first class in the Johns Hopkins hospital school of nursing, Baltimore, of which school she was principal from 1894 to 1907, when she was given the chair of institutional administration at Teachers' college, Columbia university, New York. There in 1910 the first university department for the education of nurses was created and she was assigned to the chair of nursing and health. During the World War she was appointed by President Wilson chairman of the committee on nursing under the National Defence Council. In 1920 the "Adelaide Nutting Historical Collection," showing the progress in America and other countries of the profession she had helped to develop, was established in her honour at Teachers' college. She retired in 1925. With Lavinia Dock she wrote *A History of Nursing* and she was also the author of *A Sound Economic Basis for Schools of Nursing*.

NUX VOMICA, a poisonous drug, consisting of the seed of *Strychnos Nux-Vomica*, a tree (Fam. *Loganiaceae*) indigenous to most parts of India, and found also in Burma, Siam, Cochin China and northern Australia. The tree is of moderate size, with a short, thick, often crooked stem and ovate entire leaves, marked with three to five veins radiating from the base of the leaf. The flowers are small, greenish-white, tubular and arranged in terminal corymbs. The fruit is the size of a small orange, and has a thin hard shell, enclosing a bitter, gelatinous white pulp, in which from one to five seeds are vertically embedded. The seed is disc-shaped, about 1in. in diameter, and ¼in. thick, slightly depressed towards the centre, and in some varieties furnished with an acute keel-like ridge at the margin. Externally, it is greyish-green and satiny from a coating of appressed silky hairs. Internally it consists chiefly of horny albumen, which is easily divided along its outer edge into halves by a fissure, in which lies the embryo. The latter is about $\frac{3}{16}$in. long, and has a pair of heart-shaped membranous cotyledons.

The chief constituents of the seeds are the alkaloids strychnine (*q.v.*) and brucine, the former averaging about 0·4%, and the latter about half this amount. The seeds also contain an acid, strychnic or igasuric acid; a glucoside, loganin; sugar and fat. The pharmacology of nux vomica is practically that of strychnine.

NYACK, a village of Rockland county, New York, U.S.A., on the west bank of the Hudson river (which here expands into Tappan Zee, 3 m. wide) 25 m. above New York city. It is served by the Erie railroad and a ferry to Tarrytown, nearly opposite. Pop. (1920) 4,444 (81% native white). With the adjacent villages of Upper Nyack and South Nyack, the population was estimated locally at 10,000 in 1928. The industries include shipyards, machine shops and several factories. Permanent settlement here dates from about 1700. Nyack was incorporated in 1833 and was named after a tribe of Algonkin Indians.

NYANZA, the Bantu name for any water area of considerable size; especially applied to the great lakes of east Central Africa. The word is variously spelt, *e.g.*, Nyanja, and Nyasa.

NYASA, the third in size of the great lakes of Central Africa. It occurs south of the confluence of the two great rift valleys and extends from 9° 29′ S. to 14° 25′ S. The lake measures along its major axis, which is slightly inclined to the west of north, exactly 350 m., while the breadth varies very little, the maximum being 45 m. about the middle. The total area may be estimated at 11,000 sq.m. The lake lies at an altitude of about 1,650 ft. above the sea. The sides of the valley in which Nyasa lies, which are somewhat irregular towards its southern end, take a decided character of parallel fault scarps in the northern third, and are continued as such beyond the northern extremity. The depth seems to vary between 200 and 400 fathoms, in accordance with the steepness of the shores. The lake receives its water-supply chiefly from the streams which descend from the mountains to the north, all the rest becoming very small in the dry season. Like other lakes of Central Africa it is subject to fluctuations of level, apparently caused by alternations of dry and wet series of years.

At the north-western end is a plain of great fertility, traversed by the Kivira, Songwe and other streams. On the delta of the Rukuru, is the British station of Karonga, the northern port of call for the lake steamers. Southwards the plain narrows, and the sandstone scarp of Mt. Waller rises sheer above Florence bay, the high western plateaux continuing to fall steeply to the water. At Cape Chirombo (11° 40′ S.) the coast bends to the west, and soon the plateau escarpments recede, and are separated from the lake along its southern half by an undulating plain of varying width, with Bandawe and Kota Kota ports on the coasts. A little north of the latter the Bua river, coming from a remote source on the upper plateau, enters by a projecting delta. At Domira bay the coast turns east, contracting the lake to a narrow neck, with Fort Rifu (west), and Fort Maguire, near Makanjira point (east). Beyond this the lake runs southwards into two bays separated by a granitoid peninsula, off which lie several small rocky islands. From the extremity of the eastern bay the Shiré makes its exit to the Zambezi. On the eastern side the escarpments and the boundary fault keep close to the lake, leaving few plains along its shores. In the north-east, the coast is formed by the unbroken wall of the Livingstone range (*q.v.*). On this coast is the station of Lumbira (Tanganyika Territory). The valley of the Ruhuhu, the only important stream which enters the lake from the east, breaks through the Livingstone range. The formation is here Karroo sandstone, corresponding to that of Mt. Waller on the opposite shore. Just north of the Ruhuhu is Manda, on an excellent harbour. To the south the wall of mountains recedes somewhat, and the remainder of the eastern shore shows a variation between rocky cliffs, marshy plains and low hills, to be followed farther south by a wide semicircular bay, generally rock-bound, and ending in Malo point, off which are the largest islands the lake possesses, Likoma and Chisamulu. In the southern half the coast is highest where the Mapangi hills rise to 3,000 ft.

Nyasa, reached in 1859 both by David Livingstone (from the south) and by the German, Albrecht Roscher (from the east), was explored by the former to about 11°, and to its northern end by E. D. Young in 1876. From this date onwards it has been the scene of much civilizing work on the part of British missionaries, traders and government officials, and of Germans also. Its shores are divided between Great Britain (with Tanganyika Territory and Nyasaland Protectorate) and Portugal (with Portuguese East Africa). British steamers, including gunboats, have been launched on Nyasa, which forms an important link in the water-route from the Zambezi mouth to the heart of the continent. The first detailed survey of its shores was executed by Dr. James Stewart (1876–1877), but this has been superseded by later work.

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NYASALAND PROTECTORATE. Nyasaland covers rather more than 40,000 sq.m., of which 37,890 are land. The country is situated between 9° 45′ and 17° 15′ S., and between 33° and 36° E. Its length from north to south is about 520 m., while its width varies from 50 to 100 miles. It is bounded on the west by northern Rhodesia and Portuguese East Africa, on the north-east by Tanganyika Territory, and on the east and south by Portuguese East Africa. The northern half of its eastern boundary is formed by Lake Nyasa.

Physical Features.—Nyasaland consists of elevated plateaux, sometimes separated by low-lying ground. The most important of these are the Nkonde mountains in the north-west, 6,000 to 7,000 ft. high, the Nyika plateau, rising to over 8,000 ft., and the Angoniland plateau, whose highest points range between 5,000 and 6,000 ft., both of these plateaux being on the western side of the lake: the Mlanje massif, in the extreme south-east, mostly over 6,000 ft., with several peaks rising above the general level, one attaining 9,843 ft., and the Shiré highlands between Lake Shirwa and the Shiré river, reaching, in their highest point, an elevation of 7,000 feet.

Lake Nyasa (*q.v.*), situated 1,645 ft. above sea-level, receives a number of comparatively small rivers from the neighbouring highlands, and is drained southward by the Shiré river, which flows into the Zambezi. The lake has few good harbours, and is swept from time to time by violent northerly and southerly winds. Other large lakes are Lake Shirwa and Lake Chiuta, a sheet of water situated north of Lake Shirwa, and being 30 m. long and from 2 to 8 m. broad. The water of Lake Chiuta, like that of Lake Nyasa, is fresh.

Climate.—In the low-lying regions about the Shiré river and the lakes, the climate is hot and trying; the temperature may rise to 120° in the shade, and the annual rainfall is less than 35 inches. The climate of the plateaux is naturally somewhat cooler and more healthy; frost may occur at night during the cool season, though even then the day temperatures may be considerable. The rainy season lasts from the end of November to the end of March, but the rains vary considerably in quantity and duration. Records are insufficient to give reliable averages, but some of the higher stations may receive from 40 to 60 in. per annum. Much of the rain may fall in short, heavy showers. Europeans living in Nyasaland need to spend a period in a temperate climate every few years to recuperate their vitality. Malaria and blackwater fever are fairly common.

Vegetation.—Large tracts of the country are still covered with forest, especially away from the centres of European or native settlement. The forests are of little economic value, apart from their effect in checking rapid run-off and soil erosion. Most of the trees are small, the diameter of their trunks at about 4 ft. from the ground being usually from 4 to 12 inches. Timber trees of greater size and value are to be found in damp ravines on the mountain sides and along the banks of the rivers. The most important of these are the patches of Mlanje cypress (*Widdringtonia Whytei*), which yields a soft, durable wood, immune from the attacks of termites. These trees grow on the higher slopes of Mlanje mountain, and are not found elsewhere in Nyasaland. Two species of Brachystegia—Mombo and Nchenga—provide the natives with material for bark cloth and ropes. Tree planting is encouraged, and seeds are easily procurable of the Mlanje cypress, and of several kinds of eucalyptus, which is the most important

of the exotic trees.

Population.—In 1925 the population consisted of 1,462 Europeans, most of whom live in the Shiré highlands, 669 Asiatics, and 1,210,344 natives. (*See* separate articles on the tribes YAOS, ANGONI, etc.). In 1901 the native population numbered only 736,724, the subsequent increase being due, to a considerable extent, to the immigration of Anguru from Portuguese territory.

Communications.—Passengers and cargo, landing at Chinde, may proceed up the Zambezi to Chindio, and thence by rail to Port Herald and Blantyre (*q.v.*). In the wet season boats may ascend the Shiré as far as Port Herald. The economic progress of the country waits upon the development of transport. In 1922 a line was opened from the Zambezi opposite to Chindio, to Beira, there linking up Nyasaland with a modern port. The lack of a bridge across the Zambezi is, however, a serious handicap. A railway from Luchenza, on the Shiré Highlands railway, to the southern end of Lake Nyasa, is also projected. It would do much to open up the northern districts. On the lake is a regular service of ships. The cheapest form of transport in the outlying districts is the ox-wagon, where that is possible. In the more settled areas motor transport is being increasingly used, and most of the white settlers have either a motor car or motor cycle.

Economic Development.—Most of the country is composed of igneous and metamorphic rocks. Comparatively small areas are covered by sedimentary rocks, but among the latter are equivalents of the South African Karroo system, in which some coal occurs. Other minerals occur, apparently sporadically, such as graphite, gold, etc. At present there are no minerals being exploited on a commercial scale. Agriculture and pastoralism are, and will probably continue to be, the chief occupations. Native labour is cheap, the usual wage being 6 s. or 7 s. per month, but the more ambitious natives emigrate to Rhodesia and South Africa, attracted by higher wages. Various crops have been popular in turns. Among these are coffee, cotton and tobacco, the latter being the most important at the present time. In 1921, 14,218 ac. were under tobacco, and nearly five million pounds were exported. The extent of cotton cultivation declined from 28,372 ac. in 1917–18 to 18,274 in 1920. The difficulty of transport makes cotton growing in the outlying districts unprofitable when prices are low. Ginneries have, however, been erected, even in remote parts of the country, and efforts are being made to encourage cotton growing among the natives. Tea is grown in the high rainfall area on the south-east slopes of Mlanje mountain. Coffee planting has declined, because of the irregularity of the rainfall. Sisal hemp (*Cegroe rigida var sisilana*) and Mauritius hemp grow well in loose, sandy soil throughout Nyasaland, but the lower Shiré and the lake districts are probably the most suitable for them. Maize is cultivated on the hills by the natives. The native tribes keep cattle, non-woolled sheep, goats and pigs in various parts, but there are large areas from which cattle are excluded by the tsetse fly. Various tick-borne diseases, such as east coast fever, are also rather common.

The chief imports are provisions, building material, agricultural implements, vehicles, and textiles for native clothing.

Administration.—At the head of the administration is a governor, assisted by executive and legislative councils, nominated by the Crown. The headquarters are at Zomba, situated at the foot of the Zomba plateau. The township is lighted by electricity and has a hospital and two churches. Nyasaland is divided into three provinces, each in charge of a provincial commissioner, under whom are residents of districts, whose chief duties are, naturally, in connection with native affairs. A good deal of responsibility is given to native chiefs and headmen, who are used as the medium of communication between the residents and the tribesmen.

Education and Religion.—Though many of the native people are either heathens or Mohammedans, there are several thriving Christian missions in the country. Among these may be mentioned the Universities mission, with a large cathedral at Likoma, the Livingstonia mission of the United Free Church of Scotland, the Church of Scotland mission, with its headquarters at Blantyre, the Dutch Reformed Church of South Africa mission and the White Fathers. Most of these missions do a large amount of educational and medical work among the natives. In 1924 there were 2,447 native schools in the country. The educational training is varied. Apart from the usual school training, leading on to training colleges for teachers, courses are given in theology, medicine, and the various crafts. At Limbe is a school, kept by Marist Fathers, for white children.

See Sir H. H. Johnston, *British Central Africa* (1897); *Handbook of Nyasaland* (1922). (R. U. S.)

HISTORY

The modern story of Nyasaland begins with the coming of David Livingstone, who in his Zambezi expedition penetrated up the Shiré affluent of that river and discovered Lake Nyasa. That was in 1859. Livingstone's subsequent journeys to the south end of Lake Tanganyika, to Lake Mweru and to Lake Bangweulu (where he died in 1873), opened up this part of South Central Africa, and centred in it British interests in a very particular manner. Livingstone's discovery of Lake Nyasa was soon followed by the entry of various missionary societies, and these missionaries, together with a few Scottish settlers, steadily opposed the attempts of the Portuguese to extend their sway from Mozambique or their settlements on the Zambezi to the newly opened up country. Out of the missionary societies grew a trading company, the African Lakes Trading Corporation. Blantyre was founded and in 1883 the first British consul was sent out. Soon afterwards the settlers came into conflict with a number of Arab slavers who had established themselves at the north end of Lake Nyasa. About 1885 a struggle began between Arab and Briton for the possession of the country, which was not ended until the year 1896. The African Lakes Corporation in its unofficial war enlisted volunteers, amongst whom were Captain (afterwards Lord) Lugard and Mr. (afterwards Sir) Alfred Sharpe. Both these men were wounded, and the operations they undertook were not crowned with complete success. At this time "the scramble for Africa" among European Powers was acute and in 1889 the British South Africa Company obtained a charter and sent emissaries to Central Africa. In the same year Mr. (afterwards Sir) H. H. Johnston was sent out to endeavour to effect an arrangement between the Arabs and the African Lakes Corporation, and also to ensure the protection from Portuguese aggression of the region where the British settlers had established rights of occupation, and of native chiefs who owed no allegiance to Portugal. The outcome of these efforts and the treaties made was the creation of the British protectorate and sphere of influence north of the Zambezi. The dispute with Portugal was settled by a convention signed in 1891, when Johnston returned to the country as imperial commissioner and consul-general. In the interval between 1889 and 1891 Alfred Sharpe and others, on behalf of Cecil Rhodes, had brought a large area west and north of Lake Nyasa into treaty with the British South Africa Company. A British protectorate over the regions adjoining the Shiré and Nyasa was formally proclaimed in 1892, the adjacent territories, now part of Northern Rhodesia, being administered for four years by Sir Harry Johnston on behalf of the Chartered Company. Between 1891 and 1895 a long struggle continued, between the British authorities on the one hand and the Arabs and Mohammedan Yaos on the other, over the suppression of the slave trade. By the beginning of 1896 the last Arab stronghold was taken and the Yaos were reduced to submission. Then followed, during 1896-98, wars with the Zulu (Angoni) tribes, who claimed to dominate and harass the native populations to the west of Lake Nyasa. The Angoni having been subdued, and the British South Africa Company having quelled the turbulent Awemba and Bashukulumbwe, a period of peaceful development followed.

The great majority of the inhabitants had from the first accepted and even welcomed British rule, and they made distinct progress. Besides the example of the white officials there was the influence of the missionaries, both strong and beneficent. Of the three chief societies represented, two were Presbyterian and one Anglican; of missionaries, Dr. Robert Laws, who worked over 50 years in the country, was pre-eminent for his civilizing and edu-

cational work and his statesmanlike qualities.

Sir Harry Johnston was succeeded as commissioner in 1897 by Sir Alfred Sharpe, whose intimate knowledge of the country was valuable in the work of development. The progress made was marked in 1904 by the transfer of the protectorate, up to that time under Foreign Office control, to the Colonial Office. In 1907 the title of the chief official was changed from commissioner to governor and in the same year executive and legislative councils were established. Called at first the Nyasaland Protectorate, the name had been changed in 1893 to "The British Central Africa Protectorate," but in 1907 the old name was revived. When in 1910, Sir Alfred Sharpe retired, the urgent problems awaiting solution were economic; chief concern being over Nyasaland's communications with the sea, the river route having proved unsatisfactory. When the World War began northern Nyasaland was invaded by Germans from East Africa. The governor, Mr. (later Sir) George Smith, was capable and energetic, and he received the full support of the people (black and white). The Germans were repelled, and later Nyasaland became a base for operations against them. There was, however, during the war, a disquieting incident. Among the natives were a number of professed Christians who claimed freedom from white control. One of these men, John Chelembwe, who had been educated in the United States, on his return built a church and preached the independence of Africans. With some 500 followers he rose in revolt in Jan. 1915. Three white settlers were murdered, one a Mr. Livingstone (a descendant of David Livingstone), and Chelembwe preached a sermon in his church with Mr. Livingstone's head placed on the pulpit. The revolt was speedily suppressed by a small force of British and natives, Chelembwe, who had taken to flight, being shot dead (Feb. 3), by native police. This rising was a symptom of Ethiopianism.

A number of men who came from South Africa or Great Britain during the war settled in Nyasaland as planters. But except in the Shiré highlands little of the country is suitable for Europeans. As was said by the governor, Sir Charles Bowring, in 1924, "The prosperity of the protectorate depends on the development of its tropical agricultural resources, partly by a limited number of European plantations, but principally by the natives themselves with European instructors."

To overcome transport difficulties, a railway, completed in 1915, was built from Port Herald, on the Shiré, to Chindi, on the north bank of the Zambezi, and in 1922 another railway, from Beira to the southern bank of the Zambezi, was opened.

The chief exports are now tobacco, cotton, tea and fibres. Imports, which in 1910–11 were valued at £111,000, had risen to £869,462 in 1928. Exports were valued at £97,000 in 1910–11 and at £706,756 in 1924. Revenue, which was £76,000 in 1909–10, was estimated at £380,000 in 1928, while expenditure rose in the years named from £108,000 to £381,948.

See *Nyasaland* (1920), a handbook, with bibl., issued by the British Foreign Office; S. S. Murray, *A Handbook of Nyasaland* (1922), the *Report of the East African Commission* (1925); and the annual report issued by the Colonial Office, London. (F. R. C.)

NYBORG, a seaport of Denmark on the island of Fünen, in the *amt* (county) of Svendborg. Pop. (1928), 9,836. The town was founded in the 12th century and a castle erected on Knudshoved (Canute's Head). From the 13th to the 15th century Nyborg was one of the most important places in Denmark. In 1658 it was held by the Swedes for about a year. The fortress, built by Christian IV. and Frederick III., was dismantled in 1869, and the ruins of the castle are used as a prison.

NYE, EDGAR WILSON (1850–1896), American humorist, was born at Shirley, Me., on Aug. 25, 1850. His parents removed to a farm on the St. Croix river in northern Wisconsin in 1852, and young Nye was educated in Wisconsin at the academy at River Falls, where he studied law. In 1876 he was admitted to the bar at Laramie, Wyo., where he served as justice of the peace, superintendent of schools, member of the city council and postmaster. Here he began to contribute humorous articles under the pseudonym of "Bill Nye" to newspapers, especially the Cheyenne *Sun* and the Denver *Tribune*. In 1881 he founded at Laramie the *Boomerang*, and his reputation as a humorist was soon widespread. Later he became a successful lecturer, and in 1885, with James Whitcomb Riley, the poet, made an extended tour through the country, each reading from his own writings. Nye removed to New York city in 1886, and passed the later years of his life at Arden, a village in North Carolina, where he died on Feb. 22, 1896. His principal books are *Bill Nye and Boomerang* (1881); *Forty Liars and other Lies* (1882); *Nye and Riley's Railway Guide* (1886), with James Whitcomb Riley; and two comic histories, *Bill Nye's History of the United States* (1894) and *Bill Nye's History of England from the Druids to the Reign of Henry VIII.* (1896).

See *Bill Nye, His Own Life Story; continuity* by F. W. Nye (1926).

NYIKA. This Swahili word means "forest and thorn bush country" and is used by the Swahili to designate a set of Eastern Bantu tribes, who during the 16th century under pressure from the Galla migrated down the coast from the steppes on the left bank of the Tana river. It does not include the Taita, Pokomo, Segeju and Akamba, though these are ethnically connected with the tribes to whom it is applied. The nine tribes included in the term Nyika are the Giryama, now living about 3° south of the Equator, the Rabai, the Duruma and the Digo—all upper Nyika tribes and the most important of the group: the other five are the lower Nyika—the Kauwa, Chonyi, Dzihana, Kambe and the Rihe or Ribe.

Generally speaking they are tall, muscular, well set up and broad-headed. The Digo, however, though well built are slender and have refined oval faces. There are evident affinities with the Northern Hamites, and their general colour is dark brown, becoming paler the nearer Mt. Kilimanjaro is approached. Waist clothes are worn by the men, and women wear many pleated-kilts, but are nude from the waist up, though now the tendency is to dress like Swahili women.

The *kaya* or fortified village was fundamental to their clan organization, but now that war is no longer anticipated, and villages are built outside the fortification, it has lost some of its significance, though still used for the assemblies of elders. The *kaya* is always situated on a hill or in a dense forest and is strongly palisaded. The Pokomo build circular huts like the Galla, but this group generally is characterized by rectangular huts, with a ridge-pole and a thatched roof extending to the ground and thus dispensing with walls. The houses are either gable- or hip-ended.

The Nyika tribes are divided into exogamous clans, which observe certain prohibitions and avoidances and share a general veneration for the hyaena in which all the cognate tribes join except the Pokomo: but now at any rate there is no trace of totemism. The clans of the Digo and Duruma are matrilineal; the rest are patrilineal with the exception of the Rabai, who are in a transitional stage. The Rabai have two sets of clans, male and female, and every man inherits the clan of his father and of his mother, but for all practical purposes he is reckoned as a member of his father's clan; a woman, on the other hand, while she similarly inherits both clans, stresses the mother's. Every clan has its own clubhouse (*lwanda*) and there is also the *moro* or council house, which is the general inter-clan meeting place for men, and houses the friction drum used for convening the council.

The Digo, probably under Arab influence, have hereditary sultans, but otherwise there are no paramount chiefs. The government is in the hands of elders, who wear an ivory armlet as a badge of office. Every 13 years males have to be initiated at circumcision into an association analogous to Masai age-grades and after passing through the preliminary degrees they eventually reach the status of elders, among whom there is an inner circle called the Hyaena, which alone knows all the magical spells and consequently inspires great terror. From this circle are selected the "owners of the land," who carry on the government during the space of a *rika* or circumcision cycle.

The bow is the most usual weapon and the arrows are often poisoned. They also carry swords which are, however, as much implements as weapons. The Giryama have a parrying stick unique in the eastern area. Agriculture is carried on by women

who grow maize, millet, vegetables and sweet potatoes. They have sheep and goats but few cattle, and like most of the coastal tribes are careful not to take the cattle out till the heavy dew has dried from the grass, a precaution which does not seem to be necessary to the Bantu and Nilo-Hamitics living at higher altitudes.

The Nyika worship the typical Eastern Bantu deity *mulungu*, a vague abstraction of the sky combined with ancestor-worship with the main emphasis on the latter, the spirits of the dead (*koma*) surviving mortality and taking the world of the living under their charge. *Mulungu* is the dispenser and creator and from his union with the earth have sprung all things in the world including human beings, who are *mulungu's* hens and chickens. There are no professional rainmakers.

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NYIREGYHAZA, the capital of the county of Szabolcs, in Hungary, is situated on the sandy loess Nyirseg plateau. It is an agricultural centre, specializing in the intensive cultivation of fruit and vines. There are also small manufactures, *e.g.*, of soda, soap and agricultural machinery. Pop. (1920), 43,340.

NYKÖPING, a seaport of Sweden, chief town of the district (*län*) of Södermanland, 98 m. S.W. of Stockholm by a branch from the Stockholm-Malmö railway. Pop. (1928), 12,201.

Nyköping (*i.e.*, New-Market, Latinized as *Nicopia*) begins to appear as a town early in the 13th century. Its castle was the seat of the kings of Södermanland, and after those of Stockholm and Kalmar was the strongest in Sweden. It was burned by Albert of Mecklenburg's party in 1389, by an accidental conflagration in 1665, and by the Russians in 1719. Nyköping lies at the head of the Byfjord, an inlet of the Baltic. The ruins of its once famous castle, the town hall (1662), and the district governor's residence, are notable buildings.

NYMPH, in zoology, is the name given to the immature stages through which all insects with incomplete metamorphosis pass after leaving the egg. At its last moult the nymph gives rise to the perfect insect. (*See* INSECTS.)

NYMPHAEUM, a monument consecrated to the nymphs (*q.v.*), especially those of springs. These monuments were originally natural grottoes, which were traditionally considered the habitations of the nymphs. They were arranged to furnish a supply of water. Subsequently, artificial grottoes took the place of natural. The nymphaea of the Roman period were borrowed from the Hellenistic east (*e.g.*, The Great Nymphaeum of Ephesus). The majority were rotundas, adorned with statues and paintings. They served the threefold purpose of sanctuaries, reservoirs and assembly-rooms. A special feature was their use for the celebration of marriages. Such nymphaea existed at Corinth, Antioch and Constantinople; the remains of some 20 have been found at Rome and of many in Asia Minor, Syria and Africa. The term nymphaeum was also applied to the fountain in the atrium of the Christian basilica. (*See* FOUNTAIN.)

NYMPHS, in Greek mythology, the generic name of a large number of female divinities of inferior rank. The word, the etymology of which is uncertain, seems to mean simply a marriageable woman; this is appropriate, as they are mostly associated with fertile, growing things (as trees), or with water. They are frequently associated with the superior divinities, as Artemis, Apollo, Dionysus, Pan and Hermes (*q.v.*).

The nymphs were distinguished according to the different spheres of nature with which they were connected. Sea nymphs were *Oceanids* or *Nereïds,* daughters of Oceanus or Nereus. *Naiades* (from Gr. νάειν, flow, cf. νᾶμα, stream) presided over springs, rivers and lakes. *Oreades* (ὄρος, mountain) were nymphs of mountains and grottoes, one of the most famous of whom was Echo. *Napaeae* (νάπη, dell) and *Alseïdes* (ἄλσος, grove) were nymphs of glens and groves. *Dryades* (*q.v.*) or *Hamadryades* were nymphs of forests and trees.

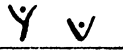
In Italy they tended to be identified with native divinities of springs and streams (Iuturna, Egeria, Carmentis, Fons), while the Lymphae (originally Lumpae), Italian water-goddesses, owing to the accidental similarity of name, were identified with the Greek Nymphae.





This letter, the fourth vowel of the modern alphabet, corresponds to the Semitic *ayin*, which represented not a vowel but a breathing. The Greeks, or possibly their Asianic predecessors, in adapting the Semitic alphabet to their own use used this letter (*omicron*) to express the vowel O, as was the case also with the letters *aleph, he, cheth* and *yodh*. Vowels were not expressed alphabetically in Semitic. The form of the letter on the Moabite stone was small, O, and this small form appears in early Greek inscriptions from Thera and Corinth. In Corinth and in the inscriptions from Abu-Simbel in Egypt there is a form ◇. A form with a dot in the centre occurs in Thera, ⊙, and this is paralleled in the large Etruscan ⊙. At Miletus a form Ω occurs. The Latin form, taken from the Chalcidic or Etruscan, was O. The minuscule form retains the shape of the majuscule letter.

The Greeks used the letter to represent the short close vowel ŏ. For the long vowel they used a sign Ω (*omega*) probably adapted

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	B.C. 1,200	
CRETAN	1,100-900	
THERAEAN	700-600	
ARCHAIC LATIN	700-500	
ATTIC	600	
CORINTHIAN	600	
CHALCIDIAN	600	
IONIC	403	
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	
URBAN ROMAN		
FALISCAN		
OSCAN		
UMBRIAN		
CLASSICAL LATIN AND ONWARDS		

THE DEVELOPMENT OF THE LETTER "O" FROM THE EARLIEST TIMES TO THE PRESENT DAY

from O to one of the forms of which in use at Miletus it closely approximates. The western dialects used Ω to represent the long vowel, whether open or close. In the east it was used only for the open vowel, *ov* being used for the long close vowel as well as for the true diphthong. In the Cyclades however a reversal of this process frequently took place. Ω being used for the close sound whether long or short, O for the open. In Latin the letter stood for the same vowel without distinction of length, and the sound has passed almost unchanged into the Romance languages.

In modern English the vowel has undergone changes. The long *ō* has become a diphthong (*ou*) as in the words *bone, rose*. Short *ŏ* has become more open and lower, as in *rob*. Before the consonant *r* the sound is rounded and pronounced very far back in the mouth, e.g., *glory, north*. In the word *do* the single letter is used where a more usual orthography would require its doubling. Again in the word *son* one would expect the vowel *u*. In words such as *word, work, world* the sound has been affected by the preceding bilabial. The short sound is the descendant of Middle English short *ŏ* in which both the close and open short *ŏ*, which were distinguished in Old English, met. The long *ō*, now a diphthong, descends from Middle English long *ō*, an open sound, which was derived from Old English long *ā*. In Middle English this was a rounded back vowel akin to the modern vowel in the words *shore, north*. Old English close long *ō* became in Middle English *oo* (*ū*). (B. F. C. A.)

OAK, the name given to trees and shrubs of the botanical genus *Quercus* of the beech family (Fagaceae, *q.v.*), a large group which includes some of the most important timber trees. The oaks are widely distributed over the temperate parts of Europe, Asia, northern Africa and North America, and extend southward in mountains and highlands into the Tropics. On the mountains of Europe and North America they grow only at modern elevations and none approach the arctic circle. The tendency of many species to vary in a marked degree and the existence of numerous hybrid forms makes the determination of the exact number of species difficult, but it is estimated at from about 300 to upwards of 500.

The oaks are readily distinguished by their peculiar fruit, an acorn or nut, enclosed at the base in a woody cup. The female flower contains a single ovary, three-celled at first, but becoming one-celled and one-seeded by abortion. The male flowers are in small clusters on the usually slender and pendent stalk, forming an interrupted catkin. The alternate leaves are more or less deeply lobed or cut in many species, but in some of the deciduous and many of the evergreen kinds are nearly or quite entire on the margin.

The well-known *Q. Robur*, one of the most valued of the oaks, and the most celebrated in history and myth, may be taken as a type of oaks with sinuated leaves. Though known in England, where it is the only indigenous species, as the British oak, it is a native of most of the milder parts of Europe and of the Caucasus mountains in Asia. In Great Britain and in most of its Continental habitats two varieties exist, now usually regarded as distinct species: one, *Q. pedunculata*, has the acorns, generally two or more together, on long stalks, and the leaves nearly sessile; while in the other, *Q. sessiliflora*, the fruit is without or with a very short peduncle, and the leaves are furnished with well-developed petioles. The British oak is one of the large trees of the genus, though old specimens are often more remarkable for the great size of the trunk and main boughs than for very lofty growth. The spreading branches have a tendency to assume a tortuous form, causing a zigzag development; to this peculiarity the picturesque aspect of ancient oaks is largely due. When standing in dense woods the trees are rather straight and formal in early growth, and the gnarled character traditionally assigned to the oak applies chiefly to its advanced age. The fruit is shed the first autumn.

Vast oak forests still covered the greater part of England and central Europe in the earlier historic period. Many of the ancient oaks that remain in England may date from Saxon times; the growth of trees after the trunk has become hollow is extremely slow, and the age of such venerable giants is only a matter of vague surmise. The celebrated Newland oak in Gloucestershire, known for centuries as "the great oak," was 47½ ft. in girth at 5 ft. from the ground. The wood of the British oak, when grown in perfection, is one of the most valuable produced in temperate climates.

The heart-wood varies in colour from dark brown to pale yellowish-brown; hard, close-grained, and little liable to split accidentally. The oak of Britain was formerly in great demand for the construction of merchant shipping. The finely-grained heart-wood is sought by the cabinetmaker for the manufacture of furniture, as are also the gnarled and knotted portions of slowly-grown trees, which are sawn into veneers. Oak was formerly largely used by wood-carvers and was thus applied at a very early date; the shrine of Edward the Confessor, still existing in the abbey at Westminster, sound after the lapse of 800 years, is of dark-coloured oak-wood.

The cultivation of this oak in Europe forms one of the most important branches of forestry. Its growth is slow, though it varies greatly in different trees; when grown for large timber oak can rarely be profitably felled till the first century of its growth is completed. The British oak is often grown as an ornamental tree in the eastern United States, where, however, it is usually short-lived. In the southern parts of Australia and in New Zealand it seems to flourish as well as in its native home. An important product of oak woods is the bark, formerly the chief tanning material of Europe. The acorns of the oak possess a considerable economic importance as food for swine. In the Saxon period the "mast" seems to have been regarded as the most valuable produce of an oak wood.

Of the European timber oaks, the next in importance to the British oak is *Q. Cerris*, the Turkey oak of the nurserymen. This oak abounds all over the Turkish peninsula, on the Taurus ranges, and in many parts of southern Europe; it was introduced into England about 1735, and is now common in parks and plantations.

The evergreen oak of southern Europe is *Q. Ilex*, usually a small tree, frequently of rather shrub-like appearance, with abundant glossy dark-green leaves, more or less prickly at the margin. The ilex, also known as the "holm oak" from its resemblance to the holly, abounds in all the Mediterranean countries. The stem sometimes grows 90 ft. in height, but it does not often reach a great size. In its native lands it attains a vast age; Pliny attributes to several trees then growing in Rome a greater antiquity than the city itself.

The cork oak, *Q. Suber*, the bark of which yields cork (*q.v.*), is a native of the west Mediterranean area. In Spain the wood is of some value, being hard and close-grained, and the inner bark is used for tanning.

The valonia of commerce, one of the richest of tanning materials, is the acorn of *Q. Aegilops*, a fine species indigenous to Greece and the coasts of the Levant.

Some oaks are of indirect importance from products formed by their insect enemies. Of these the Aleppo gall (*see* GALLS) is yielded by *Q. infectoria*, a native of Asia Minor and western Asia. *Q. coccifera*, a small bush growing in Spain and many countries around the Mediterranean, furnishes the kermes dye. (*See* KERMES.) *Q. persica*, or according to some *Q. mannifera*, attacked by a kind of *Coccus*, yields a sweet exudation which the Kurds collect and use as manna (*q.v.*).

In North America the oaks are generously represented. They attain their greatest size and economic importance in the southern United States, especially in the lower Mississippi valley, and reach their maximum diversity as regards species in the highlands of Mexico, notably in the western Sierra Madre range, where they form vast forests. In a recent monograph (*The American Oaks*, 1925), W. Trelease enumerates 371 species, of which 253 occur in Mexico, 54 in Central America, 3 in Panama, 4 in Colombia, and 1 in the Antilles (Cuba), while 84 are found in the United States, 10 extending into the southern border of Canada. These vary greatly in size from small, straggling or even creeping shrubs, to magnificent forest trees, 150 ft. or more in height, with trunks exceeding 6 ft. in diameter. In addition Trelease recognizes more than 50 named hybrid oaks whose parent species are regarded as satisfactorily determined.

The American oaks fall into two main groups—the white oaks and the red or black oaks—about equal in number and comprising practically all the species. In the white oak group (*Leucobalanus*) the acorns ripen at the end of the first season, the shell of the nut is smooth inside, and the leaves or their lobes, which are usually rounded, are without bristle tips. In the black or red oak group (*Erythrobalanus*) the acorns ripen at the end of the second season, the shell of the nut is hairy inside, and the leaves or their lobes, which are usually sharp-pointed, have bristle tips.

Of the oaks found in the United States, upwards of 50 species attain the stature of trees, more than half of which are of economic value for timber or other useful purposes. Fully 20 species attain a height of 100 ft. or more, and 5 equal or exceed a height of 150 ft., with correspondingly massive trunks. These larger oaks constitute the chief supply of native hardwood lumber in North America. Three-fourths of them occur east of the Rocky Mountains; the others are found in the Pacific States, chiefly in California, the quality of their timber in general being inferior to that of the eastern oaks.

Among the most valuable eastern white oaks are the typical white oak (*Q. alba*), 80 ft. to 100 ft. high, with a trunk 3 ft. to 4 ft. in diameter, one of the finest North American trees; the rugged massive bur oak (*Q. macrocarpa*), sometimes 170 ft. high, with a trunk 6 ft. to 7 ft. in diameter; and the chestnut oak (*Q. montana*), the post oak (*Q. stellata*), the overcup oak (*Q. lyrata*), and the swamp chestnut or basket oak (*Q. Prinus*), all growing to a height of 100 ft. and highly valued for lumber. Noteworthy representatives of the eastern red or black oak group are the red oak (*Q. borealis*), sometimes 150 ft. high; the Shumard red oak (*Q. Shumardi*), 120 ft. high; the black oak (*Q. velutina*), 150 ft. high, and the somewhat smaller scarlet oak (*Q. coccinea*) and willow oak (*Q. Phellos*), all important timber trees.

The oaks of the Rocky Mountain region are mostly small trees, often becoming shrubby at the higher elevations. The Rocky Mountain white oak (*Q. leptophylla*), rarely 45 ft. high, is the largest Colorado oak, and the Arizona white oak (*Q. arizonica*), sometimes 60 ft. high, is the chief oak of New Mexico and Arizona.

In California some 15 species of oak occur. Among the deciduous kinds are the valley oak (*Q. lobata*), often 100 ft. to 125 ft. high, sometimes with a massive trunk 10 ft. in diameter; the Oregon white oak (*Q. Garryans*), 60 ft. to 100 ft. high, found from San Francisco bay to British Columbia, and the California black oak (*Q. Kelloggii*), sometimes 100 ft. high, found also in Oregon. Among the evergreen species are the coast live oak (*Q. agrifolia*) and the interior live oak (*Q. Wislizenii*), both medium-sized trees; the scrub oak (*Q. dumosa*), usually 2 ft. to 8 ft. high, abundant in the chaparral (*q.v.*), and the maul oak (*Q. chrysolepis*), sometimes branching into an immense crown 150 ft. across, and sometimes growing erect to a height of 110 feet.

The only evergreen species of the eastern States is the live oak (*Q. virginiana*), found near the coast from Virginia to Texas; it grows to a height of 75 ft., usually branching near the buttressed base into a round-topped head, sometimes 130 ft. across. The very strong wood was formerly much used in ship building.

The total cut of oak lumber in the United States in 1925 was 2,129,181,000 bd.ft., valued at the mill at $78,779,698, 55% of which was cut in Arkansas, Tennessee, Louisiana, West Virginia and Mississippi. Commercially oak lumber is classified as white oak and red oak. White oak lumber is cut principally from the white, chestnut, post, bur, overcup and swamp chestnut oaks; red oak lumber is cut chiefly from the red, Shumard red, scarlet, black and willow oaks.

For world distribution *see* A. Engler and K. Prantl, *Die Natürlichen Pflanzenfamilien* (1887–1909); *see* also C. S. Sargent, *Manual of North American Trees* (2 ed., 1922); W. Trelease, "The American Oaks," *Mem. Nat. Acad. Sci.* v. xx. (1925); G. B. Sudworth, "Check List of the Forest Trees of the United States," *U.S. Dept. Agr. Mis. Cir. 92* (1927).

OAKDALE, a city of Allen parish, Louisiana, U.S.A., in the south-western part of the State, on the Calcasieu river, and served by the Santa Fe and the Missouri Pacific railways. Pop. 4,016 in 1920 (33% negroes). It has lumber mills and other industries. The city was incorporated in 1923.

OAKHAM, a market town, and the county town of Rutland, England, 94 m. N. by W. of London by the L.M.S.R. Pop. urban district (1921) 3,340. The church of All Saints ranges in style

from Early English to Perpendicular. Of Oakham castle, founded in the reign of Henry II., the Norman hall is used as the county hall. The manor came in the time of Henry II. into the hands of Walcheline de Ferrers, and subsequently passed to the earls of Winchelsea.

OAKLAND, a city of California, U.S.A., on the eastern shore of San Francisco bay, opposite San Francisco (3 m. distant) and facing the Golden Gate; the county seat of Alameda county and the third city of the State in size. It has a municipal airport of 825 ac.; is a port of call for 50 steamship lines; and is served by the Santa Fe, the Southern Pacific, the Western Pacific and electric railways, and by ferries and motor-coach lines. The population was 216,216 in 1920, of whom 49,895 were foreign-born, including 4,536 Chinese and Japanese, and was estimated locally at 342,000 in 1928. The business section of the city is built on a level crescent-shaped plain along the bay, averaging 2·5 m. in width, behind which gently sloping hills rise to an elevation of 1,500 ft., providing residential sections with magnificent views of the bay, with San Francisco and the Golden Gate directly opposite. The area of the city is 60·25 square miles. Adjoining it on the north is Berkeley; to the south, across an arm of the bay, is Alameda. These three cities and the seven smaller municipalities of the "Eastbay" district (Richmond, Emeryville, Piedmont, San Leandro, Albany, El Cerrito and Hayward) had a population of over 530,000 in 1928.

Parks, Museums and Schools.—In the heart of the city, surrounded by a park equipped as a general recreation centre, is Lake Merritt, a 160 ac. body of salt water. One part of the lake is a Federal refuge for birds, the regular winter resort of thousands of wild ducks. The city maintains 57 fully equipped playgrounds; public parks with an additional area of 628 ac.; and two municipal camps for week-end holidays and summer vacations, one in the high Sierras and the other on Feather river. There is a municipal auditorium seating 8,800 and a beautiful city-hall, both built since the World War. The public library contains 140,000 volumes. The city has an art gallery and three museums. The public-school system includes 44 elementary, 15 junior high and 8 high schools. The University of California, in Berkeley, is only 4 m. from the Oakland city-hall. In Oakland, on a 60 ac. campus in the foot-hills, is Mills college for women, opened in 1871 by Dr. Cyrus T. Mills and Mrs. Mills. Oakland is the seat also of St. Mary's college for men (Roman Catholic, 1863). Since 1910 the city has operated under a commission form of government.

Port Facilities and Commerce.—Oakland has 27 m. of water front. A channel has been dredged, and two large docks constructed. The railroads have built four solid filled moles and trestles, extending from the shore 1½ to 3 miles. The commerce of Oakland Harbor (including the Alameda side of the inner harbour) was 3,217,897 tons in 1927, valued at $200,325,445, of which $14,690,794 represented exports to foreign countries, $22,588,088 imports, $81,854,793 coastwise receipts, $60,363,075 coastwise shipments and $20,828,695 local traffic.

Manufactures.—The industrial district lies just behind the water front and is traversed by 34 m. of main-line railroad trackage. Since the World War Oakland has had a great industrial expansion. In 1925 the Federal census of manufactures reported 602 establishments, with an aggregate output valued at $144,840,830, five times the value for 1914. The motor-vehicles, bodies and parts manufactured in 1925 were valued at $44,428,588, nearly ¼ the value of the total factory output. Next in importance were lumber and lumber products, electrical machinery, apparatus and supplies, canned and preserved fruits and vegetables, and boats and ships. There are four large shipbuilding plants.

History.—The site of Oakland was part of the holdings of Don Luis Maria Peralta, who received vast grants from the Spanish Crown. In 1842 he divided his lands among his four sons, and the two to whom this region fell established themselves on their estates. From one of them in 1850 Moses Chase leased a tract, and he became the founder of the future city. In 1852 the settlement was incorporated as a town and in 1854 it was chartered as a city. The name was suggested by the grove of oaks in which the first houses were built. By 1860 it had a population of 1,543, which increased rapidly to 10,500 in 1870 and 34,555 in 1880.

OAKMONT, a residential borough of Allegheny county, Pennsylvania, U.S.A., on the Allegheny river and the Pennsylvania railroad, 12 m. N.E. of Pittsburgh. Pop. (1920) 4,512 (83% native white).

OAK PARK, a village of Cook county, Illinois, U.S.A., 9 m. W. of Chicago. It is served by the Chicago and North Western, the Chicago, Aurora and Elgin, and the Baltimore and Ohio Chicago Terminal railways. Pop. 39,858 (1920); estimated locally at 64,000 (1928). It is a residential suburb. The assessed valuation of property in 1926 was $20,819,631. Incorporation, 1901.

OANNES (also IANNES, EUAHANES), in Babylonian mythology, the name given by Berossus to a mythical being who taught mankind wisdom. He is identical with the god Ea (*q.v.*), although there may not be any direct connection between the two names. Berossus describes Oannes as having the body of a fish but underneath the figure of a man. He is described as dwelling in the Persian gulf (Erythraean sea) and rising out of the waters in the day-time and furnishing mankind instruction in writing, the arts and the various sciences. Other epithets of Oannes are Annēdotus, Odakōn, Euedokus, Eneugamos, Eneuboulos, Anēmentos. This antediluvian myth of a fish-like monster is based on the water god Enki of Eridu, patron of wisdom, symbolised as a "goat fish," and identified with Capricorn.

For the legend of Uttuku, or Tagtug, *see* S. Langdon, *Le Poème Sumerien du Paradis* (1919); *Revue d'Assyriologie*, vol. xxii., 32–38 (1925). On the biblical and other traditions concerning the revelation of all wisdom in the beginning before the Flood, *see* A. Jeremias, *Handbuch der Altorientalischen Geisteskultur* (Leipzig, 1913), 14–18, with references to literature. (S. L.)

OAR: *see* ROWING.

OAR-FISH, an oceanic fish, *Regalecus*, characterized by the long, compressed body, short head, large eye and long dorsal fin, forming a crest on the top of the head. The oar-fish is distinguished from its allies, the deal-fishes (*q.v.*) by the long filamentous pelvis fins ending in a spatulate expansion (hence their name). These fish reach a length of nearly 40ft.

OASIS, a fertile spot surrounded by desert (the Greek form is ὄασις which is doubtfully referred to the Coptic word *ouahe*, a dwelling place). On the desert Libyan plateau immediately west of the Nile between Aswan and Cairo are areas where the water comes to the surface or is found in shallow wells, *e.g.*, Oases of Khârga, Dâkhla and Farâfra. The water may come to the surface in springs, upon the artesian principle, or it may collect and remain in mountain hollows. These areas vary considerably in extent; they are always intensively cultivated, and support thick growths of date-palms; and all kinds of tropical vegetables, grains and small fruits are grown. Some oases have a large population with substantial dwellings, others are merely halting-places.

OASTLER, RICHARD (1789–1861), English reformer, was born at Leeds on Dec. 20, 1789, and in 1820 succeeded his father as steward of the Thornhills' extensive Fixby estates at Huddersfield, Yorkshire. In 1830 John Wood, a Bradford manufacturer, called Oastler's attention to the evils of child employment in the factories of the district. Oastler at once started a campaign against the existing labour conditions by a vigorous letter, under the title "Yorkshire Slavery," to the *Leeds Mercury*. After many years of agitation, in which Oastler played a leading part, the Ten Hours Bill and other Factory Acts were passed, Oastler's energetic advocacy of the factory-workers' cause procuring him the title of "The Factory King." In 1838, however, owing to his opposition to the new poor law and his resistance of the commissioners, he had been dismissed from his stewardship at Fixby; and, in 1840, being unable to repay £2,000 which he owed his late employer, Thomas Thornhill, he was sent to the Fleet prison, where he remained for over three years. From prison he published the *Fleet Papers*, a weekly paper devoted to the discussion of factory and poor-law questions. In 1844 his friends raised a fund to pay his debt, and on his release he made a triumphant entry into Huddersfield. Oastler died on Aug. 22, 1861.

See W. R. Croft. *The History of the Factory Movement, or, Oastler and his Times* (1888).

OAT, a cereal (*Avena sativa*) belonging to the family Gramineae or grasses. The genus *Avena* contains about 70 species mostly dispersed through the temperate regions of the Old World. The spikelets form a loose panicle, familiar in the cultivated oat, the flowering glume having its dorsal rib prolonged into an awn, which is in some species twisted and bent near the base.

Cultivated Oats.—The various cultivated oats seem to have been derived from the wild species, *A. fatua, A. sterilis* and *A. barbata. A. strigosa* is "the bristle-pointed oat." The white and black varieties of this species were cultivated on poor exposed land in Scotland. The "naked oat," *A. nuda,* was found by Bunge in waste ground about Peking; it was identified by the botanist Lindley with the pilcorn of the old agriculture; it was in cultivation in England in the 13th century. Both this and the "common otes," *A. vesca,* are described by Gerard. Parkinson tells us that in his time (early in the 17th century) the naked oat was sown in sundry places, but "nothing so frequent" as the common sort. The chief differences between *A. fatua* (wild oat) and the cultivated oat, are that in the former the chaff-scales which adhere to the grain are thick and hairy, and in the latter they are not so coarse and are hairless. The wild oat, moreover, has a long stiff awn, usually twisted near the base. In the cultivated oat it may be wanting, and if present it is not so stiff and is seldom bent. The grain is very small and worthless in the one, but larger and full in the other. The many varieties of the cultivated oat are included under two principal races—common oat or panicled oat with a spreading panicle, *A. sativa* proper, and Tatarian oats or banner oats which is often regarded as a distinct species, *A. orientalis,* with contracted one-sided panicles. With regard to the antiquity of the oat, A. de Candolle observes that it was not cultivated by the Hebrews, the Egyptians, the ancient Greeks or the Romans. Central Europe appears to be the locality where it was cultivated earliest, at least in Europe, for grains have been found among the remains of the Swiss lake-dwellings perhaps not earlier than the bronze age, while Pliny alludes to bread made of it by the ancient Germans. Pickering also records Galen's observations (*De Alim. Fac.* i. 14), that it was abundant in Asia Minor where it was made into bread as well as given to horses.

Besides the use of the straw when cut up and mixed with other food for fodder, the oat grain constitutes an important food for both man and beast. The oat grain (excepting the naked oat), like that of barley, is closely invested by the husk. Oatmeal is made from the kiln-dried grain from which the husks have been removed; and the form of the food is the well-known "porridge." In Ireland, where it is sometimes mixed with Indian-corn meal, it is called "stirabout." Groats or grits are the whole kernel from which the husk is removed. Their use is for gruel, which used to be consumed as an ordinary drink in the 17th century at the coffee-houses in London. The meal can be baked into "cake" or biscuit, as the Passover cake of the Jews; but it cannot be made into loaves in consequence of the great difficulty in rupturing the starch grains, unless the temperature be raised to a considerable height. With regard to the nutritive value of oatmeal, as compared with that of wheat flour, it contains a higher percentage of albuminoids than any other grain, viz. 12·6—that of wheat being 10·8—and less of starch, 58·4 as against 66·3 in wheat. It has rather more sugar, viz. 5·4—wheat having 4·2—and a good deal more fat, viz. 5·6, as against 2·0 in flour. Lastly, salts amount to 3·0% in oat, but are only 1·7 in wheat. Its nutritive value, therefore, is higher than that of ordinary seconds flour.

Economically, the oat ranks as one of the most valuable cereals. In 1925 the total world production, exclusive of Russia and China, was estimated at 3,957,000,000 bu. of 32 lb. each, of which the United States contributed 1,502,529,000 and Canada, 513,384,000. Germany yielded 384,737,000 bu.; France, 327,645,000; Poland, 228,145,000; and the United Kingdom, 206,878,000. (*See* OATS: *Cultivation and Trade.*)

For details *see* A. de Candolle, *Origin of Cultivated Plants* (1884); W. W. Robbins, *Botany of Crop Plants* (Philadelphia, 1924); J. Percival, *Agricultural Botany,* (7th ed., 1926).

OATES, TITUS (1649–1705), English conspirator, was the son of Samuel Oates (1610–1683), an Anabaptist preacher, chaplain to Pride, and afterwards rector of All Saints' Church, Hastings. On leaving Cambridge he took Anglican orders, and officiated in several parishes, Hastings among them. Having brought malicious charges in which his evidence was rejected, he narrowly escaped prosecution for perjury. He next obtained a chaplaincy in the navy, from which he was speedily dismissed. He now applied for help to Dr. Israel Tonge, a rector who was obsessed with the idea of Roman Catholic plots; Oates was to help him in unravelling the plots. To this end it was decided that Oates should pose as a Catholic. He spent some time at the Jesuit colleges of Valladolid and St. Omer, being expelled from both.

Returning in June 1678 to Tonge, he forged a plot by piecing together things true and false, or true facts falsely interpreted, and by inventing treasonable letters and accounts of preparations for military action. The whole story was written by Oates in Greek characters, copied into English by Tonge, and finally told to one of Charles II.'s confidential servants named Kirkby. Kirkby having given the king his information, Oates was sent for. He gave details, in 43 articles, of the plot and the persons who had engaged to assassinate Charles. Charles at no time believed this incredible farrago. To bolster up the case a fresh packet of five forged letters was concocted; but the forgery was transparent, and even Sir William Jones, the attorney-general, though a violent upholder of the plot, dared not produce them as evidence.

Oates now made an affidavit before Sir Edmond Berry Godfrey (*q.v.*) to an improved edition of his story, in 81 articles. Among the persons named was Coleman, secretary to the duchess of York, whom Godfrey knew, and to whom he sent word of the charges. Coleman in turn informed the duke, who induced Charles to compel Oates to appear before the privy council. Here Oates was exposed by a few simple questions. But among the papers seized at Oates's request were Coleman's, and in them were found copies of letters written to Père la Chaise, suggesting that Louis should furnish him with money, which he would use in the French and Catholic interest among members of parliament. Among them, too, were these passages: "Success will give the greatest blow to the Protestant religion that it has received since its birth"; "we have here a mighty work upon our hands, no less than the conversion of three kingdoms, and by that perhaps the utter subduing of a pestilent heresy, which has so long domineered over great part of the northern world." The credit of Oates was thus, in the eyes of the people, re-established, and Coleman and others named were imprisoned.

On Oct. 12, occurred the murder of Godfrey. On Oct. 21, parliament met, and Oates was called before the House. A new witness was wanted to support Oates's story, and in November a man named William Bedloe came forward. At first he remembered little; by degrees he remembered everything that was wanted. Oates then accused the queen before Charles of high treason, and carried his tale before the House of Commons. The Commons voted for the queen's removal from court, but, the Lords refusing to concur, the matter dropped. It was not, however, until 1679 that the slaughter of Jesuits and other Roman Catholics upon Oates's testimony and that of his accomplices was checked. Sir George Wakeman, the queen's physician, was accused of purposing to poison the king, and the queen was named as being concerned in the plot. Sir Philip Lloyd proved Oates to have perjured himself, and Wakeman was acquitted. On June 26, 1680, upon Oates's testimony, the duke of York was presented as a recusant at Westminster. But the panic had worn itself out, and Oates retired on a pension. Shortly before the death of Charles, James brought, and won, a civil action against Oates, with damages of £100,000; in default of payment Oates was taken to prison; while there he was indicted for perjury, and was tried in May 1685, soon after the accession of James II. He received a severe sentence with repeated floggings, which was expected to kill him, but to the astonishment of all he survived.

Oates was in prison for three and a half years. Finally he received a royal pardon, with a pension of £300 a year. The remainder of his life was spent in retirement, varied by sordid intrigue. In 1691 he became acquainted with William Fuller, whom he induced to forge another plot, though not with the success he

had himself attained. In 1696 he dedicated to William III. a book called *Eikon Basilike,* a tissue of invective against "the late king James." In 1698 he obtained admission as a member of the Baptist Church, and used to preach at Wapping; but in 1701, as the result of a financial scandal, he was formally expelled from the sect. He died on July 12, 1705.

BIBLIOGRAPHY.—Oates's, Dangerfield's and Bedloe's *Narratives; State Trials; Journals of Houses of Parliament;* North's *Examen;* the various memoirs and diaries of the period; Fuller's *Narrative;* Dryden's *Absalom and Achitophel;* Burnet's *History;* Narcissus Luttrell's *Relation.* Lingard's *History* gives an exhaustive and trustworthy account of the Popish terror and its victims; and the chief incidents in Oates's career are graphically described by Macaulay. On the question of the place of his education see *Notes and Queries* (Dec. 22, 1883). *See* also T. Seccombe's essay in *Twelve Bad Men* (1894, bibliography).

OATH (O.Eng. *âdh*), an asseveration or promise made under non-human penalty or sanction. The word is found throughout the Teutonic languages, but without ascertainable etymology.

Retribution for Violation (*see* DYNAMISM).—The harm or penalty consequent on perjury may be considered to result directly, without any spirit or deity being mentioned. Thus among the Nagas of Assam, two men will lay hold of a dog or a fowl by head and feet, which is then chopped in two with a single blow of the dao, this being emblematic of the fate expected to befall the perjurer. Or a man will take hold of the barrel of a gun, a spear-head or a tiger's tooth, and solemnly declare, "If I do not faithfully perform this my promise, may I fall by this!" (Butler in *Journ. Asiatic Soc., Bengal,* 1875, p. 316).

In Siberia, in lawsuits between Russians and the wild Ostiaks, it was usual to bring into court the head of a bear, the Ostiak making the gesture of eating, and calling on the bear to devour him in like manner if he does not tell the truth. Similar oaths are sworn on the head or skin of a tiger by the Santals and other indigenous tribes of India. Death by a tiger precludes reincarnation and therefore involves social and physical extinction. Both in the old and modern world oaths by rivers are most sacred. In earlier ages men swore inviolably by Styx or Tiber, and an oath on water of the Ganges is to the Hindu the most binding of pledges, for the goddess will take awful vengeance on the children of the perjurer. The Tungus brandishes a knife before the sun, saying, "If I lie may the sun plunge sickness into my entrails like this knife."

The transition to invoking gods conceived in human form is shown in the treaty-oath between the Macedonians and the Carthaginians recorded by Polybius (vii. 9); here the sun and moon and earth, the rivers and meadows and waters, are invoked side by side with Zeus and Hera and Apollo, and the gods of the Carthaginians. The heaven-god, able to smite the perjurer with his lightning, was invoked by the Romans, when a hog was slain with the sacred flint representing the thunderbolt, with the invocation to Jove so to smite the Roman people if they broke the oath (Liv. i. 24; Polyb. iii. 25). But bears and tigers are as apt to kill truth-tellers as perjurers, and the lightning-flash falls without moral discrimination. In the *Clouds* of Aristophanes, the Socrates of the play points out that notorious perjurers go unharmed, while Zeus hurls his bolts at his own temple and the tall oaks, as if an oak-tree could perjure itself.

The doctrine of miraculous earthly retribution on the perjurer lasted on in legend, as where Eusebius relates how three villains conspired to bring a false accusation against Narcissus, bishop of Jerusalem, which accusation they confirmed by solemn oath before the church, one wishing that if he swore falsely he might perish by fire, one that he might die of the pestilence, one that he might lose his eyes; a spark no man knew from whence burned to ashes the first perjurer's house and all within, the second was consumed by the plague from head to foot, whereupon the third confessed the crime with tears so copious that he lost his sight (Euseb. *Hist. Eccl.* vi. 9). In general the supernatural retribution on perjury has been transferred to beyond the grave.

International Forms.—Gestures such as grasping hands, or putting one hand between the hands of another in token of homage, are not oaths, but ceremonies of compact. Even the covenant among many ancient and modern nations by the parties mixing their blood or drinking one another's is in itself only a solemn rite of union, not an oath proper.

The act of swearing by weapons may signify that the swearer if forsworn is to die by such a weapon; or the warrior may appeal to his weapon as a powerful or divine object (*see* Du Cange, *s.v.* "Juramenta super arma"; Grimm, *Deutsche Rechtsalterth.*, p. 896). Stretching forth the hands towards the object or deity is a natural gesture, used by Israelites (Gen. xiv. 22; Deut. xxxii. 40; *see* Dan. xii. 7; Rev. x. 5). In France a juror takes oath by raising his hand, saying, "Je jure!" The Scottish judicial oath is taken by the witness holding up his right hand uncovered, and repeating after the usher, "I swear by Almighty God, and as I shall answer to God at the great day of judgment, that I will," etc.

In the ancient world sacrifice (*q.v.*) often formed part of the ceremony of the oath; typical examples may be found in the Homeric poems. Details of the old Scandinavian oath have been preserved in Iceland in the Landnámabók (*Islendinga Sögur,* Copenhagen, 1843); a bracelet (baugr) of two rings or more was to be kept on the altar in every head court, which the godi or priest should wear at all law-things held by him, and should redden in the blood of the bullock sacrificed, the witness pronouncing the remarkable formula: "Name I to witness that I take oath by the ring, law-oath, so help me Frey, and Niörd, and almighty Thor" (hialpi mer svâ Freyr, ok Miördr, ok hinn almâttki Âss), etc. This was doubtless the great oath on the holy ring or bracelet which the Danes swore to King Alfred to quit his kingdom.

Under Christ's injunction, "Swear not at all" (Matt. v. 34; also James v. 12), many Christians have shrunk from taking oaths, *see* writings of the Fathers. In more modern times Anabaptists, Mennonites and Quakers have refused to take even judicial oaths. On the other hand, the laws of Christendom from early ages have been directed against such swearing as was considered profane or otherwise improper, and against perjury. Constantine's laws required every witness in a cause to take oath; this is confirmed in Justinian's code which even in some cases requires also the parties and advocates to be sworn (*Cod. Theod.* xi. 39; *Justin. Cod.* iv. 20, 59). Bishops and clergy were called upon to take oath in ordination, monastic vows, and other ecclesiastical matters (*see* details in Bingham, *Antiq. of Chr. Church,* xvi. 7). The Reformation conformed to this principle in Art. xxxix. of the church of England. The Christian oath on a copy of the Gospels seems derived from the late Jewish oath taken holding in the hand the scroll of the law (or the phylacteries), a ceremony itself possibly adapted from Roman custom (*see* treatise "Shebuoth" in *Gemara*). The practice of kissing the book, established in England, appears in the middle ages (J. E. Tyler, *Oaths,* pp. 119, 151). The book was often laid on the altar, or the swearer laid his hand on the altar itself, or looked towards it; or touched relics of saints on the altar. Other objects, as the cross, the bishop's crosier, etc., were sworn by (*see* Du Cange, *s.v.* "Jurare"). An oath ratified by contact or inspection of a sacred object was called a "corporal" or bodily oath, as distinguished from a merely spoken or written oath.

Oath Formulas.—Among the oath formulas used in Christendom, that taken by provincial governors under Justinian is typical of one class: "I swear by God Almighty, and His only begotten Son our Lord Jesus Christ, and the Holy Ghost, and the Most Holy Glorious Mother of God and ever Virgin Mary, and by the Four Gospels which I hold in my hand, and by the Holy Archangels Michael and Gabriel," etc. The famous oath of the kings Louis and Charles at Strassburg in A.D. 842 runs: "By God's love and the Christian people and our common salvation, as God shall give me knowledge and power," etc. In the oath of fealty in the capitularies of Charlemagne in 802, is found the familiar form "Sic me adjuvet Deus," corresponding to formulas of pre-Christian Rome. This became widely spread in Europe, appearing in Old French "Si m'ait Dex," German "So mir Gott helfe," English "So help me God." A remarkable point in its history is its occurrence in the "So help me Frey," etc., of the old Scandinavian ring-oath already described. William the Conqueror swore "by the splendour of God," Richard I. "by God's legs," John "by God's teeth"; other phrases are given in Du Cange as "per omnes gentes," "per coronam," "par la sainte figure de Dieu," "par la mort Dieu," etc.

Law.—In England the coronation oath is administered by an archbishop or bishop in the presence of the people, who, on their parts, reciprocally take the oath of allegiance to the crown. *The archbishop or bishop shall say:* "Will you solemnly promise and swear to govern the people of this United Kingdom of Great Britain and Ireland and the dominions thereto belonging according to the statutes in parliament agreed on, and the respective laws and customs of the same?" *The king shall say:* "I solemnly promise so to do." *Archbishop or bishop:* "Will you to the utmost of your power cause law and justice, in mercy, to be executed in all your judgments?" *King:* "I will." *Archbishop or bishop:* "Will you to the utmost of your power, maintain the laws of God, the true profession of the Gospel, and the Protestant reformed religion established by law? And will you maintain and preserve inviolably the settlement of the Church of England and the doctrine, worship, discipline and government thereof, as by law established in England? And will you preserve unto the bishops and clergy of England, and to the churches therein all such rights and privileges as by law do or shall appertain to them, or any of them?" *King:* "All this I promise to do." *After this the king, laying his hand upon the holy Gospels, shall say:* "The things which I have here before promised I will perform and keep; so help me God," *and then shall kiss the book.* (*See* CORONATION.)

The chief officers of state take an "official" oath well and truly to serve his majesty. Special oaths are taken by privy councillors, archbishops and bishops, peers, baronets and knights, recruits and others. The old oath of allegiance, as administered (says Blackstone, *Commentaries,* book i. chap. x.) upwards of 600 years, was replaced in the reign of William III. by a shorter form; and it now runs: "I . . . do swear that I will be faithful and bear true allegiance to His Majesty . . . , his heirs and successors, according to law." Statutes of Charles II. and George I. enacted that no member should vote or sit in either house of parliament without having taken the several oaths of allegiance, supremacy and abjuration. In modern times a single parliamentary oath was substituted for the three, and this was altered to enable Roman Catholics to take it; Jews were enabled to sit in parliament by being allowed to omit the words "on the true faith of a Christian." In its present form the parliamentary oath consists of an oath of allegiance and a promise to maintain the succession to the crown as limited and settled in the reign of William III. The right to affirm in lieu of taking the parliamentary oath was first raised in the case of Charles Bradlaugh (*q.v.*).

The "judicial" oath taken by judges of the court of appeal or of the High Court of Justice, and by justices of the peace, is "to do right to all manner of people after the laws and usages of this realm, without fear or favour, affection or ill-will." Jurors are sworn, whence indeed their name (*iuratores*); in felonies the oath administered is: "You shall well and truly try and true deliverance make between our sovereign lord the king and the prisoner at the bar whom you shall have in charge, and a true verdict give according to the evidence." (*See* JURY.) The oath of the jurors in the Scottish criminal courts is: "You [the jury collectively] swear in the name of Almighty God and as you shall answer to God at the great day of judgment that you will truth say and no truth conceal in so far as you are to pass upon this assize." In the ancient custom of compurgation, once prevalent in Europe, the accused's oath was supported by the oaths of a number of helpers or compurgators who swore to their belief in its validity.

Witnesses in English law courts must give their evidence under the sanction of an oath, or of what is equivalent to an oath, and the ordinary form of oath adapted to Christians is: "The evidence you shall give . . . shall be the truth, the whole truth, and nothing but the truth. So help you God." Many alterations of the English law as to oaths have been made in relief of (1) those Christians who object on conscientious grounds to the taking of an oath, and (2) of those persons who refuse to admit the binding force of an oath. Special provision was first made for Quakers, Moravians and Separatists; then followed general enactments relating to civil and criminal proceedings respectively, till finally the law was embodied in the Oaths Act 1888, which enacted that "every person upon objecting to being sworn, and stating, as the ground of such objection, either that he has no religious belief, or that the taking of an oath is contrary to his religious belief, shall be permitted to make his solemn affirmation instead of taking an oath." . . . The form of affirmation prescribed by the Oaths Act was as follows: "I, *A. B.*, do solemnly, sincerely, and truly declare and affirm," etc. Under s. 5 of the same act a person might swear in the Scottish form, with uplifted hand (no book of any kind being used) and if he desired to do so "the oath shall be administered to him in such form and manner without question." With the desire of making universal the method of administering the oath the Oaths Act 1909 was passed. A Christian swears on the Gospels, holding a copy of the New Testament in his uplifted right hand, the hand being uncovered, and his head being also uncovered. A witness may elect to be sworn on any version of the Bible which he considers most binding on him, as a Roman Catholic on the Douai Testament or Bible. A Jew is sworn on the Pentateuch, holding a copy thereof in his right hand, the head being covered. A Mohammedan is sworn upon the Koran. He places his right hand flat upon the book and puts the other hand upon his forehead, bringing his head down to the book and in contact with it. He then looks at the book for some moments. Buddhists are sworn on the Buddhist doctrines, Sikhs upon the Granth, Parsees upon the Zend Avesta, Hindus upon the Vedas, or by touching the Brahmin's foot, and, according to caste custom, Indian witnesses sometimes insist upon the oath being administered by a Brahmin; but in India witnesses now generally affirm. Kafir witnesses swear by their own chief, and a Kafir chief by the king of England. When a Chinese witness is to be sworn, a saucer is handed to him which he takes and, kneeling down, breaks into fragments.

The administering or taking of unlawful oaths is criminal in English and Scots law. Statutes relating to the offence were passed in 1797, 1799, 1810 and 1812, and it is evident from the preamble of the latter act (Unlawful Oaths Act 1812) that they were aimed at those societies in the United Kingdom at the time of the French Revolution which required or permitted their members to take an unlawful oath. Supplementary statutes were passed in 1817 and 1837. Children of tender years, who, in the opinion of the court, have not sufficient intelligence to understand the nature of an oath, may give evidence without being sworn.

United States.—In the United States oaths required by way of qualification for public office or citizenship are generally prescribed by constitutions or statutes. At an early date provisions were made for simple affirmation for the benefit of those whose religious faith proscribed the taking of an oath. Witnesses in the law courts or before legal or administrative officials invested with the power of administering oaths must give their evidence under oath or by affirmation. Belief by the witness in a God and an appeal to him as an avenger of falsehood are the essentials of the oath. Liberal allowances may thus be made for the taking of oaths by non-Christians, the witness being sworn in such fashion as he considers binding on his conscience. Professed atheists have on occasion been excluded from the witness stand, but generally the religious belief of a witness can only be used to impeach his credibility. No special form need accompany the administration of an oath, unless required by statute, provided that some formal act be done to impress the witness with the distinction between sworn statements and bare assertions.

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OATS: CULTIVATION AND TRADE. Oats are the principal cereal crop in Great Britain, their acreage in England and Wales exceeding that of wheat by one-fifth and in other parts of the kingdom by a still greater margin.

The oat is a comparatively hardy, robust plant and is adaptable to a wide range of soils. Although not immune to the effects of soil acidity, oats may be grown with success on land that is too sour for barley or wheat, and it is a common crop on peaty soils. The heaviest yields of grain are obtained either where the soil is moist, as in fen districts, or where the summer rainfall is ample, as in the western counties. Lack of moisture induces premature

grain formation. Too much moisture, on the other hand, causes excessive growth of straw with a tendency to lodging and uneven or late ripening.

Although there are seven species in the genus *Avena*, all the varieties of oat grown in this country belong to the species *sativa* and its sub-species *sativa orientalis*, which comprises such sorts as Tartarians, whose panicle is one-sided instead of being open as in the main group. Hunter classifies the numerous varieties of open-headed oats in five groups:—1. Winter hardy oats (Grey Winter, Black Winter, etc.); 2. Semi-hardy sorts (Black Bell, Mogul, etc.); 3. Potato division (Potato, Sandy, etc.); 4. Abundance division (Abundance, Victory, Golden Rain); and 5. Early ripeners (Aurora, Sixty Day, etc.).

Winter varieties are preferred to spring sorts in dry, warm localities, where frit fly is troublesome on oats sown after mid-March; they also ripen early and favour autumn cleaning operations preparatory for root crops. Grey winters are somewhat hardier and are more suitable for poor soils than Blacks, but the latter are capable of higher yields on better land and are less liable to lodging. White winter oats are not sufficiently hardy to be considered a reliable winter-sowing sort, but they do very well for February and even January sowing.

Oats are very adaptable in the matter of crop sequence: they may follow any crop in the rotation, and are the favourite first-crop on reclaimed or broken up grass land. The soil preparations for oats are of the simplest description: the land is ploughed about 5 in. deep some time during the winter, usually January, and nothing more is done until the soil is dry enough to receive the seed in spring. In humid districts, broadcasting is still common, but elsewhere the seed is usually drilled; the seed is advisedly covered rather more deeply than other cereals, 2 in. to 3 in. being the proper depth. Thorough harrowing and, when the soil is dry enough, heavy rolling complete the cultivations for the crop. It is not customary to apply manure to the oat crop, except a little nitrogenous top dressing where the soil is poor.

Early sowing—March, or even February with hardy varieties—is desirable to avoid frit fly attack, but successful results may attend April sowing in more humid districts. Typically 170–200 lb. of seed are sown per acre, but with very large grained sorts or in hill farming, heavier seeding is believed to be beneficial. Winter oats are drilled at lighter rates, typically 120 lb. per acre, and October is the normal month for sowing.

Winter oats are generally ready for cutting in the latter half of July, and spring sown varieties about the second week in August. Owing to their tendency to shed grain, oats are advisedly cut rather before they would be dead ripe. Generally the crop is ready for stacking after ten days drying in stooks. The average yield per acre is 14 cwt. of grain and about 20–25 cwt. of straw.

Most of the oats grown in Great Britain are used on the farms for feeding to live stock, but of the 2 to 2¼ million tons produced annually about 600,000 to 650,000 tons are sold off the farms and are purchased mainly for feeding to town horses, poultry, etc., and for the making of oatmeal.

Average Annual Imports of Oats

Countries from which consigned	1909–13	1922–26
	Tons	Tons
Argentina	282,000	130,000
Chile	30,000	29,000
Germany	120,000	5,700
Rumania	30,000	2,600
Russia	287,000	2,500
United States	38,000	99,000
Total Foreign Countries*	802,000	284,000
Canada	72,000	142,000
New Zealand	21,000	1,300
Total British Countries*	98,000	170,000
Total	900,000	454,000

*Includes imports from countries not named.

In the years 1922–26 imports of oats averaged about 454,000 tons per annum, about 284,000 tons coming from foreign countries and 170,000 tons from Empire countries overseas. Much smaller quantities are now imported than formerly, the average annual imports in 1909–1913 being about 900,000 tons, and even in the seventies of the nineteenth century the average annual imports were 600,000 tons. The reduction in imports as compared with the five years before the World War is wholly in imports from foreign countries, more being received from British countries. (J. R. B.; H. C. L.)

Cultivation in the United States.—Oats are grown to some extent in almost all parts of the United States, but principally in a belt extending westward from New York to North Dakota and south to the latitude of the mouth of the Ohio river. Most crops in the United States are spring-sown, fall sowing being practised only in the South. The date of fall seeding varies from Sept. 15 to Nov. 15, according to the locality, while the date of spring seeding varies from January to May, in like manner. Oats are seeded broadcast or with a grain drill, the latter method being preferable.

Oats are sometimes grown in combination with other crops for the production of hay or grain and are used as a nurse crop for clover and grass and as a cover crop in orchards. They are very useful likewise for clearing land of weeds. Oats are frequently grown in rotation with corn and grass or clover in the North, and with cotton and corn in the South. Where new land is being brought under cultivation, oats are usually grown on old land, corn, or sorghum, wheat or flax being more commonly grown on sod land.

Oats Trade of the United States.—Oats enter into commerce much less than wheat because they are too bulky in relation to price to bear the burden of long distance transportation. The production of oats in the United States in the past five years has averaged about 1,300 million bushels of which about one-fourth has entered into commerce. The bulk of oats production is north of the area of maize production. Minneapolis and Chicago are the most important primary markets. St. Louis, Omaha and Milwaukee are also important markets. The bulk of the oats crop is consumed by animals in the United States. Only about 3% is for human consumption. Very little of the crop is exported.

Oats, as well as corn and wheat, moving into interstate commerce, are subject to inspection by the Federal Government. For commercial purposes there are four classes, namely, white, red, grey and black oats. (O. C. S.)

OAXACA (wah-hah'ka) or **OAJACA** (officially OAXACA DE JUÁREZ), a southern State of Mexico, including the southern and larger part of the Isthmus of Tehuantepec. Pop. (1900) 948,633, (1910) 1,040,398, (1920) 1,159,789, a large majority of whom are Indians. The State has an area of 35,382sq.m. broken by mountain ranges into numerous broad fertile valleys, chiefly lying in the *tierra templada* region. The isthmus districts, however, have lower elevations and are distinctly tropical. The coast line is 329m. long; behind it is a narrow strip of lowlands lying within the *tierras calientes*. In places this strip nearly disappears, the sierras rising almost immediately from the seashore. The highest points are Zempoaltepetl (11,145ft.), San Felipe del Agua (10,253ft.), and the Cerro del Leone, the highest summit in the Sierra Madre del Sur. The only ports on the coast open to foreign trade are Salina Cruz and Puerto Mexico—the first, the Pacific terminus of the Tehuantepec railway, with a spacious artificial harbour, and the second a deep but narrow natural harbour, the coast terminus of the Tehuantepec National railway. The greater part of the State has a sub-tropical climate, with high sun temperatures, moderate rainfall and mild, healthful conditions. The less healthful regions include the isthmus districts, the coastal zone on the Pacific and the low country near Vera Cruz. The chief products are Indian corn, wheat, coffee, sugar, rubber, cotton, cacao, tobacco, indigo and a great variety of tropical fruits. Among the manufactured products are cotton, woollen and "pita" fibre fabrics, sugar, rum, mescal, beer, furniture, pottery, soap, candles, leather, matches, chocolate, flour and cigarettes. Two important railway lines traverse the State—the Tehuantepec National (trans-isthmus) and the Mexican Southern line (narrow-

gauge) from Puebla to Oaxaca. Two progressive Indian races, the Zapotecas and Mixtecas, descendants of those who built the remarkable cities of Mitla and Monte Alban (*see* CENTRAL AMERICA: *Archaeology*) form the greater part of the population.

OAXACA or **OAXACA DE JUÁREZ** (official title) (from Aztec *Huaxyacac*), capital of the Mexican State of Oaxaca. Pop. (1921) 27,792, largely Indians, most of whom are Mixtecas and Zapotecas. Oaxaca is connected with Puebla (211 m.) by the Mexican Southern railway. The city lies in a broad, picturesque valley 5,085 ft. above sea-level, and has a mild temperate climate. It has a fine old cathedral in the Spanish Renaissance style and dating from 1553; rebuilt in 1702.

According to tradition the Aztec military post and town of Huaxyacac was founded in 1486. The date of the first Spanish settlement is uncertain, but it was probably between 1522 and 1528. The city suffered severely in the earthquakes of 1727 and 1787, the cathedral being greatly damaged in 1727. In war and revolution, it has been repeatedly captured.

OB or **OBI,** river of Asiatic Russia, known to the Ostiaks as the As, Yag, Kolta and Yema; to the Samoyedes as the Kolta or Kuay; and to the Tatars as the Omar or Umar. Its length is roughly 2,400 m.; the area of its basin is considerably more than a million sq.m. and the navigable waters in its basin total more than 17,000 m. Its source is in the Altai mountains and its course is through hilly country to the Kirghiz steppe and thence it flows to its delta in the gulf of Ob, an inlet of the Arctic ocean 600 m. in length. In its middle course, south of its junction with the Irtysh, and extending between the two streams, are the Vasuigan swamps, named from the Vasuiga, a left bank tributary of the Ob. They extend for 100,000 sq.m. and in summer are impassable marshes, with dense thickets of cedars, larches and pines. In spring they are flooded and are then known as the Vasuigan sea. In winter they become ice-bound and may be crossed. When drained the land proves fertile. North of the swamps the river flows through coniferous forest to Berezov, and passes Obdorsk, where there is a Veterinary Institute for the help of the reindeer breeders and to which small sea-going vessels can penetrate.

After receiving its largest tributary, the Irtysh, the Ob divides into more than one arm and is of little use for navigation except for barges bringing fish from the delta in the autumn. Above the junction of the Irtysh, steamers and barges ply upon the Ob and its tributaries the Irtysh, the Tobol, the Tavda and the Tura in summer. In 1915 there were 350 steamers and several hundred barges chiefly carrying corn, flour, salt and timber, in addition to passengers. The east-west river traffic is giving place to railway communication, but the north-south route is still very important. The river is frozen from November to May or June; floods, ice and floating timber impede navigation for some time after the thaw.

The fact that in its southern parts the Ob approaches so close to the Yenisei that short and easy portages link them, made the penetration of Siberia by the Cossacks an easy task. The Chulim, a tributary of the Ob, in its upper course is at one point only six m. from the Yenisei, but a canal link is impossible owing to the great difference in level, while the Ket river, another right bank tributary of the Ob has canal communication with the Kas, a tributary of the Yenisei.

The Irtysh, which is quite as important as the Ob, rises as the Black Irtysh, south of the Mongolian border, and flows through the Dzungarian gate into Russia, where it expands into Lake Zaisan, and then cuts its way across a spur of the Altai into the plains. There are lakes, many of which are salt and are rapidly drying; flourishing villages stand on the site of what in the early part of last century was Lake Chany.

OBADIAH, the fourth of the "minor prophets," the otherwise unknown author of the shortest book in the Old Testament, whose 21 verses, even, show evidence of the expansion or addition of which a manuscript, as distinct from a printed book, so easily admits. Whilst the first fourteen verses address Edom in the second person singular, with apparent reference to recent disasters that have befallen that people, the last six address Israel in the second person plural, promising judgment on the nations, including Edom, and proclaiming the eschatological "Day of Yahweh," when the lost territories shall be recovered. (The "join" is made in verse 15, of which *a* belongs to the latter, and *b* to the former, prophecy.) The Edomites (identified with "Esau," verse 6; *cf.* Gen. xxxvi. 1) occupied the mountainous country south of the Dead Sea, on both sides of the Arabah; hence the reference to their rock-dwellings (verse 3). The aid which they gave to the Babylonians against Jerusalem in 586 (Ps. cxxxvii. 7, etc.) was never forgiven, and its remembrance inspires the present prophecy (verses 11ff.). The actual disaster that befell the Edomites was probably some invasion by the neighbouring nomads, *e.g.*, the Nabatean Arabs (verse 7). The opening paragraph of Malachi may refer to the same event; if so, we may suppose the prophecy of Obadiah in its earlier part to belong to the first half of the fifth century B.C. The dominant thought of it is that at last Edom has received its deserts at the hand of Yahweh. We do not know at what date this earlier portion was continued and incorporated into the more general prophecy concerning the future vindication of Judah, with which the book now closes. The original prophecy has elsewhere been reproduced, as well as expanded. Its first five verses occur in almost the same form in Jer. xlix. 14–16 & 9 (*cf.* also Joel ii. 32), a passage probably later than Obadiah. *See* EDOM.

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OBAN, burgh and seaport, Argyllshire, Scotland, 113 m. N.W. of Glasgow by L.M.S., and about the same distance by water. Pop. (1921) 6,344. Its bay is screened by the island of Kerrera and sheltered by hills to the north and east. The Roman Catholic pro-cathedral was erected by the 3rd marquis of Bute. Oban, a government fishing station in 1786, is now the centre of tourist traffic for western Argyllshire and the islands.

At the north end of the bay stands the ruin of Dunolly Castle, the old stronghold of the Macdougalls of Lorne, whose modern mansion adjoins it. In the grounds is a huge conglomerate rock called the Dog Stone (*Clach-a-choin*), from the legend that Fingal used to fasten his favourite dog Bran to it. About 3 m. N.E. are the ruins of Dunstaffnage Castle. It was here that the "Stone of Destiny," now contained in the base of the coronation chair at Westminster Abbey, was kept before its removal to Scone.

OBBLIGATO or **OBLIGATO,** in the modern sense, a musical term for an instrumental accompaniment to a musical composition which, while in one way independent, is included by the composer on purpose and in a prescribed form, instead of being left to the discretion (*ad libitum*) of a performer.

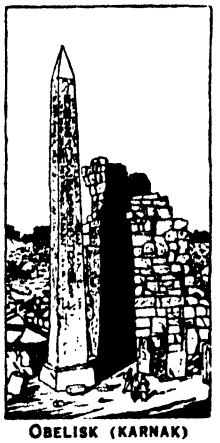
OBEDIENT-PLANT (*Physostagia virginiana*), a North American herb of the mint family (*Labiatae*), called also false dragon-head and lion's-heart, native to moist soil from Quebec to Ontario and Minnesota, and south to Florida and Texas. It is an erect, smooth, usually unbranched perennial, 1 to 4 ft. high, bearing oblong or lance-shaped, sharply-toothed, pointed leaves and dense terminal clusters (spikes) of pale-purple, rose-coloured or sometimes white flowers, about 1 in. long. The flower displays the peculiar characteristic of remaining temporarily at whatever angle it may be placed with reference to the stem.

OBELISK, a form of monumental pillar; and also the term for a bibliographical reference-mark in the form of a dagger. The typical Egyptian obelisk is an upright monolith of nearly square section, generally ten diameters in height, the sides slightly convex, tapering upwards very gradually and evenly, and terminated by a pyramidion whose faces are inclined at an angle of 60°. Obelisks were usually raised on pedestals of cubical form resting on one or two steps, and were set up in pairs in front of the entrance of temples. Small obelisks have been found in tombs of the Old Kingdom. The earliest temple obelisk still in position is that of

Senwosri I. of the XIIth Dynasty at Heliopolis (68 ft. high). A pair of Rameses II. (77 and 75 ft. high respectively) stood at Luxor until one was taken to Paris in 1831. Single ones of Tethmosis I. and Hatshepsut still stand at Karnak and remains of others exist there and elsewhere in Egypt. Colossal obelisks were erected by only a few kings, Senwosri I. in the Middle Kingdom and Tethmosis I., Hatshepsut, Tethmosis III. and Rameses II. of the Empire. Smaller obelisks were made in the Saïte period. The Romans admired them, and the emperors carried off some from their original sites and made others in imitation (*e.g.*, that for Antinous at Benevento); 12 are at Rome, one in Constantinople; two, originally set up by Tethmosis III. at Heliopolis, were taken by Augustus to adorn the Caesareum at Alexandria: one of these, "Cleopatra's Needle," was removed in 1877 to London, the other in 1879 to New York. The pyramidions were sheathed in bright metal, reflecting the sun's rays as if they were thrones of the sunlight. They were dedicated to solar deities, and were especially numerous at Heliopolis, where there was probably one of immemorial antiquity sacred to the sun. The principal part of the sun-temple at Abusir built by Neuserrē of the Vth Dynasty appears to have been in the shape of a stumpy obelisk on a vast scale; only the base now remains, but hieroglyphic pictures indicate this form. The hieroglyph of some other early sun-temples shows a disc on the pyramidion . The material employed for the great obelisks was a pink granite from Syene, and in these quarries there still remains, partially detached, an example 70 to 80 ft. long. The largest obelisk known is that in the piazza of St. John Lateran at Rome, set up by Tethmosis III. at Heliopolis in the 15th century B.C. and brought from Egypt by Constantine the Great and erected in the Circus Maximus, being ultimately re-erected in 1552 by Pope Sixtus V. It was 105 ft. 9 in. high, including the pyramidion, and its sides measured 9 ft. 10 in. and 9 ft. 8 in. respectively. On the base of the obelisk of Hatshepsut at Karnak, 97 ft. 6 in. high, there is an inscription stating that it and its fellow were made within the short space of seven months.

There was another form of obelisk, also tapering, but more squat than the usual type, with two of the sides narrow and terminating in a rounded top. One such of Senwosri I., covered with sculpture and inscriptions, lies at Ebgīg in the Fayum.

In Abyssinia, at Axum and elsewhere, there is a marvellous series of obelisk-like monuments, probably sepulchral. They range from rude menhirs a few feet high to elaborately sculptured monoliths of 100 feet. The loftiest of those still standing at Axum is about 60 ft. high, 8 ft. 7 in. wide, and about 18 in. thick, and is terminated by a rounded apex united by a necking to the shaft. The back of the obelisk is plain, but the front and sides are subdivided into storeys by a series of bands and plates, each storey having panels sunk into it which seem to represent windows with mullions and transom. These architectural decorations are derived from a style of building as found by a German expedition extant in an ancient church; courses of stone here alternate in the walls (both inside and out) with beams of wood held by circular clamps. In front of the best-preserved obelisk is a raised altar with holes sunk in it apparently to receive the blood of the sacrifice to the ancestors. Most of these must date before the adoption of Christianity as the State religion in the 6th century.



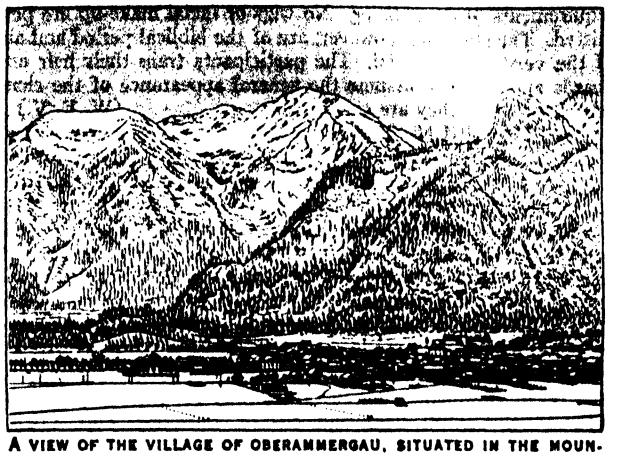
OBELISK (KARNAK)

See G. Maspero, *L'Archéologie égyptienne* (new ed., 1907); H. H. Gorringe, *Egyptian Obelisks* (New York, 1882; London, 1885, etc.); F. W. von Bissing and L. Borchardt, *Das Re-Heiligtum des Königs Ne-woser-Re* (1905); on the ancient method of raising obelisks, L. Borchardt, "Zur Baugeschichte des Amonstempel von Karnak," in Sethe's *Untersuchungen zur Geschichte und Altertumskunde Aegyptens*, vol. xv. For the Abyssinian obelisks *see* especially E. Littmann and D. Krencker, *Vorbericht der deutschen Aksum Expedition* (1906). (F. Ll. G.)

OBERAMMERGAU, a village of Bavaria, Germany, situated among the foot-hills of Kofel mountains, a range of the Alps, in the Ammer valley, 64 m. S.S.W. of Munich. Pop. about 1,700. The outside walls of many of the houses are decorated with fresco paintings, reproductions of famous biblical masterpieces. The villagers make toys and pottery, and carve wooden crucifixes, rosaries and images of saints. These carvings are shipped to all parts of the world and are found in many churches.

THE OBERAMMERGAU PASSION PLAY

The village is famous for its performance of a Passion play every ten years. This is probably the most important survival of



A VIEW OF THE VILLAGE OF OBERAMMERGAU, SITUATED IN THE MOUNTAINS OF BAVARIA

the miracle plays so popular from the 13th to the 16th century. Contrary to popular belief, this production is not a portrayal of the life of Christ, but only of the events of his last few days on earth, known as Passion week.

In 1633 the village was stricken with the scourge of the Black Death. As an expression of gratitude for the cessation of the scourge the inhabitants vowed to enact the Passion and death of Christ every ten years. The first performance was given in 1634 and repeated every ten years until 1674, after which the dates were changed so as to fall on decimal years. This now has been faithfully kept with the exception of 1870, when the Franco-Prussian War interfered. The earliest extant text of the play was written in 1662, probably by the monks of Ettal, a monastery situated a few miles from Oberammergau. The text is slightly revised every ten years. The music was composed by Rochus Dedler, a schoolmaster of the parish, in 1814. The initial performance of the play is given the first Sunday in May, and is repeated every Sunday, with two or three extra performances each week. On account of the unsettled conditions resulting from the World War the 1920 production was postponed until 1922, during which year it was played 61 times. It starts at eight o'clock in the morning and continues for eight hours, with a short intermission at noon. The characters are chosen by a committee made up of the village priest, burgomaster, village council and members selected by popular vote. No one may participate in the spectacle unless he is a native of the village and is of unimpeachable moral character and dramatically qualified to enact the rôle for which he is chosen. Over 700 characters participate in the play. This includes the orchestra of 50 members and the chorus of 46. It is estimated that more than 300,000 witness the production each season. The proceeds are divided into four equal parts: one for the preparation of the play, one for the furnishing of homes for the visitors, one for the church and one for the players.

The play is enacted on a large open-air platform, the audience occupying an auditorium with a capacity of about 6,000, viewing the play through an immense oval opening in front of the auditorium. The play consists of 18 acts and a number of tableaux. Each act is prefaced by an orchestral selection and a choral anthem giving the motif of the act. This, in turn, is followed by

a tableau based on the Old Testament prefiguring the theme of the act. For instance, the scene depicting the Crucifixion is preceded by a tableau representing the offering of Isaac as a sacrifice by Abraham. The chief characters are the Christus, the Twelve Disciples, Mary the mother of Jesus, Mary Magdalene and Martha. Anton Lang holds the distinction of portraying the part of the Christus for three decades, 1900, 1910 and 1922. The participants regard their rôles with religious devotion and enact their parts with the deepest reverence. In the years intervening between the representations of the play performances are given of many classics for the purpose of training the prospective players for the Passion play, in enunciation, stage bearing and all other requirements of dramatizing. No wigs or facial make-up are permitted. The costumes, however, are of the biblical period and are of the very best material. The participants train their hair and beards and study to assume the general appearance of the characters for which they are candidates. (W. E. V.)

OBERHAUSEN, a town in the Prussian Rhine province, 5 m. from the east bank of the Rhine, 20 m. N.E. of Düsseldorf, on the main railway line to Hanover and Berlin, and at the centre of an important network of lines radiating hence into the Westphalian coal and iron fields. Pop. (1925) 105,135. The first houses of Oberhausen were built in 1845, and it received its municipal character in 1874. The town has large iron-works, coal-mines, rolling-mills, zinc smelting-works, dye-works, railway workshops and manufactures of wire-rope, glass, chemicals, sugar, porcelain and soap.

OBERLIN, a village of Lorain county, Ohio, U.S.A., 34 m. W.S.W. of Cleveland, on Federal highway 20, and served by the New York Central lines and electric railways. Pop. (1920) 4,236. It is a pleasant residential village, the seat of Oberlin college and other educational institutions. Since 1926 it has had a manager form of government. Oberlin college was founded in 1833 by the Rev. John J. Shipherd (1802–44) and Philo P. Stewart (1798–1868), and was named after Jean Frédéric Oberlin (d. 1826), the Alsatian pastor and philanthropist. Its educational plant is valued (1928) at about $4,700,000; its endowment funds aggregate $16,000,000; the library has about 300,000 bound volumes; and the student body numbers 1,800. Oberlin college includes the Graduate School of Theology, and the Conservatory of Music.

The "Oberlin Theology" (not now identified with the college) centred in the teachings of President Finney, a powerful preacher and teacher, who carried on remarkable revival services in eastern cities of America and in England and Scotland. The modern theological position of the college is reflected in the writings of Emeritus President King and of the late Dean Edward I. Bosworth of the theological seminary (1861–1927). Oberlin was the first American college to adopt co-education, and in Aug. 1841, three women were regularly graduated from the classical course —the first women in America to receive the degree of bachelor of arts on conditions like those prevailing in the best men's colleges of the time. Oberlin was also a pioneer (1835) in refusing to debar students on account of race. A substantial proportion of the students earn part of their expenses.

Oberlin was a "station" on the Underground Railroad. The attic of President Finney's home frequently sheltered slaves who were escaping to Canada. In 1858 a runaway slave, Littlejohn, was captured in Oberlin by a U.S. marshal, and was rescued at Wellington (10 m. S.) by a band of Oberlin professors and others, in consequence of which 30 professors were arrested and imprisoned. This was a famous fugitive slave case. The village was founded as a home for the college, and was incorporated in 1846. The Anti-Saloon League was here started in 1893.

OBERON, king of the elves. In the legendary history of the Merovingian dynasty he is a magician, brother of Merowech (Mérovée). In the *Nibelungenlied* he guarded the treasure of the Nibelungen. In the German mediaeval poem of *Ortnit*, the hero is aided in his wooing by his father Alberich, the king of the dwarfs. As Oberon, king of the fairies, he fills a similar rôle in *Huon of Bordeaux* (*q.v.*). Shakespeare used the fairy element in *A Midsummer Night's Dream*, and Wieland in his epic *Oberon* (1780). Ben Jonson wrote a masque of *Oberon, or the Fairy Prince* (*Works*, 1616). Weber's opera, *Oberon*, to the words of J. R. Planché, was first produced at Covent Garden in 1826.

See also C. Voretzsch, *Epische Studien. Die Kompositionen des Huon von Bordeaux* (Halle, 1900).

OBITER DICTUM, that which is said by the way; specifically, in law, an opinion expressed by a judge incidentally in the course of a case, on a point of law not material to the issue or to the grounds of the decision; such *obiter dicta* have no binding authority.

OBJECT and **SUBJECT,** in philosophy, the terms used to denote respectively the external world and consciousness. The term "object" is used generally in philosophy for that in which an activity of the mind ends, or towards which it is directed. With these may be compared the ordinary uses of the term for "thing" simply, or for that after which one strives, or at which one aims. "Subject," is originally the material or content of a discussion or thought, but in philosophy is used for the thought or the thinking person. The relation between the thinking subject and the object thought is analogous to the grammatical antithesis of the same terms: the "subject" of a verb is the person or thing from which the action proceeds, while the "object," direct or indirect, is the person or thing affected. The true relation between mind or thought (subject) and matter or extension (object) is the chief problem of philosophy, and may be investigated from various standpoints (*see* PSYCHOLOGY and METAPHYSICS).

OBJECTIVISM, in philosophy, a term used, in contradistinction to SUBJECTIVISM, for any theory of knowledge which to a greater or less extent attributes reality (as the source and necessary pre-requisite of knowledge) to the external world. The distinction is based upon the philosophical antithesis of the terms Object and Subject, and their respective adjectival forms "objective" and "subjective." In common use these terms are opposed as synonymous respectively with "real" and "imaginary," "practical" and "theoretical," "physical" and "psychic." A man "sees" an apparition; was there any physical manifestation, or was it merely a creation of his mind? If the latter the phenomenon is described as purely subjective. Subjectivism in its extreme form denies that mind can know more than its own states. Objects, *i.e.*, things-in-themselves, may or may not exist: the mind knows only its own sensations, perceptions, ideal constructions and so forth. In a modified form "subjectivism" is the philosophic theory which attaches special importance to the part played by the mind in the accumulation of experience. *See* PSYCHOLOGY and related articles.

OBLATE, an ecclesiastical term for persons not professed monks, friars or nuns, who have devoted themselves or have been devoted as children by their parents to a religious life. "Oblate" is more familiar in the Roman Church as the name of a religious congregation of secular priests, the Oblate Fathers of St. Charles. This congregation was founded in 1578 under the name of Oblates of the Blessed Virgin and St. Ambrose by St. Charles Borromeo, archbishop of Milan (*see* BORROMEO, CARLO). There is a similar congregation of secular priests, the Oblates of Mary the Immaculate, founded at Marseilles in 1815. *See* the *Catholic Encyclopaedia, s.v.* "Oblate."

OBLATION, an offering, a term, particularly in ecclesiastical usage, for a solemn offering or presentation to God. It is thus applied to certain parts of the Eucharistic service in the Roman Church. There are "two oblations," the "lesser oblation," in which the bread and wine yet unconsecrated are presented after the offertory, and the "greater oblation," the "oblation" proper, forming the latter part of the prayer of consecration, when the "Body and Blood" are ceremonially presented. *See* the *Catholic Encyclopaedia, s.v.* "Oblation."

OBLIGATION, in law, a term derived from the Roman law, in which *obligatio* signified a tie of law (*vinculum iuris*), whereby one person is bound to perform or forbear some act for another. The *obligatio* of Roman law arose either from voluntary acts or from circumstances to which legal consequences were annexed. In the former case it was said to arise from contract, in the latter

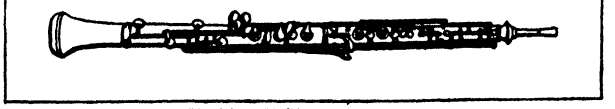
from tort, or from acts or omissions to which the law practically attached the same results as it did to contract or tort. *Obligatio* was used to denote either end of the legal chain that bound the parties, the right of the party who could compel fulfilment of the *obligatio*, the *creditor*, or the duty of the party who could be compelled to fulfilment, the *debitor*. In English law obligation has only the latter sense. Creditor and debtor have also lost their Roman law signification; they have been narrowed to mean the parties where the obligation is the payment of a sum of money. But in legal systems, chiefly founded on Roman law, the original meanings remain. In English law obligation is used in at least four senses—(1) any duty imposed by law; (2) the special duty created by a *vinculum juris*; (3) not the duty, but the evidence of the duty—that is to say, an instrument under seal, otherwise called a bond; (4) the operative part of a bond. The third and fourth uses of the word are chiefly confined to the older writers. The party bound is still called the obligor, the party in whose favour the bond is made the obligee. The word "bond" is, of course, a mere translation of *obligatio*. Obligations may be either perfect or imperfect. A perfect obligation is one which is directly enforceable by legal proceedings; an imperfect or moral obligation (the *naturalis obligatio* of Roman Law) is one in which the *vinculum juris* is in some respects incomplete, so that it cannot be directly enforced, though it is not entirely destitute of legal effect.

American law is in general agreement with English. The term obligation is important in the U.S.A. from its use in art. i. s. 10 of the constitution, "No state . . . shall pass any . . . law . . . impairing the obligation of contracts." This does not affect the power of Congress to pass such a law.

OBOE or **HAUTBOY.** The treble member of the class of wood-wind instruments having a conical bore and a double reed mouthpiece, the oboe consists of a conical wooden tube, composed of three joints, upper, middle and bell, and of a short metal tube to which are bound by many turns of waxed silk the two thin pieces of cane that form the mouthpiece. These pieces of cane are so bevelled and thinned at the end which is taken into the mouth that the gentlest stream of compressed air suffices to set them vibrating and thereby to set up the rhythmical series of pulses which generate the sound waves in the stationary column of air within the main tube of the instrument.

The compass of the oboe is from B flat below the treble stave to F in alt, or even a note or two higher, with all chromatic semitones. Its quality of tone is thin, penetrating and even somewhat nasal. It is possible to play on it diatonic and chromatic scale and arpeggio passages, legato and staccato; leaps; cantabile passages; sustained notes, crescendo and diminuendo, grace notes and shakes (with reservations).

The first appearance of the instrument in a musical work occurs in Sebastian Virdung's *Musica getutscht und aussgezogen* (1511). It there bears the name of *Schalmey*, and is already associated with an instrument of similar construction called *Bombardt*. There exists, however, much earlier evidence, in the illuminated mss. and in the romances of the Middle Ages, of the great popularity of the instrument in all parts of Europe. The oboe was known during the early Middle Ages as *Calamus*, *Chalumeau* (France), *Schalmei* (Germany) and *Shawm* (England), while after the Renaissance we find instruments of this type ranged in complete families from the soprano to the bass and known respectively as the little Schalmey; the discant Schalmey; the alto Pommer; the tenor Pommer; the bass Pommer; and the great double quint Pommer.



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THE OBOE IN ITS MODERN FORM

The 17th century brought no great changes in the construction of the four smaller instruments of the family. Extensively used in France, they were there called "haulx bois" or "hault-bois," to distinguish them from the two larger instruments which were designated by the words "gros bois." Haultbois became hautbois in French, and oboe in English, German and Italian; and this word is now used to distinguish the smallest instrument of the family still in use.

The reform in the construction of the flute due to Theobald Boehm of Munich about 1840, a reform which principally consisted in the rational division of the tube by the position of the lateral holes, prompted Triebert to try to adapt the innovation to the oboes and bassoons; but he failed, because the application of the system denaturalized the timbre of the instruments, which it was necessary, before all things, to preserve. Further improvements, however, made upon the same lines by Barret and later by Rudall Carte, have transformed the oboe into the most delicate and perfect of reed instruments, as which it constitutes one of the most valuable and indispensable members of the modern orchestra.

OBOK, a seaport on the north shore of the Gulf of Tajura, N.E. Africa, acquired by France in 1862. It gave its name to the colony of Obok (now French Somali coast protectorate). (*See* SOMALILAND: *French.*) The port is separated from the open sea by coral reefs, but is only partially sheltered from the winds. The French in 1896 transferred to Jibuti, on the opposite shore of the Gulf, the seat of government of the colony. Obok is connected with Aden and Jibuti by submarine cables. It is only a native village with a population of about 300.

OBRECHT, JACOB (also HOLBRECHT) (*c.* 1430–*c.* 1500), Dutch composer, was born probably at Utrecht about 1430. About 1474 Erasmus was under him as a choir boy at Utrecht, where he was chapel master, and in the same year Obrecht seems to have held an appointment at Ferrara. He was afterwards director of the Cambrai school of singing, and at some time lived in Florence, where his name is associated with Josquin, Isaac and Africola, and the musicians who clustered round Lorenzo's court. The principal records of his later years are found in Antwerp Cathedral, where he was chapel master from 1491 until his death. That he possessed immense contrapuntal skill and was considered one of the greatest masters of the age there is evidence in the praise of his contemporaries and successors, the honours bestowed upon him, and the visits received by him at Antwerp. The finest of his eight masses, *Fortuna Desperata*, was published in Amsterdam (1870) and appears in 1880 in the *Maatschappij tot Bevordering der Toonkunst* (*No. ix.*). He also wrote chansons and motets. The finest of the motets is *Salve crux arbor vitae*. Great interest attaches to his *Passion*, in which the chorus impersonates all the characters in the story and the narrative is given to the tenor in recitative.

A definitive edition of his works has been published by Johannes Wolf (*Werke van Jacob Obrecht*, Amsterdam and Leipzig).

OBREGÓN, ALVARO (1880–1928), Mexican soldier and president, was born in the district of Alamos, Sonora, on Feb. 17, 1880. During his early life as a planter he became an advocate of land reforms to better the condition of the peons and Indians, and in 1912 he entered the services of Madero, a man of similar ideals. With Indian troops which he recruited, Obregon aided in suppressing the revolt of Orozco against Madero, and later he again took the field against Felix Diaz whose successful revolt led to the downfall of Madero and the establishment of Huerta as provisional president. Obregon then joined the counter-revolution of Carranza who had remained true to Madero. After a string of victories culminating in the successful storming of Sinaloa and Culiacan and the capture of Guadalajara, the way to Mexico City was opened, and on Aug. 15, 1914, Obregon led the Carranza troops into the capital. Huerta fled.

In the struggle which arose between Carranza and Zapata and Villa, Obregon remained loyal to Carranza. He defeated Zapata finally at Pueblo in Jan. 1915. In April he conducted a campaign against Villa for the control of central Mexico and by winning the battles of Celaya and Leon forced Villa back to his mountain fastnesses. As leader of the radical wing of Carranza's followers and chief of the army, Obregon possessed power enough to force into the new Constitution of 1917, against Carranza's wishes, the

famous article 27 which provided for the restoration of communal lands to the Indian villages, limited the size of individual land holdings, deprived religious organizations of the right to hold lands and reserved to the Government the ownership of all mineral and petroleum resources. The new Constitution also provided that no president should succeed himself, but in 1920 Carranza took steps to have himself retained in power, one of these steps being an order for the arrest of Obregon. Obregon escaped to Sonora where a revolt against Carranza was already in progress and put himself at the head of the troops. In a short time he was master of the situation and on Dec. 1, 1920, was elected president. He immediately adopted a friendly tone toward the United States and other foreign countries, and in 1923 the United States recognized his Government. His administration was made notable by many labour and agrarian reforms and by a sincere effort to carry the provisions of the 1917 Constitution into force. In 1924 he supported Calles, his minister of the Interior, for president. His opponents under de la Huerta charged fraud in the election and started a revolution. Obregon once more took the field, defeated the rebels and drove de la Huerta into exile. Obregon was again elected president on July 1, 1928, but on July 17 before taking office he was assassinated.

He wrote *Ochomil kilómetros en Campaña* (1917). *See* also J. A. Tamayo, *El Gral, Obregón y la guerra* (1922); E. J. Dillon, *President Obregón, a World Reformer* (1922); H. I. Priestly, "Calles and Obregón," *California University Chronicle*, vol. xxx. (1928).

OBRENOVIĆ, the name of a dynasty which supplied several rulers of Serbia in the 19th century. *See* MILOŠ OBRENOVIĆ; MICHAEL; MILAN; and ALEXANDER.

O'BRIEN, WILLIAM (1852–1928), Irish patriot, was born at Mallow, Co. Cork, on Oct. 2, 1852, son of James O'Brien, a solicitor's clerk. He was educated at the Cloyne diocesan college and at Queen's college, Cork, and began journalism in 1869 on the *Cork Daily Herald*. In 1875 he joined the staff of the *Freeman's Journal*. In 1880 he founded his own paper, *United Ireland*, conducted with amazing vigour. Forster, on reading the first number, is said to have exclaimed, "Who is this new madman?" O'Brien's paper was suppressed for the time being, and he was shut up in Kilmainham gaol, with Parnell and others. There O'Brien drew up the famous "No Rent" manifesto, which was smuggled out of Kilmainham, read at a Land League meeting in Dublin, and led to the proclamation of the league as an illegal association.

After Forster's recall from Ireland, O'Brien resumed his campaign in *United Ireland*. In 1887, under the Balfour régime in Ireland, O'Brien started the slogan of "no reduction, no rent." For this "plan of campaign" *see* IRELAND: *History*. Parnell was much out of Ireland, and though he eventually disavowed the "plan," O'Brien had stirred up a fierce agitation, met by the British Government with the Coercion Act of 1887. Under this act O'Brien was sent to Tullamore gaol. He had been elected M.P. for Mallow in 1883, and on his release he appeared in the House of Commons to renew his obstructive tactics there.

After the Parnell divorce case he tried to mediate between the Parnellites and the anti-Parnellites. He advised the retirement of Parnell until the storm should have blown over. Finally in 1900 he reunited the party. In 1903 O'Brien, who had begun his career as a land agitator, thought that the Wyndham Land Act of 1903 offered a bridge between the Nationalists and the southern Unionists. He wanted an "act for Ireland" party which should include men of all creeds and of various opinions. He split the Irish Party, and in the general election of 1918 his followers retired, leaving a clear fight at the polls between the Nationalists and the Sinn Feiners. Thus the man who had sought conciliation with southern Unionists in 1903 was fated, though he had no faith in Sinn Fein methods, to secure the Sinn Fein victory.

O'Brien married a French woman, Sophie Raffalovich, the daughter of a Paris banker. He died on Feb. 26, 1928.

O'BRIEN, WILLIAM SMITH (1803–1864), Irish revolutionary, was born in Co. Clare on Oct. 17, 1803, and educated at Harrow and at Cambridge. He took the additional name of Smith on inheriting his maternal grandfather's estates in Limerick. He entered parliament in 1828 as member for Ennis, and from 1835 to 1848 represented the county of Limerick. Although he spoke in 1828 in favour of Catholic emancipation, he differed on other points from the general policy of O'Connell. But he opposed the Irish Arms act of 1843, and became an active member of the Repeal association. In July 1846 the "Young Ireland" party, with Smith O'Brien and Gavan Duffy at their head, left the Repeal association, and in the beginning of 1847 established the Irish Confederation. In May 1848 he was tried at Dublin for sedition, but the jury disagreed. In the following July he established a war directory, and attempted to make a rising among the peasantry of Ballingarry, but the movement lacked cohesion, and the crowd dispersed before the approach of the dragoons. O'Brien was arrested at Thurles, tried and sentenced to death. The sentence was, however, commuted to transportation to Tasmania for life. In May 1856 he obtained a full pardon, and returned to Ireland. He died at Bangor, North Wales, on June 18, 1864.

OBSCENITY. By English common law it is an indictable misdemeanour to give an obscene exhibition or to publish any obscene matter, whether it be in writing or by pictures, effigy or otherwise. The precise meaning of "obscene" is, however, decidedly ambiguous. It has been defined as "something offensive to modesty or decency, or expressing or suggesting unchaste or lustful ideas or being impure, indecent or lewd."

Besides the remedy by indictment there are statutory provisions for punishing as vagabonds persons who expose to public view in public streets or adjacent premises obscene prints, pictures or other indecent exhibitions. These are supplemented by the Indecent Advertisements Act 1889, which was passed to suppress indecent advertisements. By the Obscene Publications Act 1857 powers are given for searching premises on which obscene books, etc., are kept for sale, distribution, etc., and for ordering their destruction, and the post office authorities have power to seize postal packets containing such matter and to prosecute the sender under the Post-Office Act.

The use of obscene or indecent language in public places is punishable as a misdemeanour at common law, but it is usually dealt with summarily, under the Metropolitan Police Act 1839, or the Town Police Clauses Act 1847, or under local by-laws.

In the United States, the different States provide punishment for obscene libel, the exhibition of obscene pictures and the display or use of obscene language in public. The Federal Government penalizes sending of obscene matter through the mails.

Indecent acts committed with intent to insult females are punishable under the Vagrancy Act 1824 as amended by sect. 42 of the Criminal Justice Act 1925, and if committed otherwise under the Acts of 1839 and 1847. (W. DE B. H.)

OBSERVATORY (ASTRONOMICAL). The erection of special buildings adapted to the pursuit of astronomical research is a practice of long standing.

FROM THE EARLIEST TIMES TO 1800

It is said by Diodorus that the great temple of Belus at Babylon was built for astronomical purposes, and, since there is indication in the Chinese records that the gnomon was used for measuring the height of the sun in the reign of the emperor Yao (2300 B.C.) it may be said that the beginning of practical astronomy was contemporaneous in Eastern and Western Asia. There is no evidence of the existence of an observatory of Greek or Alexandrine origin until the time of Ptolemy Soter, who, about 300 B.C., built one at Alexandria. The earliest records from an observatory known to be extant are those of Hipparchus (*c.* 140 B.C.) who has left a catalogue of stars from observations made at the island of Rhodes, repeating those made earlier at Alexandria. Three hundred years later, Ptolemy (A.D. 150) compiled a star catalogue, but it is doubtful whether this was from his own observation and, therefore, whether he had an observatory beyond that at Alexandria.

The art of astronomical observation was revived several hundred years later in Western Asia when observatories were established at Damascus and Baghdad and one at Mokatta by Caliph Hakim about A.D. 1000. A splendid observatory was built at Maragha in north-west Persia by Hulagu Khan about A.D. 1260,

but the most productive was that of the Persian Prince Ulugha Beigh, grandson of the great Tamerlaine, who, at Samarcand with his assistants, made a catalogue of stars from observations with a large quadrant in the first half of the 15th century. Later in that century, about 1471, John Müller of Königsberg, better known as Regiomontanus, set up an observatory at Nuremberg, with the help of Bernard Walther of that city, furnished with instruments of his own design, and after his death in 1476, clocks, then a recent invention, were added to the equipment, but the first observatory that may be considered a prototype of modern national observatories was that of Tycho Brahe on the island of Hveen. Here, on Aug. 8, 1576, there was laid the foundation stone of a building to serve as a residence and an observatory to which he gave the appropriate name Uranibourg.

Tycho Brahe's Observatory.—This building was of some magnificence and large enough to house Tycho and several young men who lived with him as students or observers. It was furnished with a large quadrant attached to a wall in the plane of the meridian, for to this astronomer is due the credit of appreciating the advantage of size in instruments of this type, and of the principle which is embodied in the mural circle. Here Tycho Brahe lived in some state, with a dwarf as jester among his small retinue, for 20 years, and with his assistants, one of whom was Longomontanus, a name well known in the science, observed the heavens and produced a catalogue of the position of more than 1,000 stars. On the death of his patron, Frederick II. in 1588, Tycho was deprived of royal favour and income. In 1597 Tycho left Denmark, the observatory at Hveen having been already dismantled.

The invention of the telescope in 1609 opens a new chapter in the history of observatories, and the first of a new class may be taken to be the building at Padua from which Galileo made the first observation of Jupiter's satellites on Jan. 8, 1610. Others were created as additions to universities or similar institutions during the 17th century, an observatory called the "Tower of the Winds" having been established at the Vatican by Gregory XIII., the Pope who gave his name to the Gregorian Calendar, and another attached in 1632 to the university at Leyden, that had been in existence for half a century. In 1637, King Christian IV of Denmark, established a permanent observatory at Copenhagen which was completed 20 years later and then placed under the direction of Longomontanus. It exists in some form at the present date.

John Hevel, or Hevelius, a member of a noble family of Danzic, built an observatory in 1641 in his own house and furnished it with an azimuthal quadrant of 5ft. radius and a sextant of 6ft., with which he measured the meridian altitudes of stars, sun, moon and planets, and their distances from one another in the manner of Tycho—that is, with plain sights, believing this to be superior to the newly adopted telescopic method.

Paris, Greenwich and Others.—Hevelius died early in 1687 and his work was not carried on, but by that date there had come into existence the two national observatories at Paris and Greenwich. The former was built in the years 1667–71, according to the plans of Claude Perrault, as an architectural monument. However, under Cassinis and others, it has done much for astronomy. The Royal Observatory, Greenwich, was founded in 1675 for the definite purpose of the improvement of navigation. Architectural pride again entered into the design, for Sir Christopher Wren wrote of it to Bishop Fell of Christ Church, Oxford, as built "a little for pomp" referring to the main building. The essential instruments were housed apart from this, and at the present time, Wren's beautiful creation is merely a small item in its extensive domain.

Few establishments of the kind were erected during the next half century. Newton placed his telescope on the roof of the tower over the gateway of Trinity college, Cambridge, and his contemporary, and perhaps rival, Leibnitz, is said to have originated at Berlin university in 1705 an observatory of similar modest dimensions, that became of importance more than 100 years later. The year 1751 is assigned as the date of foundation of the observatory at Göttingen which was supplied by George II. of England with a mural quadrant of 6ft. radius made by the Englishman, Bird, and in charge of Tobias Mayer. It was re-established in another situation in 1816. Induced mainly by the occurrence of the transit of Venus in 1769, George III. built and furnished the King's Observatory at Kew. The improvement in reflecting telescopes by Short and the invention of the achromatic object glass in the latter part of the 18th century marked the beginning of many observatories that have since become famous. The Radcliffe observatory at Oxford was erected 1771–74 from funds bequeathed by Dr. Radcliffe, a Court physician "for charitable purposes," the words being interpreted somewhat widely. Provost Andrews bequeathed a substantial sum for building and endowing an astronomical observatory for the University of Dublin, which was built at Dunsink in 1783, but not furnished with instruments until many years later. At the charge of Primate Robinson an observatory was established and endowed at Armagh in Ulster in 1793, whilst the most prolific British observatory of the period was that of William Herschel at Bath, Datchet and Slough successively.

Early Continental Observatories.—Continental observatories established during this period were those of Mannheim (1775), which was transferred to Karlsruhe in 1880, and again to Heidelberg in 1896; Lilienthal founded by Schroter in 1779, and furnished with a reflector made by Herschel; Leipzig where a small observatory existed on the tower of the university in the years 1787–90; Breslau (1790); also one at Seeberg near Gotha, founded by Duke Ernest II. in 1788 that was made famous by Zach and Encke. The observatory at Palermo, Sicily, where Piazzi made his famous catalogue of stars, was founded in 1790; and at about the same time Lalande and his assistants were observing transits of stars from an observatory in l'École Militaire, Paris.

THE NINETEENTH CENTURY

British Observatories.—A full list of observatories, public and private, founded in Great Britain during this next 100 years would be large. An observatory on Calton Hill, founded by a private association, the Edinburgh Astronomical Institution, in 1818, was taken over by the Crown as a Royal Observatory in 1834, and transferred to its present site on Blackford Hill in the years 1889–96 (*see* Plate). Cambridge university observatory was founded in 1820 and under its noted directors, Airy, Challis, Adams, Ball and Eddington has done valuable work, and now well equipped with instruments, has a solar and astrophysical observatory. The Radcliffe observatory at Oxford was originally in the charge of the Savilian professor of astronomy but this arrangement lapsed and the offices of professor and Radcliffe Observer became distinct about 1839. In 1875 the University observatory came into existence largely through the liberality of Warren De la Rue, for the use of the Savilian professor. The work of this observatory has been largely photographic. An observatory was established at Liverpool mainly for the time service of the port in 1838, and at Glasgow a small observatory attached to the university of which Dr. Alexander Wilson had been the first director about 1760, was enlarged and transferred to a new site in 1836.

As to private observatories, that of Stephen Groombridge at Blackheath (about 1802) was merely an apartment in his dwelling-house, containing a transit circle with which he made a star catalogue that has taken a notable place in fundamental astronomy. Another that achieved notoriety was that of James South, a London surgeon, who set up an observatory in south London in 1816 which he removed to Kensington. Admiral Smyth at Bedford and Dr. Lee at Hartwell were two well-known astronomers who had establishments of the kind about the year 1830. Mr. E. J. Cooper, a young enthusiast in astronomy, established an observatory in 1831 at Markree castle, Sligo, for which he bought a 13in. object glass by Cauchoix, then the largest in the world, and supplied it with other notable instruments. With the help of assistants, work was carried on at this observatory until Mr. Cooper's death in 1863. The reflecting telescope with 6ft. mirror made by Lord Rosse and set up at his seat, Parsonstown, Ireland, in 1845, is famous, and scarcely less so are the smaller instruments of the

same type made by William Lassell, and used by him at Liverpool 1844–52. Another observatory of the period was that of Mr. George Bishop at South Villa, Regent's Park, which had as its principal instrument an equatorially-mounted, clock-driven telescope of 7in. aperture, which was used for discovering and observing small planets and other work by Dawes, Hind, etc.

At his observatory established at Redhill in 1852 Mr. Richard Carrington made a catalogue of the positions of circumpolar stars, and a record of sunspots which are both works considered classic in the science.

Observatories established in England in the second half of the 19th century were those of De la Rue, a pioneer in astronomical photography, at Cranford in Middlesex; of George Knott at Cuckfield, Sussex; of William Huggins, the famous spectroscopist, at Tulse Hill, the private observatory of Norman Lockyer, who afterwards developed spectroscopic research at a state-supported establishment at South Kensington. Those of Crossley at Halifax, Yorkshire, and Espin at Towlaw, Durham, have reputations based on double-star observations, whilst the observatory at Dunecht, established by Lord Lindsay, heir to the earl of Crawford and Balcarres in 1871, which endured for about ten years, is perhaps most remembered for having introduced David Gill into the astronomical world. At present (1929) there are a dozen private observatories in England, perhaps of smaller pretensions outwardly, but each used by its actual owner for some chosen line of work.

Colonial Observatories.—A feature of the 19th century was the establishment of British Colonial observatories. Acting on the proposal of the Board of Longitude in 1820, the Lords Commissioners of the Admiralty resolved to establish an observatory at the Cape of Good Hope for the improvement of practical astronomy, which came into being in the year 1829, and has adequately fulfilled its purpose as a Government observatory under the directorship of Maclear, Stone, Gill, Hough and Jones of the present day. This observatory has a reversible transit-circle of the latest type—a heliometer and an equatorially-mounted twin telescope with objectives 24in. and 18in. in aperture for photographic and spectroscopic work; gifts of Mr. Frank McClear.

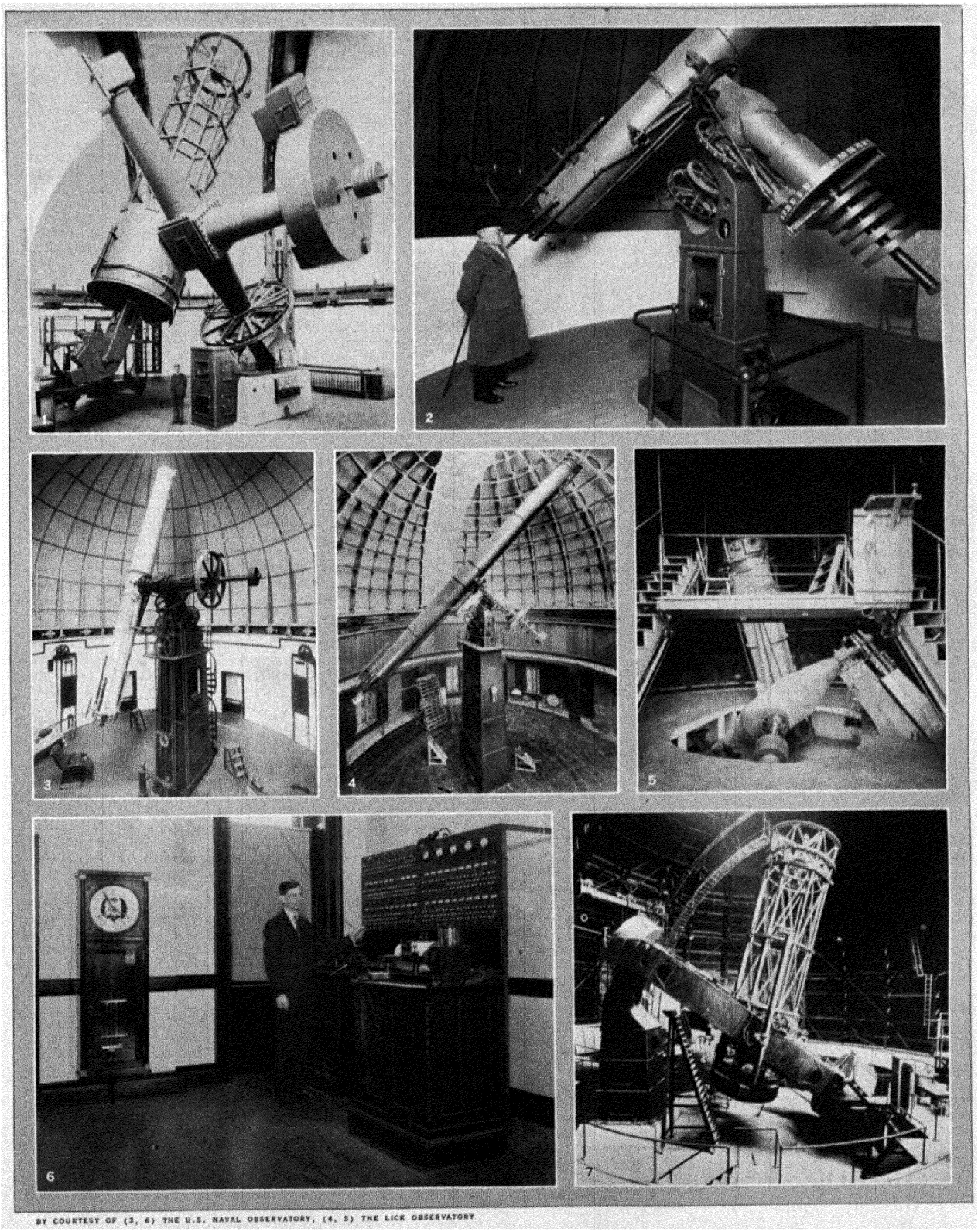
The first observatory on Australian soil was one on Dawes Point, the headland on which stands the present Sydney observatory, established in 1786 at Maskelyne's instigation for the observation of a comet expected to return in 1789. Beyond this little is known of the Dawes Point observatory, but in 1822 Sir Thomas Brisbane, then governor of New South Wales, built and furnished an observatory at Paramatta a few miles to the west of Sydney, where an excellent star-catalogue was made by Carl Runsker, and carried on at his expense until the year 1827.

In 1853 Mr. Ellery was appointed to superintend an astronomical observatory at Williamstown which was removed to Melbourne in 1861–63. With the observatories of Sydney and Perth, Melbourne is taking a share in the international work of charting the heavens by photography, and with this meridian observing, magnetism, seismology, meteorology and time-service form its activities. In 1855 Charles Todd was appointed Government astronomer of South Australia, but the Adelaide observatory was not completed until 1861. The observatory of Western Australia at Perth was established 30 years later. The aim of a small observatory established at Wellington, New Zealand, under Sir James Hector in 1869 for time-service has lately been enlarged and the institution is now called the Dominion observatory.

Continental Observatories.—During this period many observatories were established on the continent of Europe, two of which were made famous by the labours of Wilhelm Struve. The University of Dorpat, Livonia, Russia, possessed in 1809 an observatory of small dimensions, scantily equipped, of which Struve, a student of astronomy in the university, was given charge in the year 1813. His successful work attracted the attention of the Russian Government, and soon the observatory was furnished with such instruments and pecuniary means as to raise it to the rank of a first-class establishment, where Struve, almost single-handed, produced results of a very high standard. Attracted by Struve's work the Emperor Nicholas in 1833 resolved to erect a central observatory for the empire of Russia, and, largely to Struve's design, an observatory was completed in 1839, at Pulkowa near St. Petersburg, which was considered to be the finest and best equipped of the time. It may be described as a collection of buildings forming the home of a number of astronomers. Other observatories of the first half of the 19th century, though not on the magnificent scale of Pulkowa but associated with the names of distinguished astronomers, are those of Königsberg, established by the king of Prussia in 1813 and put in the charge of F. W. Bessel who had already made a reputation at the observatory at Lilienthal. The observatory at Altona near Hamburg, completed in 1823, was made famous because of its association with Schumacher, to whose personality is ascribed the encouragement given to astronomy by the Danish Government. The instruments of this observatory were not of great size for the work of Schumacher lay rather in the direction of geodesy and astronomical literature, and it is to him that astronomy owes the famous publication *Die Astronomische Nachrichten*. Schumacher died in 1850, and his successors, Petersen, Hansen and C. A. F. Peters are also remembered. In 1874, this observatory was transferred to Kiel, which had then become the chief German naval station, and formed the international central bureau for distribution of astronomical information until the World War, when this useful work was transferred to Copenhagen.

The Royal observatory at Berlin had its origin in the year 1705, and for 100 years or more consisted of instruments inadequately housed in the building that was the home of the Academy of Sciences, but was established as a separate building in the years 1832–35, and has accomplished successful work, mainly meridian, though its position in the midst of a populous city is to its detriment. It was with the 9in. refractor of this observatory that the planet Neptune was first seen. The establishment of an observatory at the University of Bonn was decided on by the king of Prussia, in 1836, and Argelander, who had been director of the Abo observatory, Finland, transferred to Helsingfors in 1837, was chosen as director. Although the instruments of this observatory are not large, the stupendous work of Argelander, carried on by his successors, in star-cataloguing, indicates its principal branch of activity. The University of Strasbourg has an observatory attached to it completed by the German Government in 1881, consisting of three magnificent buildings placed in a large open garden. Its largest telescope, the great Equatorial, a refractor with object glass of 20in. aperture, is said to have been the largest in Germany at the time of its erection. The University observatory, Vienna, built on a new site in the years 1874–80 to replace one that dated from the middle of the 18th century, is a large structure standing in grounds of 14 acres in extent, with an imposing façade and surmounted by four domes designed on the model of the Berlin observatory. Basle (1874), Bordeaux (1879), Breslau (1790), Budapest (1856), Cracow (1791), Kazan, Leipzig (1790, remodelled in 1861), Lund, are other universities of Europe that have observatories attached to them. At Heidelberg (Königstuhl), a private observatory founded by Dr. Max Wolf in 1877, was merged in a Grand-Ducal Institute, established in 1898, which combines two sections: one is an astrometric observatory that had existed successively at Schoetzingen, Mannheim and Karlsruhe since 1762 (*v. supra* Mannheim), and an astrophysical observatory under the direction of Dr. Wolf. This observatory has been successful in the discovery of comets and small planets, and in the observation of variable stars, nebulae and the Milky Way. To these may be added the municipal observatory of Hamburg, memorial to Repsold, and the private observatories of Dr. Engelmann at Leipzig, of Baron d'Engelhardt at Dresden, of von Kuffner and von Oppolzer at Vienna.

Before the World War there were ten French national observatories under the control of a consultative committee that reported annually to the Government. The Paris observatory of the 17th century has been mentioned. Some that were resuscitated or created in the ten years after the war of 1870–71, have history behind them. An observatory at Marseilles, founded by the order of Jesuits about the year 1700, was taken over in 1749, after the

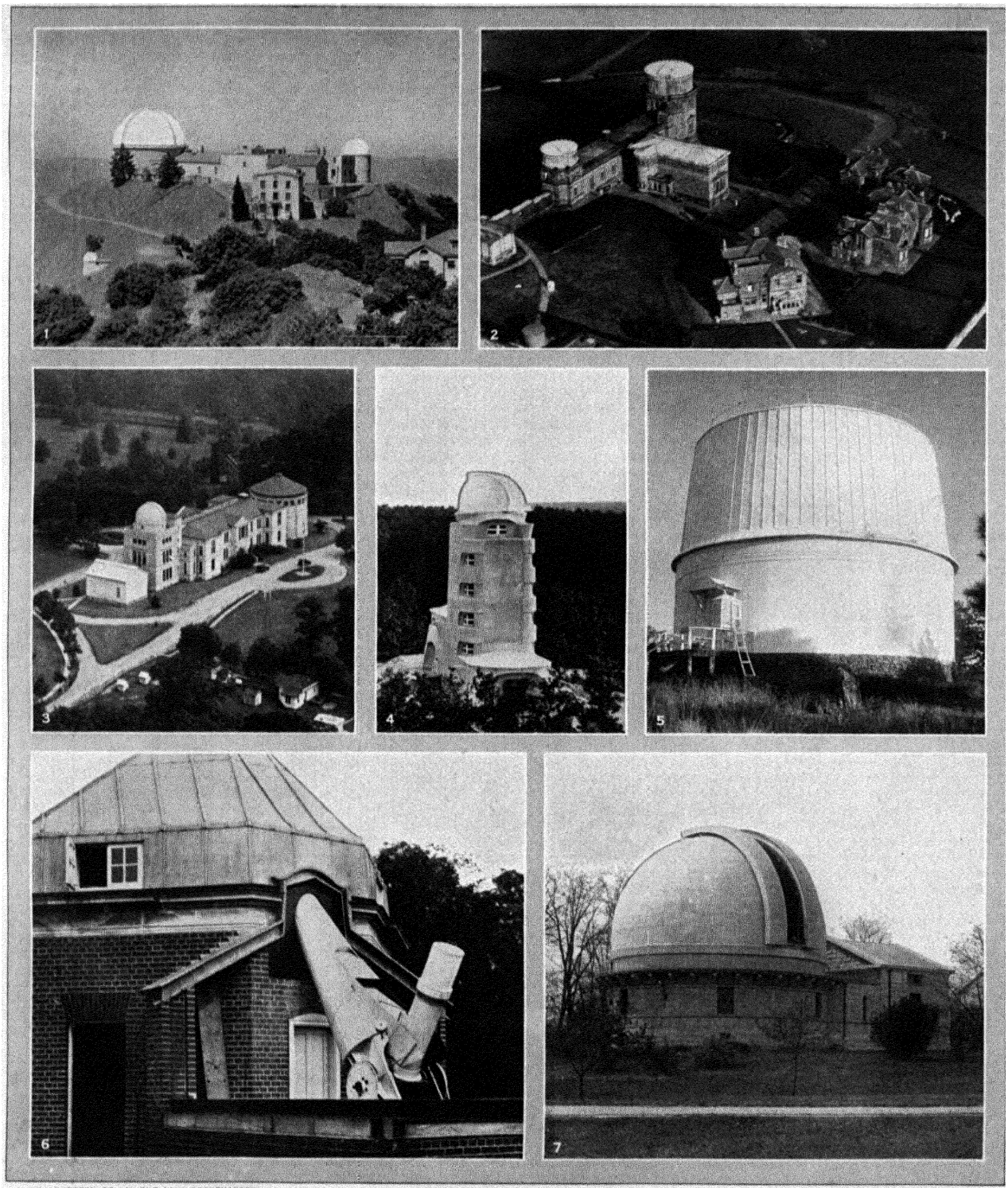


BY COURTESY OF (3, 6) THE U.S. NAVAL OBSERVATORY, (4, 5) THE LICK OBSERVATORY

TELESCOPES AND TIME SERVICE APPARATUS IN LARGE OBSERVATORIES

1. Reflecting telescope with 72-in. mirror, mounted equatorially (German type); Cassegrain spectrograph is attached to the lower end. Dominion Astrophysical Observatory, Victoria, B.C. 2. Equatorial telescope at Columbia university (the rising floor is about one-third of the way from the top). 3. 26-in. (Great) Equatorial telescope with which the satellites of Mars were discovered, U.S. Naval Observatory. 4. 36-in. refractor with spectograph attached, Lick Observatory. 5. The Crossley reflector, showing moving observing platform, Lick Observatory. 6. Time Service transmitting clock and sending apparatus, U.S. Naval Observatory. 7. The Hooker reflecting telescope with 100-in. mirror, mounted equatorially (English type); in 1928 the largest in the world. Mount Wilson Observatory, California

OBSERVATORY



BY COURTESY OF (1) THE LICK OBSERVATORY, (2) THE DIRECTOR OF THE ROYAL OBSERVATORY, EDINBURGH, (3, 7) THE U.S. NAVAL OBSERVATORY, (5) THE LOWELL OBSERVATORY

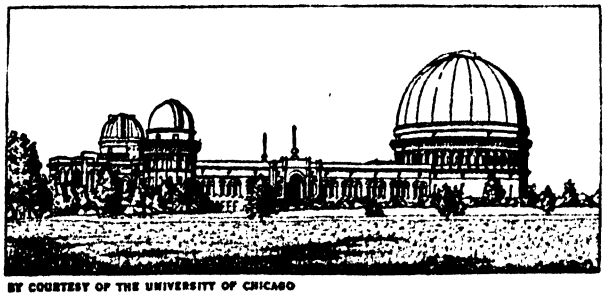
OBSERVATORIES IN DIFFERENT PARTS OF THE WORLD

1. The Lick Observatory, University of California, showing domes of the 36-in. and 12-in. refractors on main buildings
2. Royal Observatory, Edinburgh, Scotland
3. Principal astronomical buildings of the U.S. Naval Observatory, Washington, D.C.
4. The Einstein Tower at Potsdam, an astrophysical Observatory used entirely for spectroscopy. The telescope is vertical and occupies practically the entire height of the building
5. Dome of the 24-in. refracting telescope of the Lowell Observatory, Flagstaff, Arizona
6. Sheepshanks Equatorial at the Cambridge Observatory, England. The refracting telescope is furnished with a mirror at the elbow-joint. The observer occupies the upper room
7. Great Equatorial building and dome at the U.S. Naval Observatory, Washington, D.C.

expulsion of the Order, as the Royal Naval observatory and made famous by Pons, Bernard, Gambart, Valz and Chacornac. A new observatory was built in 1862 with which the older one was incorporated and the names of Stephan, Coggia and Borrelly recall many discoveries of minor planets and comets made with its instruments. The observatory at Toulouse had a predecessor as early as 1718, but the existing establishment dates from about 1840 when it was erected and supplied with excellent instruments at the public expense, but with an inadequate staff, so that it was devoted for many years solely to meteors and meteorology. After being closed for three years it was reopened in 1873, the subsequent workers there including Tisserand, Perrotin, Bigourdan and Baillaud, all well-known names in astronomy.

There had nominally been an observatory at Bordeaux for 100 years because the Academy of Sciences of Bordeaux, soon after the transit of Venus of 1769, which had been observed from that city, built a tower 75ft. high, of 20ft. interior diameter that went by that name; but of this the existing observatory, founded in 1879 and completed in 1882, is quite independent. This observatory, together with those at Paris, Toulouse and Algiers, is taking a share in the international work of charting the heavens by photography. The Algiers observatory, about half a century old, is an imposing group of buildings set up on a hill at Boudzareah, near Algiers. The two observatories that complete the ten are the solar physical observatory at Meudon near Versailles, which is actually an old chateau that was converted for the purpose in 1876, and put under the direction of M. Janssen and carried on after his death by M. Deslandres, the present director of the Paris observatory, and the observatory at Nice. This observatory on Mt. Gros was built in 1881 at a cost of five million francs and placed under the direction of M. Perrotin, the principal instrument being an equatorially-mounted refracting telescope of 30in. aperture, which has been employed with considerable success in the observation of comets, asteroids and nebulae. It was bequeathed by the founder to the University of Paris in 1899 and now ranks as a national institution.

American Observatories.—In 1832, Airy closed his report on astronomy to the British Association by remarking that, as for the United States, he did not know of the existence of a single public observatory within the whole country. The first American observatory is said to have been erected at Chapel Hill (N.C.), in 1831–32. It was destroyed by fire in 1838. Projects for observatories were set on foot at Williams college, Mass., in 1836; at Hudson, O., 1836–37; and for the National observatory at Washington which was actually established by Lieut. J. M. Gilliss of the U.S. Navy in 1843–44. The movement was encouraged and in many cases observatories were created by collective financial help. By the efforts of Prof. D. M. Mitchel money was raised for shares



BY COURTESY OF THE UNIVERSITY OF CHICAGO

YERKES OBSERVATORY AT WILLIAMS BAY, WISCONSIN

in a public company to build an observatory at Cincinnati. The first meeting of stockholders was held on May 23, 1842, and an object glass 11in. in diameter, which was quite large for that epoch, was procured during the summer. The Litchfield observatory of Hamilton college, New York, was founded by public subscription in 1852. An observatory attached to the University of Missouri in 1853 was afterwards improved by a gift from Dr. S. S. Laws. In 1856, the Dudley observatory, Albany, was established by gifts from citizens of that city, and took its name from the largest donor, Mrs. Blandina Dudley. The Allegheny observatory was founded as an annex to the university in 1860, and was completed in 1867 through the liberality of Mr. W. Shand. The Dearborn observatory of the University of Chicago was built in 1864 at the expense of a liberal benefactor at a cost of $30,000, and the instruments were paid for by public subscription. The Halsted observatory, attached to Princeton university, came into existence in 1866 by munificent gifts which paid for site and buildings. At the present time (1928) there are in the United States 70 observatories, some used merely for purposes of education, while others are doing original and brilliant astronomical work.

The U.S. Naval observatory at Washington is something akin to Greenwich, since it is a state-supported institution for the purposes of the Navy. Chronometers and compasses are tested, and the staple astronomical work has been the making of star-catalogues. Excluding this, the most famous of these observatories of last century is that of Harvard college, Cambridge, Mass., whose origin is associated with the personality of William Cranch Bond, a member of a Cornish family that emigrated in 1786 and settled in Portland, Me., where he was born in 1789. Bond had great aptitude for scientific research, especially astronomy, and when, in 1837, it was decided to build an observatory for Harvard college, he, though engaged in a profitable manufacturing business, accepted the invitation to take charge. No salary was attached to the office until the year 1846. The original Harvard observatory (Dana House, 1839) and the new observatory (1843–47) were established by public subscription. Under the direction of Prof. E. C. Pickering, the work of this observatory was mainly photometric and spectroscopic. Harvard had no telescope of size, until the new observatory was furnished with a 15in. equatorial telescope, the largest made up to that time, though the observatory at Pulkowa had one of like dimensions. At the present time it has a refracting telescope of 24in. aperture, the gift of Miss Catherine Bruce. It had a branch observatory in Arequipa, Peru, at a high elevation in the Andes, built and largely supported by a sum of money bequeathed for the purpose by Uriah Boyden, but this branch was in 1928 transferred to South Africa. Yale university has an observatory, founded in 1882, which is known for its work on the determination of stellar parallaxes. The private observatory of Percival Lowell at Flagstaff, Arizona, has attracted attention because of the observations of the surfaces of the planets made there, for which it was founded in 1894.

As to South America, there had been an observatory at Buenos Aires in 1822, whose period of activity was short, so that the National observatory at Santiago (Chili) may be regarded as the first permanently founded (1856) on this continent. The National observatory of the Argentine Republic, established at Cordoba in 1870, has done good service in cataloguing the stars of the Southern hemisphere. There are other observatories in South America.

The last quarter of the 19th century may be said to have seen the beginning of the era of the large telescope, though the large specula of Parsonstown and Melbourne (4ft.) were earlier. The 26in. refractor at Washington dates from 1873, but a few years later, a telescope was made on a considerably larger scale through the benevolence of Mr. James Lick, who died in San Francisco on Oct. 1, 1876. On Jan. 9, 1887, Mr. Lick's body, transferred from its original place of burial, was deposited in the foundation pier of a great equatorial telescope, with object glass 36in. in diameter, that had been set up in a fine observatory on Mt. Hamilton, Calif., at a total cost of $610,000, including $90,000 invested as endowment. In 1895 a reflector with a silver-on-glass mirror of 36in. diameter, that had been used by Dr. Common, was presented by Mr. Crossley of Halifax, England, and with these two instruments and others, the Lick observatory, dedicated to the University of California, has done much photographic and spectroscopic observation. The size of the larger instrument was surpassed ten years later when at the instigation of Mr. George E. Hale, Mr. C. T. Yerkes presented a refracting telescope with object glass of 40in. aperture, together with a large observatory building containing it on the shore of Williams bay, Lake Geneva, Wis., to the University of Chicago in Oct. 1897. From that date the Yerkes observatory has been a centre of astronomical activity. The programme has been, to a great extent, spectroscopic and

astrophysical but micrometrical work on double stars, planets and satellites, has had a place, together with work in connection with the discovery and observation of comets.

TWENTIETH CENTURY

Modern Observatories.—The names and locations of nearly 300 active observatories will be found in the *Nautical Almanac* for 1930. The progress of astronomy and the changes in the aim of celestial research have brought changes in the characteristics of observatories. At the beginning of the 19th century the equipment of a public observatory may be said to have consisted of a meridian instrument with an equatorial as subsidiary; today the latter is generally the more important instrument, and often is supplemented by plate measuring apparatus.

The routine determination of the positions of sun, moon, the planets and stars still continues as staple work at Greenwich, Washington and other national observatories, for such records are necessary for the maintenance of fundamental astronomy. But the Government and university observatories have now added equatorial instruments, generally large, and frequently adapted for photography, to their equipment and pursue in addition some branch of astrophysical work.

Outstanding facts of the 20th century have been the making of large telescopes, in some cases of novel design for special researches, and the establishment of branches to existing observatories in places considered more suitable meteorologically than those of their parents. The earliest example is the solar observatory set up on Mt. Wilson, 5,700ft. above sea-level, near Pasadena, California, in 1904–05 as an offshoot of the Yerkes observatory. This observatory is now at the charge of the Carnegie Institution of Washington. In 1918 the word "solar" was dropped since the physical qualities of stars other than the sun are there studied. The instruments are on the mountain for observing. The library, laboratory and administrative offices of the observatory are in the valley below. A new type of telescope has been evolved for solar observation—the tower telescope. A revolving mirror known as a coelostat, and a fixed mirror on the top of a tower reflect the sun's light through an object-glass downwards, to form an image of the sun on the slit of a spectroscope in a pit below. The light then passes through the spectroscope to record itself on the photographic plate, or to be otherwise examined, the scheme obviating the difficulty of carrying long instruments on a moving frame. This observatory has a tower telescope 150ft. high and also a reflecting telescope with a mirror 100in. in diameter, the largest yet in use (*See* Plate), carried in the usual manner on an equatorial mounting, and with this is used an Interferometer for measuring the size of the stars. Another large telescope is the 72in. reflector (*see* Plate) at the Dominion of Canada Astrophysical observatory established in 1916 at Victoria, B.C., as a branch of the Dominion observatory at Ottawa, that itself had grown from a modest establishment used by the Survey department. In the eastern hemisphere an observatory specially adapted for solar investigation was established at Canberra by the Federal Government of Australia as a link in the chain of such institutions round the world, of which the Solar Physics observatory at Cambridge (England) (removed from South Kensington in 1911) and that at Kodaikanal, southern India (which was established as a Government institution about 1900 and replaces, in part, the observatory of the Government of Madras founded in 1792), are others. A site has been chosen in south-west Africa under the auspices of the Smithsonian institution of Washington for a station for the special study of solar radiation. The Harvard southern station has been transferred from Arequipa in Peru to Mazelspoort, 14m. from Bloemfontein, Yale university observatory has set up a southern branch at Johannesburg; and the Ann Arbor observatory of Michigan has lately done the same at Bloemfontein by the help of a generous donor, the principal instrument being a refractor of 27in. aperture, that is to be used largely for observing double stars. In the same connection it may be noted that the observatory of the Union of South Africa at Johannesburg which dates under its present name from 1912 (having previously been known as the Transvaal observatory, when it was mainly a meteorological station) has lately procured a 26in. refracting telescope, so that, including the Royal observatory at Capetown, there are now five observatories with large instruments in this part of the globe as well as several belonging to amateurs who work on special lines. On the other hand the observatory at Durban, in charge of the colonial Government of Natal, was closed in 1912.

Some notable additions have been made to the observatories of Europe in the quarter of a century just passed. As the climate of Pulkowa was considered to be unfavourable for observation, through the influence of Oscar Backlund, who was its director for 21 years, branch establishments were founded—one at Odessa in 1898 for the astronomy of position; another at Nicolaieff, 75m. from Odessa, in 1912, for a similar purpose; and a third at Simeis in the Crimea. Backlund died in 1916, but in the last few years of his life the Russian Government sanctioned the expenditure of large sums of money for the purpose of procuring astrophysical and astrophotographic equipment for the new observatories, and recently (1926) a reflecting telescope with a mirror one metre in diameter and a photographic refractor with an objective of 41in. aperture have been supplied to the Simeis observatory by a British firm. The observatory of Geneva, which is of very early foundation (1772), now possesses a reflector with mirror, one metre in diameter, the gift of a member of the staff. The Astrophysical observatory at Potsdam, that dates from the year 1878, was enriched by the addition of a 32in. photographic refractor in the year 1899, and in 1921 a tower-telescope was erected in its grounds as a tribute to Prof. Einstein. The building is modern and original (*see* Plate). The primary purpose of the apparatus is to test the Einstein theory, so far as it refers to the shift of spectral lines, but it will be available for other astrophysical work.

A tower-telescope has been set up at the Royal Astrophysical observatory at Arcetri (Florence) designed for solar observation. A new object-glass was supplied to this institution in 1925 by the German Government, by way of war reparation. The Italian Royal Observatory at Milan, with which the name of Schiaparelli is associated, has been removed and improved by the help of resources similarly supplied. Another observatory that has been largely developed in this century is that of the City of Hamburg, at Bergedorf. Citizens supplied funds for buying instruments for the local school of navigation which already had a small equipment, and so the Hamburg municipal observatory developed and had a long and honourable career. In 1906 it was decided to transfer it to Bergedorf, about 5m. south of Hamburg, and the new establishment was completed in the course of the year 1909. This observatory continues to do star-cataloguing work and supplies a time service for the city, but it is well equipped for astronomical observations of other kinds. It has a reflector, one metre in aperture, and a large twin telescope for photography. This observatory has been specially successful lately in the discovery of comets.

In Great Britain, the Norman Lockyer observatory, originally the Hill observatory, is on the top of Salcombe Hill near Sidmouth, Devon. This observatory, at a height of 560ft., contains instruments from the observatory of the late Dr. Frank McClean at Rusthall, near Tunbridge Wells, and others used at the Government establishment formerly at South Kensington. The spectroscopic classification of stars and the determination of their parallaxes from examination of their spectra, are items in its programme.

Mention has not been made of all the observatories of past and present importance. Other countries of Europe besides those named have observatories in active work. The Society of Jesus has establishments in various parts of the world devoted to seismology, meteorology, and in some cases to astronomy. The Nizamiah observatory, Hyderabad, which is taking a share in the International Astrographic Catalogue is a striking instance of an observatory devoted to a special line of work.

(H. P. H.)

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OBSERVER CORPS IN AIR DEFENCE. At the beginning of the World War the requirements of air defence had hardly been considered, but very soon the importance of knowing the movements of the hostile aircraft became evident. The information was required both for purposes of active defence, and also for the system of air raid warnings. At first, in Great Britain the defences were in the hands of the Admiralty, who arranged with the police to telephone reports of any aircraft heard or seen within 60 miles of London. Early in 1915 this system was extended to include East Anglia, Northampton, Oxfordshire, Hampshire and the Isle of Wight; and in April, 1915, chief constables were asked to telegraph similar messages to the War Office; there was much overlapping. The system was then extended to cover England and Wales, the reports to come to the Admiralty, who would inform the War Office. Direct interchange of intelligence was also arranged between the chief constables. In 1916 the War Office took over, and a more regular system of observers was introduced, cordons were organized 30 miles outside vulnerable areas, London was provided with two cordons, and coastal posts were organized.

Later Intelligence Arrangements.—The above system was in force when the London air defences were re-organized under General Ashmore in the autumn of 1917. The aeroplane patrol work was improving at the end of 1917, but information from the cordons, etc., was not quick or certain enough for the use of the pilots. Early in 1918 therefore a new system was inaugurated; the German activity was then confined to London and the south and east of it, and this area was well covered with the various units of the defence, coastal posts, squadrons, guns, searchlights and balloon aprons. A system of reporting from all these units was arranged by which their information came through certain centres, and so on to a big map in the headquarters. During operations the lines were always through, and no ringing up was required. The necessary telephone construction work was heavy, and the system was not ready until after May 19, 1918, the occasion of the last raid.

Beginnings of the Observer Corps.—On the revival of air defence in the beginning of 1924, it was plain that unless special measures were taken, large areas would be blank so far as any aircraft intelligence was concerned. The requirements were simple; no hostile aircraft must be allowed to move over any part of the country without its movements being known constantly and instantly at the headquarters of the air defences. To obtain the information it was necessary to cover the country, within range of bombing, with a series of posts, six to eight miles apart, provided with suitable watchers and a complete telephone organization for quick reporting. The first experiment was made in 1924. A few posts were organized at the required interval round Cranbrook, which was the reporting centre. The experiment went to show that the scheme was feasible, and valuable experience was gained.

Organization and Working.—In 1925 the system was extended to two zones covering the whole of Kent and Sussex; each zone consisting of a network of observer posts connected by direct telephones to an observation centre, the centres again being connected up to the headquarters of the air defences. The posts and centres were manned by special constables, enrolled for this object by the chief constables of counties and boroughs. The 1925 lay-out was well tested by day and night work with the R.A.F. After the 1925 work, the organization received the official sanction of the Home Office and the War Office, and the general terms of service for the special constables were fixed. In 1926, two further zones were organized, so that by 1927 the system was in working order from the west of Hampshire, through Hampshire, Sussex, part of Surrey, Kent, Essex and half Suffolk. The administration under the chief constables and regular police works smoothly. The observers, who do the work without pay, are keen and efficient. Each group of about 25 posts communicates direct to a centre.

In the centre is a large table map on to which the observer lines are laid. Plotters sit round the table with telephone headsets on, three posts to each plotter. As the reports come in, they are plotted on the control map, and an independent recorder keeps a record. A teller overlooks the control map, and reports to the air defence headquarters the courses as they appear. Periodical exercises are held in which large numbers of bombing and fighting aeroplanes fly over the posts. The system transmits the courses with certainty and with great rapidity, and has proved itself an indispensable part of the air defence organization. (E. B. A.)

OBSIDIAN, a glassy volcanic rock of acid composition. Rhyolitic lavas frequently are vitreous, and when the glassy matter greatly predominates and the crystals are few and inconspicuous the rock becomes an obsidian; the chemical composition is essentially the same as that of granite; the difference in the physical condition of the two rocks is due to the fact that one consolidated at the surface, rapidly and under low pressures, while the other cooled slowly at great depths and under such pressures that the escape of the steam and other gases it contained was greatly impeded. Few obsidians are entirely vitreous; usually they have small crystals of felspar, quartz or a ferromagnesian mineral, and when these are numerous the rock is called a porphyritic obsidian. These crystals have, as a rule, good crystalline form, but the quartz and felspar are often filled with enclosures of glass.

All obsidians have a low specific gravity (about 2·4) both because they are acid rocks and because they are non-crystalline. Their lustre is vitreous except when they contain many minute crystals; they are then velvety or even resinous in appearance. Black, grey, yellow and brown are the prevalent colours of these rocks. In hand specimens they often show a well-marked banding which is sometimes flat and parallel, but may be sinuous and occasionally is very irregular, resembling the pattern of damascened steel. When crystals are present they generally have their long axes parallel to the fluxion.

Even when conspicuous and well formed crystals are not visible in the rock there is nearly always an abundance of minute imperfect crystallizations (microlites, etc.). They are often so small that high magnifications may be necessary to ascertain their presence. Some are globular and others are rod-shaped; they may be grouped in clusters, stars, rosettes, rows, chains or swarms of indefinite shape. In banded obsidians these microlites may be numerous in some parts but few or absent in others. The larger ones polarize light, have angular outlines like those of crystals, and may even show twinning and definite optical properties by which they can be identified as belonging to felspar, augite or some other rock-forming mineral.

These microlites or crystallites (*q.v.*) show that the glassy rock has a tendency to crystallize which is inhibited only by the very viscous state of the glass and the rapidity with which it was cooled. Another type of incipient crystallization which is excessively common in obsidian is spherulites (*q.v.*), or small rounded bodies which have a radiating fibrous structure. They are of globular shape, less frequently irregular or branching, and may be elongated and cylindrical (axiolites). In some obsidians from Teneriffe and Lipari the whole rock consists of them, so closely packed together that they assume polygonal shapes like the cells of a honey-comb. In polarized light they show a weak grey colour with a black cross, the arms of which are parallel to the cross-wires in the eyepiece of the microscope and remain stationary when the section is rotated. Often bands of spherulites alternate with bands of pure glass, a fact which seems to indicate that the growth of these bodies took place before the rock ceased to flow.

As cooling progresses the glassy rock contracts and strain phenomena appear in consequence. Porphyritic crystals often contract less than the surrounding glass, which accordingly becomes strained, and in polarized light may show a weak double refraction in a limited area surrounding the crystal. Minute cracks are sometimes produced by the contraction; they are often more or less straight, but in other cases a very perfect system of rounded fissures arises. These surround little spherules of glass which are detached when the rock is struck with a hammer. There may be concentric series of cracks one within another. The minute globular bodies have occasionally a sub-pearly lustre, and glassy rocks

which possess this structure have been called perlites (*q.v.*).

Although rocks wholly or in large part vitreous are known from very ancient geological systems, such as the Devonian, they are certainly most frequent in recent volcanic countries. Yet among the older rocks there are many which, though finely crystalline, have the chemical composition of modern obsidians and possess structures, such as the perlitic and spherulitic, which are very characteristic of vitreous rocks. By many lines of evidence we are led to believe that obsidians in course of time suffer devitrification, in other words they pass from the vitreous into a crystalline state, but as the changes take place in a solid mass they require a very long time for their achievement, and the crystals produced are only of extremely small size. A dull stony-looking rock results, the vitreous lustre having entirely disappeared, and in microscopic section this exhibits a cryptocrystalline structure, being made up of exceedingly minute grains principally of quartz and felspar. Often this felsitic devitrified glass is so fine-grained that its constituents cannot be directly determined even with the aid of the microscope, but chemical analysis leaves little doubt as to the real nature of the minerals which have been formed. Many vitreous rocks show alteration of this type in certain parts where either the glass has been of unstable nature or where agencies of change such as percolating water have had easiest access (as along joints, perlitic cracks and the margins of dikes and sills). Obsidians from Lipari often have felsitic bands alternating with others which are purely glassy. In Arran there are pitchstone dikes, some of which are very completely vitreous, while others are changed to spherulitic felsites more or less silicified.

Obsidians occur in many parts of the world along with rhyolites and pumice. In Europe the best-known localities for them are the Lipari Islands, Pantellaria, Iceland and Hungary. Very fine obsidians are also obtained in Mexico, at the Yellowstone Park, in New Zealand, Ascension and in the Caucasus. Included in this group are some rocks which are more properly to be regarded as vitreous forms of trachyte than as glassy rhyolites (Iceland), but except by chemical analyses they cannot be separated. It is certain, however, that most obsidians are very acid or rhyolitic. The dark, semi-opaque glassy forms of the basic igneous rocks are known as tachylytes. The typical obsidians exhibit the chemical peculiarities of the acid igneous rocks (viz., high percentage of silica, low iron, lime and magnesia, and a considerable amount of potash and soda) as shown in the following table.

	I. Yellowstone Park	II. Iceland	III. Mexico
SiO_2	74·70	75·28	73·63
Al_2O_3	13·72	10·22	14·25
FeO	0·62	..	1·80
Fe_2O_3	1·01	4·24	..
CaO	0·78	1·81	tr.
MgO	0·14	0·25	1·42
K_2O	4·02	2·44	4·39
Na_2O	3·00	5·53	4·61
H_2O	0·62	0·23	..

(J. S. F.)

OBSTETRICS (Midwifery). Obstetrics, together with Gynaecology (*q.v.*) and Paediatrics cover the greater part of the reproductive cycle (*i.e.*, from the parents of one generation to those of the next), the portion falling strictly within the sphere of Obstetrics being from conception through pregnancy, labour and lying-in up to the time of the return of the mother to her ordinary duties. The start may be made even before conception for the obstetrician may be called on to advise as to the marriageability of a woman, *i.e.*, of her capacity to be a wife and mother, because of some disease or deformity of the genital organs or bony pelvis, or general disease, as of the heart, lungs or elsewhere, on which his experience of the effects in pregnancy and labour will be required. Midwifery is associated in the minds of the public with attendance at a confinement, and the woman who engages a doctor thinks of his duties as seeing her safely through the crisis of childbirth and relieving her, so far as the resources of medicine will allow, of the pains associated therewith.

Labour.—Labour comes on about 280 days after the first day of the last menstrual period and is divided into three stages. The first and longest is occupied by the opening up of the mouth of the womb; the second stage, lasting usually two hours or less, represents the time from full dilatation to the expulsion of the child; the third stage, half an hour or less, covers the period of the expulsion of the afterbirth. The motive power in all stages of labour is the contractions of the strong muscular wall of the womb, aided in the last two stages by the bearing down efforts of the abdominal muscles. The "pains of labour" are caused by the powerful colic-like contractions of the womb with, towards the end, the stretching of the passages as the child is being born.

The first stage may last even to days without harm to mother or child so long as the waters are unbroken, as the water-bag is an efficient protection to both, but danger to the child especially may result in those cases of premature breaking of the waters in which the presenting part does not come down and block the escape of all the water. The "dry" labour in which the water is lost is always a difficult one.

To be normal the head of the child, and the top of the head (vertex) should come first, that is, present, and does so in over 95 per cent. of cases and its position should be such that the hind part of the head is born before the forehead. The labour is often longer and more difficult when the back of the child is backwards in the womb.

The chief difficulties arise from other presentations than those of the top of the head,—sometimes the face presents (once in 300 cases) and may cause a long and difficult labour, and more rarely the brow (1 in 1,200), a still more difficult presentation, as the passage of a full-time child is not possible until the presentation is altered to a face or a vertex. The most frequent abnormal presentation is a breech, when the buttocks come first and the head last, as it occurs about 1 in 40 cases. It, however, is not more serious to the mother than a vertex presentation, but the child is more likely to be still-born, being suffocated owing to the head coming last. Another, and happily rare, malpresentation is the cross-birth (1 in 250) in which the child lies across the passage, as if not changed, it completely obstructs the birth. Twins occur about once in 80 births, and add slightly to the risks, because the children are often small and the labour premature and slow with the first child. The second child is usually born easily because the passages are already dilated. A single unduly large child is much more likely to give rise to difficulty; it is always unfortunate if the child weighs over 10lb.,—the more desirable weight is one of 6 to 7lb.

Complications.—Among the more serious complications are those giving rise to (1) haemorrhage during birth (commonly due to misplacement of the after-birth which is in front of the child and to early separation of the placenta), (2) convulsions (eclampsia), occurring usually in women with kidney disease and (3) labour obstructed by deformity of the pelvic bones narrowing the bony canal through which the child must pass or by tumours blocking the canal. In the marked degrees of pelvic deformity the only chance of obtaining a living child is by Caesarean Section (*q.v.*). Delivery by the natural passages in such cases may be possible only by destroying the child and the risk of injury to, and death of, the mother in these destructive operations may be as great as the Caesarean operation.

Much the most common cause of failure of the woman to deliver herself is due to relative or absolute weakness of the uterine contractions (pains). Relative, if in a first confinement the soft passages, and especially the outlet, are rigid, or in any confinement in which owing to the size of the child or its position or the narrowness of the passages, some extra effort on the part of the womb is required and is not forthcoming. Absolute weakness is present in those cases in which no additional effort is called for and yet there is insufficient power to expel the child without great prolongation of labour.

Feeble action of the womb may be due to loss of the stimulus of the dilating bag by early breaking of the waters; if the presenting part comes down to take the place of the bag, all will go well,

but if it does not there is nothing to prevent all the waters dribbling away and a dry labour of this kind is always difficult, and the child may be stillborn. A loaded bowel or a full bladder also interferes with uterine action and these viscera must be kept empty. Fatigue is a very important factor in this regard for the womb of the tired out woman will not function efficiently. Anxiety, lack of confidence in her own powers and long continued pain act in the same way and hasten the production of fatigue. The relief of pain, the obtaining of rest and general management of the patient is, therefore, a most important part of the medical attendant's duties. The problem is not an easy one because sedatives, anaesthetics and means of relieving pain also tend to lessen, at any rate, for a time, the muscular activity of the uterus.

Lying-in Period.—During the lying-in period, rest and quiet are essential, particularly for highly-strung women, but rest to mind more than to body. The patient should sit up in bed and move about so as to promote free escape of the discharges. She is not an ill woman and is kept in bed to allow time for healing and the return of the enlarged and relaxed structures to their pre-pregnancy state. It is useless to say how long the woman should remain in bed or in her room; every case must be decided as an individual problem;—a longer stay being required by those who have had complications, who are worn out and require rest, sleep badly or are of a nervous and over-anxious temperament; a shorter by those in whose cases everything has been straightforward, who sleep well and are of an easy-going nature and do not worry. Much can be done in the way of massage and bed exercises and after rising by Swedish exercises to restore the abdominal and pelvic muscles,—a most important measure in preserving the figure and lessening the chances of dropping of the abdominal viscera and womb. The chief danger during the lying-in period is that of puerperal fever (*q.v.*) and its sequelae.

Preventive Obstetrics.—In the last 20 years a striking change has occurred in the science of obstetrics and its practice, chiefly as the result of its invigoration by the spirit of preventive medicine.

The term "preventive medicine" (*q.v.*) does not connote any special creed or peculiar doctrine in medicine. Its first object is to seek out the causes of disordered function and remove them before they can become operative and, in the second place, when these causes are unknown, to detect the early signs of deviation from normality and restore the normal before trouble arises. The maintenance of natural function in all bodily systems is its aim.

If obstetrics is regarded from this point of view the difference between the new and the old practice will become obvious. Its immediate purpose will be to secure normal reproduction by detecting and removing all known causes of disorder of function and by observing the healthy pregnant woman from conception onwards to discover any sign of departure from the normal. Though a physiological state, pregnancy imposes a strain on the efficient working of every system of the body, and the thorough examination of the state of health of mind and body of the woman early in her pregnancy and further observation to see how she is standing the test seem but reasonable precautions. Apart from those who have some organic weakness and may break down under the strain, there are disorders of function that may develop in those previously of sound physique. A special strain falls on the excretory organs, and the kidneys and the liver may be affected and lead to acute or chronic disease. Hence the need for the routine and repeated examination of the urine. The good health of the mother throughout childbearing increases her resistance to infection (*e.g.*, puerperal fever) and her efficiency in the rearing of her family.

The care of the pregnancy itself is likewise a matter of greater concern than in the older obstetrics, not only because of the loss of prospective life, but because miscarriage is a prolific cause of operative interference, during or after its occurrence, and of infective and other diseased conditions of the reproductive tract and thus of subsequent disability. Premature labour results in the birth of weakly infants difficult to rear and is a prominent factor in the persistent high mortality among new-born infants. Another important object of the supervision of the pregnant woman, that of foreseeing and avoiding difficulties and complications during labour, provides the simplest illustration of the changed outlook in obstetrics.

The usual custom of a generation ago was for the woman to retain her doctor for attendance on her confinement and for the doctor to do little more than note the expected date on which his services might be required. Unless consulted by the patient because of some disturbance of health, he might not see her again until summoned at the onset of labour. He then made a thorough investigation to see if all was straightforward or if there was any malpresentation or other difficulty, and was prepared to do his best to remedy any untoward condition that might be present or arise later, often being exceedingly ingenious and resourceful in so doing. His obstetric training as a student had been directed largely toward teaching him the management of normal labour, the emergency treatment of abnormal presentations and obstructions to the passage of the foetus through the birth canal and other complications during labour, and his reputation as an accoucheur was largely determined by his capacity to cope with emergencies.

Modern Methods.—The training of the modern student is conducted on other lines, and whenever a complication occurs the first question discussed is, "Could this have been foreseen?" and if so, the next question is, "What should then have been done?" and a comparison of the case as he has seen it with what it might have been had the emergency been anticipated is used to impress on him that the sole criterion of sound obstetrics is the securing of natural parturition and the prevention of unexpected difficulties and complications so far as the present state of our knowledge allows.

To avoid difficulties in labour, examination is begun about six weeks before the expected date of confinement in order to determine that the child is presenting normally and that there is sufficient accommodation in the bony pelvic canal to allow of its easy passage. This examination is repeated two or three times to make sure that no change has occurred in the presentation and position and that the child does not become unduly large to pass readily. For the most part these matters can be determined with a fair degree of accuracy by the ordinary methods of obstetric examination, but in difficult and special cases examination under anaesthesia and by X-rays may be required. Should it be discovered that even at six weeks before full time there will be difficulty in the child being born by the natural passages, because of rickety or other deformity of the pelvic bones, the question arises whether it is better to resign all hope of the delivery of a living child by the natural passages and perform Caesarean section or to induce labour and learn if the natural powers can effect the delivery of a small and premature infant.

If there does not appear to be any obstruction at the time of the first examination but at a later one there is evidence of a tight fit, labour should be brought on then to avoid the risk of the child becoming too large to be born without difficulty. By eliminating difficulties due to disproportion in size between the child and the mother's pelvic canal and such malpresentations as those previously mentioned most of the serious difficulties in labour can be obviated in some way or other. The change in presentation and position of the child can be effected by manipulation through the abdomen, if done before the child is too large to be moved readily, and in favourable cases and under anaesthesia sometimes even up to and after the onset of labour, but if left until the waters have broken or labour is advanced, requires internal operative procedures with their additional risks of injury and infection.

In these instances the cause of difficulty can be anticipated and removed before labour begins, but there are also many conditions of which the cause is unknown so that the obstetrician must fall back on the second line of defence, that of discovering the earliest signs of disturbance, taking them as a warning of danger ahead and making the best possible dispositions. Premature detachment of the after-birth commonly shows itself by haemorrhage and all pregnant women whilst under supervision are warned to report at once any bleeding, so that immediate measures may be taken to

lessen the chances of serious consequences. Albuminuria, discovered by frequent examination of the urine, convulsions (eclampsia), excessive vomiting and visual disturbances are warnings of dropsy.

Pre-maternity supervision is in its infancy, but with experience of its working much more will be possible in the way of prevention. Many of its problems have scarcely begun to be worked out and an example of one of the most outstanding of them is worth a little consideration as an example of the problems that obstetrics has to face.

A Widened Outlook.—When these wider questions are looked into, there is little ground for complacency among those responsible for the obstetric practice of the country. There has been no reduction in maternal mortality equivalent to the drop in the general death-rate or to the remarkable fall in the infantile mortality, which has been halved since the beginning of this century. Further analysis of the registrar-general's figures in England and Wales shows that septicaemia, a form of blood-poisoning practically eliminated from general surgery by the antiseptic and aseptic technique, is still too prevalent and still causes (as puerperal sepsis) about a third of the deaths in childbearing. The annual rate of maternal deaths per 1,000 live births registered in England and Wales is a little under four. In the bad years immediately after the War, the rate was over four per 1,000. In the United States (1920) the rate was 7·99 per thousand. This may not appear large but means that about 3,000 women in the prime of life die in childbearing with the loss of their maternal care to many more young children, and of these mothers over 1,000 die from puerperal sepsis, a preventable disease. Its prevention is a more complicated matter than, and a somewhat different problem from, that of surgical sepsis, because septic organisms may be present in the lower genital tract and spread upwards and into the blood stream, apart from any question of failure of aseptic technique on the part of the attendant.

The statistics of all maternity hospitals show that fever in childbed increases with all complications and difficulties calling for internal manipulation, all of which tend to the introduction or upward spread of infective organisms. The more prolonged and the higher up the tract the manipulation, the greater is the incidence of fever. By far the commonest operative interference is delivery by the forceps because it is advocated by many merely in order to shorten the patient's suffering. Instead of trying to secure natural delivery in cases of weak uterine action, a substitute for the uterine power is adopted in the shape of the muscular power of the attendant exerted through the obstetric forceps. The causes of weak uterine power are difficult to determine and often impossible to foresee, but here is a direction in which investigation is necessary.

Particularly calling for solution are the questions, how far modern social conditions have lessened the power of the woman of to-day to stand the hardship, fatigue and mental and physical strain of child-birth and rendered her less capable of completing the expulsion of the child naturally than the mothers in the days before anaesthesia and frequent forceps delivery; what are the factors tending to produce this lessened capacity; and, how far are they removable?

The obstetrical centre of gravity has thus been shifted backwards from the care of labour to the supervision of pregnancy and a wider outlook over the reproductive cycle is taken so that the part played by obstetrics is seen as but part of the wider subject that is concerned with securing the health of the new generation at the minimum of cost to the old. The pre-maternity supervision looks forward to the nursing of the child and the rearing of the family. It anticipates the natural feeding of the infant by removing all causes that may interfere with breast feeding. It has an educational side and endeavours to inculcate sound principles of hygiene in the preparation for, and the care of, the babe when born, because success in this direction will mean a better start for the new generation. The observation of the developing child falls to paediatrics and the two subjects, as maternity and child welfare, have become a duty and charge to local health authorities, and as such are well known to the public.

In conclusion a tribute should be paid to the late Dr. Ballantyne of Edinburgh, as the advocate of pre-maternity supervision and the pioneer of the antenatal clinic, which more than anything else has served to further the permeation of obstetrics by the spirit of preventive medicine. *See* J. S. Fairbairn, *Gynaecology with Obstetrics* (1926). (J. S. Fa.)

OCALA, a city in the interior of Florida, U.S.A., 100 m. S.W. of Jacksonville; the county seat of Marion county. It is on Federal highway 41; has a municipal airport; and is served by the Atlantic Coast Line and the Seaboard Air Line railways. Pop. 6,721 in 1925 (State census), of whom 2,681 were negroes; estimated locally at 8,500 in 1928. The city has extensive lime quarries, phosphate mines, turpentine distilleries and hardwood factories, and is a shipping point for fruits and vegetables. Five miles east is Silver spring (so called from the remarkable transparency and refractive powers of its waters) which has a circular basin 300 ft. in diameter and 65 ft. deep, and discharges over 300,000 gal. a minute, its outflow forming a navigable stream 9 m. long, emptying into the Oklawaha river. Ocala was settled in 1845 and chartered as a city in 1848. It has a council-manager form of government. The name is Seminole, meaning green land.

OCAÑA, a town of central Spain, in the province of Toledo; on the extreme north of the tableland known as the Mesa de Ocaña, with a station on the railway from Aranjuez to Cuenca. Pop. (1920) 6,196. Ocaña is the Vicus Cuminarius of the Romans, and was the dowry that El Motamid of Seville gave his daughter Zaida on her marriage with Alphonso VI. of Castile (1072–1109).



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THE OCARINA, A WIND INSTRUMENT POPULAR AMONG STREET PLAYERS

OCARINA, a wind instrument invented in Italy, which must be classed with musical toys or freaks. It consists of an earthenware vessel in the shape of an egg with a pointed base and perforated with holes and a tube like a spout in the side, which contains the mouthpiece. In America, it is sometimes called a "sweet potato."

O'CAROLAN (or CAROLAN), **TURLOGH** (1670–1738), Irish bard, son of John O'Carolan, a farmer, was born at Newtown, near Nobber, Co. Meath. At eighteen he became blind from smallpox. He received special instruction in music, and used to wander with his harp round the houses of the surrounding gentry, mainly in Connaught. The number of Carolan's musical pieces, to nearly all of which he composed verses, is said to exceed two hundred. He died on March 25, 1738, and was buried at Kilronan.

His poetical *Remains* in the original Irish, with English metrical translations by Thomas Furlong, were printed in Hardiman's *Irish Minstrelsy* (1831). Many of his songs were preserved among the Irish MSS. in the British Museum.

OCCAM, WILLIAM OF (*c.* 1300–1349), English schoolman, known as *Doctor invincibilis* and *Venerabilis inceptor,* was born at Ockham, Surrey, and after joining the Franciscans, studied from 1312 to 1318 at Merton college, Oxford, where he taught until 1324, when he was summoned to Avignon to account for some of his doctrines. While he was confined to his convent, in 1326, John XXII. ordered various theses from his works to be examined by the masters of theology, but his works were not actually condemned. Two years later his championship of the Spirituals brought him into a further conflict with the pope, and as a result, he and Michael of Cesena, general of the order, joined the emperor Louis of Bavaria who was at that time in contest with the papal curia. It was for Occam's share in this controversy that he was best known in his lifetime. Michael of Cesena died in 1342, and Occam, who had received from him the official seal of the order, was recognized as general by his party. He probably died at Munich in 1349, having tried to be reconciled with the Church after the death of the emperor.

Occam was one of the most interesting figures in the great contest between pope and emperor, which laid the foundation of modern theories of government, in the disintegration of scholasti-

cism and in the rise of theological scepticism. In the *Opus nonaginta dierum* (1330) (written in reply to John XXII.'s libellus against Michael of Cesena), and in its successors, the *Tractatus de dogmatibus Johannis XXII. papae* (1333–34), the *Compendium errorum Johannis XXII. papae* (1335–38) and in the *Defensorium contra errores Johannis XXII. papae* (1335–39), Occam only incidentally expounds his views as a publicist, the *Compendium* being of special interest because it selects four papal constitutions which involved a declaration against evangelical poverty, and insists that they are full of heresy. The *Super potestate summi pontificis octo quaestionum decisiones* (1339–42) attacks the temporal supremacy of the pope, insists on the independence of kingly authority, which he maintains is as much an ordinance of God as is spiritual rule, and discusses what is meant by the State. His views on the independence of civil rule were even more decidedly expressed in the *Tractatus de jurisdictione imperatoris in causis matrimonialibus*, in which he contends that it belongs to the civil power to decide cases of affinity and to state the prohibited degrees. By 1343 his great work the *Dialogus* (*see* Goldast ii. 398–957), in which he attempted to summarize his views, was in circulation. His last work, *De Electione Caroli IV.*, restates his opinions upon temporal authority.

In philosophy, Occam's most significant doctrines fall within the departments of psychology, metaphysics and theology. In the first, he contends that since singulars alone exist, the universal, which is a kind of mental label, has an objective value only inasmuch as it is thought; that the *intellectus agens* and the *species intelligibiles* are superfluous because abstraction follows naturally upon perceptions or intuition, the fundamental form of human knowledge; that will and not intellect is the primary faculty of the soul, and that both faculties, like memory, are identical with the substance of the soul; and that a *forma corporeitatis* must be admitted if the independence of the soul is to be preserved. In metaphysics, Occam teaches that matter has its own essence apart from form; that accidents are only aspects of substance; that the problem of individuation is meaningless because each thing is singular in itself, and that between essence and existence there is no real distinction. The famous dictum—*Essentia non sunt multiplicanda praeter necessitatem*—has become known as "Occam's Razor," but it was already stressed by Duns Scotus. In theology, Occam's scepticism is especially noticeable in his assertion that the existence of God and His attributes, including His unity and infinity, are not strictly provable. According to Occam, the most characteristic activity of God is willing, and moral laws are good only because God wills them and not in their own right.

BIBLIOGRAPHY.—Occam's political works were edited by Goldast (Frankfurt, 1614) and further mss. by R. Scholz (Rome, 1914). The *Dialogus* appeared separately in 1495, the *Defensorium contra Joannem XXII.* in 1513, and the *De Imperatorum et pontificum potestate* in 1927 (edit. C. K. Brampton). Of the non-political works, the *Commentary on the Sentences* appeared in 1483 and 1495, the *Quodlibet* in 1487 and 1491 and the logical treatises fairly frequently in the 15th and 16th centuries.

See Prantl, *Geschichte der Logik* (1855–70); Riezler, *Die literarischen Widersacher der Päpste zur Zeit Ludwig des Baiers* (1874); A. J. Little, *Grey Friars in Oxford* (1892); F. Bruckmüller, *Die gotteslehre W. v. Ockham* (Munich, 1911); L. Kugler, *Der Begriff d. Erkenntniss bei W. v. Ockham* (Breslau, 1913); J. Hofer, "Biographische Studien über W. von Ockham" in *Arch. Fran. Hist.* (1913); R. L. Poole, *Illustrations in Mediaeval Thought* (2nd ed., 1920); A. Pelzer, "Les 51 articles de G. d'Occam censurés à Avignon en 1326" in *R. Hist. eccles.* (1922); F. Federhofer, "Ein Beitrag zur Bibliographie und Biographie des W. v. Ockham" in *Philos. Jahrb.* (1925), and "Die Psych . . . W. v. Ockham," in *Philos. Jahrb.* (1926). Full bibliography in Überweg, *Gesch. der Philosophie* (ed. 2, 1928).

OCCASIONALISM, in philosophy, a term applied to that theory of the relation between matter and mind which postulates the intervention of God to bring about in the one a change which corresponds to a similar change in the other. The theory thus denies any direct interaction between matter and mind. It was expounded by Geulincx and Malebranche to avoid Descartes's dualism of thought and extension, and to explain causation.

OCCLEVE (or HOCCLEVE), **THOMAS** (1368–1450?), English poet, was born probably in 1368/9. What is known of Occleve's life has to be gathered mainly from his works. At eighteen or nineteen he obtained a clerkship in the Privy Seal Office, which he retained on and off, in spite of much grumbling, for about thirty-five years. In 1399 he received a small annuity, which was not always paid as regularly as he would have wished. "The Letter to Cupid," his first poem to which we can affix a date, was translated from *L'Epistre au Dieu d'Amours* of Christine de Pisan in 1402, evidently as a sort of antidote to the moral of *Troilus and Cressida*, to some mss. of which we find it attached. About 1410 he settled down to married life, and the composition of moral and religious poems. His longest work, *The Regement of Princes* or *De Regimine Principum*, written for Prince Hal shortly before his accession, is a tedious homily on the virtues and vices, imitated from Aegidius de Colonna's work of the same name, from the supposititious epistle of Aristotle, known as the *Secreta secretorum* and the work of Jacques de Cessoles (*fl.* 1300) rendered into English later by Caxton as *The Game and Playe of Chesse*.

On the accession of Henry V. Occleve turned his muse to the service of orthodoxy and the Church, and one of his poems is a remonstrance addressed to Oldcastle, calling upon him to "rise up, a manly knight, out of the slough of heresy." Then a long illness was followed for a time, as he tells us, by insanity. His "Dialog with a Friend," written after his recovery, gives a naïve and pathetic picture of the poor poet, now fifty-three, with sight and mind impaired, but with hopes still left of writing a tale he owes his good patron, Humphrey of Gloucester, and of translating a small Latin treatise, *Scite Mori*, before he dies. His hopes were fulfilled in his moralized tales of "Jereslaus' Wife" and of "Jonathas," both from the *Gesta Romanorum*, which, with his "Learn to die," belong to his old age. After finally retiring from his privy seal clerkship, he was granted in 1424 sustenance for life in the priory of Southwick, Hants, on which, with his former annuity, he appears to have lived till about the middle of the century. A "Balade to my gracious Lord of Yorke" probably dates from 1448 or later.

The main interest for us in Occleve's poems is that they are characteristic of his time. They illustrate the blight that had fallen upon poetry on the death of Chaucer. The nearest approach to the realistic touch of his master is to be found in his "Male Regle," which, written about 1406, gives some interesting glimpses of his "misruly youth." But these pictures of 15th-century London are without even the occasional flash of humour that lightens up Lydgate's *London Lackpenny*.

A poem, "Ad beatam Virginem," generally known as the "Mother of God," and once attributed to Chaucer, is copied among Occleve's works in ms. Phillipps 8151 (Cheltenham), and may thus be regarded as his work. Occleve found an admirer in the 17th century in William Browne, who included his "Jonathas" in the *Shepheards Pipe* (1614). Browne added a eulogy of the old poet, whose works he intended to publish in their entirety (*Works*, ed. W. C. Hazlitt, 1869, ii. 196–198). In 1796 George Mason printed six *Poems by Thomas Hoccleve never before printed . . .*; "De Regimine Principum" was printed for the Roxburghe Club in 1860, and by the Early English Text Society in 1897. *See* Dr. F. J. Furnivall's introduction to *Hoccleve's Works; The Minor Poems, in the Phillipps MS. 8151, and the Durham MS. III. 9*, ed. F. J. Furnival; ii. *The Minor Poems in the Ashburnham MS. Addit. 133*, ed. Israel Gollancz; iii. *The Regement of Princes A.D. 1411–12, and fourteen of Hoccleve's minor poems*, ed. F. J. Furnivall (Early English Text Society, 3 vols., 1892–1925).

OCCULTATION, in astronomy, the hiding of one celestial body by another passing in front of it; commonly the passage of the moon or of a planet between the observer and a star or another planet.

OCCULTISM: *see* MAGIC.

OCEAN AND OCEANOGRAPHY. "Ocean" is the name applied to the great connected sheet of water which covers the greater part of the surface of the earth. But the ocean is less than the hydrosphere in so far as the latter term includes also the water lying on or flowing over the surface of the land. The conception of an encompassing ocean bounding the habitable world is found in the creation myths of the most ancient civilizations. The Babylonians looked on the world as a vast round mountain rising from the midst of a universal sheet of water. In the Hebrew scriptures the waters were gathered together in one place at the word of God, and the dry land appeared. The Ionian geographers looked on the circular disc of the habitable world

as surrounded by a mighty stream named Oceanus, the name of the primeval god, father of gods and men, and thus the bond of union between heaven and earth.

Since the Pythagorean school of philosophy upheld the spherical as against the disc-shaped world, some of the ancient geographers, including Eratosthenes and Strabo, looked upon the hydrosphere as forming two belts at right angles to each other, one belt of ocean following the equator, the other surrounding the earth from pole to pole as in the *terra quadrifida* of Macrobius; while others, including Aristotle and Ptolemy, looked upon the inhabited land, or *oikoumene*, as occupying the greater part of the earth's surface. Until the discovery of America and of the Pacific ocean the belief was general that the land surface was greater than the water surface. (*See* MAP.) Only in our own days has the existence of the southern continent been demonstrated within the limits of Antarctica.

Oceanography is the science which deals with the ocean. Of recent years the use of "hydrography" as the equivalent of physical oceanography has acquired a certain currency, but as the word is also used with more than one other meaning (*see* SURVEYING) it ought not to be used for oceanography. This article is restricted to general oceanography in its physical aspects and deals with phenomena common to the whole ocean.

History of Research and Organization.—Research in oceanography began in recent times, especially since the rapid increase in the study of the exact sciences during the 19th century. Observations at sea with accurate instruments became common, and the ships' logs of to-day are provided with headings for entering daily observations of the phenomena of the sea-surface. The contents of the sailors' scientific logs were brought together by the American enthusiast in the study of the sea, Matthew Fontaine Maury (1806–73), whose methods and plans were adopted at international congresses. Many millions of observations are recorded in ships' logs; this firsthand material is preserved in appropriate offices of various nations. The contents of these logs, it is true, refer more to maritime meteorology than to oceanography properly so-called.

This material for the study of the surface phenomena of the ocean has been supplemented in relation to the study of the depths of the ocean, by the records of numerous scientific expeditions and latterly by publications embodying systematic observations on a permanent basis. Valuable observations were made in oceanography during the expeditions of Captain James Cook and the polar explorers, especially those of Sir John Ross in the north and Sir James Ross in the south. The period of deep sea investigation began about 1850 when it became possible to measure ocean depths with precision. (*See* SOUNDING.) At this time, an exact knowledge of the depths of the ocean assumed an unlooked-for practical importance for the laying of telegraph cables at the bottom of the sea. Another stimulus came from the biologists, who began to realize the importance of a more detailed investigation of the life conditions of organisms at great depths in the sea.

These preliminary trips of scientific marine investigation were followed by the greatest purely scientific expedition ever undertaken, the voyage of H.M.S. "Challenger" round the world under the scientific direction of Sir Wyville Thomson and the naval command of Sir George Nares. This epoch-making expedition lasted from Christmas 1872 to the end of May 1876, and gave the first wide and general view of the physical and biological conditions of the ocean as a whole. Almost simultaneously with the "Challenger," a German expedition in S.M.S. "Gazelle" conducted observations in the south Atlantic, Indian and south Pacific oceans; and the U.S.S. "Tuscarora" made a cruise in the north Pacific, sounding out lines for a projected Pacific cable. Since that time investigation has been carried out by ships of all nations, on a scale too extensive for detailed record.

In 1902 at Stockholm was founded the International Council for the study of the sea, whose headquarters are in Copenhagen. At present (1928) all the north-east and north-west European States, with the exception of Russia, are represented there. The idea is to help and control the fisheries in the Baltic, the North sea, the Norway sea and Barents sea, as well as in British and Irish waters. Portugal, Spain and Italy have also become members of this union, which has done much to improve the instruments and methods of oceanography. Generally, each Government has built or fitted out a research steamer for the work. The United States of America, Canada and Japan also take part.

Extent of the Ocean.—The hydrosphere covers nearly three-quarters of the earth's surface as a single and continuous expanse of water surrounding four great insular land-masses known as the continents. Water predominates in the unexplored north polar area, and it is very unlikely that new land of any great extent exists there. On the other hand, recent antarctic exploration makes it certain that a great continent surrounds the south pole with a total area of about 14,000,000 sq.km. Thus there is a total land area of 148,892,000 sq.km., and a total water area of 361,059,000 sq.km., 29% of land and 71% of water, or a ratio of 1:2·43.

Divisions of the Ocean.—The arrangement of the water surface on the globe is far from uniform, the ocean forming 61% of the total area of the Northern and 81% of that of the Southern Hemisphere. Of the whole ocean only 43% (154·7 million sq.km.) lies in the Northern Hemisphere and 57% (206·4 million sq.km.) in the Southern. A great circle can be drawn upon a globe in such a way as to divide it into two hemispheres, one of which contains the greatest amount of land and the other the greatest amount of sea of any possible hemispheres. The centre of the so-called land hemisphere lies near the mouth of the Loire (47½° N. and 2½° W.), while the centre of the so-called water hemisphere lies to the south-east of New Zealand and eastward of Antipodes island. Even in the land hemisphere the water area (135·6 million sq.km.) is in excess of the land area (119·4 million sq.km.), while in the water hemisphere the amount of land is quite insignificant, 29·6 million sq.km. compared with 225·4 million sq.km. of water.

The outline of the water surface depends on the outline of the basins in which it is contained. The four great continental masses, therefore, give the ocean a distinctly tripartite form, the three great divisions being known as the Atlantic, the Indian and the Pacific oceans, all three running together into one around Antarctica. Thus the connecting belt of water is narrow as compared with the extent of the oceans from north to south. The proportions are not readily grasped from a map of the world on Mercator's projection and must be studied on a globe.

Each of the three meridional oceans has an Antarctic facies in the southern part. Some authors prefer to consider these southern parts as a Great Southern ocean. Only the Atlantic possesses a really Arctic facies north from the narrowest part of Davis strait, north of Denmark strait and north of a line running from Iceland to Jan Mayen and Spitzbergen.

Where the ocean touches the continents the margin is in places deeply indented by peninsulas and islands marking off portions of the water surface which from all antiquity have been known as "seas." These seas are more or less dependent on the ocean for their régime, being filled with ocean water. These seas may be classified according to their form either as "enclosed" or as "partially enclosed" (or "fringing"). Enclosed seas extend deeply into the land and originate either by the breaking through of the ocean or by the overflowing of a subsiding area. They are connected with the ocean by narrow straits, the salinity of the water contained in them differs in a marked degree from that of the ocean, and the tidal waves are of small amplitude. Four great intercontinental enclosed seas are included between adjacent continents—the Arctic sea, the Central American or West Indian sea, the Australo-Asiatic or Malay sea and the Mediterranean sea. There are also four smaller continental enclosed seas each with a single channel of communication with the ocean, viz., the Baltic sea and Hudson bay with very low salinity, the Red sea and Persian gulf with very high salinity.

The fringing or partially enclosed seas adjoin the great land masses and are only separated from the oceans by islands or peninsulas. Hence their tidal conditions are quite oceanic, though their salinity is usually rather lower than that of ocean water. The four fringing seas of eastern Asia parallel the main lines of dis-

location in the neighbouring land masses, as do the Andaman sea and the Gulf of California. On the contrary, the North sea, the British fringing seas, and the Gulf of St. Lawrence cross the main lines of dislocation.

In addition to these seas notice must be taken of the subordinate marginal features, such as gulfs and straits. Gulfs may be classified according to their origin as due to fractures of the crust or overflowing of depressed lands. The former are either the extensions of oceanic depressions, *e.g.*, the Arabian sea, or such caldron-depressions as the gulf of Genoa or rift-depressions like the Gulf of Aden. Compound gulfs are formed seawards by fracture and landwards by the overflowing of depressed land, *e.g.*, the Bay of Biscay, Gulf of Alaska and Gulf of the Lion. Gulfs formed by the overflowing of depressed lands lie upon the continental shelf, *e.g.*, the Gulf of Maine, Bay of Fundy.

Straits have been formed (1) by fracture across isthmuses, longitudinally as in the Strait of Bab-el-Mandeb, or transversely as in the Strait of Gibraltar; (2) by erosion, *e.g.*, the Strait of Dover; (3) by overflowing subsided land, as in the straits of Bering, Torres and Formosa.

Surface of the Ocean.—If the whole globe were covered with a uniformly deep ocean and if it were of uniform density, the surface would form a perfect ellipsoid of revolution. At any point a sounding line would hang in the line of the radius of curvature of the water surface. But the water surface is broken by land, and the mean density of the substance of the land is 2·6 times as great as that of sea-water, so that the gravitational attraction of the land must necessarily cause a heaping up of the sea around the coasts, forming what has been called the continental wave, and leaving the sea-level lower in mid-ocean. Hence the geoid or figure of the sea surface is not part of an ellipsoid of rotation but irregular. The differences of level between different parts of the geoid have been greatly overestimated in the past; F. G. Helmert has shown that they cannot exceed 200 metres and are probably much less. Recent pendulum observations have shown great local differences in density in the earth's crust, a marked deficiency of mass under high mountains and excess under the bed of the ocean. There is thus a condition of isostasy or equilibrium between them as a general rule. The intensity of gravity at the surface of the sea far from land has been measured on several occasions. The inequalities of the geoid are not over 100 metres. Distortion of the ocean surface may also arise from meteorological causes and be periodic or unperiodic in its occurrence, but it does not amount to more than 1 or 2 metres. Atmospheric precipitation poured into the sea by the great rivers must necessarily create a permanent rise of the sea-level at their mouths, and from this cause the level round the coasts of rainy lands must be higher than in mid-ocean. The level of the Skagerak should be about 0·6 metre higher than that of the open Norwegian sea between Jan Mayen and the Lofoten islands, the level of the Gulf of Finland at Kronstadt and of the Gulf of Bothnia at Haparanda should similarly be 0·4 metre higher than that of the Skagerak. The level of the Mediterranean has also been determined by exact measurements to be from 0·4 to 0·6 metre lower than that of the Atlantic on account of evaporation. The atmosphere affects sea-level also by its varying pressure, the difference in level of the sea surface from this cause between two given points being 13 times as great as the difference between the corresponding readings of the mercurial barometer. In the north tropical belt of high pressure south of the Azores the atmospheric pressure in January is 22mm. higher than in the Irminger sea; hence the sea-level near the Azores is almost 0·3 metre lower than in the northern sea. The Baltic is fuller in the time of the summer rains than in winter, when the rivers and lakes are frozen and most of the precipitation on the land is snow. A similar range occurs on the Dutch coast in the North sea, where the maximum level is reached in October, the month of highest rainfall, and there is a range of 200mm. to the minimum level at the time of least rainfall in early spring.

In the monsoon regions the half-yearly change from on-shore to off-shore winds produces noticeable differences in level, the total range being 237mm. The influence of wind on water-level is most remarkable in heavy storms on the flat coasts of the North sea and Baltic, when the rise may amount to very many feet. In the region of tropical hurricanes the converging wind system of a circular storm causes a heaping up of water capable of devastating the low coral islands of the Pacific. The old speculations as to a great difference of level between the Mediterranean and the Red sea, and on the two sides of the Isthmus of Panama, have been proved by precision levelling to be totally erroneous.

Deep-sea Soundings.—The hand-lead attached to a line divided into fathoms was a well-known aid to navigation even in high antiquity, and its use is mentioned in Herodotus (ii. 5) and Acts (xxvii. 29). The earliest deep-sea sounding on record is that of Capt. Phipps on Sept. 4, 1773, in the Norwegian sea, in 65° N. 3° E., on his return from his expedition to Spitsbergen. He spliced together all the sounding-lines on board, and with a weight of 150lb. attached he found bottom in 683 fathoms and secured a sample of fine soft blue mud. He detected the moment of the lead touching the bottom by the sudden slackening in the rate at which the line ran out. The honour of first sounding really oceanic depths belongs to Sir James Clark Ross, who made some excellent measurements in very deep water using expensive kilometre-long stout hemp lines. Captain Matthew Fontaine Maury, U.S.N., introduced a ball of strong twine attached to a cannon shot, which ran it out rapidly; when the bottom was reached the twine was cut and the depth deduced from the length of string left in the ball on board. The time of touching bottom was judged by timing each 100-fathom mark and noting the sudden increase in the time interval when the shot reached the bottom. In 1854, J. M. Brooke, a midshipman of the United States Navy, invented a method of sounding by means of an automatically released heavy weight.

Modern surveying ships sound with steel piano wire not more than 0·6 to 0·9mm. in diameter and a detachable lead seldom weighing more than 70lb. (*See* SOUNDING.)

Since 1920 the acoustic method has been used to measure the ocean depths. The first results are satisfactory and the so-called "echo-data" are increasing rapidly in number and value. When the sound wave is engendered in the water, one must measure the time (in seconds) which the wave takes to reach the sea bottom and the time the echo takes to get back from there to the ship. The speed of the sound increases with the temperature, with the salt content and with the pressure, and varies between 1,400 and 1,620 metres per second. Generally the results of echo-observations and wire loosening are in fairly close agreement; but formerly one was not sure whether the wire dropped vertically or whether it was deflected by currents and thus registered too great a depth.

Relief of the Ocean Floor.—Recent soundings have shown that the floor of the ocean on the whole lies some 3 or 4 km. beneath the surface and E. Kossinna has, 1921, calculated the mean depth to be 3,800 metres, while the mean elevation of the surface of the continents above sea-level is only 840 metres. Viewed from the floor of the ocean the continental block would thus appear as a great plateau rising to a height of 4,640 metres. The greatest depths of the ocean below sea-level and the greatest heights of the land above it are not of the same order of magnitude, the summit of Mt. Everest rising to 8,800 metres above the sea-level, while the Philippine Trench near Mindanao sinks to 10,800 metres (5,900 fathoms) below sea-level. Of course the area at great heights is very much less than the area at corresponding depths. According to Kossinna's calculation the areas of the ocean beyond various depths are as follows:—

Metres	Millions sq.km.	% of 361·06 million sq.km.
More than		
200 . . .	333·5	65·3
1,000 . . .	318	62·3
2,000 . . .	303	59·4
3,000 . . .	278·5	54·6
4,000 . . .	207·5	40·7
5,000 . . .	88·5	17·4
6,000 . . .	4·5	0·9

Considering these areas and those of continental lands of various elevations, it is possible to classify the whole into three groups, (1) the area of the continents and their shelves down to the 200 metre submarine contour, this makes up 34·7% of the earth's surface; (2) The area between the 200 metre and 3,000 metre submarine contour, 10·7% of the earth's surface; (3) The area below the 3,000 metre submarine contour, 54·6% of the earth's

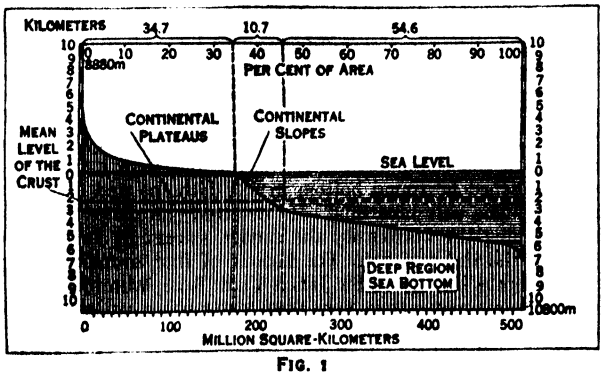

FIG. 1

surface. (Fig. 1.) If land and water were evenly balanced on the earth the most widespread depth figure for the ocean should be about 2,400 metres, but the actual facts are surprisingly different. Several students, including A. Wegener, interpret matters by supposihg that the continental masses are of material different from that of the deep-sea floor. The first, which they call sial, rich in silica, has a specific gravity of 2·6. The second, which they call sima, is formed of basic material and has a specific gravity of 2·9. They think that the continental masses float in the deep-sea floor rocks, much as icebergs float in the sea. This interpretation makes the deep-sea floor something quite different from the continents and is, at any rate, a useful working hypothesis. On the whole the floor of the ocean is not so smooth in its contours as had been believed until recently. According to the new "echo data" the apparent great flat stretches show marked variations of relief. Modern orometry has introduced the calculation of the mean angle of the slope of a given uneven surface provided that maps can be prepared showing equidistant contour lines. If the distance between the contour lines is h and the length of the individual contour lines l, the sum of their lengths $\Sigma\ (l)$, and A the area of the surface under investigation, then the mean angle of slope is obtained from the equation

$$\alpha = \frac{h\ \Sigma\ (l)}{A}.$$

Calculating from sheets of the prince of Monaco's *Atlas of Ocean Depths*, Krümmel obtained a mean angle of slope of 0° 27′ 44″ or an average fall of 1 in 124 for the north Atlantic between 0° and 47° N., the enclosed seas being left out of account. Large angles of slope may, however, occur on the flanks of oceanic islands and the continental borders. On the submarine slopes leading up to isolated volcanic islands, angles of 15° to 20° are not uncommon, at St. Helena the slopes run up to 38½° and even 40°, at Tristan d'Acunha to 33½°. E. Hull found a mean angle of slope of 13° to 14° for the edge of the continental shelf off the west coast of Europe, and off Cape Toriñana (43° 4′ N.) as much as 34°. Where the French telegraph cable between Brest and New York passes from the continental shelf of the Bay of Biscay to the depths of the Atlantic the angle of slope is from 30° to 41°. Such gradients are of a truly mountainous character; the angle of slope from the Eibsee to the Zugspitze is 30°. Particularly steep slopes are found in the case of submarine domes, usually incomplete volcanic cones, and there have been cases in which after such a dome has been discovered by the soundings of a surveying ship it could not be found again as its whole area was so small and the deep floor of the ocean from which it rose so flat than an error of 4 or 5 km. in the position of the ship would prevent any irregularity of the bottom from appearing.

In spite of the increase of deep-sea soundings in the last few decades, they are still very irregularly distributed in the open ocean, and the isobaths (lines of equal depth) on a chart of the world include wide generalizations. Bearing this caution in mind, the existing bathymetrical charts, amongst which that of the prince of Monaco stands first, give a very fair idea of the great features of the bed of the oceans. (*Carte générale bathymétrique des océans dressée par ordre de S.A.S. le Prince Albert de Monaco*, 24 sheets [Paris, 1904]; 2nd edition, Paris, 1913 *seq.*) A definite terminology for the larger forms of sub-oceanic relief was put forward by the International Geographical Congress at Berlin in 1899 and adopted by that at Washington in 1904. Equivalent terms, which are not necessarily identical or literal translations, were adopted for English, French and German.

The larger forms designated by special generic terms include the following: The *continental shelf* is the gentle slope which extends from the edge of the land to a depth usually about 100 fathoms or 200 metres, though in some cases as much as 300 fathoms or about 600 metres, and is there demarcated by an abrupt increase in the steepness of the slope to ocean depths. In the deep sea two types of feature are recognized under the general names of *depression* and *elevation*. The depression is distinguished according to form and slope as (1) a *basin* when of a roughly round outline, (2) a *trough* when wide and elongated, or (3) a *trench* when narrow and elongated lying along the edge of a continent. The extension of a basin or trough stretching towards the continent is termed an *embayment* when relatively wide and a *gully* when narrow. The elevation includes (1) the gently swelling *rise* which separates troughs and basins in the middle of the ocean, (2) the steeply sloping *ridge* which interposes a narrower barrier between two depressions, and (3) the *plateau* or wide elevation rising steeply on all sides from a depression. The deepest part of a depression is termed a *deep*, and the highest part of an elevation when not reaching the surface a *height*. In addition to these larger forms a few minor forms must be recognized. Amongst these are the *dome*, an isolated elevation rising steeply but not coming within 100 fathoms (200 metres) of the surface; the *bank*, an elevation coming nearer the surface than 100 fathoms, but not so near as 6 fathoms (10–11 metres); and finally the *shoal* or *reef*, which comes within 6 fathoms of the surface, and so may constitute a danger to shipping. Similarly we may note the *caldron* or small steep depression of a round outline, and the *furrow* or long narrow groove in the continental shelf.

According to the resolutions of the International Geographical Congress the larger individual forms which have been described by generic terms shall have specific names of a purely geographical character; but in the case of the minor forms the names of ships and persons are considered applicable. In 1899 A. Supan published a chart of the oceans with a suggested nomenclature based on these principles; and the larger forms in the prince of Monaco's great chart also are named in accordance with the rule. This system is not yet general. Sir John Murray considers that only deeps exceeding 3,000 fathoms in depth should be named.

The Continental Shelves.—The continental shelves are those parts of the continental blocks which have been covered by the sea in comparatively recent times, and their surface consequently presents many similarities to that of the land, modified of course by the destructive and constructive work of the waters. Waves and tidal currents produce their full effects in that region, and in high latitudes the effect of transport of materials by ice is very important; while in the warm water of the tropics the reef-building animals and plants (corals and calcareous algae) carry on their work most effectively there. The continental shelves include not only the oceanic border of the continents but also great areas of the enclosed seas and particularly of the fringing seas, the origin of which through secular subsidence is often very clearly apparent, as for instance in the North sea and the tract lying off the mouth of the English channel. A closer investigation of the numerous long narrow banks which lie off the Flemish coast and the Thames estuary shows that they are composed of fragments of rock abraded and transported by tidal currents and

storms. Numerous old river valleys and furrows entrenched in the continental shelf bear witness to its land origin. Such valleys are very clearly indicated in the belts of the western Baltic, the Cape Breton deep, the Hudson Furrow, the so-called Congo Cañon, the Swatch of No Ground off the Ganges delta, and numerous similar furrows.

The seaward edge of the continental shelf often falls steeply to the greatest depths of the ocean, and not infrequently forms the slope of a *trench*, a form of depression which has usually a steep slope towards a continent or an island-bearing rise on one side and a gentler slope towards the general level of the ocean on the other. Soundings exceeding 7,000 metres occur in trenches; there are few trenches known (on west coast of Central America) in which the maximum depth is less than 5,000 metres. Most trenches are narrow, but of considerable length, and their steeper side is believed to be due, not to a fracture, but to a folding of the earth's crust, because these trenches are only found parallel to young fold mountains like the Cordillera of North and South America. The deep trenches are distributed chiefly around the Pacific near to the shore or near the limits of former lands (Mindanao, 10,800m.). Outside the Pacific we find a trench (8,526m.) north of Porto Rico, and another north of the south Sandwich Islands in the south Atlantic. In the Indian ocean there is a trench (7,450m.) west and south of Sumatra-Java, where a double-folding occurs. On a coast with old block mountains, as around Africa and the Deccan, these trenches are absent. The region of these depressions is also specially subject to great earthquakes. These submarine trenches occupy only 1% of the area of the oceans. There are also numerous "fossil" trenches, filled with various deposits, at the foot of fold mountains, as, for example, the Ganges valley.

TABULAR VIEW OF OCEANS AND SEAS

The following table gives the average depth, the area, and the volume of the oceans, seas and the hydrosphere according to the 1921 computations of E. Kossinna:—

Mean Depth, Area and Volume of Oceans and Seas.

Name	Depth		Area	Volume
	Metres	Fathoms	Sq.km.	Cu.km.
Atlantic ocean	3,926	2,147	82,441,500	323,613,000
Indian ocean	3,963	2,167	73,442,700	291,030,000
Pacific ocean	4,282	2,342	165,246,200	707,555,000
I. Oceans	4,117	2,251	321,130,400	1,322,198,000
Arctic sea	1,205	659	14,090,100	16,980,000
Malay sea	1,212	663	8,143,100	9,873,000
Central American sea	2,216	1,212	4,319,500	9,573,000
Mediterranean sea	1,429	782	2,965,900	4,238,000
Inter-continental seas	1,378	754	29,518,600	40,664,000
Baltic sea	55	30	422,300	23,000
Hudson bay	128	70	1,232,300	158,000
Red sea	491	269	437,900	215,000
Persian gulf	25	14	238,800	6,000
Smaller enclosed seas	172	94	2,331,300	402,000
II. Enclosed seas	1,289	705	31,849,900	41,066,000
Bering sea	1,437	786	2,268,200	3,259,000
Okhotsk sea	838	458	1,527,600	1,279,000
Japan sea	1,350	738	1,007,700	1,361,000
East China sea	188	103	1,249,200	235,000
Andaman sea	870	476	797,600	694,000
Californian gulf	813	445	162,200	132,000
North sea	94	52	575,300	54,000
English channel and Irish sea	58	32	178,500	10,000
Laurentian sea	127	70	237,800	30,000
Bass sea	70	39	74,800	5,000
III. Fringing seas	874	478	8,078,900	7,059,000
Seas (enclosed and fringing)	1,205	659	39,928,800	48,125,000
Hydrosphere	3,795	2,075	361,059,200	1,370,323,000

Oceanic Deposits.—It has long been known that the deposits which carpet the floor of the ocean differ in different places, and coasting sailors have been accustomed from time immemorial to use the lead not only to ascertain the depth of the water but also to obtain samples of the bottom, the appearance of which is often characteristic of the locality. Various devices have been attached to leads intended to catch and hold the material when soft enough to be penetrated. One of the most effective early forms was the snapper or "deep-sea clamm" of Sir John Ross, a pair of powerful spring jaws held apart by an arrangement which, when released on striking the bottom, allowed the jaws to close, biting out and holding securely a substantial portion of the ground. A simpler form of collector, now almost universally used, is a plain brass tube, which is driven into the bottom of the sea by the weight of the sounding lead, and in which the deposit may be retained by a valve or other contrivance, though in many cases friction alone suffices to hold the punched-out core. Larger quantities of deposit may be conveniently collected by means of the Monaco snapper or of the dredge, which can be worked in any depth and brings up large stones, concretionary nodules or fossils, which a sounding-tube could not collect.

The voyage of the "Challenger" supplied for the first time the nucleus of a collection of deep-sea deposits sufficient to serve as the basis for comprehensive classification and mapping. The "Challenger" collections supplemented by those of other expeditions and of many telegraphic and surveying-ships were studied in detail by Sir John Murray and Prof. A. Renard, whose monograph (*"Challenger" Reports*, "Deep Sea Deposits"), published in 1891, laid the foundations and reared the greater part of the structure of our present knowledge on the subject. The classification adopted was a double one, thus:—

I. Deep sea deposits (beyond 100 fathoms or 200 metres)	1. Red clay 2. Radiolarian ooze 3. Diatom ooze 4. Globigerina ooze 5. Pteropod ooze	A. Pelagic deposits (formed in deep water remote from land)
	6. Blue mud 7. Red mud 8. Green mud 9. Volcanic mud 10. Coral mud	B. Terrigenous deposits (formed in deep or shallow water close to land)
II. Shallow water deposits (in less than 100 fathoms)	Sands, gravels, muds, etc.	
III. Littoral deposits (between high and low-water marks)	Sands, gravels, muds, etc.	

Krümmel preferred, 1907, to simplify this by grouping the deposits in a single category arranged according to position:

(*a*) *Littoral* (including Murray and Renard's littoral and shallow water deposits [II. and III.]).

(*b*) *Hemipelagic* (including Nos. 6–10 of deep sea deposits).

(*c*) *Eupelagic* (including Nos. 1–5 of deep sea deposits).

As so defined the hemipelagic deposits are those which occur in general on the slope from the continental shelves to the ocean depths and in the deep sea basins of enclosed and fringing seas. K. Andrée (*Geologie des Meeresbodens*, 1920) adopts this.

Littoral and Shore Deposits.—The littoral deposits include those of the actual shore on the wash of the waves and of the surface of the continental shelf. Shore deposits are the product of the waste of the land arranged and bedded by the action of currents or tidal streams. On the rocky coasts of high latitudes blocks of stone detached by frost fall on the beach, and becoming embedded in ice during winter, are often drifted out to sea and so carry the shore deposits to some distance from the land. Where the force of the waves on the beach produces its full effect the coarser material gets worn down to gravel, sand and silt, the finest particles remaining long suspended in the water, to be finally deposited as mud in quiet bays. A particularly fine-grained mud is formed on the low coasts of the eastern border of the North sea by a mixture of the finest sediment carried down by the slow-running rivers with the calcareous or siliceous remains of plankton. Pure calcareous sand and calcareous mud are formed by

wave action on the shores of coral islands where the only material available is coral and the accompanying calcareous algae, crustacea, molluscs and other organisms secreting carbonate of lime. Recent limestones are being produced in this way and also in some places by the precipitation of calcium carbonate by sodium or ammonium carbonate which has been carried into the sea or formed by organisms. The precipitated carbonate may agglomerate on mineral or organic grains which serve as nuclei, or it may form a sheet of hard deposit on the bottom, as occurs in the Red sea, off Florida, and round many coral islands in the Pacific. The very finest sediment is kept in a state of movement until it drops into the gulleys or furrows of the shelf, where it can come to rest together with the finer fragments of the remains of littoral or bank vegetation. Thus are formed the "mud-holes" of the Hudson Furrow. Sand may be taken as the predominating deposit on the continental shelves, often with a large admixture of remains of calcareous organisms, for instance the deposits of *maërl* made up of nullipores off the coasts of Brittany and near Belle Isle. Amongst the most widely-distributed of the deposits actually formed on the continental shelf are phosphatic nodules: these are especially abundant on the east coast of the United States and on the Agulhas bank, where the amount of calcium phosphate in the nodules is as much as 50%. Sir John Murray finds the source of the phosphoric acid to be the decomposition of large quantities of animal matter.

Hemipelagic Deposits.—These are a mixture of deposits of terrigenous and pelagic origin. The most abundant of the terrigenous materials are the finest particles of clay and calcium carbonate as well as fragments derived from land vegetation, of which twigs, leaves, etc., may form a perceptible proportion as far as 350 to 400 km. from land. Blue mud, according to Murray and Renard, is usually of a blue or slatey or grey-green colour when fresh, the upper surface having, however, a reddish tint. The proportion of calcium carbonate varies greatly according to the amount of foraminifera and other calcareous organisms it contains. Blue mud prevails in large areas of the Pacific ocean, the Indian ocean, and the Atlantic. As a glacial-marine mud it occurs round the whole of the Antarctic shelf, down to depths of 4,500 metres. A blue and brown mud is the chief deposit of the North Polar basin and of the Norwegian sea also. Max Weber states that blue mud occurs in the deep basins of the eastern Malay sea.

Red mud may be classed as a variety of blue mud, from which it differs on account of the larger proportion of ochreous substance. This variety surrounds the tropical parts of the continental shelves of South America, South Africa and eastern China.

Green mud differs to a greater extent from the blue mud, and owes its characteristic nature and colour to the presence of glauconite, the spines of echini and the spicules of sponges. It occurs in such abundance in certain geological formations as to give rise to the name of green-sand. Green mud abounds off Cape Hatteras, the north of Cuba, and off the coast of California. The "Challenger" expedition found it on the Agulhas bank, on the eastern coasts of Australia, Japan, South America and on the west coast of Portugal. When the proportion of calcium carbonate in the blue mud is considerable a calcareous ooze results. The floors of the Caribbean, Cayman and Mexican basins in the Central American sea are covered with a white calcareous ooze with calcareous concretions. Similar formations are found in the Mediterranean, where a dark mud predominates in the western part, passing into a grey, marly slime in the Tyrrhenian basin and replaced by a calcareous ooze in the Eastern basin. The bottom of the Black sea is covered by a stiff blue mud. Sir John Murray found pyrites make up nearly 50% of the deposit. In the Red sea the "Pola" expedition discovered a calcareous ooze similar to that of the Mediterranean, and the formation of stony crust by precipitation of calcium and magnesium carbonates may be recognized as giving origin to a recent dolomite.

The terrigenous ingredients in the deposits become less and less abundant as one goes farther into the deep ocean. Finely-divided colloidal clay is found in all parts of the ocean, however remote from land, in very small amount, and there is less in tropical than in cooler waters. There is present in sea-water far from land a different clay derived from the decomposition of volcanic materials. To this very slowly-growing deposit of inorganic material over the ocean floor there is added an overwhelmingly more rapid contribution of the remains of calcareous and siliceous planktonic and benthonic organisms, which tend to bury the slower accumulating material under a blanket of globigerina, pteropod, diatom or radiolarian ooze. When those deposits of organic origin are wanting or have been removed, the red clay composed of the mineral constituents is found alone. It is a remarkable geographical fact that on the rises and in the basins of moderate depth of the open ocean the organic oozes preponderate, but in the abysmal depressions below 5,000 metres there is found only the red clay, with a minimum of calcium carbonate, though sometimes with a considerable admixture of the siliceous remains of radiolarians.

Eupelagic Deposits.—Globigerina ooze was recognized as an important deposit as soon as the first successful deep-sea soundings had been made in the Atlantic. Murray and Renard define globigerina ooze as containing at least 30% of calcium carbonate, in which the remains of pelagic (not benthonic) foraminifera predominate. In many parts of the Atlantic, as Lohmann points out, 70% of the globigerina ooze consists of coccoliths (minute calcareous algae). The striking absence of mineral constituents distinguishes the eupelagic globigerina ooze from the hemipelagic calcareous mud. Out of 118 samples of globigerina ooze by the "Challenger" expedition, 84 came from depths of 3,000 to 4,500 metres, and only 16 from depths greater than 4,500 metres. Viewed as a whole, this deposit may be taken as a partial precipitation of the plankton living in the upper waters of the open sea. Globigerina ooze is the characteristic deposit of the Atlantic ocean, where it covers not less than 48,500,000 sq. kilometres. In the Indian ocean the area covered is 31,000,000 sq.km., and in the huge Pacific ocean only 30,000,000 sq. kilometres.

Pteropod Ooze.—This is merely a local variety of globigerina ooze in which the comparatively large but very delicate spindle-shaped shells of pteropods happen to abound. These shells do not retain their individuality at depths greater than 3,000 metres, and, in fact, pteropod ooze is only found in small patches on the ridges.

Diatom Ooze.—This was recognized by Sir John Murray as the characteristic deposit in high latitudes in the Indian ocean, and later it was found to be characteristic also of the corresponding parts of the Atlantic and Pacific, covering a total area of about 23,000,000 sq. kilometres. It is in these latitudes not seldom combined with marine glacial deposits. It has been found sporadically near the Aleutian islands, between the Philippines and Marianne islands and to the south of the Galapagos group. It is made up to a large extent of the siliceous frustules of diatoms. It is usually yellowish-grey and often straw-coloured when wet, though when dried it becomes white and mealy.

Red Clay.—This was discovered and named by Sir Wyville Thomson on the "Challenger" in 1873 when sounding in depths of 5,000 metres and more on the way from the Canary islands to St. Thomas. The reddish colour comes from the presence of oxides of iron, and particles of manganese also occur in it, especially in the Pacific region, where the colour is more that of chocolate; but when it is mixed with globigerina ooze it is grey. Red clay is the deposit peculiar to the abysmal area; 70 carefully investigated samples collected by the "Challenger" came from an average depth of 5,000 metres. Red clay has not yet been found in depths less than 3,500 metres. The main ingredient of the deposit is a stiff clay which is plastic when fresh, but dries to a stony hardness. Isolated gritty fragments of minerals may be felt in the generally fine-grained homogeneous mass. The dredge often brings up large numbers of nodules formed upon sharks' teeth, the ear-bones of whales or turtles, or small fragments of pumice or other volcanic ejecta, and all more or less incrusted with manganese oxide until the nodules vary in size from that of a potato to that of a man's head. A very interesting feature is the small proportion of calcium carbonate, the amount present being usually less as the depth is greater; red clay from depths exceeding 5,500 metres does not contain so much as 1% of calcareous matter. The

red clay is the characteristic deposit of the Pacific ocean, where about 101,000,000 sq.km. are covered with it, while only 15,000,000 sq.km. of the Indian ocean and 14,000,000 sq.km. of the Atlantic are occupied by this deposit; it is, indeed, the dominant submarine deposit of the water-hemisphere, just as globigerina ooze is the dominant submarine deposit of the land-hemisphere.

Radiolarian Ooze.—This was recognized as a distinct deposit and named by Sir John Murray on the "Challenger" expedition, but it may be viewed as red clay with an exceptionally large proportion of siliceous organic remains, especially those of the radiolarians which form part of the pelagic plankton. It does not occur in the Atlantic ocean at all, and in the Indian ocean it is only known round Cocos and Christmas islands; but it is abundant in the Pacific.

Murray and Renard recognized a progressive diminution of carbonate of lime with increase of depth as a characteristic of all eupelagic deposits. The whole collection of 231 specimens of deep sea deposits brought back by the "Challenger" shows the following general relationship:—

Proportion of Calcium Carbonate in Deep Sea Deposits

68 samples from less than 2,000 fathoms (3,600 metres) = 60–80%
68 samples from 2,000–2,500 fathoms (3,600–4,600 metres) = 46·7%
65 samples from 2,500–3,000 fathoms (4,600–5,500 metres) = 17·4%
8 samples from more than 3,000 fathoms (5,500 metres) = 0·9%

New studies of the "Meteor" expedition show that near the great depths the configuration of the floor plays an important part. Where, as a result of an elevation of the ocean floor, the water in a basin is stagnant or moves only slowly, *e.g.*, in the Congo deep, north of the Walfisch ridge, the diminution of the calcium carbonate with increasing depth is much less marked than where the ground currents bring a continuous inflow of new water. Thus we find in the floor deposits at about 5,000 metres depth west of the mid-Atlantic ridge in the Brazil deep only 2% of calcium carbonate, while eastward in the Congo deep we have 46%.

Opinions are still varied as to the time necessary for the formation of 1 cm. or 1 ft. of deep sea deposit. It is generally believed that the red clay accumulates extremely slowly because sharks' teeth and whales' ear-bones which serve as nuclei in it belong, in some cases, to extinct species and are not found in the globigerina ooze, although there is no reason to suppose that at any one time they were unequally distributed over the ocean floor. Cable engineers report that a layer of globigerina ooze 2 cm. thick can be formed in ten years. For 2 cm. of coccolith ooze to be formed, however, it is computed that 4,000 years are necessary.

The frequently observed stratification within a sample is also important. All samples are not homogeneous, one of 50 cm. depth can include very varied deposits. In some samples sand which can be deposited only near a coast is found under a layer of globigerina ooze, whence it is evident that the study of marine deposits is of great importance in connection with investigations of geomorphological evolution.

Permanence of the Ocean Beds.—There are no known sedimentary rocks that appear to have been deposited at the bottoms of oceans comparable in depths with those we know—that is, there are no formations known that resemble, for instance, the globigerina ooze now being deposited on the Atlantic floor. On the other hand, the geographical distribution of many species of plants and animals points very decidedly towards the existence in the past of land connections between the various continents, and this evidence cannot be put aside. It was therefore given as another theory by Neumayer, Frech and others (1885, 1902) that, in the north and south Atlantic, in the central part of the Indian ocean, and possibly in the central part of the Pacific, there were, during the Mesozoic period, extensive land regions that have now subsided. Thus there are indications that large regions of continental land have been depressed to form the floors of deep oceans, but there are no clear indications that deep ocean beds have ever been elevated to form dry land.

A third hypothesis set out by A. Wegener in 1915, suggests that the great continental land elevations actually slip on the plastic layer beneath. The Atlantic basin has been formed by the slipping westward of the Americas. The coastal mountain ranges on the Pacific margin of the Americas were formed by the crumpling of the crust under the westward drift of the American continents, and so on. The hypothesis requires that there should be evidence of progressive change of longitude. Observed changes are doubted. It also requires some stress-difference under which the continental land masses yield and shift place relative to the earth-axis. All these three very different theories—that of permanence, that of bridge continents and that of slipping continents—have their difficulties and objections. It follows that there can be no agreement as to the age of the oceans.

AGE OF THE OCEANS

According to Wegener the Atlantic is the youngest, the Indian older, and the Pacific the oldest of the oceans. Certainly the Atlantic, in the zone stretching from the West Indies to the Mediterranean, has experienced great changes since Tertiary times. Other investigators suggest that the Atlantic, with the exception of the West Indian region, is the oldest ocean, and that the Pacific is still, so to speak, in the making. As proofs of this are mentioned the many deep trenches or geosynclines around its borders and the numerous earthquakes which point to the continuation of the folding and subsidence. Some data now exist for the formation of estimates of the age of the oceans. The evidence comes partly from the study of radioactivity (*q.v.*); it is known that helium and lead are the end-products of radioactive disintegration of certain minerals, and from the ratios of these materials to their parent substances it is believed that a period of several thousands of millions of years must have elapsed since the first solid and cool earth-crust was formed. Some cosmographic investigations (due mainly to Jeans and Jeffreys) suggest that at least about 1,300,000,000 years have elapsed since the first oceans were formed.

Salts of Sea Water.—Common salt, Epsom salts, gypsum and magnesium chloride were early recognized amongst the constituents of sea water. Modern analyses reveal the existence of 32 out of the 80 known elements as dissolved in sea water. Copper, lead, zinc, nickel, cobalt and manganese have been found only in the substance of sea weeds and corals. Silver and gold also exist in solution in sea water. E. Sonnstadt detected first, in 1870, gold by means of a colour test, Haber's analyses 1926–27 give 4 (10^{-6}) grains of gold per kgm. of sea water, making any ideas of recovery hopeless.

The elements in addition to oxygen which exist in largest amount in sea salt are chlorine, bromine, sulphur, potassium, sodium, calcium and magnesium. Since the earliest quantitative analyses of sea water were made by Lavoisier in 1772 the view has been held that the salts are present in sea water in the form in which they are deposited when the water is evaporated. The most numerous analyses have been carried out by Forchhammer, who dealt with 150 samples, and Dittmar, who made complete analyses of 77 samples obtained on the "Challenger" expedition. Dittmar found the following average proportions of the salts in ocean water:—

The Salts in Ocean Water

	Per 1,000 parts water	% Total salts	Per 100 molecules $MgBr_2$
Common salt, sodium chloride ($NaCl$)	27·213	77·758	112,793
Magnesium chloride ($MgCl_2$)	3·807	10·878	9,690
Magnesium sulphate ($MgSO_4$)	1·658	4·737	3,338
Gypsum, calcium sulphate ($CaSO_4$)	1·260	3·600	2,230
Potassium sulphate (K_2SO_4)	0·863	2·465	1,200
Calcium carbonate ($CaCO_3$) and residue	0·123	0·345	298
Magnesium bromide ($MgBr_2$)	0·076	0·217	100
	35·000	100·000	

The variations in the proportion of individual salts to the total salts are very small; all analyses since Dittmar's have confirmed this result. Although the salts have been grouped in the above table it is not to be supposed that a dilute solution like sea water contains all the ingredients thus arbitrarily combined. There must be considerable dissociation of molecules and as a first approximation it may be taken that of ten molecules of most of the components about nine (or in the case of magnesium sulphate five) have been separated into their ions, and that it is only during slow concentration as in a natural *saline* that the ions combine to produce the various salts in the proportions set out in the above table. One can look on sea water as a mixture of very dilute solutions of particular salts, each one of which after the lapse of sufficient time fills the whole space as if the other constituents did not exist, and this inter-diffusion accounts easily for the uniformity of composition in the sea water throughout the whole ocean, the only appreciable difference from point to point being the salinity or degree of concentration of the mixed solutions.

The origin of the salt of the sea was attributed by some authorities entirely to the washing out of salts from the land by rain and rivers and the gradual concentration by evaporation in the oceans. This hypothesis, however, does not accord with the theory of the development of the earth from the state of a sphere of molten rock, surrounded by an atmosphere of gaseous metals, by which the first-formed clouds of aqueous vapour must have been absorbed. The great similarity between the salts of the ocean and the gaseous products of volcanic eruptions at the present time, rich in chlorides and sulphates of all kinds, is a strong argument for the ocean having been salt from the beginning. Two other facts are totally opposed to the origin of all the salinity of the oceans from the concentration of the washings of the land. The proportions of the salts of river and sea water are quite different, as Julius Roth shows thus:—

	Carbonates	Sulphates	Chlorides
River water . . .	80	13	7
Sea water	0·2	10	89

The salt of salt lakes which have been formed in the areas of internal drainage in the hearts of the continents by the evaporation of river water are entirely different in composition from those of the sea, as the existence of the numerous natron and bitter lakes shows. Magnesium sulphate amounts to 4·7% of the total salts of sea water according to Dittmar, but to 23·6% of the salts of the Caspian according to Lebedinzeff; in the ocean magnesium chloride amounts to 10·9% of the total salts, in the Caspian only to 4·5%; on the other hand calcium sulphate in the ocean amounts to 3·6%; in the Caspian to 6·9%. These two disparities make it extremely difficult, if not impossible, to view ocean water as merely an extract of the salts in the rocks.

The determination of salinity was formerly carried out by evaporating a weighed quantity of sea water to dryness and weighing the residue. This method was inexact. Sörensen and Knudsen after a careful investigation abandoned the old definition of salinity as the sum of all the dissolved solids in sea water and substituted the weight of the dissolved solids in 1,000 parts by weight of sea water on the assumption that all the bromine is replaced by its equivalent of chlorine, all the carbonate converted into oxide and the organic matter burnt. The advantage of the new definition lies in the fact that the estimation of the chlorine (or rather of the total halogen expressed as chlorine) is sufficient to determine the salinity. According to Knudsen the salinity is given in weight per thousand parts by the expression $S = 0.030 + 1.805c$ Cl, where S is the salinity and Cl the amount of total halogen in a sample. This definition was adopted by the International Council for the Study of the Sea in 1902.

Besides the determination of salinity by titration of the chlorides, the method of determination by the specific gravity of the sea water is still used. In the laboratory the specific gravity is determined in a pyknometer by actual weighing, and on board ship by the use of an areometer or hydrometer. In all areometer work it is necessary to ascertain the temperature of the water sample under examination with great exactness, as the volume of the areometer as well as the specific gravity of the water varies with temperature. All determinations must accordingly be reduced to a standard temperature for comparison. Following the practice of J. Y. Buchanan on the "Challenger," it has been usual for British investigators to calculate specific gravities for sea water at 60° F compared with pure water at the maximum density point (39·2°) as unity. On the continent of Europe it has been more usual to take both at 17·5° C (63·5° F), which is expressed as

$$\frac{\text{"S}_{17.5}\text{"}}{17.5}.$$

A careful investigation of the relation between the amount of chlorine, the total salinity and the specific gravity of sea water of different strengths including an entirely new determination of the thermal expansion of sea water was made by M. Knudsen, 1899; the results are published in his *Hydrographical Tables* in a convenient form for use (1901).

The temperature of maximum density of sea water of any specific gravity was determined by Knudsen, the temperature of maximum density is lower as the concentration of the sea water is greater, as is shown in the following table:—

Maximum Density Point of Sea Water of Different Salinities

Salinity per mille	0	10	20	30	35	40
Temperature θ° C	3·95°	1·86°	−0·31°	−2·47°	−3·52°	−4·54°
Density $\sigma\theta$. .	1·00000	1·00818	1·01607	1·02415	1·02822	1·03232

In this table density $\sigma\theta$ signifies the specific gravity of the sea water in question at θ temperature.

Further Physical Properties of Sea Water.—The laws of physical chemistry relating to complex dilute solutions apply to sea water, and hence there is a definite relation between the osmotic pressure, freezing-point, vapour tension and boiling-point by which when one of these constants is given the others can be calculated.

Salinity per mille . .	10	20	30	35	40
Freezing-point (C) . .	−0·53	−1·07	−1·63	−1·91	−2·20
Osmotic pressure (atmospheres)	6·4	13·0	19·7	23·1	26·6
Elevation of boiling-point (C)	0·16	0·31	0·47	0·56	0·64
Reduction of vapour pressure (mm.) . .	4·2	8·5	13·0	15·2	17·6

The biologic importance of the osmotic pressure of sea water will be easily understood from the fact that a frog placed in sea water loses water by exosmosis and soon becomes 20% lighter than its original weight, while a true salt water fish suddenly transferred to fresh water gains water by endosmosis, swells up and quickly succumbs. The elevation of the boiling-point is of little practical importance, but the reduction of vapour pressure means that sea water evaporates more slowly than fresh water, and the more slowly the higher the salinity. The fact that sea water does evaporate more slowly than fresh water has been proved by the observations of Mazelle at Trieste and of Okada in Azino (Japan). Their experiments show that in similar conditions the evaporation of sea water amounts to from 70 to 91% of the evaporation of fresh water. G. Wüst calculates that in one year on an average 0·82 metre of water is evaporated over all the seas of the world; in the trade wind zone something like 1·10 metres and in high latitudes only 0·5 metre or less.

Transparency and Colour of Sea Water.—The optical properties of sea water are of direct importance in biology, as they affect the penetration of sunlight into the depths. The transparency of sea water has frequently been measured at sea by the simple experiment of sinking white-painted discs and noting the depth at which they become invisible. In the North sea north of the Dogger bank, for instance, the disc is visible in calm weather to a depth of from 20 to 30 metres, but in rough weather only to 10 metres. The greatest transparency hitherto reported is in the Sargasso sea, where Krümmel observed a 2 metre disc to depths of 66 metres, but in the cold currents of the north Atlantic and also in the equatorial current the depth of visibility was only from

20 to 30 metres. In the tropical Indian and Pacific oceans the depth of visibility increases to from 40 to 50 metres.

Spindler and Wrangell in the Black sea studied transparency by sinking an electric lamp; experiments have also been made by using photographic plates to find the greatest depths to which light penetrates. Fol and Sarasin detected the last traces of sunlight in the western Mediterranean at a depth of 370 metres, and Murray and Hjort observed that photographic plates, after an exposure of two hours at a depth of 1,500 metres in mid-Atlantic, had become dark. The chief cause of the different transparency is the varying quantity of mineral particles in suspension or of plankton. Schott gives the following as the result of measurements of transparency by means of a white disc at 23 stations in the deep ocean, where quantitative observations of the plankton under 1 square metre of surface were made at the same time.

	Volume of plankton	Depth of visibility	Colour
	ccm.	metres	
Mean of 11 stations poor in plankton	85	26	Blue
Mean of 12 stations rich in plankton	530	16	Green

The colour of ocean water far from land is an almost pure blue, and all the variations of tint towards green are the result of local disturbances, the usual cause being turbidity of some kind, and this in the high seas is almost always due to swarms of plankton. The colour of sea water as it is seen on board ship is most readily determined by comparison with the tints of Forel's xanthometer which consists of a series of glass tubes filled with a mixture of blue and yellow liquids in varying proportions. Observations with the xanthometer have shown that the purest blue (0–1 on Forel's scale) is found in the Sargasso sea, in the north Atlantic and in similarly situated tropical or subtropical regions in the Indian and Pacific oceans. The northern seas have an increasing tendency towards green, the Irminger sea showing 5–9 Forel, while in the North sea the water is usually a pure green (10–14 Forel), the western Mediterranean shows 5–9 Forel, but the eastern is as blue as the open ocean (0–2 Forel). A pure blue colour has been observed in the cold southern region, where the "Valdivia" found 0–2 Forel in 55° S. between 10° and 31° E., and even the water of the North sea has been observed at times to be intensely blue. Over shallows even the water of the tropical oceans is always green. There is no relationship between colour or transparency on the one side and the temperature or salinity on the other, but a distinct relationship between colour, transparency and plankton or mineral particles in suspension in the ocean. The most transparent water which is the most free from plankton is always the purest blue, while an increasing turbidity is usually associated with an increasing tint of green. The physical explanation for these facts, according to the investigations of K. Grien near Capri, is the selective absorption of light in water. In the following table the originally existing amount of light is supposed to equal 1,000.

Colours of the spectrum	Red	Yellow	Green	Blue	Violet
Wave lengths in $\mu\mu$	650	600	550	450	410
Depth 5 metres	3·7	2·5	250	450	866
,, 20 ,,	0·03	1·2	5·8	277	666
,, 50 ,,	0·002	0·03	2·2	201	200
,, 100 ,,	..	0·001	0·03	5·5	10
,, 200 ,,	..	..	0·004	0·04	1

At a depth of 50 metres red and yellow are wholly absorbed, while $\frac{200}{1,000}$ of the blue and violet rays of the original amount of light still exist. Blue is the natural colour of water over the greater depths and the colour seen by divers. Clear sea water looks blue from the surface because some of the non-absorbed rays are reflected, but if the water contains mineral substances or plankton the red and yellow rays may also be reflected and the colour of the water is green. Discoloration is always due to foreign substances. Brown or even blood-red stripes have been observed in the north Atlantic when swarms of the copepod *Calanus finmarchicus* were present; the brown alga *Trichodesmium erythraeum*, as its name suggests, can change the blue of the tropical seas to red; swarms of diatoms may produce olive-green patches in the ocean, while some other forms of minute life have at times been observed to give the colour of milk to large stretches of the ocean surface.

Other Properties.—On account of its salinity, sea water has a smaller capacity for heat than pure water. The specific heat diminishes as salinity increases, so that for 10 per mille salinity it is 0·968, for 35 per mille it is only 0·932, that of pure water being taken as unity. The internal friction or viscosity of sea water has been shown by E. Ruppin to increase with the salinity. Thus at 0° C the viscosity of sea water of 35 per mille salinity is 5·2% greater and at 25° C 4% greater than that of pure water at the same temperatures; in absolute units the viscosity of sea water at 25° C is only half as great as it is at 0° C.

The compressibility of sea water increases with decreasing temperature, salt content and pressure. The difficult calculation of the amount of compressibility has recently been carried out by W. Ekman, Bjerknes and Sandström. The following series from the Philippine trench shows the variations.

Depth (metres)	Temperature °F	Salinity ‰	Specific gravity	
			Without compression	With compression
0. .	80·8	34·32	1·02220	1·02220
100. .	76·6	34·86	1·02331	1·02370
1,000. .	40·1	34·53	1·02739	1·03215
5,000. .	34·7	34·68	1·02777	1·05107
10,000. .	36·7	34·68	1·02768	1·07123

One litre of water at this last depth therefore weighs not 1027·68 grams but actually 1071·23 grams. If the whole mass of water in the ocean were relieved from pressure its volume would expand from 1,369 million cub. km. to 1,381 million cub. km., which, for a surface of 361 million sq. km., means an increased depth of 32 metres.

THE GASES OF SEA WATER

The water of the ocean, like any other liquid, absorbs a certain amount of the gases with which it is in contact, and thus sea water contains dissolved oxygen (O_2), nitrogen (N_2), and carbonic acid (CO_2) absorbed from the atmosphere. Great quantities of CO_2 are, in addition, present in carbonates. It is important for the sea organisms, particularly for fish which breathe through gills, that the absorbed air, although the amount is very small, contains more oxygen per cent than that of the atmosphere. At the surface one litre of sea water of 35‰ salinity and at a temperature of 50° F contains normally 18·7 c.c. of gas, consisting of 6·4 c.c. of oxygen, 12·0 c.c. of nitrogen and 0·3 c.c. of carbonic acid gas. These 6·4 c.c. of oxygen are 34% of the whole absorbed air, while oxygen forms only 21% of the atmosphere. The quantity of oxygen usually increases with decreasing temperature and decreasing salt content; it is also greater at the surface than in the depths, where the oxygen is consumed by the breathing of organisms and cannot be directly replaced.

In the last 20 or 30 years the distribution of oxygen in time and place, in the Atlantic and European enclosed seas, at least, has been fairly thoroughly examined. It has been found that in the Tropics, between 20° S. and 20° N., the water between 100 and 1,000 metres deep is very poor in oxygen, having generally only 2 or 3 c.c. per litre, but in the high polar latitudes the water contains 7 or 8 c.c. of oxygen per litre at the surface and even in the depths. In these high latitudes the water evidently sinks at times from the surface to the sea floor and maintains the oxygen at the bottom. This polar ground water flows away towards the Equator and so the water at the bottom of tropical seas has enough oxygen to enable organisms to exist. Where this vertical sinking of the surface water does not occur, as in the Baltic, the bottom water is very poor in oxygen; often oxygen is absent, *e.g.*, north of

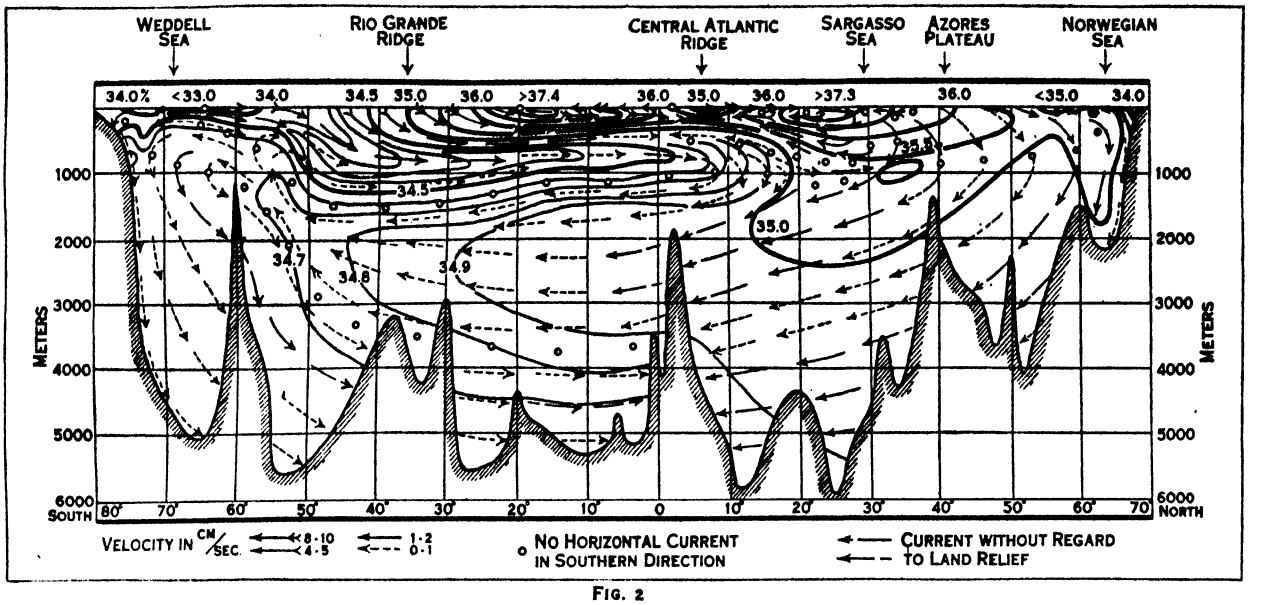

FIG. 2

Gothland, and animal life is then limited. In the Black sea the deep water is always and everywhere free from oxygen, and organisms are quite absent. On the other hand, one observes in the upper, sun-penetrated layers an abundance of oxygen, when in spring the plankton plants develop and produce oxygen through the so-called assimilation process. Where oxygen is scarce or absent there is generally a marked increase of CO_2, *e.g.*, on the floor of some Baltic hollows. This increase in the amount of CO_2 up to 12 times the normal amount, is caused by slow accumulation in the absence of renewal of the water and by the breathing of the sea animals; the water in these hollows is thus in the end poisoned. In contrast with the Baltic the North sea depths are sufficiently supplied with oxygen, and there is no marked increase in carbonic acid. For these reasons conditions are much more favourable for fish in the North sea than in the Baltic.

The gaseous, absorbed nitrogen plays no part here; its significance arises from the fact that nitrogen compounds have a nutritive value for plants, as on dry land. It has already been pointed out that in addition to carbonic acid gas, there is a large amount of CO_2 present in the dissolved carbonates. The greater part of the CO_2 occurs as carbonate and bicarbonate.

In the open ocean the alkali proportion of the salt content is set out in the formula

$$A\ (\text{alkalinity}) = 0{\cdot}77\ S.\ (\text{salinity})$$

where S is in ‰ and A in c.c. per litre. In this case, where the salt content is 35‰ the average alkalinity is 27 c.c. But great deviations appear, especially a great increase near coasts, where rivers bring down a large amount of carbonate.

Since 1851 it has been known that all sea water has an alkaline reaction. Absolutely pure water, which does not exist naturally, is neutral, it contains an equal amount of hydrogen ions and hydroxyl ions; it does not conduct an electric current and is neither alkaline nor acid. In sea water a considerable part of the water is resolved into the two components, (1) the positive hydrogen ion (H), and (2) the negative hydroxyl ion (OH^1), because weak acids, such as carbonic acid, and their salts in aqueous solution are subject to hydrolitic dissociation. The estimation of the hydrogen ions is used as a means of measuring the alkaline reaction of sea water, which depends both on the amount of free CO_2 and on the alkalinity discussed above. This hydrogen ion concentration of the sea varies around 10^{-8} grams per litre. All these factors have fixed relations to one another.

DISTRIBUTION OF SALINITY

In each of the three oceans there are two maxima of salinity of the surface water—one in the north, the other in the south tropical belt, separated by a zone of minimum salinity in the equatorial region, and giving place poleward to regions of still lower salinity. The three oceans differ somewhat between themselves. The north Atlantic maximum is the highest with water of 37·9 per mille salinity; the maximum in the south Atlantic is 37·4; in the north Indian ocean, 36·7; the south Indian ocean, 36·4; the south Pacific, 36·9; and the north Pacific has the lowest maximum of all, only 35·7. The comparatively fresh equatorial belt of water has a salinity of 35·0 to 34·0 in the Atlantic and in the Indian ocean, 34·5 in the western and 33·5 in the eastern Pacific. Taking each of the oceans as a whole, the Atlantic has the highest general surface salinity with 35·37.

The salinity of enclosed seas naturally varies much more than that of the open ocean. The saltiest include the eastern Mediterranean with 39·5 per mille, the Red sea with 41 to 42 per mille in the Gulf of Suez, and the Persian gulf with 40 near Bushire. The fresher enclosed seas include the Malay and the East Asiatic fringing seas with 30 to 34·5 per mille, the Gulf of St. Lawrence with 30 to 31, the North sea with 35 north of the Dogger bank, diminishing to 32 further south, and the Baltic, which freshens rapidly from between 25 to 31 in the Skagerak to 7 or 8 eastward of Bornholm and to practically fresh water at the heads of the Gulfs of Bothnia and Finland. The Arctic sea presents a great contrast between the salinity of the surface of the ice-free Norwegian sea with 35 to 35·4, and that of the central Polar basin, which is dominated by river water and melted ice, and has a salinity less than 25 per mille in most parts.

The causes of difference of surface salinity are mainly meteorological. The belt of equatorial minimum salinity corresponds with the excessively rainy belt of calms and of the equatorial countercurrent, the salinity diminishing towards the east. The tropical maxima of salinity on the poleward side of the trade-winds coincide with the regions of minimum rainfall, high temperature, strong trade-winds and consequently of maximum evaporation. Evaporation is naturally greatest in the enclosed seas of the nearly rainless subtropical zone such as the Mediterranean and Red sea. Where the evaporation is at a minimum, the inflow of rivers from a large continental area and the precipitation from the atmosphere at a maximum, there is necessarily the greatest dilution of the sea water, the Baltic and the Arctic seas being conspicuous examples.

The salt content of the sea water in the depths of the oceans has been investigated with certainty only during the last 10 or 20 years. While the variation at the surface is somewhere between 30 and 40‰, the variation at depths of more than 200 metres lies only between 35·5‰ and 34·5‰. These variations are there occa-

sioned not by meteorological phenomena, but by the currents of the deep sea. If we study the Atlantic, which is best known (fig. 2), we see that there is a great difference between the part in the northern hemisphere and that in the southern. In north latitudes the salt content diminishes steadily with the depth from 37 to 34·8‰ but in south latitudes the diminution proceeds only to a depth of 800 or 1,000 metres, where a first minimum of 34·3‰ is reached. From 800 metres or 1,000 metres to 2,000 or 3,000 metres the salt content increases to 34·9‰ in order to decrease from this layer again down to the sea floor, where a second minimum of 34·6‰ is observed. The particulars of the course of the isohalsines or lines of equal salinity are explained best through looking at the deep currents along the arrow lines in the figure. In high south latitudes the heavy water, poor in salt, sinks from the surface into the depths and moves northward right over the Equator into the northern hemisphere at a moderate depth of from 600–1,000 metres as the so-called Intermediate Current or *Zwischenstrom*. In the northern mid-latitudes the salty, heavy water sinks from the surface into the depths and moves, at a depth between 1,000 and 3,000 metres, towards the southern hemisphere as the Depth current or *Tiefenstrom*. Finally at a still deeper level, on the ocean floor, the water moves from the southern to the northern hemisphere (the Floor current or *Bodenstrom*). Thus one finds currents with very different origins and varying salt content moving in various directions resulting from a combination of both vertical and horizontal movements. This scheme of the divisions of salt content and movement of water applies also to the Indian sea depths, and, fundamentally at least, to the Pacific. Most important for the origin of these movements is the fact that round the earth in the neighbourhood of Antarctica are present immense masses of water of high specific gravity which flow away northward at the surface of the sea and which then, somewhere around Lat. 50° S., sink towards the depths as the Intermediate current or *Zwischenstrom*. Without this immense south polar sea the properties of the deep sea water would be very different; the north polar seas, shut off from the south by ridges, can send forth no such great streams.

In general, the salt content of the depths of the great oceans is less than that of the surface; it is only the manner and rate of the decrease that is different in northern and in southern latitudes. In addition the polar seas have another factor of vertical distribution of salt content. In the icy seas, down to a depth of 100 or 200 metres, as a result of freezing, the water is very cold but poor in salt; under this, from 200 to 1,000 metres, is a layer of warmer, saltier water; from there to the bottom the temperature diminishes, but only a very little, and the salt content remains almost unaltered (fig. 2). The following table combines the latest figures for salt-content and temperature at five latitudes along meridian 30° W.

Salinity ‰					
	South			North	
Depths (metres)	60°	30°	0°	30°	60°
0	33·96	36·07	35·20	36·82	35·30
100	34·42	36·03	35·65	36·75	35·29
200	34·60	35·56	35·27	36·39	35·28
500	34·66	34·90	34·72	35·78	35·25
1,000	34·69	34·26	34·64	35·45	35·05
1,500	..	34·53	34·94	35·39	34·98
2,000	34·65	34·94	34·92	35·17	34·97
3,000	..	34·96	..	34·97	..
4,000	34·67	34·76	34·86	34·94	..
Temperature (° F)					
0	29·5	68·9	79·2	70·7	46·4
100	29·5	65·8	62·6	66·7	45·9
200	31·5	60·6	54·7	63·7	45·5
500	32·9	50·0	44·6	55·6	43·5
1,000	32·4	38·3	39·6	47·5	40·3
1,500	32·0	37·2	39·2	42·6	39·2
2,000	31·6	37·6	37·9	39·6	37·4
3,000	31·3	36·0	37·0	37·4	..
4,000	31·3	34·2	34·7	36·7	..

In a few enclosed seas—differing from the ocean—the salt content increases with the depth, *e.g.*, in the Baltic and Black seas, because salty water flows into the seas along the floor from the North and Mediterranean seas respectively; the result is that in the middle of the Baltic, near Gothland, the salt content at the surface is only 6 or 7‰ while from a depth of 100 metres it rises to 11 or 13‰.

Temperature of the Oceans.—The temperature of the surface of the sea is obtained from samples dipped by a bucket. The measurement of temperature in the depths involves stopping the ship and employing thermometers of special construction. The best instrument and the one in general use to-day is the outflow or reversing thermometer, first introduced by Aimé in the Mediterranean in 1841–45, but greatly improved and simplified by Negretti and Zambra, London, and Richter Wiese, Berlin. The principle is to have a constriction in the tube above the bulb so proportioned that when the instrument is upright it acts in every way as an ordinary mercurial thermometer but when it is inverted the thread of mercury breaks at the constriction. Magnaghi introduced a convenient method of inverting the thermometer by means of a propeller actuated on beginning to heave in the line; greater precision and certainty are obtained by using a lever actuated by a weight slipped down the line to cause the reversal. All thermometers sunk into deep water must be protected against the enormous pressure to which they are exposed.

The warming of the ocean is due practically to solar radiation alone; such heat as may be received from the interior of the earth can only produce a small effect and is fairly uniformly distributed. On account of the high specific heat and of the turbulence of sea-water the diurnal range of temperature at the surface is very small. According to A. Buchan's discussion of the two-hourly observations on the "Challenger" the total range between the daily maximum and minimum in the warmer seas is between 0·7° and 0·8° F, and for the colder seas still less (0·2° F), compared with 3·2° F in the overlying air. The maximum usually occurs between 1 and 2.30 P.M., the minimum shortly before sunrise. The temperature of the surface water is generally a little higher than that of the overlying air, the daily average difference being about 0·6° F, varying from 0·9° lower at 1 P.M. to 1·6° higher at 1 A.M. There are few observations available for ascertaining the depth to which warmth from the sun penetrates in the ocean. The investigations of Aimé in 1845 and Hensen in 1889 indicate that the amount of cloud has a great effect. Aimé showed that on a calm, bright day in the Mediterranean the temperature rose 0·1° C between the early morning and noon at a depth of about 20 metres. The penetration of warmth from the surface is effected by direct radiation, by convection by particles rendered dense by evaporation increasing salinity, and through the turbulence of movement in the upper layers. After a storm the whole of the water in the North sea assumes a homothermic condition, *i.e.*, the temperature is the same from surface to bottom, and this occurs not only south of the Dogger bank, where the condition is normal, but also, though less frequently, in the deeper water farther north. Similar effects are produced in narrow waters by the action of tidal currents, and the influence of a steady wind blowing on or off-shore has a powerful effect in mixing the water.

The warmest parts of the Indian ocean and Western Pacific have a mean annual temperature of 82° to 84° F, but such high temperatures are seldom found in the tropical Atlantic. In the Indian ocean between 15° N and 5° S. the surface temperature in May averages 84° to 86° F, and in the Bay of Bengal the temperature is 86°, and no part of the Atlantic has so high a monthly mean temperature at any season. G. Schott's investigations show that the annual range of surface temperature in the open ocean is greatest in 40° N., with 18·4° F, and in 30° S., with 9·2° F; on the contrary, near the equator it is less, only 4° F in 10° N., and in high latitudes it is also small, 5·2° F in 50° S. The figures quoted above are differences between the average surface temperatures of the warmest and of the coldest month. As to the absolute extremes of surface temperature, Sir John Murray points out that 90° F frequently occurs in the western part of

the tropical Pacific, while among seas the Persian gulf in summer months reaches 96° F, only 2° under blood-heat, and the Red sea follows closely with a maximum of 94°. The greatest change of temperature at any place has been recorded to the north-east of Japan with a minimum of 27° F and a maximum of 83°. In those localities, however, it is not the same water which varies in temperature with the season, but the water of different warm and cold currents which periodically occupy the same locality as they advance and retreat. The zones of surface temperature are arranged roughly parallel to the equator, especially in the southern hemisphere. Between 40° N. and 40° S. the currents produce a considerable rearrangement of this order. The arrangement of the isotherms thus affords a basis for valuable deductions as to the direction of ocean currents.

Krümmel's calculation gives the proportional areas at a high temperature as follows:—

Percentage of Ocean Surface

With temperature	Atlantic	Indian	Pacific
Over 77° F (25° C).	22·4	38·0	40·1
Over 68° F (20° C).	50·1	51·7	58·4

The vertical distribution of temperature in the open ocean is better known than that of salinity. Such information has already been given above (p. 689) in the table of salinity. The regional differences of temperature at like depths become less as the depth increases. Thus at 300 fathoms or roughly 500 metres greater differences than 22° F hardly ever occur between 60° N. and 60° S., in 800 fathoms or 1,500 metres the differences are less than 15°, and in 1,500 fathoms or 3,000 metres less than 7°. Even in the tropics the high temperature of the surface is confined to a very shallow layer; thus in the Central Pacific where the surface temperature is 82° F the temperature at 200 metres is only 52° F. The whole ocean must thus form but a cold dwelling-place for the organisms of the deep sea. Sir John Murray calculates that at least 80% of the water in the ocean has a temperature always less than 40° F, and a recent calculation by Krümmel gave in fact a mean temperature of 39° F for the whole ocean.

The vertical distribution of temperature in mid-ocean in the greater depths, *i.e.*, depths of more than 200 metres or 100 fathoms, shows first a peculiar situation under the equator and secondly a great difference between the same latitudes north and south. If we use the above table of five points in the Atlantic we find that the water, from a depth of 100 metres to one of at least 600 metres, is colder under the equator than at lat. 30° S. and lat. 30° N., *e.g.*, the water, 200 metres down at the equator, is 9° F colder than at the Bermudas (54·7° and 63·7° respectively). One gathers from this that even at these moderate depths much water in the equatorial zone is rising from the underlying depths, while in mid-latitudes it is sinking. Particularly is this the case in the Sargasso sea between the Azores and the Bermudas. This region shows relatively the highest temperature even down to depths of 2,000 or 3,000 metres; it is considered as the starting point of the North Hemisphere Depth Current or *Tiefenstrom*. (*See* fig. 2.) The North Atlantic is on the whole much warmer than the South Atlantic; this is seen by a comparison of the temperatures at equal depths at 30° lat. N. or S., and still more at 60° lat. In the region 60° N. and 30° W., south of Iceland, one does not find polar or arctic temperatures in the depths, but at 60° S. and 30° W., near South Georgia, they are well marked. Similarly in the Indian and Pacific oceans, the water at a depth of from 100 to 600 metres, near the equator is colder than that north and south of it; and in both these oceans the water at greater depths in middle latitudes is colder in the Southern than in the Northern hemispheres, depth for depth. Everywhere, as in the case of salt content, one finds the northward-reaching influence of the huge, cold, antarctic body of water. The Indian ocean has no connection with the north polar region, the Pacific has ice in quantity only in the Sea of Okhotsk and parts of the Bering sea, and it is separated from the Arctic basin by the narrow Bering strait. But in the depths the Atlantic is also well sheltered from the north polar water by great submarine ridges. Thus it happens that the world ocean is much colder in southern than in northern latitudes.

Generally, the temperature, like the salt content, decreases with the depth. In polar waters this is not the case; here the temperature increases below the surface layers, which had been cooled by ice and cold air to 29·5° F, until at 1,000 metres it is somewhere around 32° or 33° F, and diminishes slowly thence to the bottom. Therefore the arrangement of the temperature is usually *anatherm* (ἀνά above θερμός warm) but in the polar seas it is *katatherm* (κατά under) or *dichotherm* (δίχα apart). There are also deep regions described as *homotherm*, where from the level of the barrier to the bottom, the temperature remains uniform. Thus south-west of Cape Province (S. Africa) in the Cape Trough, the temperature decreases continuously until it reaches 33·3° F in the greatest depths, while north of the Walfisch ridge and east of the south Atlantic rise in the so-called Congo Deep the temperature remains uniform at 36·4° F from 3,500 metres down to the bottom. Thus in the Central American sea below 1,700 metres, the depth on the bar, no water is found at a temperature lower than that prevailing in the open ocean at that depth, viz., 39·6° F, not even at the bottom of the great Bartlett Deep in 6,290 metres. Such homothermic masses of water are characteristic of all deep enclosed seas. Thus in the Malay sea the various basins are homothermic below the depth of the rim, at the temperature prevailing at that depth in the open ocean. In other enclosed seas shut off from the ocean by a very shallow sill the rule holds good that the homothermic water below the level of the sill is at the lowest temperature reached by the surface water in the coldest season of the year, provided always that the stratification of salinity is such as to permit of convection being set up. To this group belongs the Arctic sea. The Mediterranean sea also belongs to this group; its various deep basins are nearly homothermic (at the winter surface temperature) below the level of their respective sills.

An undercurrent flows out from the Red sea through the Strait of Bab-el-Mandeb, and from the Mediterranean through the Strait of Gibraltar, raising the salinity as well as the temperature of the part of the ocean outside the gates of the respective seas. The action of the Red sea water affects the whole of the Gulf of Aden and Arabian sea, raising the temperature at the depth of 1,000 metres to 52° or 53° F or 9° F higher than the water of the Bay of Bengal at the same depth. The effect of the Mediterranean water in the North Atlantic does not require such large figures to express it, but is extraordinarily far-reaching. There are clear traces of the warm and salty Mediterranean water northward as far as Ireland, westward as far as the Azores and southward as far as the Canaries, at a depth of from 1,000 to 1,600 metres. In shallow seas as the North sea and the British fringing seas, where tidal currents run strong, there is a general mixing together of the surface and deeper water, thus making the arrangement of vertical temperature anathermic in summer and katathermic in winter, while at the transitional periods in spring and autumn it is practically homothermic. Thus at Station E_2 of the international series at the mouth of the English channel in 49° 27′ N., 4° 42′ W., the following distribution of temperature F has been observed by Matthews:—

	Aug., 1904	Nov., 1904	Feb., 1905	May, 1905
Surface	63·7°	56·2°	50·7°	51·3°
30 metres	55·5	56·5	50·8	50·5
100 metres	55·4	56·5	50·8	50·5

It is noticeable that there is a marked vertical temperature gradient only at the end of summer when a warm surface layer is formed, though in Aug. 1904 that was only 14 metres thick. The heat content of the water column, at Station E_2 and other places where investigations have occurred in great detail, has been shown by Harvey to vary greatly from year to year.

Sea Ice.—The freezing-point of sea water is lower as the salinity increases and normal sea water of 35 per mille salinity freezes at 28·6° F. Experience shows that sea water can be cooled

considerably below the freezing-point without freezing if there is no ice or snow in contact with it. The dissolved salts are excluded in the process in a regular order according to temperature. As very low air temperatures seldom occur, freshly formed sea ice always has a salt content of from 12 to 18‰ if the original salt content of the water was 34‰, and the sea ice is therefore not suitable as a source of drinking water. In general the salt is returned to the lower unfrozen water, but during a continued hard frost it may appear as crystals on the surface; these crystals are known to polar explorers by the Siberian name of *rassol*. Ice is a very poor conductor of heat and accordingly protects the surface of the water beneath from rapid cooling; hence new-formed pancake ice does not increase excessively in thickness in one winter, and even in the centre of the Arctic basin the ice-covering only amounts to 2 or at most 3 metres in the course of a year, while in the Antarctic regions the season's growth is only half as great; in the latter also the accumulated snow is an important factor in the thickness of the ice, and snow is an even worse conductor of heat. The influence of wind and tide breaks up the frozen surface of the sea, and sheets yielding to the pressures slide over or under one another and are worked together into a hummocky ice-pack, the irregularities on the surface of which, caused by repeated fractures and collisions, may be from 3 to 7 metres high. Such formations termed *toross* by the Russians, may extend under water, according to Makaroff's investigations, to at least an equal depth. Such old sea ice, when prevented from escaping, forms the palaeocrystic sea of Nares; but, as a rule, it is carried southward in the East Greenland and Labrador currents, and melted in the warmer seas of lower latitudes. In the Southern Hemisphere the ice-pack forms a nearly continuous fence around the Antarctic continent. Pack ice forms regularly in the inner part of the Baltic every winter, but not in the Norwegian fjords. Even in the Mediterranean, sea ice is formed annually, in the northern part of the Black sea, and more rarely in the Gulf of Salonika and at the head of the Adriatic off Trieste. Hudson bay is blocked by ice for the greater part of the year, and the Gulf of St. Lawrence is blocked every winter. Ice also clothes the continental shores of the northern fringing seas of eastern Asia. In addition to sea ice, icebergs which are of land origin occur at sea. In the north, icebergs break off, as a rule, from the ends of the great glaciers of Greenland, and in the far south from the edge of the great Antarctic ice-barriers. The latter often give birth to prodigious icebergs and ice islands, which are carried northward by ocean currents nearly as far as the tropical zone, before they melt. The Antarctic icebergs are of tabular form and much larger than those of Greenland, but in either case an iceberg rising to 70 metres above sea-level is uncommon and one exceeding 100 metres is very rare. The Greenland icebergs are carried by the Labrador current across the great banks of Newfoundland, where they are often very numerous in the months from March to August, when they constitute a danger to shipping as far south as 40° N. No icebergs occur in the North Pacific and none has ever been reported nearer the coasts of Europe than off the Orkney islands, and there only once in 1836.

Oceanic Circulation.—Although observations on marine currents were made near land or between islands even in antiquity, accurate observations on the high seas have only been possible since chronometers furnished a practicable method of determining longitude, *i.e.*, from the time of Cook, the circumnavigator. The difference between the position as determined astronomically and by dead-reckoning gives an excellent idea of the general direction and velocity of the surface-currents. The first comprehensive study of the currents of the Atlantic was that carried out by James Rennell (1790–1830), and since that time Findlay in his *Directories*, Heinrich Berghaus, Maury and the officials of the various hydrographic departments have produced increasingly accurate descriptions of the currents of the whole ocean. Direct observations of currents in the open deep sea are difficult, but Americans have measured directly from anchored ships the Gulf Stream currents in the Caribbean sea. Similarly, for the whole South Atlantic region, the German survey ship "Meteor" (1925–27) was anchored to measure the currents at all depths with Ekman's current-meter. One of the indirect methods of investigating currents is by taking account of the initial temperature of the current and following it by the thermometer throughout its course. Benjamin Franklin (1775) and Charles Blagden (1781), by means of numerous observations of temperature made on board the packets plying on the Atlantic passage, determined the boundaries and seasonal variations of Gulf Stream and Labrador current. In the northern European seas, salinity often proves a sharper criterion of the boundaries than temperature. Evidence drawn from driftwood, wrecks or special drift bottles is less distinct but still interesting and often useful. Icebergs and plankton also serve as indicators of the trend of currents.

Ocean surface-currents depend in general on the prevailing winds, the configuration of the coast and its submarine approaches. The trade-wind regions correspond pretty closely with westward-flowing currents, while in the equatorial calm belts there are eastward-running counter-currents. In a similar manner the Brazil, the Agulhas and the East Australian currents originate from the drift of the south-east trades, and the Japan current arises from the north-east trade drift. In the region of the westerly winds on the poleward side of 40° N. and S. the currents again flow generally eastward.

The general accordance of wind and surface-currents is so obvious that it was fully recognized by seafaring men in the time of the first circumnavigators. Modern investigations have shown, however, that the relationship is by no means simple. We must remember that the ocean is a continuous sheet of water of a certain depth; if a single water particle is set in motion, the whole ocean must respond, as Varenius pointed out in 1650. Only a complete system of circulation can exist in the ocean, and horizontal and vertical movements of water are definitely related to one another. Modern oceanographic investigations of temperature and salt content in the depths, as well as dynamic analyses show that surface water where two surface-currents come together, sinks into the depths (fig. 3), but that where two surface-currents diverge water from the depths rises (fig. 4). The Sargasso sea is an important convergence region. A divergence region lies southward of the Cape Verde islands. Many hitherto enigmatic phenomena are explained by such convergence and divergence lines; *e.g.*, long ribbons of foam, drifting bodies in long lines, ripples, and small patches of cold water in the midst of warm water.

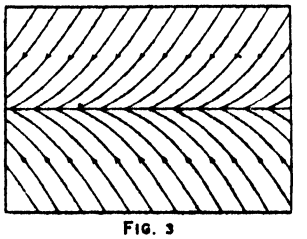

FIG. 3

We also know that the surface-currents have only a very small depth in consequence of the combined action of earth rotation and eddying friction. Following a suggestion by F. Nansen, W. Ekman in 1906 pointed out that current at the absolute surface is deflected 45° to the right (Northern Hemisphere), or 45° to the left (Southern Hemisphere) of the wind direction; the north-east trades therefore produce not a south-westerly but a westerly current, a fact established by observation. Analogous deflections are characteristic for all depths, and already at a depth of 100–150–200 metres the direction is generally opposite to that at the surface as fig. 5 shows. The depth at which the current practically ends is called the friction-depth; it is dependent on the velocity at the surface and on the latitude. The eddying friction which reduces the velocity of water below the surface, on the other hand causes surface movements to become rapidly movements beneath the surface.

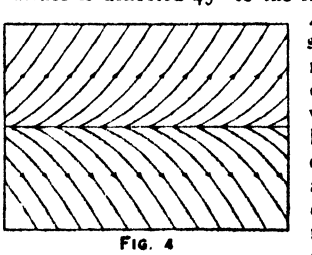

FIG. 4

W. Ekman showed further that a pure wind-drift current when towards the coast, causes a heaping up of the water, and if away from the land, a welling up of deep water. The latter phenomenon is most clearly shown by the stripes of cold water along coasts of

north-west and south-west Africa and the west coasts of North and South America. Upwelling coastal water is coldest close to the shore. The heaping up of surface water upon the coast, gives rise in the depths to a counter-current from the coast. This bottom counter-current maintains its level, is also subject to deflection on account of the rotation of the earth, and has a large share in securing vertical circulation and ventilation of the ocean.

There are also currents produced by variations in the density of water (p. 688). Ekman calls these convection streams; they depend ultimately on the varying rates of cooling, warming or evaporation of water at various places. The consequent variations in density produce variations in pressure at one and the same depth; the heavier water endeavours to flow under the lighter, and the lighter strives to spread itself out over the heavier. The great horizontal compensatory ocean streams between the Northern and Southern Hemispheres are to be explained most probably by differences of pressure; but we have also density or convection streams on the surface of the ocean, associated with or separate from the wind or drift currents. The so-called "Atlantic Current" on the west coast of Europe—a so-called continuation of the Gulf Stream—is only in small part a wind drift. It is principally the result of a density current, for in the Norway sea the density is very high while between lat. 40° and 50° it is low. In particular cases, in straits linking seas of differently constituted water, the density or convection currents develop in such a way that a surface-current goes in one direction, then appears a boundary zone, where the velocity is zero, and under this there is a deep current flowing in a direction contrary to that of the surface-current.

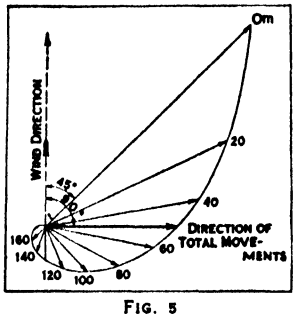

FIG. 5

The very dense water of the Red sea and the Mediterranean makes the column of water salter and heavier and the level lower than in the ocean beyond the straits. Hence a strong surface-current sets inwards through the straits of Bab-el-Mandeb and Gibraltar, while an undercurrent flows outwards, raising the temperature and salinity of the ocean for a long distance beyond the straits. Through the Bosporus and Dardanelles at the entrance of the Black sea, and through the sound and belts at the entrance of the Baltic, streams of fresh surface water flow outwards to the salter Mediterranean and North sea, while salter water enters in each case as an undercurrent. Wind and tide greatly alter the strength of these currents.

Strongly marked differences in density are produced by the melting of sea ice. O. Pettersson has made a careful study of ice melting as a motive power in oceanic circulation, and points out that it acts in two ways; on the surface it produces dilution of the water, forming a fresh layer and causing an outflow seaward of surface water with very low salinity; towards the deep water it produces a strong cooling effect, leading to increase of density and sinking of the chilled layers. Similarly, warmer deep water is attracted polewards to the region of the frozen seas as a result of the flowing away thence of cold surface water. This helps to explain the peculiar distribution of temperature and salt content around the poles.

Modern oceanography has found means to calculate quantitatively the circulatory movements produced by wind and the distribution of temperature and salinity, not only at the surface but in deep water. The methods, first suggested by H. Mohn and subsequently elaborated by V. Bjerknes, Sandstrom, Helland-Hansen and others, have been very usefully applied in many cases by means of so-called dynamical sections, but they should be supplemented by direct observations of currents and of the fundamental processes and conditions underlying them. The determination of the exact relationship of cause and effect in the origin of ocean currents is a matter of great practical importance. The researches of Pettersson, Meinardus, H. N. Dickson and others leave no doubt, for example, that the variations in the intensity of the Gulf Stream, whether these be measured by the change in the strength of the current or in the heat stored in the water, produce great variations in the character of the weather of northern Europe.

The connection between variations of current strength and the conditions of existence and distribution of plankton are no less important, especially as they act directly or indirectly on the life-conditions of food fishes.

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OCEAN GROVE, a summer resort of Monmouth county, New Jersey, U.S.A., on the Atlantic coast, adjoining Asbury Park on the south. It is served by the Central of New Jersey, the New York and Long Branch and the Pennsylvania railways and motor-coach lines. The resident population in 1928 was about 3,000. There are 40 or more hotels, many private cottages and a mile of "board walk" along the sea front. Ocean Grove was founded in 1869 by the Ocean Grove Camp-Meeting Association of the Methodist Episcopal Church, as a place for religious worship, rest and recreation, free from all kinds of undesirable amusements, and it keeps much of its original character. It is governed under a corporation charter which authorizes restrictions in the leases.

OCEANIA, a geographical area extending from Australia, in the west, to the most easterly islands of Polynesia, in the east, and from New Zealand, in the south, to Micronesia and the Sandwich islands, in the north. Ethnologically the area is divisible into six principal regions (*q.v.*): Australia; Tasmania; Melanesia, a group of islands extending from Fiji, in the south-east, to New Guinea, in the west; New Guinea, which, however, is a geographical rather than an ethnological unit, for the eastern and north-eastern coastal regions are Melanesian, while the west really falls under Indonesia; Polynesia, an island area of considerable racial and cultural uniformity, comprising the greater part of the Pacific; Micronesia, an island area comprising that part of the Pacific which lies between New Guinea, Polynesia and the Philippines.

Racial History.—There is little doubt that man first entered this area from the west, and subsequent migrations have all had an easterly, or, in the case of Australia, a southerly trend. The problem of dissecting out the racial components of the peoples on the eastern and southern periphery is, therefore, comparatively simple. Furthermore, the uniformity, both of physical type and culture, and evidence of a more or less historical kind, show that the Polynesian area is of comparatively recent occupation, even allowing for more than one principal set of migrations. But in New Guinea and Melanesia, the principal gateways into Oceania, conditions are more complex, and the racial history of this area has been only tentatively elucidated. Australia, again, shows considerable physical and cultural uniformity with many variations, but the existence of varieties of the Papuan type of man in Tasmania, with a very primitive culture, suggests that man entered and crossed the length of Australia at an extremely early date.

Principal Groups.—The six principal divisions of this region, Australia, Tasmania, Melanesia, New Guinea, Polynesia and Micronesia, can be fairly readily distinguished from one another, both racially and culturally, though, in the case of New Guinea, there is not that racial and cultural uniformity which characterizes each of the other areas. Apart from New Guinea, with its great diversity of race and culture, some general characterization of culture as well as race can be made of each of the other areas. Language, for example, will readily separate Australia, and in all probability Tasmania, from the group Melanesia, Polynesia and Micronesia. The speech of these three areas, together with the Melanesian and Indonesian part of New Guinea, is clearly referable to one family, the Austronesian (*q.v.*), extending from part of India and Burma, through Malaya and Indonesia to the extremities of Polynesia. But while the Polynesian languages may be described as dialects of one language, there is considerably more diversity within the Melanesian sub-division of this family.

This Austronesian speech is associated with a distinctly higher culture, particularly in Polynesia and Micronesia, the Melanesians being in some respects intermediate between these groups and the Papuans of New Guinea, though among Papuans there is great variety of culture, the result, no doubt, of various degrees of blending of immigrant cultures with perhaps more than one indigenous culture brought into New Guinea and Melanesia by the original Papuans.

The Australians, culturally as well as physically, betray a marked contrast, not only with the Austronesian-speaking peoples of Oceania, but also with the Papuans of New Guinea. Horticulture, well-developed throughout the rest of the area, excepting Tasmania, is entirely absent, and the economic life is, consequently, of a very low order. Nevertheless, an elaborate social organization and ceremonial life and considerable variation in such stable aspects of culture as the disposal of the dead, survive in Australia.

Mode of Life.—The Australians and Tasmanians, being hunters and collectors, are necessarily nomadic, though within more or less well-developed tribal areas. Their most important possessions are their hunting weapons, spears, boomerangs and tools rudely chipped out of stone. The aridity of most of Australia during the greater part of the year, and the very short period during which nature provides abundant food, cause most of the non-economic activities of the Australians to be concentrated in the brief period of spring, when magico-religious rites with the object of increasing the food supply are performed, initiations are conducted, and, in fact, most of the tribal, in contrast with family, activities take place.

In the rest of the area, with its basis of horticulture, the economic struggle is not so keen, and the population is a settled one, except for a few nomadic or semi-nomadic peoples in New Guinea. Diet is mainly vegetarian, taro, yams, bread-fruit, sweet potato, coco-nuts, sago and bananas being the principal foods. In island and coastal regions fish is largely consumed, and almost everywhere pigs are reared and reserved for consumption on occasions of importance, such as marriage festivals and mortuary feasts. Although cannibalism is common, the eating of human flesh is usually a ceremonial act of revenge, or associated with mortuary or other rites. Canoes capable of long sea voyages are constructed, principally in the island areas. Double canoes, and outrigger canoes of various patterns and, formerly, double canoes which only survive at the present day in a limited part of New Guinea, are the commonest, the larger ones being provided with sails. While intercommunication is much hampered by warfare, goods are traded over considerable distances, and in many areas well-developed systems of currency occur.

Social Organization.—One feature of social organization appears to be common to the whole of this area, namely, the systematic non-genealogical use of relationship terms, generally known as the classificatory system. If we select any person in a village and enquire as to his relationship to others in the village, he will rarely be at a loss, for everyone is likely to be a mother, or a brother, an uncle or a father-in-law, etc., in this classificatory sense, and such relationships will be found to hold to a large number of persons in other more distant villages. Moreover, these classificatory relationships are important determinants of conduct, many rights and duties being dependent on relationship, though when the relationship is very distant in the classificatory sense they are hardly distinguishable. One of the most important functions of this relationship system lies in the regulation of marriage, those lying in certain relationships being prohibited from marriage, while in some cases only those persons who can establish a given relationship between themselves are allowed to marry. Marriage, however, is generally regulated, at least in part, by the clan (*q.v.*) which is usually, throughout this area, the most important social unit. Particularly in Australia, Melanesia and New Guinea, and to a slightly less extent in Polynesia, is the clan a fundamental unit of the social structure. Membership of the clan is determined by descent through the father or the mother, both varieties being common, and marriage is prohibited within the clan. As a rule, the clan is also totemic (*see* TOTEMISM), this totemic aspect being peculiarly important in Australia, where totemic rites form a large part of the ceremonial life of the natives. In parts of the area, especially Australia and Melanesia, the clans are grouped into two exogamous moieties (*see* DUAL ORGANIZATION), and there is some evidence which suggests that a dual organization once extended over most of the area or occurred among their ancestors before their migrations into Oceania.

Political Organization.—In Australia and parts of Melanesia, age appears to be an important qualification of leadership, councils of elders deciding matters of tribal importance. In parts of Melanesia there is little vested authority, a more or less communistic system prevailing, while in other parts, authority depends on the acquirement of prestige derived from the holding of feasts, or the acquisition of wealth. Hereditary chieftainship is

common in Polynesia, where a considerable social gulf may exist between nobles and commoners.

Initiation.—Ceremonies of initiation into manhood occur amongst Australians and many Papuans, and are found amongst some Melanesians, mainly in connection with secret societies (*q.v.*), which in some cases dominate the social organization.

Religion.—The belief in spirits of the dead is general throughout this area, and some degree of cult of the dead is present everywhere. In some cases, mortuary ceremonial reaches a very high degree of elaboration, particularly in the case of chiefs. Violent orgies of mutilation on the occasion of a death are reported from Australia, and in extreme form from Polynesia. But the existence of an elaborate mortuary ceremonial is not necessarily associated with anything that can be called a worship of the dead, which is probably confined to Polynesia, parts of Melanesia and Micronesia. Between spirits of the dead, or ghosts, and spirits or gods not definitely associated with some ancestor, there is no sharp line of demarcation, but sometimes there are separate words for these two kinds of beings, and a different cult is associated with each, a practice common in Melanesia. Certain ghosts or spirits may be of sufficient importance to rank as gods, who are able to affect more or less the destinies of man, or who are credited with having performed certain acts of creation, or to have introduced important foods or new customs. An elaborate mythology centres around these culture heroes throughout the area, and provide us with suggestive hints as to culture movements and culture contacts in the past.

There is, perhaps, more uniformity throughout the area in the realm of magic (*q.v.*) than in that of religion, in so far as it is possible to separate the two, for there is a transparent sympathetic basis of almost all the magical practices. In addition to direct sympathetic magic without the aid of ghosts or spirits, we also find, particularly in Melanesia, the coercion of both ghosts and spirits for the attainment of what are usually anti-social ends. Divination of sorcerers is also common, which, together with fantastic beliefs concerning the powers of sorcery, accounts for a good deal of the strain to which social relations between individuals, and between groups is subjected in this part of the world. One of the commonest causes of murder is revenge for supposed sorcery.

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(W. E. A.)

ARCHAEOLOGY

From permanent contact with European settlers in the latter part of the 18th century the transition from the Stone to the steel age was rapid. Previously writing was unknown in the area, if we except the pictographic "script," as yet imperfectly explained, of Easter island (*q.v.*).

Although it is improbable that any of the more important monuments have entirely escaped observation and record, the greater part of the area has never been properly surveyed in an archaeological sense, and the published records available for many islands are meagre and of unequal value. The only islands of which anything like detailed surveys have been published are Easter, the Australs, the Marquesas, Hawaii (some islands), the Carolines (Ponape, and Kusaie) and, in part, New Zealand and the Chathams (*see* Bibliography). Surveys of Tonga, Tahiti, Necker I., Rapa-iti, and some smaller islands (Fanning, Malden, Christmas, etc.) are now in preparation by the Bishop Museum, Honolulu.

Absence of Palaeolithic Culture.—In the moist climate, perishable objects were quickly destroyed, and pottery being absent in Polynesia (except Fijian vases introduced into Tonga), the materials for archaeological study are practically limited to stone tools and monuments. No evidence of a Palaeolithic culture has been found in any part of Oceania. The prevailing tools are everywhere axes or adzes of stone (occasionally also of shell), polished wholly or in part, although flaked obsidian was also used in certain islands where it occurred (*e.g.* Easter, New Zealand, New Britain), and roughly flaked quarrying tools bearing a superficial resemblance to palaeolithic hand-axes are found in Easter island. Judged by its tools, the prehistoric culture of the area belongs entirely to the neolithic phase.

The ethnographical division into Melanesia and Polynesia holds good, in the main, for archaeology. In the former region adzes are of the "celt" type and rounded or sublenticular in section; in the latter they are predominantly straight-edged and angular in section, and further subdivided into a tanged and tangless type, characteristic of east and west Polynesia respectively. The distribution of monuments is in substantial agreement with that of the tools, and the elaborate structures of masonry characteristic of Polynesia scarcely occur west of Fiji, where the few stone monuments found are crude and megalithic in character. Exceptions in the Solomon and Banks islands may be regarded as relics of Polynesian migrations eastwards, or as due to later reflex movements.

Absence of Stratified Sites.—No stratified sites showing culture sequence, except in a minor degree in New Zealand, have been found. The habit of making funerary offerings seems to have been little developed, and grave-goods, where discovered, do not differ markedly from artifacts of recent date. Only in parts of Melanesia has the occurrence of deposits distinct in character from the products of the historic inhabitants been observed.

POLYNESIA

In Polynesia there is at present little archaeological evidence of a succession of cultures; monuments and implements represent at most an earlier and, in some cases, a higher phase of the culture that continued into historic times. Exceptions do occur, however; adzes of distinctively Melanesian type, found in Tahiti, and the carvings of bird-headed men in Easter island suggest the possibility of a pre-Polynesian occupation of parts of eastern Oceania by the negroid race. The evidence is too scanty to be entirely convincing, and the presence of a strong negroid strain in the inhabitants of eastern Polynesia is more probably due to racial intermixture during the Polynesian migrations through Melanesia than to a fusion in the islands in which it is found.

Eastern Polynesia.—In all the island groups east of Tonga and Samoa, without a single important exception, occur the remains, now more or less ruined, of megalithic structures, the sacred places or *marae* of the Polynesians. These consist typically of paved rectangular enclosures, surrounded by stone walls, and containing one or more rectangular stone platforms, sometimes, as in Tahiti, of stepped pyramidal form. The elements were variously combined, and differ in details of construction, contour and size. Thus in the Marquesas the walls are low or absent, in the Australs the platforms are generally lacking, while in Tahiti and Hawaii all features are generally present. The platforms were faced with large boulders or hewn blocks of stone or coral, sometimes weighing many tons, and often neatly fitted in regular courses, although mortar was never employed. The core consisted of earth or rubble, and sometimes contained burial pits or vaults. Platforms served also as substructures for sacred houses built of perishable material, for the exposure of the dead, as sacrificial altars, etc.; and the question whether they were intended primarily as tombs has yet to be settled by excavation. Many of them were originally surmounted by large figures of wood or stone in conventionalized human form. Such stone figures, some still *in situ*, are found in Hawaii (Necker), Easter island, Pitcairn, Tahiti, and the Australs (Raivavai), and in the Marquesas, where they exactly resemble those carved in wood. In the Marquesas, platforms, which always had vertical sides, were also much used for secular purposes, both in public assembly places (*tohua*) as seats for the spectators of dances, and as foundations for the ordinary dwelling-houses. The extreme development of terraces and platforms in the latter islands is due to the scarcity of level ground in the steep and narrow valleys, and to the abundance of suitably shaped boulders and easily worked volcanic stone. The largest recorded platform, that of Oborea, in Tahiti, now almost destroyed, measured 90 by 29yd. at the base, and rose in 10 or 11 steps to a height of about 50ft.;

but in general these structures did not exceed 12ft. in height. The antiquity of particular structures cannot be determined from internal evidence, but they were presumably built by ancestors of the historical Polynesians, who on traditional evidence did not reach the area earlier than the 7th century A.D. The fact that they occur in similar form in all groups, including Tahiti and Hawaii, which remained without intercommunication after the great voyages of the 13th and 14th centuries, as well as on intermediate islands, afterwards uninhabited, like Malden and Fanning, shows that the type must have been fully developed by the time of these voyages. Many were still in use when discovered, and some were even constructed in the historic period.

In Pitcairn island, which was uninhabited when occupied by the mutineers of the "Bounty" in 1789, are found many traces of a former Polynesian settlement. The *maraes* and stone figures are said to resemble those of Easter; but a number of large stone chisels and broad-edged axes dug up in the soil are quite exceptional in type. Other small islands, uninhabited at the time of their discovery, but bearing evidence of former Polynesian settlement, include Palmerston, Flint, Malden, Christmas, Fanning, Necker (Hawaii).

Western Polynesia.—In Samoa and Tonga typical walled *maraes* are not found, but in the former island there are numerous flat-topped mounds and platforms of considerable antiquity. Some of these were substructures for temples; others were used for burial. But certain earth and stone mounds of exceptionally large size, in Upolu and Savaii, appear to have been constructed for defensive purposes. One of these, near Apia, measures approximately 100yd. square at the base and is 35ft. high; it is traditionally supposed to have served as a platform for the houses of Tongan chiefs. In the mountainous interior of Upolu (Samoa) is a group of upright basalt slabs on a paved floor (*O Le Fale-o-le-Fe'e*), evidently the supports of a former house or temple, while in Savaii there are remains of roads and raised causeways elaborately engineered but long disused, and partly destroyed by an overflow of lava.

The most striking example of a true megalithic monument is the trilithon (Haamonga) on Tongatabu; it consists of two uprights and a lintel stone mortised into them, 15ft. high, and is stated by tradition to have been erected in the 13th century by Tui-ta-Tui in connection with a Kava feast. Not far distant are a large upright slab and two stone-faced house platforms. On the north coast of Tongatabu are the equally remarkable "tombs of the kings" (*langi*), formerly reserved for the burial of sacred chiefs called "Tooitongas"; these are stepped or terraced platforms containing burial vaults and are faced with hewn coral blocks measuring up to 22ft. in length. The earliest of these also probably date from the 13th century, but the construction of similar tombs continued down to the middle of the 19th century. Some of them are merely enclosures of rough stones.

Stone fortifications occur on many islands, and reach their highest development in the terraced entrenchments and solid stone towers on the mountains of Rapa-iti. Of the petroglyphs, representing stylized human and animal figures, concentric circles, etc., which are found abundantly in Hawaii and the Marquesas, some by their situation seem to have had religious significance, while others are only "travellers' marks"; many are of recent date.

New Zealand and Chatham Islands.—The final settlement of New Zealand by Polynesian immigrants from Rarotonga in the 14th century was preceded by an earlier branch of the same race, possibly also by people of Melanesian affinities, though this is disputed. Archaeology throws little light on this question, except in so far as no adzes of Melanesian type have been found in the older deposits. Only one properly stratified site has been excavated, viz.: Moa-bone Point Cave, near Christchurch, Otago, where the remains found in the lowest stratum prove the early inhabitants to have hunted the extinct moa. Although accurate dating is impossible, considerable antiquity is suggested by the fact that the coast has sunk several feet since the deposits were formed. The rock-paintings and the implements, which include knives, saws, drills, spear-points and finely "retouched" scrapers, of quartzite, obsidian, chalcedony and chert, indicate that the culture of the moa-hunters did not differ essentially, except in its higher standard of craftsmanship, from that of the historical Otago Maori.

The earthwork and stone fortifications belong for the most part to Maori (*q.v.*) culture, as do probably the pit dwellings and terraces of the Pelorus and Auckland districts and the artificial caves and figures carved in the soft tuff of Rotorua. Curious figures incised in a sandstone pit in Auckland and rock-carvings in the Kaingaroa plains representing canoes of modified Maori type are among the more interesting recent discoveries. The Chatham Islands appear to have been colonized by pure Polynesians, the extinct Moriori (*q.v.*), coming from the South island of New Zealand in about the 12th century. Their stone implements resemble Maori types, with the exception of tanged obsidian blades; tree-carvings and much weathered bird figures incised on cliffs have been reported.

MICRONESIA

The most important monuments of Micronesia are found in the Caroline islands, where both on Ponape and Kusaie extensive groups of buildings intersected by canals were constructed on artificially enlarged reefs protected by sea-walls. They take the form of rectangular paved courtyards, frequently in contiguous clusters, constructed by laying natural columnar blocks of basalt lengthwise and crosswise in alternate layers. These walls rise in places to a height of more than 20ft., but were not roofed. The enclosures formerly contained houses of perishable material, traces of which remain; also platforms, terraced or pyramidal, in which were sepulchral vaults roofed with coral or basalt slabs. The most striking and best preserved of these structures is the royal cemetery of Nan Tauach at Matolenim (Ponape), which stands in a double enclosure and contains four burial chambers. Enclosed burial platforms of a somewhat similar type occur farther west in Yap and the Bunaj islands. They have certain elements in common with the *marae* of Polynesia, to which they are possibly related either directly or as collateral branches from the same cultural stem. Although the date at which these "sacred cities" of the Carolines were begun is not clear, they were still inhabited at the time of their discovery, and the tradition of how they were constructed by means of inclined planes of tree trunks survives. The stone pounders, and shell and other objects found in the tombs, do not suggest a high antiquity.

In several of the Marianne islands occur groups of conical pillars called *Lat'te*, of square-cut coral, surmounted by large hemispherical capitals, and constructed either of monoliths or layers of coral cemented together. These are always arranged regularly in two parallel rows, and the most probable explanation is that they were supports for the floors of raised temples or houses, since destroyed. Remains of a burial have been found in a cavity in one of the capitals, but this was presumably only a secondary usage. The largest, in Tinian, are 15ft. in height with capitals 6 or 7ft. in diameter; those of Guam and other islands are much smaller. Associated with these monuments, and suggestive of some ceremonial purpose, are remains of burials, pottery, stone mortars and other artifacts.

MELANESIA

In various parts of Melanesia, from New Guinea to Fiji, are found relics of a prehistoric culture or cultures, which cannot as yet be dated or correlated satisfactorily. An important region covers the east end of New Guinea, New Britain and the adjacent archipelago, where the remains found include ornamented pottery (somewhat similar to that of prehistoric Japan), engraved skulls, obsidian implements and stone pestles and mortars, some of which occur at a considerable depth in river gravels and all of which are quite distinct from the products of recent inhabitants. In the same region, but within a more limited area, are low stone circles, lines and heaps of stones, now used as squatting places and, in part at least, of recent origin. Rock paintings and engravings are numerous in the district behind Port Moresby, some of them coated with a film of calcium carbonate, indicating a certain antiquity. Megaliths are widely distributed and irrigation terraces are found throughout Melanesia. In the Solomon islands (Bou-

gainville and San Cristoval) upright stones occur singly and in groups; in San Cristoval some villages are bordered with stone walls or platforms, and numerous stone-faced and earth mounds, containing shafts leading to burial chambers, and sometimes surmounted by stone statues, small dolmens or upright stones, are still in use. They may be related to Polynesian burial platforms. Their form and the mortuary customs associated with them have led to a comparison with early Egyptian mastabas; attention has also been called to a supposed resemblance of certain pig-tail figures to Egyptian royal statues, but this seems too remote to justify the emphasis laid upon it by some authorities. In the New Hebrides the antiquities include menhirs, stone sacrificial "tables" or dolmens, walls and high platforms, and obsolete types of pottery ornamented in a great variety of styles. There is an exceptional development of stone walls and buildings in the Banks islands, some, however, of recent construction. In general, chronological evidence is almost entirely lacking for these monuments, and the difficulties of distinguishing between ancient and modern are increased by the fact that parts of Melanesia are still living in a "megalithic period." In New Caledonia stone statues (in caves in Lifu) and a few "dolmens or trilithons" have been reported. Petroglyphs are common to all these groups, and particularly numerous in New Caledonia, where they take the form of human and animal figures, spirals and other patterns. Some of the better structures may be attributed either to late waves of Indonesian immigrants, or to reflex Polynesian influence, which has affected many of these islands in comparatively recent times; the *nanga* of Fiji so closely resemble Polynesian *marae* as to leave no doubt of their common origin.

Migrations and Hypotheses.—There is general agreement, on the evidence of oral traditions supported by physical, linguistic and botanical evidence, that the ancestors of the Polynesians—a composite stock including Caucasian, Mongolian and Negroid elements—must have come originally in a series of migratory waves from the Asiatic continent. Their starting-point cannot be definitely fixed; hypotheses vary as between India (Ganges or Chota Nagpur), Assam, and the Cambodia-Siam region of Indo-China. In favour of the latter view is the fact that a people speaking an allied language (Mon-Khmer) and having physical affinities with the Polynesians is still living there. They had probably settled in the Indonesian archipelago by the latter part of the first millennium B.C., whence they proceeded in at least two main streams of migration by way of Melanesia or Micronesia to Fiji, which they reached in about the 5th century A.D. Thence eastern Polynesia and New Zealand were settled in successive voyages during the 7th to 14th centuries. Hawaii seems to have been reached first by a direct migration from Indonesia and subsequently by a branch of the main wave from south-eastern Polynesia; this conclusion is supported by archaeological study which recognizes two distinct types of *heiau* (*marae*), the later of which corresponds more closely with the Tahiti-Marquesas type.

The hypothesis that Oceania served as a highway for the diffusion of an "archaic civilization," originating in Egypt in the 3rd millennium B.C., and including the practices of sun worship, mummification and the building of megalithic structures; and that the stone monuments of Oceania are attributable to the bearers of this culture-complex, has been a subject of considerable controversy. If tradition is right in asserting that Polynesian migrations did not reach the eastern Pacific before the 6th or 7th centuries A.D., and if, as appears probable, these people were the builders of the monuments in that area, it is evident that the older civilizations of America cannot have been inspired by them. On the other hand, since they were in contact with Asia till a relatively late period, they can hardly have escaped the influence of old-world culture or have failed to carry some of its elements with them into the Pacific. The view that Oceania was peopled by migration from America finds little support at the present time. But the theory has recently been advanced that the monuments and culture of eastern Oceania may owe something to the influence of Central and South America, the coasts of which were quite probably visited by the intrepid Polynesian navigators. The absence of pottery has been used by others as an argument for the very early isolation of the Polynesians; the loss of this art was, however, an inevitable result of prolonged wanderings among coral islands, where the material with which to practise it was not available.

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OCEANUS, in Greek mythology, the river which encircles the earth (conceived as flat) (Gr. Ὠκεανός). Beyond it, to the west, are the land of the Cimmerians, where the sun never shines, the country of dreams, and the entrance of the underworld. Oceanus is in Hesiod (*Theog.* 133, 337–370) the son of Uranus and Ge, the husband of Tethys, father of 3,000 streams and 4,000 ocean nymphs. In Homer he is the origin of the gods. Herodotus and Euripides use the word in practically the modern sense of *ocean; see* OCEAN.

OCELLUS LUCANUS, a Pythagorean philosopher, born in Lucania in the 5th century B.C., perhaps a pupil of Pythagoras himself. Stobaeus (*Ecl. Phys.* i. 13) has preserved a fragment of his Περὶ νόμου (if he was really the author) in the Doric dialect but the only one of his alleged works which is extant is a short and unauthentic treatise *On the Nature of the Universe.*

Editions of the Περὶ τῆς τοῦ παντὸς φύσεως, by A. F. Rudolph (1801, with commentary), and by F. W. Mullach in *Fragmenta philosophorum graecorum,* i. (1860); H. Diels, *Die Fragmente der Vorsokratiker* (4th ed., 1922); Eng. trans. (1831) by Thomas Taylor. *See* also Überweg, *Grundriss der Gesch. der Philosophie,* Bd. i. (1926).



BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

OCELOT (FELIS PARDALIS)
A wild tree-cat found in the American forests between Arkansas and Paraguay

OCELOT, an American member (*Felis pardalis*) of the family *Felidae,* ranging from Arkansas in the north to Paraguay. The fur is tawny yellow or reddish-grey, marked with black spots, aggregated in streaks and blotches, or in elongated rings. The total length may reach 4 feet. The ocelot is a forest cat, and a ready climber; its disposition is fierce and bloodthirsty. In Asia the group is represented by the Tibetan *Felis tristis.*

OCHINO, BERNARDINO (1487–1564), Italian Reformer, was born at Siena. He entered the order of Observantine Friars, the strictest sect of the Franciscans, and rose to be its general, but, craving a yet stricter rule, transferred himself in 1534 to the newly founded order of Capuchins, of which in 1538 he was elected vicar-general. In 1539 he delivered at Venice a remarkable course of sermons, showing a tendency to the doctrine of justification by faith, which is more marked in his *Dialogi VII.* published soon after. He was suspected and denounced, and when the Inquisition was established at Rome, Ochino was at once cited, but was deterred from presenting himself at Rome by the warnings of Peter Martyr and of Cardinal Contarini. After some hesitation he escaped across the Alps to Geneva. He was cordially received by Calvin, and within two years published six volumes of

Prediche (Eng. trans., Ipswich, 1548), tracts rather than sermons, explaining and vindicating his change of religion. He was minister of the Italian Protestant congregation at Augsburg from 1545 until 1547, when the city was occupied by the imperial forces in the Schmalkaldic War. Escaping by way of Strasbourg he found an asylum in England, where he was made a prebendary of Canterbury, received a pension from Edward VI.'s privy purse, and composed his chief work, *A Trajedy or Dialogue of the unjust usurped Primacy of the Bishop of Rome* (1549), originally written in Latin, but extant only in the translation of John Ponet, bishop of Winchester. The conception of the *Trajedy* bears a remarkable resemblance to that of *Paradise Lost;* and it is almost certain that Milton, whose sympathies with the Italian Reformation were so strong, must have been acquainted with it, and with some of Ochino's later works. In the *Labyrinth* (dedicated to Queen Elizabeth), he assailed the Calvinistic doctrine of predestination.

The accession of Mary in 1553 drove him from England, and he became pastor of the Italian congregation at Zürich. In 1563 the publication of his *Thirty Dialogues*, in one of which his adversaries maintained that he had justified polygamy under colour of a pretended refutation, led to his banishment. He found refuge in Poland until the edict of the 6th of August, 1564, banished all foreign dissidents. He died at Schlakau in Moravia, about the end of 1564.

See *Life* by B. O. Benrath (2nd ed., Brunswick, 1892; Eng. trans. by Helen Zimmern, 1876).

OCHRES, which vary in colour from pale yellow to deep red, brown and violet, and are native earths coloured with hydrated iron oxide, are of two kinds—one having a clayey basis, while the other is a chalky earth; the former variety is in general the richer and purer in colour of the two. Both kinds are widely distributed in beds or pockets, mainly in stratified rocks and rubble and rarely as extensive deposits. Some ochres require only grinding, whereas other varieties require calcination whereby the original colour is modified. In this process the associated earth exercises a marked influence, clayey ochres developing red and violet tints, while chalky varieties take brownish-red and dark brown hues. The well-known ochre, Terra di Siena, which in its native state is a dull-coloured earth, assumes when burnt a fine warm mahogany-brown hue highly valued by artists. Ochres containing much organic matter are sometimes calcined to improve their drying properties in varnish or oil. Ochres are also artificially prepared in large quantities—Mars yellow is either a pure hydrated ferric oxide or an intimate mixture of that substance with an argillaceous or calcareous base, and such compounds by careful calcination can be transformed into Mars orange, violet or red, all reliable pigments. *See* PAINTS, CHEMISTRY OF.

OCHRIDA (Serbo-Croatian *Ohrid*), a city of South Serbia, Yugoslavia, on the north-east shore of Lake Ochrida. Pop. (1921), 9,603, mainly Albanians, with some Serbs and Bulgars. The lake, 2,260 ft. above sea level, with an area of 107 sq.m. and a maximum depth of 938 ft., lies amid magnificent mountain scenery and is famous for its salmon trout. Malaria is prevalent. Ochrida occupies the site of the ancient *Lychnidos,* which was added to the Macedonian empire by Philip II. (382–336 B.C.) and destroyed by the Bulgars in A.D. 861. The Bulgarian tsar, Samuel, made Ochrida his capital, but was expelled, and in 1014 his empire was conquered by the Greek emperor Basil II. The see of Ochrida was founded by St. Clement in 916, and during the Bulgarian occupation their patriarchate was established here. In 1459 the Serbian patriarchate being suppressed, the administration of the Church was transferred to Ochrida. In 1890 a Bulgarian bishop was appointed to the see, which has since been the centre of Bulgarian propaganda.

See Gelzer, *Der Patriarchat von Achrida* (Leipzig, 1902); Dr. Jovan Cvijic, "Researches in Macedonia," etc., *Geog. Journal,* vol. xvi. (1900); T. R. Georgevitch, *Macedonia* (1918).

OCHS, ADOLPH SIMON (1858–), American newspaper publisher, was born in Cincinnati, O., on March 12, 1858, of well educated Jewish parents who had emigrated in their youth to the United States from Bavaria. The father, Julius Ochs, was an officer of the U.S. forces in the Mexican War of 1848, and the Civil War 1861–65. In 1865 the family settled in Knoxville, Tenn., where Adolph while attending primary schools delivered newspapers. At the age of 14, he became a printer's devil on the *Knoxville Chronicle.* In 1875–76 he was employed as a compositor by the *Louisville* (Ky.) *Courier Journal.* In 1877 he assisted in establishing the *Chattanooga Dispatch,* and in 1878, at the age of 20, with little or no capital, he gained control of the *Chattanooga Times,* a decrepit newspaper. Assuming the duties of publisher, editor and business manager, he soon placed it on a firm basis, and brought it to a leading position among Southern newspapers. His activities in promoting the growth and prosperity of Chattanooga won him the sobriquet "Builder of Chattanooga," and on his fiftieth anniversary as proprietor and publisher of the *Chattanooga Times* was officially acclaimed "Citizen Emeritus of Chattanooga." He was also a founder of the Southern Associated Press.

In 1896 he acquired the controlling ownership of *The New York Times,* which was in financial difficulties after 30 years of prosperity, and formed The New York Times Company. With a ripe experience in all departments of newspaper making, he steadily strengthened the paper's journalistic and financial position, and resuscitated it from a bankrupt newspaper with less than 10,000 bona fide circulation to a net paid sale (1929) of 425,000 copies week-days and 750,000 Sundays, and from 2,000,000 to 30,000,000 agate lines of advertising annually. Times square, New York, was named after the Times building, which was erected in 1905. It was an early attempt to make a "skyscraper" architecturally attractive, for the tower was fashioned after the famous Campanile of Giotto, in Florence.

The influence of Ochs upon newspaper publishing in the United States has been marked and beneficial. Entering New York publishing when so-called "yellow journalism" was at its height, and in competition with half a dozen of the richest and most powerful newspapers in America, he boldly adopted the slogan, "All The News That's Fit to Print," and devoted his paper not to sensations, but to giving intelligent readers a daily news report, trustworthy, complete, non-partisan and decent. In a few years, Ochs made *The Times* the outstanding example of enterprise in news gathering, spending $500,000 annually on cable, wireless and telegraph tolls. *The Times* identified itself with pioneers and explorers in various fields—Marconi, Peary, Lindbergh, Byrd (North and South Pole and transatlantic flights), Amundsen, Ellsworth, Scott, Shackleton and others. *The Times* is classed as Independent Democratic, an advocate of sound money, tariff reform, the League of Nations, World Court and the commercialization of debts between nations. It opposed Bryan in his presidential aspirations and was an outstanding supporter of President Wilson. It is more widely read throughout the United States than any other American newspaper.

Steadily withstanding the temptation to print a "comic" section and other features detached from the news of the day, Ochs was a pioneer in many newspaper innovations, among which were the introduction in newspapers of rotogravure printing of news pictures, a book review supplement and an open forum for letters to the editor with the widest latitude for the presentation of views in conflict with the editorial view of *The Times.* Ochs has made *The New York Times* "The newspaper of record" by printing an edition on rag paper for libraries and those who preserve records, and *The Times* also publishes the only complete American newspaper index. He was a pioneer in adoption of standards to improve newspaper advertising typography, and of censorship of advertising so as to exclude whatever is false or misleading. In 1918 the trustees of Columbia university awarded *The New York Times* the first Pulitzer Gold Medal in Journalism for Meritorious Public Service. On May 4, 1927, the National Institute of Social Sciences awarded to Ochs its gold medal for his service to society in promoting and maintaining high standards of journalism.

Ochs and The New York Times Company underwrote in 1925, at a cost of over $500,000, the preparation of the manuscript of the *Dictionary of American Biography* by the Learned Societies of America, and supports the preparation of the *American Year Book.*

Mr. Ochs has been a conspicuous leader in the establishment and preservation of public parks. He was one of the originators and incorporators of the Chickamauga-Chattanooga National park. He is also the originator and supporter of the Lookout Mountain and Chattanooga park and is an active supporter of the Saratoga Battlefield park. His alert defence of Central park in New York city from invasion and alteration from its original purpose has given *The New York Times* the reputation of being "The Watchdog of Central park."

Ochs was an organizer of the Publishers' Association of the City of New York, and has been for 25 years a director of the Associated Press. In 1901 he became proprietor of the *Philadelphia Times*, which he merged with the *Public Ledger* and sold to Cyrus H. K. Curtis in 1912.

For the story of *The New York Times* see *History of the New York Times* by Elmer Davis (1921) and *Seventy-fifth Anniversary Supplement of the New York Times*, published Sept. 18, 1926. For the history of the *Chattanooga Times* see *Chattanooga Times Jubilee Issue*, July 1, 1928. (L. Wr.)

OCHTERLONY, SIR DAVID, Bart. (1758–1825), British general, was born at Boston, Mass, U.S.A., on Feb. 12, 1758, and went to India as a cadet in 1777. He served under Lord Lake in the battles of Koil, Aligarh and Delhi, and was appointed resident at Delhi in 1803. In 1804, having been promoted to the rank of major-general, he defended the city with a very inadequate force against an attack by Holkar. He served in the Nepal War (1814–15), which he brought to a successful conclusion; and in the Pindari War (1817–18) he was equally successful. He was appointed resident in Rajputana in 1818, with which the residency at Delhi was subsequently combined. When Durjan Sal revolted in 1825 against Balwant Singh, the infant Raja of Bharatpur, Ochterlony acting on his own responsibility supported the raja by proclamation and ordered out a force to support him. Lord Amherst, however, repudiated these proceedings. Ochterlony, who was bitterly chagrined by this rebuff, resigned his office, and retired to Delhi. He died at Meerut on July 15, 1825.

See Major Ross of Bladensburg, *The Marquess of Hastings* ("Rulers of India" series) (1893).

OCHTMANN, LEONARD (1854–), American painter, was born in Zonnemaire, Zeeland, Holland, on Oct. 21, 1854. His family removed to Albany (N.Y.), in 1866. In 1882 he began to exhibit landscapes at the National Academy, and he became a National Academician in 1904. His most characteristic pictures, which recall the work of Inness, are scenes on Long Island sound and on the Mianus river.

OCKLEY, SIMON (1678–1720), English orientalist, was born at Exeter in 1678. He was educated at Queen's College, Cambridge, became fellow of Jesus College and vicar of Swavesey, and in 1711 was made professor of Arabic at Cambridge. The pecuniary embarrassments of his later days form the subject of a chapter in D'Israeli's *Calamities of Authors*. The preface to the second volume of his *History of the Saracens* is dated from Cambridge Castle, where he was imprisoned for debt. His chief work is *The History of the Saracens* (1708–1718 3rd. posthumous, vol. 1757). Unfortunately Ockley took as his main authority a ms. in the Bodleian of the pseudo-Wakidi's *Futuh al-Sham*, which is rather historical romance than history.

O'CLERY, MICHAEL (1575–1643), Irish chronicler, grandson of a chief of the sept of O'Clery in Donegal, was born at Kilbarrow on Donegal Bay, and was baptized Tadhg (or "poet"), but took the name of Michael when he became a Franciscan friar. He had already gained a reputation as a student of Irish history and literature, when he entered the Irish College of St. Anthony at Louvain. In 1620, through the initiative of Hugh Boy Macanward (1580–1635), warden of the college, and himself a famous Irish historian and poet, and one of an old family of hereditary bards in Tyrconnell, he began to collect Irish manuscripts and to transcribe everything he could find of historical importance; he was assisted by other Irish scholars, and the results were his *Reim Rioghroidhe* (Royal List) in 1630, *Leabhar Gabhala* (Book of Invasions) in 1631, and his most famous work, called by John Colgan (d. 1659), the Irish biographer, the "Annals of the Four Masters" (1636). Subsequently he produced his *Martyrologium* of Irish saints, based on various ancient manuscripts, an Irish glossary and other works. He lived in poverty, and died at Louvain.

OCONEE BELLS (*Shortia galacifolia*), a rare North American plant of the family Diapensiaceae, called also little colt's-foot, found only locally in the mountains of North and South Carolina. It is an early-blooming stemless herb, with round, shining, slightly-toothed leaves borne on stalks rising from the base, and beautiful white, somewhat bell-shaped flowers, each solitary on a stalk, 3 to 6 in. long, which rises above the leaves. It is sparingly cultivated as an ornamental plant.



BY COURTESY OF THE WILD FLOWER PRESERVATION SOCIETY

OCONEE BELLS (SHORTIA GALACIFOLIA), A RARE PLANT FOUND IN THE CAROLINA MOUNTAINS

O'CONNELL, DANIEL (1775–1847), Irish statesman, known as "the Liberator," was born on Aug. 6, 1775, near Cahirciveen, a small town in Kerry. He was sprung from a race the heads of which had been Celtic chiefs, had lost their lands in the wars of Ireland, and had felt the full weight of the harsh penal code which long held the Catholic Irish down. His ancestors in the 18th century had sent recruits to the famous brigade of Irish exiles in the service of France, and those who remained at home either lived as tenants on the possessions of which they had once been lords, or gradually made money by smuggling. While a boy he was adopted by his uncle, Maurice O'Connell of Derrynane, and sent to a school at Queenstown, and then to the colleges of St. Omer and Douai in France.

In 1798 O'Connell was called to the bar of Ireland, where he came rapidly to the front. In examining witnesses, he had no rival at the Irish bar. He was, however, a thorough lawyer besides, inferior in scientific learning to two or three of his most conspicuous rivals, but well read in every department of law, and especially a master in all that relates to criminal and constitutional jurisprudence; as an advocate, too, he stood in the very highest rank.

From early manhood O'Connell had turned his mind to the condition of Ireland and the mass of her people. The worst severities of the penal code had been, in a certain measure, relaxed, but the Catholics were still in a state of vassalage, and they were still pariahs compared with the Protestants. The rebellion of 1798 and the union had dashed the hopes of the Catholic leaders, and their prospects of success seemed very remote when, in the first years of the 19th century, the still unknown lawyer took up their cause. Up to this juncture the question had been in the hands of Grattan and other Protestants, and of a small knot of Catholic nobles and prelates; but they aimed only at a kind of compromise, which, while conceding their principal claims, would have placed their church in subjection to the state. O'Connell gave the Catholic movement an energy it had not before possessed. He formed the bold design of combining the Irish Catholic millions, under the superintendence of the native priesthood, into a vast league against the existing order, and of wresting the concession of the Catholic claims from every opposing party in the state by continuous agitation, embracing almost the whole of the people, but maintained within constitutional limits, though menacing and shaking the frame of society. The Catholic Association, at first small, but slowly assuming larger proportions, was formed; attempts of the government and of the local authorities to put its branches down were skilfully baffled by legal devices of many kinds; and at last, after a conflict of years, all Catholic Ireland was arrayed in a powerful organization. O'Connell stood at the head of this great national movement which, controlled from first to last by himself and the priesthood, was essentially conservative in character. His election for Clare in 1828 proved the forerunner of the inevitable change, and the Catholic claims were granted the next year.

O'Connell joined the Whigs on entering parliament, and gave effective aid to the cause of reform. The agitation, however, on the Catholic question had quickened the sense of the wrongs of

Ireland, and the Irish Catholics were engaged ere long in a crusade against tithes and the established church, the most offensive symbols of their inferiority in the state. It may be questioned whether O'Connell was not rather led than a leader in this; the movement, at least, passed beyond his control, and the country for many months was terrorized. Lord Grey proposed measures of repression which O'Connell opposed with extreme vehemence. This caused a breach between him and the Whigs; but he gradually returned to his allegiance to them when they practically abolished Irish tithes, cut down the revenues of the established church and endeavoured to secularize the surplus. In the British House of Commons O'Connell stood in the front rank as a debater; and his oratory, massive and strong in argument, made a powerful impression. O'Connell steadily supported Lord Melbourne's government, gave it valuable aid in its general measures, and repeatedly expressed his cordial approval of its policy in advancing Irish Catholics to places of trust and power in the state, though personally he refused a high judicial office. He sincerely advocated the rights of conscience, the emancipation of the slave and freedom of trade. But his rooted aversion to the democratic theories imported from France grew stronger with advancing age. His conservatism was most apparent in his tenacious regard for the claims of property. He actually opposed the Irish Poor Law, as encouraging a communistic spirit; he declared a movement against rent a crime, though he advocated a reform of the precarious tenure enjoyed by the Irish peasant.

O'Connell changed his policy as regards Ireland when Peel became minister in 1841. He declared that a Tory régime in his country was incompatible with good government, and he began an agitation for the repeal of the union. He had denounced the union in early manhood as an obstacle to the Catholic cause; he had spoken against the measure in parliament; he believed that the claims of Ireland were set aside or slighted in what he deemed an alien assembly; and, though he had ceased for some years to demand repeal, and regarded it as rather a means than an end, he was throughout life an avowed repealer. In his judgment the repeal of the union would not weaken the real bond between Great Britain and Ireland. The Catholic Association of 1828–29 was recreated for the new project. Enormous meetings convened by the priesthood, and directed or controlled by O'Connell, assembled in 1842–1843, and probably nine-tenths of the Irish Catholics were unanimous in the cry for repeal. O'Connell seems to have thought success certain; but he had not perceived the essential difference between his earlier agitation and this. The enlightened opinion of the three kingdoms for the most part approved the Catholic claims, and as certainly it condemned repeal. After some hesitation Peel resolved to put down the repeal movement. A vast intended meeting was proclaimed unlawful, and in October 1843 O'Connell was arrested and held to bail, with ten or twelve of his principal followers. He was convicted (February 1844) after the trials that followed, but the judges were biassed, and the sentence of imprisonment for a year and a fine of £2,000 was reversed on a writ of error by the House of Lords (September 1844), and he and his colleagues were again free. The spell, however, of O'Connell's power had vanished; his health had suffered much from a short confinement; he was verging upon his seventieth year; and he was disturbed by the growth of a party in the repeal ranks who scoffed at his views, and advocated the revolutionary doctrines which he had always feared and abhorred. Before long famine had fallen on the land, and under this visitation the repeal movement, already paralysed, collapsed. O'Connell died on May 15, 1847, at Genoa, whilst on his way to Rome. His body was brought back to Dublin and buried in Glasnevin cemetery.

Catholic Ireland calls O'Connell her "Liberator" still; he possessed the wisdom, the caution and the tact of a real statesman. But the battle in which he fought was not to be won in his generation. O'Connell married in 1802 his cousin Mary O'Connell, by whom he had three daughters and four sons, Maurice, Morgan, John (1810–1858), known as the "Young Liberator," and Daniel, who all sat in parliament.

See his son, John's, *Life* (1846) and *Recollections and Experiences* (1849), the biographies by W. Fagan (1847), M. F. Cusack (1872), J. O'Rourke and O'Keefe (1875), and J. A. Hamilton (1888); also R. Dunlop, *Daniel O'Connell and the Revival of National Life in Ireland* (1900), R. Houston, *Daniel O'Connell: his Early Life and Journal, 1795–1802* (1906), and A. Zimmermann, *Daniel O'Connell der Befreier und seine politische Bedeutung für Irland und England* (Paderborn, 1909).

O'CONNOR, FEARGUS EDWARD (1794–1855), Chartist leader, was the son of the Irish Nationalist politician Roger O'Connor. He entered parliament as M.P. for Cork and a follower of O'Connell in 1832; but three years later the "Liberator" had him unseated, by petition, for his indiscipline. He then turned to Radical agitation in England and on the publication of the Charter in 1838 became one of the best known Chartist leaders. Owing to his rough humour, his energy and his invective he became their most popular speaker, and the circulation of his journal, the *Northern Star*, outstripped all others. He advocated physical force, generally, however, with the proviso that moral force must be tried first, and at the Chartist convention of 1839 acquiesced on William Lovett's "moral force" leadership. Although not concerned in the insurrection of 1839 he was imprisoned for a year upon another charge. In 1841 he reorganized the movement by the foundation of the National Charter Association, and attained a position of such power that he was able practically to expel or silence Lovett and all others who advocated compromise with the middle class. But though he raised Chartism to its greatest power he was unable to direct it to victory. He permitted the general strike of 1842; in the midst of it his fears overcame him and he condemned it, securing its immediate defeat. After this fiasco he diverted Chartist energies to the support of his land company scheme for settling town workers on small holdings. For a while this appeared successful, and a first settlement, named O'Connorville, was opened at Herringsgate, Bucks. He was also elected M.P. for Nottingham in 1847. Next year, however, the company was found to be bankrupt, and the ignominious collapse of the revolutionary agitation of that year, to which he had pinned his hopes, made O'Connor's behaviour, already eccentric, plainly maniacal. He was, very belatedly, declared insane in 1852 and died in 1855. His funeral procession, 50,000 strong to Kensal Green, may be regarded as the last Chartist demonstration.

O'Connor was a tall, loud-voiced, handsome man, of unlimited devotion and energy and great oratorical powers; he was, however, vacillating, excessively vain, jealous and of small intellectual powers. (*See* CHARTISM.) (R. W. P.)

OCONOMOWOC, a city of Waukesha county, Wisconsin, U.S.A., on Federal highway 16, 33 m. W. of Milwaukee; served by the Chicago, Milwaukee, St. Paul and Pacific and the Milwaukee Electric railways. Pop. (1920) 3,301. It is a popular summer resort in a region of lakes. The city was founded about 1837 and incorporated in 1875. Its name is an Indian word said to mean "home of the beaver."

O'CONOR, CHARLES (1804–1884), American lawyer, was born in the City of New York on January 22, 1804. He was admitted to the bar in 1824. From 1853 to 1854 he was United States district attorney for New York. After the Civil War he became senior counsel for Jefferson Davis on his indictment for treason, and was one of his bondsmen. He took a prominent part in the prosecution of William M. Tweed and members of the "Tweed Ring" and published *Peculation Triumphant, Being the Record of a Five Years' Campaign against Official Malversation, A.D. 1871–1875* (1875). He removed to Nantucket, Mass., in 1881, and died there on May 12, 1884.

OCONTO, a city of north-eastern Wisconsin, U.S.A., on the W. shore of Green bay (Lake Michigan) at the mouth of the Oconto river; the county seat of Oconto county. It is on Federal highway 41, and is served by the Chicago and North Western and the Chicago, Milwaukee, St. Paul and Pacific railways. Pop. (1920) 4,920. It has a large fishing industry and several manufacturing plants. It was founded in 1846 and chartered in 1882.

OCORONAN, a small group of tribes of South American Indians, provisionally regarded as constituting an independent linguistic stock. The Ocoronas live or lived in eastern Bolivia along the upper Mamore river, at the missions of San Ignacio,

San Martin and Santa Rosa de Moxos. Apart from brief references to them by the early missionaries, little is known concerning their culture. Rivet believes that the Ocoronas are merely a sub-group of the Chapacuran (*q.v.*) stock.

See G. de Crequi-Montfort and P. Rivet, "La Famille linguistique Capakura" (*J. Soc. Américanistes de Paris* [n.s.] vol. x., pp. 119–173).

OCOTILLO (*Fouquieria splendens*), a North American shrub of the candle-wood family (Fouquieriaceae), called also coach-whip, Jacob's-staff and vine-cactus. It is a characteristic shrub of rocky deserts from western Texas to southern California and southward in Mexico. Near the base the stem divides into several slender, erect, furrowed, intensely spiny branches, usually from 8 to 20 ft. high. It bears small rounded leaves, the midribs of which harden into the spines, and showy bright-scarlet flowers in terminal clusters. The ocotillo is sometimes grown as a hedge plant; in Mexico the branches are woven into fences.

OCTAHEDRON: *see* SOLIDS, GEOMETRIC.

OCTAVE, a period or series of eight members. In ecclesiastical usage the octave is the eighth day after a particular church festival, the feast day itself and the "octave" being counted. The octave thus always falls on the same day of the week as the festival, and any event occurring during the period is said to be "in the octave." In music, an octave is the eighth full tone above or below any given note. It is produced by double or half the number of vibrations corresponding to the given note. In the interval between a note and its octave is contained the full scale, the octave of a note forming the starting-point of another scale of similar intervals to the first. The interval between a note and its octave is also called an octave. The name is also applied to an open metal stop in an organ, and to a flute (more usually known as the piccolo) one octave higher in pitch than the regular flute. It is also a term for a "parade" in fencing. The "law of octaves" was a term applied in 1865 to a relationship among the chemical elements enunciated by J. A. R. Newlands.

In literature an octave is a form of verse consisting of eight iambic lines, and complete in itself. From its use by the poets of Sicily, the form is usually called the Sicilian octave. It is distinguished from a single stanza of *ottava rima* by having only two rhymes, arranged *abababab*. In German literature the octave has been used not infrequently since 1820, when Ruckert published "Sicilianen," as they are called in German, for the first time. The word is often used to describe the eight opening lines of a sonnet.

OCTAVIA, the name of two princesses of the Augustan house. (1) Octavia, daughter of Gaius Octavius and sister of the emperor Augustus, was the wife of Gaius Marcellus, one of the bitterest enemies of Julius Caesar. In 41 B.C. her husband died, and she was married to Marcus Antonius, with the idea of bringing about a reconciliation between him and her brother. Her efforts were at first successful, but in 36 Antony left for the Parthian War and renewed his intrigue with Cleopatra. Though Octavia took out troops and money to him (35), he refused to see her and formally divorced her in 32. (2) OCTAVIA, daughter of the emperor Claudius, was the wife of Nero, by whom she was put to death. A Latin tragedy on her fate is attributed, though wrongly, to Seneca.

OCTOBER, the eighth month of the old Roman year, which began in March. In the Julian calendar, while retaining its old name, it became the tenth month, and had 31 days assigned to it. Several attempts were made to rename the month in honour of the emperors. Thus it was in succession temporarily known as Germanicus, Antoninus, and Herculeus, the last a surname of Commodus. The senate's attempt to christen it Faustinus in honour of Faustina, wife of Antoninus, was equally unsuccessful. By the Slavs it is called "yellow month," from the fading of the leaf; to the Anglo-Saxons it was known as Winterfylleth, because at this full moon (*fylleth*) winter was supposed to begin.

OCTOPUS, the name given in zoology to a single genus of eight-armed Cephalopoda (*q.v.*), one of whose distinguishing characters is the presence of two rows of suckers on each arm. As a less strictly defined term the name may be given to all the eight-armed Cephalopoda, of which some 36 genera have been described (*e.g., Eledone, Cirroteuthis, Argonauta*). The genus *Octopus* is a large one containing upwards of 140 species. Its representatives occur in nearly all seas (though it is poorly represented in Arctic and Antarctic waters) and some are found at great depths. *Octopus vulgaris* is found on British coasts (principally in the south), but it has a limited distribution in these waters, and is not often taken, the allied *Eledone cirrosa* being more common.

The sucker-bearing arms, strong jaws and sinister appearance of these animals have conferred on them a name for ferocity which is not undeserved. The stories of their attacks on man are sufficiently well attested, though they are often exaggerated.

The octopus moves about by means of its arms on the sea bottom, and is not habitually free-swimming, though like other Cephalopods, it can propel itself through the water by means of the funnel (*see* CEPHALOPODA). *Octopus* and the related genus *Eledone* live on the sea-bottom and are mainly found in shallow coastal water. According to Lo Bianco the common octopus in the Gulf of Naples prefers rocky situations for its lair during its early years. Certain forms (*e.g., Benthoctopus*) are found in very deep water, the greatest depth from which a member of the genus *Octopus* has been obtained being 1,875 fathoms. Other Octopods, however, are inhabitants of the open sea and are found swimming or floating at the surface (*Argonauta*) or at greater depths (*Eledonella, Cirroteuthis*). A species of *Eledonella* has been taken at a depth of 2,900 fathoms. Those which live permanently in very deep water are usually highly modified, having gelatinous tissues, large medusiform webs and reduced gills and dentition.

The common octopus feeds principally on crabs. Lo Bianco has shown that before killing its victims it paralyses them with a poison secreted by its salivary glands. The same observer has recorded that the common octopus in captivity will devour its own arms even if it is amply supplied with its normal food. Certain species of octopus attain a considerable size. The common octopus, *O. vulgaris*, sometimes spans over six feet with its arms and the giant *O. punctatus* of the Pacific has been known to have a diameter of 28 feet.

Most species of this genus lay eggs in grapelike clusters. Lee states that the female *O. vulgaris* broods over the clusters, holding them in the membranous expansion of its arms and syringing them with jets of water from its funnel (*see* CEPHALOPODA).

Octopods are eaten fresh or dried by the natives of many parts of the world. The flesh of young *O. vulgaris* is still considered a delicacy in Naples.

It has been mentioned above that the true octopus (*Octopus vulgaris*) is usually rare on the English coast. In 1899 and 1900, however, they became so abundant on the south coast as to attract general notice, and to constitute a veritable plague.

BIBLIOGRAPHY.—*See* CEPHALOPODA; also H. Lee, *The Octopus, or the Devil-fish of Fact and Fiction;* G. C. Robson, "The Deep Sea Octopoda," *Proc. Zool. Soc.* (London, 1926) and S. Lo Bianco "Notizie Biologiche . . . animali del Golfo di Napoli," *Mitth. Zool. Station von Neapel* (1909). (G. C. R.)

OCTOSTYLE, in architecture, a portico with eight columns in front.

OCTROI, a local tax collected on various articles brought into a district for consumption (O. Fr. *octroyer,* to grant, authorize; Lat. *auctor*).

The prescribed groups of commodities, upon which these indirect taxes were levied in 1927 by 1,092 local authorities in France (for the Alsace-Lorraine *octroi* is still governed by the pre-war German regulations) upon their entry for consumption into their area, are six, namely (1) liquids (artificial gaseous drinks, non-alcoholic beverages; vinegar; vegetable oils); (2) foods (meats, poultry, game, fish, butter, eggs, cheese, jams, fruits, etc.); (3) fuel (wood, coal, coke, candles, mineral oils, etc.); (4) fodder (fresh oil-cakes, dog biscuits, etc.); (5) building materials (plaster, lime, stone, bricks, slates, metals, sanitary appliances, woods, glass, etc.); and (6) miscellaneous (soaps, polishes, varnishes, paints, etc.). By presidential decree maximum *octroi* tariff rates for the whole of France must be published officially for all the separate classes within the above groups, particular scales being

BY COURTESY OF UFA

OCTOPUS OR DEVIL FISH

This under-water photograph of an octopus shows the animal crawling on the ocean bottom supported by three of its eight arms. The arms are sucker bearing and are used in capturing crustaceans, the animal's chief food, which have been previously paralyzed with a poison secreted by its salivary glands. Octopods also feed on bivalve molluscs and fishes

fixed according to the six population grades of localities. (Thus in the general tariff of July 1927, the rate on beef is 15 francs per cwt. in the grade under 1,000 inhabitants, 20 francs per cwt. in those from 1 to 10 thousand and 33 francs in those with over 100,000; that on butter per kilogramme ranges from 15 to 40 centimes, on coal per cwt. from 30 centimes to one franc; on petrol per 2 cwt. from 15 to 40 francs.) By a law of Feb. 1918 all *octroi* duties on alcoholic beverages, except on wine in bottle, were abolished. The general regulation of the system was profoundly altered by the law of Aug. 13, 1926, which gave greater freedom of action to the local and prefectoral authorities, within the framework of the general tariff, to modify rates or introduce new taxes, and permitted the central government to establish general regulations for the working of the system.

In 1926, out of a total of 1,042 *octrois* (apart from 18 in Alsace-Lorraine), 833 were collected directly, 116 were farmed out, one only (and it was the first instance for a long period of years) being under the farming out with participation system, and 92 employed the revenue authority mentioned. The total population subject to the *octroi* in these 1,042 localities was 14,370,500. The number of *octrois* in France has much diminished since 1918 when the total was 1,491; and for 1927 or Jan. 1928 several noteworthy towns decided to abandon the system (*e.g.*, Bordeaux, Perpignan, Troyes, Clermont-Ferrand, Chalons, St. Mihiel). There is a fairly strong abolition movement on foot which receives the vigorous support of the large body of motorists; the great difficulty is the provision of acceptable substitute local taxes especially in Paris. Lyons discarded it many years ago, and in her department (Rhone) there are only two *octrois*. They appear most numerous in the south-west and Provençal departments, where in some are found over 40 *octrois*.

In Belgium *octroi* duties were abolished in 1870, being replaced by an increase in customs and excise duties; and in 1903 those in Egypt were also abolished. *Octroi* duties exist in Italy, Spain, Portugal and in some of the towns of Austria.

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O'CURRY, EUGENE (1796–1862), Irish scholar, was born at Dunaha, county Clare, in 1796, the son of a farmer who was a man of unusual intelligence. After being employed for some time in the topographical and historical section of the Irish ordnance survey, O'Curry earned his living by translating and copying Irish manuscripts. The catalogue of Irish manuscripts in the British Museum was compiled by him. On the founding of the Roman Catholic University of Ireland (1854) he was appointed professor of Irish history and archaeology. His lectures were published by the university in 1860. Three other volumes of lectures were published posthumously, under the title *On the Manners and Customs of the Ancient Irish* (1873). His voluminous transcripts, notably eight huge volumes of ancient Irish law, testify to his unremitting industry. He died in Dublin in 1862.

ODAENATHUS or ODENATUS (Gr. Ὀδαίναθος, Palm, אזנך = "little ear"), the Latinized form of ODAINATH, the name of a famous prince of Palmyra, in the second half of the 3rd century A.D., who succeeded in recovering the Roman East from the Persians and restoring it to the Empire. He belonged to the leading family of Palmyra, which bore, in token of Roman citizenship, the *gentilicium* of Septimius; hence his full name was Septimius Odainath (Vogüé, *Syrie centrale,* Nos. 23, 28= Cooke, *North-Semitic Inscrr.* Nos. 126, 130). It is practically certain that he was the son of Septimius Ḥairān the "senator and chief of Tadmor," the son of Septimius Odainath "the senator" (*N.S.I.* p. 285). The year when he became chief of Palmyra is not known, but already in an inscription dated A.D. 258 he is styled "the illustrious consul our lord" (*N.S.I.* No. 126). He possessed the characteristic vigour and astuteness of the old Arab stock from which he sprang; and in his wife, the renowned Zenobia (*q.v.*), he found an able supporter of his policy. The defeat and captivity of the emperor Valerian (A.D. 260) left the eastern provinces largely at the mercy of the Persians; the prospect of Persian supremacy was not one which Palmyra or its prince had any reason to desire. At first, it seems, Odainath attempted to propitiate the Parthian monarch Shāpūr (Sapor) I.; but when his gifts were contemptuously rejected (Petr. Patricius, § 10) he decided to throw in his lot with the cause of Rome. The neutrality which had made Palmyra's fortune was abandoned for an active military policy which, while it added to Odainath's fame, in a short time brought his native city to its ruin. He fell upon the victorious Persians returning home after the sack of Antioch, and before they could cross the Euphrates inflicted upon them a considerable defeat.

Then, when two usurping emperors were proclaimed in the East (A.D. 261), Odainath took the side of Gallienus the son and successor of Valerian, attacked and put to death the usurper Quietus at Emesa (Ḥōmṣ), and was rewarded for his loyalty by the grant of an exceptional position (A.D. 262). He may have assumed the title of king before; but he now became "totius Orientis imperator," not indeed joint-ruler, nor Augustus, but "independent lieutenant of the emperor for the East" (Mommsen, *Provinces,* ii. p. 103)[1]. In a series of rapid and successful campaigns, during which he left Palmyra under the charge of Septimius Worod his deputy (*N.S.I.* Nos. 127–129), he crossed the Euphrates and relieved Edessa, recovered Nisibis and Carrhae, and even took the offensive against the power of Persia, and twice invested Ctesiphon itself, the capital; probably also he brought back Armenia into the Empire. These brilliant successes restored the Roman rule in the East; and Gallienus did not disdain to hold a triumph with the captives and trophies which Odainath had won (A.D. 264).

While observing all due formalities towards his overlord, there can be little doubt that Odainath aimed at independent empire; but during his lifetime no breach with Rome occurred. He was about to start for Cappadocia against the Goths when he was assassinated, together with Herōdes his eldest son, by his nephew Maconius; there is no reason to suppose that this deed of violence was instigated from Rome. After his death (A.D. 266–267) Zenobia succeeded to his position, and practically governed Palmyra on behalf of her young son Wahab-allath or Athenodorus. (*See* PALMYRA.) (G. A. C.)

ODDFELLOWS, ORDER OF, a secret benevolent and social society and subsequently a friendly benefit society also, having mystic signs of recognition, initiatory rites and ceremonies, and various grades of dignity and honour. Great antiquity has been claimed for the order of Oddfellows, but the members themselves now generally admit that the institution cannot be traced back beyond the first half of the 18th century, and explain the name as adopted at a time when the severance into sects and classes was so wide that persons aiming at social union and mutual help were a marked exception to the general rule. Mention is made by Defoe of the society of Oddfellows, but the oldest lodge of which the name has been handed down is the Loyal Aristarcus, No. 9, which met in 1745 "at the Oakley Arms, Borough of Southwark; Globe Tavern, Hatton Garden; or the Boar's Head in Smithfield, as the noble master may direct." The earliest lodges were supported by each member and visitor paying a penny to the secretary on entering the lodge, and special sums were voted to any brother in need. If out of work he was supplied with a card and funds to reach the next lodge, and he went from lodge to lodge until he found employment. The lodges gradually adopted a definite common ritual and became confederated under the name of the Patriotic Order. Towards the end of the century many of the lodges were broken up by State prosecutions on the suspicion that

[1]The late Roman chronicler Trebellius Pollio goes further and asserts "Odenatus rex Palmyrenorum optinuit totius Orientis imperium. . . . Gallienus Odenatum participato imperio Augustum vocavit," *Hist. Aug.* xxiii. 10 and 12. This is not borne out by the evidence. The highest rank claimed for him by his own people is recorded in an inscription dated 271 (*N.S.I.* No. 130) set up by the two generals of the Palmyrene army; Odainath is styled "king of kings and restorer of the whole city"; but this does not mean that he ever held the title of Augustus, and the inscription was set up after his death and during the revolt of Palmyra.

their purposes were "seditious," but the society continued to exist as the Union Order of Oddfellows until 1809. In 1813, at a convention in Manchester, was formed the Independent Order of Oddfellows, Manchester Unity, which now overshadows all the minor societies in England. Oddfellowship was introduced into the United States from the Manchester Unity in 1819, and the grand lodge of Maryland and the United States was constituted on Feb. 22, 1821. It now rivals in membership and influence the Manchester Unity, from which it severed its connection in 1842. In 1843 it issued a dispensation for opening the Prince of Wales Lodge No. 1, at Montreal, Canada. The American society, including Canada and the United States, has its headquarters at Baltimore. Organizations connected either with the United States or England have been founded in France, Germany, Switzerland, Denmark, The Netherlands, Norway, Sweden, Poland, Czechoslovakia, the British dominions and elsewhere.

The most complete and trustworthy account of the institution is that in *The Complete Manual of Oddfellowship, its History, Principles, Ceremonies and Symbolism,* privately printed (1879). (*See* also FRIENDLY SOCIETIES.)

ODE, a form of stately and elaborate lyrical verse. The original signification of an ode was a chant, a poem arranged to be sung to an instrumental accompaniment. There were two great divisions of the Greek *melos* or song. One of them, in the hands of Alcaeus, Anacreon and Sappho, came close to what modern criticism knows as lyric. On the other hand, the choir-song, in which the poet spoke for himself, but always supported, or interpreted, by a chorus, led up to what is known as ode proper. It was Alcman who first gave to his poems a strophic arrangement, and the strophe (*q.v.*) has come to be essential to an ode. Stesichorus, Ibycus and Simonides of Ceos led the way to the two great masters of ode among the ancients, Pindar and Bacchylides. The form and verse-arrangement of Pindar's great lyrics have regulated the type of the heroic ode. It is now perceived that they are consciously composed in very elaborate measures. So far from being, as critics long supposed, utterly irregular, they are more like the *canzos* and *sirventes* of the mediaeval troubadours than any modern verse. The Latins lost the secret of these complicated harmonies, and made no serious attempt to imitate the odes of Pindar. The ode, as it was practised by the Romans, returned to the lyrical form of Sappho and Alcaeus. This was exemplified, in the most exquisite way, by Horace and Catullus.

The earliest modern writer to perceive the value of the antique ode was Ronsard, who attempted to recover the fire and volume of Pindar; his principal experiments date from 1550 to 1552. The poets of the Pleïad (*q.v.*) recognized in the ode one of the forms of verse with which French prosody should be enriched, but in their use of Greek words crudely introduced, and in their quantitative experiments, they offended the genius of the French language. The ode died in France almost as rapidly as it had come to life. Early in the 19th century the form was resumed, and we have the *Odes* composed between 1817 and 1824 by Victor Hugo, the odes of Lamartine, those of Victor de Laprade (collected in 1844), and the *Odes funambulesques* of Théodore de Banville (1857).

The earliest odes in English, using the word in its strict form, were the *Epithalamium* and *Prothalamium* of Spenser. Ben Jonson introduced a kind of elaborate lyric to which he gave the name of ode; and some of his disciples, in particular Randolph, Cartwright and Herrick, followed him. The "Hymn on the Morning of Christ's Nativity," begun by Milton in 1629, may be considered an ode, and his lyrics "On Time" and "At a Solemn Music" belong to the same category. But it was Cowley who introduced into English poetry the ode consciously built up, on a solemn theme and as definitely as possible on the ancient Greek pattern. He was no more perspicacious than others, however, in observing what the rules were which Pindar had followed. He published his "Pindaric" odes in 1656. These shapeless pieces became very popular after the Restoration, and enjoyed the sanction of Dryden in three or four irregular odes which are the best of their kind in the English language. In 1705 Congreve published a *Discourse on the Pindarique Ode,* and he wrote odes, in strophe, antistrophe and epode, which were the earliest of their kind in English; unhappily they were not very poetical. The attempts of Gilbert West (1703–56) to explain the prosody of Pindar (1749) inspired Gray to write his "Progress of Poesy" (1754) and "The Bard" (1756). Collins, meanwhile, had in 1747 published a collection of odes devised in the Aeolian or Lesbian manner. The odes of Wordsworth, Coleridge and Tennyson are entirely irregular. Shelley desired to revive the pure manner of the Greeks, but he understood the principle of the form so little that he began his "Ode to Naples" with two epodes, passed on to two strophes, and then indulged in four successive antistrophes. Coventry Patmore, in 1868, printed a volume of irregular *Odes.* Swinburne, although some of his odes, like those of Keats, are really elaborate lyrics, written in a succession of stanzas identical in form, cultivated the Greek form also, and some of his political odes follow very closely the type of Bacchylides and Pindar. Neither Sir William Watson nor Laurence Binyon, each of whom has written memorable odes in more recent times, has adopted the Pindaric form.

See Philipp August Böckh, *De metris Pindari* (1811); Wilhelm Christ, *Metrik der Griechen und Römer* (1874); Edmund Gosse, *English Odes* (1881).

ODENKIRCHEN, a town in the Prussian Rhine province, 21 m. by rail S.W. of Düsseldorf, and at the junction of lines to Munich, Gladbach and Stolberg. Pop. (1925) 20,023. Odenkirchen became a town in 1856. Its principal industries are cotton spinning and weaving, tanning and dyeing.

ODENSE, a city of Denmark, the chief town of the *amt* (county) of its name, which forms the northern part of the island of Fünen (Fyen). Pop. (1928) 52,376. Odense, or Odinsey, originally Odinsoe, *i.e.,* Odin's island, is one of the oldest cities of Denmark. St. Canute's shrine was a great resort of pilgrims throughout the middle ages. In the 16th century the town was the meeting-place of several parliaments, and down to 1805 it was the seat of the provincial assembly of Fünen. The city lies 4 m. from Odense fjord on the Odense Aa, the main portion on the north side of the stream, and the industrial Albani quarter on the south side. It has a station on the railway route between Copenhagen and Jutland and Schleswig-Holstein via Korsør. A canal, 15½ ft. to 21 ft. deep, gives access to the town from the fjord. St. Canute's cathedral is one of the largest and finest buildings of its kind in Denmark. It is constructed of brick in a pure Gothic style. Originally dating from 1081–93, it was rebuilt in the 13th century. Under the altar lies Canute (Knud), the patron saint of Denmark, who intended to dispute with William of Normandy the possession of England, but was slain in an insurrection at Odense in 1086; Kings John and Christian II. are also buried within the walls. Our Lady's church, built in the 13th century and restored in 1851–52 and again in 1864, contains a carved altar-piece (16th century) by Claus Berg of Lübeck. Odense castle was erected by Frederick IV., who died there in 1730. Exports, mostly agricultural produce (butter, bacon, eggs); imports, iron, petroleum, coal, yarn and timber.

ODENWALD, a wooded mountain region of Germany, almost entirely in Hesse, with small portions in Bavaria and Baden. It stretches between the Neckar and the Main, and is 50 m. long by 20 to 30 broad. Its highest points are the Katzenbuckel (2,057 ft.), the Neunkircher Höhe (1,985 ft.) and the Krähenberg (1,965 ft.). The wooded heights overlooking the Bergstrasse are studded with castles and mediaeval ruins.

ODER (Lat. *Viadua;* Slavonic *Vjodr*), a European river, 560 m. long, which rises in the Odergebirge (Lower Carboniferous rocks of the Bohemian massif). After flowing south-east it quickly turns north-east and after a short distance north-west enters upon the Silesian plain, which general direction it maintains across the recent deposits of the lowlands in a wide valley and with low banks. In its lower course it frequently bifurcates, forming many islands, and its main channel passes Stettin into the Grosses Haff, which is connected with the Baltic sea by three arms, the Peene, Swine and Dievenov forming the islands of Usedom and Wollin. The Swine in the middle, is the main channel for navigation.

Rising in Czechoslovakia it touches the Upper Silesian coalfield

and enters Germany above Ratibor, after forming the frontier between Germany and Poland from Bohumin. It receives a number of left-bank tributaries from the gneisses and granites of the Bohemian massif, the chief being the Glatzer Neisse, Katzbach, Bober and Lausitzer Neisse, but the biggest affluents are those on the right-bank, the Warthe with its tributaries the Netze (Notéc) and the Obra, the Malapane and Bartsch, all of which rise in Poland. The most important towns on the river banks are Ratibor, Oppeln, Brieg, Breslau, Glogau, Frankfort-on-Oder, Küstrin, Stettin and Swinemünde. The river forms an important highway into eastern Germany, Poland and Czechoslovakia. It is utilized by three main currents of traffic, traffic between Stettin and Berlin, goods transported to or from the mining area of Upper Silesia (this traffic was reduced by the partition of Upper Silesia between Germany and Poland) and the traffic to and from Poland by the Warthe and its connections. The river begins to be navigable for barges at Ratibor, when it is about 100 ft. wide, and for larger vessels at Breslau where constant dredging is always necessary. Several parts of the main stream have been canalized, especially in the low-lying reaches, in its upper courses and between Stettin and the sea. It is now possible for sea-going vessels, drawing 24 ft. of water to reach Stettin. In addition navigation is possible on the Warthe, Netze and Obra, and the river is connected by canals with the Vistula, the Havel and the Spree.

By the Treaty of Versailles (1919) Poland extended her territory westwards to include the province of Posen (Posnania) but, although the boundary nowhere touches the Oder, long portions of its right-bank are now in Poland. The treaty also declared international the Oder and all navigable portions of its system which provide natural access to the sea for more than one State, and also appointed a commission consisting of three representatives of Prussia, and one each of Poland, Czechoslovakia, Great Britain, France, Denmark and Sweden to prepare an Act of Navigation. The work of this commission was by no means easy, for unforeseen difficulties arose upon the question of the right of the commission to legislate for the upper reaches of the Warthe, the Netze and the Old Netze.

ODESSA, a seaport of the Ukrainian S.S.R., in 46° 29′ N., 30° 44′ E., on the southern shore of a semi-circular bay, at the north-west angle of the Black sea. Pop. (1926) 411,416. It has five harbours; the Quarantine, New Harbour, Pratique and Cabotage harbours are sheltered by two breakwaters, 4,020 ft. and 2,120 ft. in length. The Petroleum harbour is sheltered by a breakwater 840 ft. in length. There is very good anchorage in the inner roads and a floating crane with a capacity of 40 tons. There are two patent slips and a double-sided floating dock, lifting power 4,800 tons. The harbours freeze for a few days in each year, and the bay occasionally freezes. Navigation is interrupted on an average for 16 days per annum, though the powerful ice breaker now installed lessens this time. The climate is influenced by its proximity to the steppe, and is continental. Average January temperature 23·2° F, July 72·8° F, average rainfall 14 in. per annum. The exports are mainly grain, linseed, wool, cattle, sugar and timber, and the imports coal, naphtha, iron, machinery, agricultural implements, raw cotton, tobacco, manufactured goods and tea, coffee and other colonial goods. Coal cargoes are discharged in the new harbour, several travelling steam cranes being fitted for the purpose. The Cabotage harbour is reserved for Russian coasting vessels. A repairing yard with a pontoon and fitting out basin is situated near the petroleum harbour. Improvements to the port are now being carried out, with a view to providing quayside and berths for 21 steamers, with warehouses and railway lines along the quay.

The town is picturesquely situated on a plateau 150 ft. above sea-level, which is intersected by ravines and forms the limit of the steppe region. The climate is milder than that of the rest of the Ukraine and in the vicinity of Odessa are numerous health resorts along the *limans*. In these limans, or former river mouths now cut off from the sea by the silting up of the rivers, are waters containing concentrated salt solutions, with high proportions of magnesium and calcium salts, iodine and bromine. Their mud is strongly impregnated with sulphuretted hydrogen and is highly beneficial to sufferers from rheumatism, nervous disorders and skin diseases. Spring gives the environs of Odessa a brief glory of brightly coloured blossoms but summer heat and drought soon parch the vegetation. The broad streets of the town have been planted with trees, peculiarly grateful in the brief intense heat of summer and in contrast with the general treeless condition of the surrounding steppe. The population is exceedingly mixed even for a seaport, and includes Great Russians, Ukrainians, Jews, Poles, Germans, Greeks, Armenians, Tatars and Turks, among others.

History.—The bay of Odessa has had a chequered history; it was colonised by Greeks at a very early period, but their ports Istrianorum Portus, Isiacorum Portus and Odessus at the mouth of the Tiligul liman disappeared in the 3rd and 4th centuries.

In spite of its favoured position between the Dniester and the Dnieper estuaries, no further settlements were made until the 14th century, when a Tatar chief Khaji Beg or Bey founded a fort on the present site of Odessa. Olgerd, prince of Lithuania, captured the fort in 1396 and it remained alternately in the power of Lithuania and Poland until its capture by Tatars in the 16th century. During the whole of this period it continued to be an important export centre for grain, salt and fish. The Turks captured it from the Tatars in the 16th century and built a fortress Yeni-Dunia to protect the harbour. In 1774 during the Russo-Turkish War, the Russians captured the town, but returned it to the Turks, finally occupying it and the whole territory between the Dniester and the Bug in 1789. A French captain, de Ribas, who had led the Russians in their assault on the town, was afterwards entrusted with the planning, in consultation with the French engineer Voland, of a military and commercial port, and a finely laid out Russian city replaced the former Turco-Tatar settlement.

In 1803 Odessa became the chief town of a separate municipal captaincy under Armand, duc de Richelieu, who developed its trade and importance. In 1824 it became the seat of the governors of Novorossia (New Russia) and Bessarabia and, as a free port, became very prosperous. Railway communication with Kiev and Kharkov and with Jassy in Rumania was established in 1866. The free port was closed in 1859. The town successfully resisted a Turkish attack in 1876–77. A numerous floating population began to be attracted, abundant work being available in years of good harvest, but unemployment became rife in years of bad harvest. Accommodation was insufficient and starving unemployed often took refuge in the catacombs extending under the town from which sandstone for building has been removed, not without danger of subsidence to the town. Fierce discontent prevailed and in the 1905 revolution the workers, supported by the insurrectionary battleship Potemkin, of the Black sea fleet, maintained barricade warfare against the military. The rising was suppressed, but broke out with renewed vigour in October of the same year and was again suppressed. Sanguinary pogroms followed, and 80,000 inhabitants fled from the unfortunate city.

After the overthrow of the Kerenski government in October 1917, the Ukrainian Rada (Petlura) occupied the town. In January 1918 the Bolshevik workers of the town, aided by troops from the former Rumanian front and from the Black sea fleet expelled the followers of Petlura and proclaimed a Soviet republic. In mid-March German and Austro-Hungarian troops occupied the town, and later the Hetman government, installed under German protection, called in the Entente troops, who occupied the greater part of the town. The French fleet bombarded the wretched inhabitants and French, Serbian, Polish and later Greek troops were landed. Eventually, however, a second Soviet government was set up in April 1919, but was overthrown by Denikin in August 1919. In February 1920 the Soviet finally captured the town.

During this disastrous period a third of the houses were destroyed and numbers of the population were killed, while others fled into the surrounding villages. During 1921 and 1922 famine and famine diseases further devastated the town and lack of fuel caused the inhabitants to pull down many wooden buildings. But in 1923 conditions became somewhat easier and since then trade

has slowly returned. Another difficulty, however, faced the town. Formerly much of its trade came via the Dniester river and Akkerman (now Cetatea Alba) from Bessarabia and in the present absence of diplomatic relations between Rumania and Russia, a state of armed neutrality exists on that river and trade is practically non-existent. However, in spite of all these adverse conditions, the population in 1926 had reached normal size and trade was flourishing. Housing presents a terrible problem in view of the destruction of the war years, and, though there has been some building and repair work undertaken, much remains to be done and many labourers are homeless, while others are crowded together in small rooms. The extensive Square of the Victims of the Revolution contains two huge common graves, in which are buried the victims of the street fighting, and a pyramid of rough stones has been erected over them. The harbour was considerably damaged by shell fire, and the grain elevators were destroyed; new elevators were erected in 1924.

Industry.—In addition to its trading, port and shipbuilding activities Odessa has numerous industrial enterprises, amongst which the production of salt takes an important place. There are also glass, metal and brick works and factories for producing machinery, especially for agricultural purposes, and munitions, superphosphates, tin, cork, glue and oil from oleaginous seeds are produced. Recently introduced industries are the manufacture of cinematograph apparatus, of water gauges, of twine and of preserved foods. There is also an aeroplane factory and a regular air service has been established between Odessa and Kharkov, with intermediate stations at Poltavo and Zinovievsk. The water supply of the town is obtained from the Dniester river. The town has several theatres and museums. The former University of South Russia has been converted into a Technical institute, and there are Medical and Agricultural institutes, a State Public library and a Jewish Academical library. The medley of languages has encouraged the use of Esperanto and there is an Esperanto institute. There is a zoological garden, laid out chiefly for purposes of acclimatisation, and animals destined for the more severe conditions of the north are kept here for some time. The Bacteriological station was the first of its kind in Russia.

ODIN or **OTHIN,** the chief god of the northern pantheon, is represented as an old man with one eye. Frigg is his wife, Thor and Balder, among other gods, are his sons. He is also said to have been the father of several legendary kings. His exploits and adventures are a common theme in the poetic and prose Eddas. Here his character is distinguished rather by wisdom than martial prowess, and reference is frequently made to his skill in poetry and magic. In *Ynglinga Saga* he is represented as reigning in Sweden. In notices relating to religious observances Odin appears chiefly as the giver of victory or as the god of the dead. He receives the souls of the slain, who in his palace, Valhalla (*q.v.*), live a life of fighting and feasting, similar to that which has been their desire on earth. Human sacrifices were frequently offered to Odin, especially prisoners taken in battle. In the poem *Hávamál* the god himself is represented as sacrificed. The worship of Odin seems to have prevailed chiefly, if not solely, in military circles. To the Anglo-Saxons he was known as Woden (*q.v.*) and to the Germans as Wodan (Wuotan). Owing to the peculiar character of this god and the prominent position which he occupies, the mythology of the north presents a striking contrast to that of Greece. *See* TEUTONIC PEOPLES, *ad fin.;* and WODEN.

ODO or EUDES (d. 898), king of the Franks, a son of Robert the Strong, count of Anjou (d. 866), is sometimes referred to as duke of France and also as count of Paris. For his resistance to the attacks of the Normans Odo was chosen king by the Western Franks when the emperor Charles the Fat was deposed in 887, and was crowned at Compiègne in February 888. He defeated the Normans at Montfaucon and elsewhere, but was soon involved in a struggle with powerful nobles, who supported the claim of Charles, afterwards King Charles III., to the Frankish kingdom. To gain support Odo owned himself a vassal of the German king, Arnulf, but in 894 Arnulf declared for Charles. Eventually, after a struggle of three years, Odo was compelled to come to terms with his rival, and to surrender to him a district north of the Seine. He died at La Fère on Jan. 1, 898.

See E. Lavisse, *Histoire de France,* tome ii.. (1903); and E. Favre, *Eudes, comte de Paris et roi de France* (1893).

ODO or EUDES (d. *c.* 736), king, or duke, of Aquitaine, obtained this dignity about 715, and his territory included the south-western part of Gaul from the Loire to the Pyrenees. In 718 he appears as the ally of Chilperic II., king of Neustria, who was fighting against the Austrasian mayor of the palace, Charles Martel; but after the defeat of Chilperic at Soissons in 719 he probably made peace with Charles by surrendering to him the Neustrian king and his treasures. Odo was also obliged to fight the Saracens who invaded the southern part of his kingdom, and inflicted a severe defeat upon them at Toulouse in 721. When, however, he was again attacked by Charles Martel, the Saracens renewed their ravages, and Odo was defeated near Bordeaux; he was compelled to crave protection from Charles, who took up this struggle and gained his momentous victory at Poitiers in 732. In 735 the king abdicated, and was succeeded by his son Hunold.

ODOACER or ODOVACAR (*c.* 434–493), the first barbarian ruler of Italy, son of Aedico or Idico, was born in the district bordering on the middle Danube about the year 434. He was probably one of the tribe of Scyrri who had invaded Pannonia about 430. It is said that as a tall young recruit for the Roman armies, dressed in a sordid vesture of skins, on his way to Italy, he entered the cell of St. Severinus, to ask his blessing. The saint had an inward premonition of his future greatness, and in blessing him said, "Fare onward into Italy. Thou who art now clothed in vile raiment wilt soon give precious gifts unto many."

Odoacer was probably about thirty years of age when he thus entered the imperial service. By the year 472 he had risen to some eminence. In the year 475 the emperor Nepos was driven into exile, and the successful rebel Orestes was enabled to array in the purple his son, a handsome boy of fourteen or fifteen, who was named Romulus after his grandfather, and nicknamed Augustulus, from his inability to play the part of the great Augustus. Before this puppet emperor had been a year on the throne the barbarian mercenaries rose in mutiny, demanding to be made proprietors of one-third of the soil of Italy. To this request Orestes returned a peremptory negative. Odoacer now offered his fellow-soldiers to obtain for them all that they desired if they would seat him on the throne. On Aug. 23, 476, he was proclaimed king; five days later Orestes was made prisoner at Placentia and beheaded. Augustulus was compelled to descend from the throne, but his life was spared.

Odoacer was forty-two years of age when he thus became chief ruler of Italy, and he reigned thirteen years with undisputed sway. The administration was conducted as much as possible on the lines of the old imperial government. The settlement of the barbarian soldiers on the lands of Italy probably affected the great landowners rather than the labouring class. To the herd or *coloni* and *servi* it probably made little difference whether the master whom they served called himself Roman or Rugian.

In 477 or 478 the dethroned emperor Nepos sent ambassadors to Zeno, emperor of the East, begging his aid in the reconquest of Italy. These ambassadors met a deputation from the Roman senate, sent nominally by the command of Augustulus, really no doubt by that of Odoacer, to declare that they did not need a separate emperor. The senate had chosen Odoacer, and they therefore prayed Zeno to confer upon him the dignity of patrician, and entrust the "diocese" of Italy to his care. Zeno returned a harsh answer to the senate, requiring them to return to their allegiance to Nepos. In fact, however, he did nothing for the fallen emperor, but accepted the new order of things, and even addressed Odoacer as patrician. On the other hand, the latter sent the ornaments of empire to Constantinople as an acknowledgment of the fact that he did not claim supreme power. Our information as to the actual title assumed by the new ruler is somewhat confused. He does not appear to have called himself king of Italy, but only king of the tribes of barbarians that followed him. By the Roman inhabitants of Italy he was addressed as "dominus noster," but his right to exercise power would in their eyes rest, in theory, on his recognition as patricius by the Byzantine Augustus. At the same time

he marked his own high pretensions by assuming the prefix Flavius. His internal administration was probably, upon the whole, wise and moderate, and he may be looked upon as a not altogether unworthy predecessor of Theodoric.

In the history of the papacy Odoacer figures as the author of a decree promulgated at the election of Felix II. in 483, forbidding the pope to alienate any of the lands or ornaments of the Roman Church, and threatening any pope who should infringe this edict with anathema.

The chief events in the foreign policy of Odoacer were his Dalmatian and Rugian wars. In the year 480 the ex-emperor Nepos, who ruled Dalmatia, was traitorously assassinated in Diocletian's palace at Spalato by the counts Viator and Ovida. In the following year Odoacer invaded Dalmatia, slew the murderer Ovida, and reannexed Dalmatia to the Western state. In 487 he appeared as an invader in his own native Danubian lands. War broke out between him and Feletheus, king of the Rugians. Odoacer entered the Rugian territory, and defeated and captured Feletheus. In the following year Frederick, son of the captive king, endeavoured to raise again the fallen fortunes of his house, but was defeated by Onulf, brother of Odoacer, and took refuge at the court of Theodoric the Ostrogoth.

This Rugian war was probably an indirect cause of the fall of Odoacer. His increasing power rendered him too formidable to the Byzantine court. At the same time, Zeno was embarrassed by the formidable neighbourhood of Theodoric the Ostrogoth. In these circumstances arose the plan of Theodoric's invasion of Italy, the details of which belong properly to the life of Theodoric. It is sufficient to state here that he entered Italy in August 489, defeated Odoacer at the Isontius (Isonzo) on the 28th of August, and at Verona on the 30th of September. Odoacer then shut himself up in Ravenna, and there maintained himself for four years, with one brief gleam of success, during which he emerged from his hiding place and fought the battle of the Addua (Aug. 11, 490), in which he was again defeated. A sally from Ravenna (July 10, 491) was again the occasion of a murderous defeat. At length, the famine in Ravenna having become almost intolerable, and the Goths despairing of ever taking the city by assault, negotiations were opened for a compromise (Feb. 25, 493). It was stipulated that Ravenna should be surrendered, that Odoacer's life should be spared, and that he and Theodoric should be recognized as joint rulers of the Roman state. The arrangement was evidently a precarious one, and was soon terminated by the treachery of Theodoric. He invited his rival to a banquet in the palace of the Lauretum on the 15th of March, and there slew him with his own hand. "Where is God?" cried Odoacer when he perceived the ambush into which he had fallen. "Thus didst thou deal with my kinsman," shouted Theodoric, and clove his rival with the broadsword from shoulder to flank. Thelan, his son, was not long after put to death by order of the conqueror. Thus perished the whole race of Odoacer.

LITERATURE.—The chief authorities for the life of Odoacer are the so-called "Anonymus Valesii," generally printed at the end of Ammianus Marcellinus; the *Life of Severinus*, by Eugippius; the chroniclers, Cassiodorus and "Cuspiniani Anonymus" (both in Roncalli's collection); and the Byzantine historians, Malchus and John of Antioch. A fragment of the latter historian, unknown when Gibbon wrote, is to be found in the fifth volume of Müller's *Fragmenta Historicorum Graecorum*. There is a thorough investigation of the history of Odoacer in R. Pallmann's *Geschichte der Völkerwanderung*, vol. ii. (Weimar, 1864). *See* also T. Hodgkin, *Italy and Her Invaders*, vol. iii. (Oxford, 1885).

ODOFREDUS, Italian jurist of the 13th century. He was born at Bologna and studied law under Balduinus and Accursius. After having practised as an advocate both in Italy and France, he became professor at Bologna in 1228. The commentaries on Roman law attributed to him are valuable as showing the growth of the study of law in Italy, and for their biographical details of the jurists of the 12th and 13th centuries. Odofredus died at Bologna on Dec. 3, 1265.

Over his name appeared *Lecturae in codicem* (Lyons, 1480), *Lecturae in digestum vetus* (Paris, 1504), *Summa de libellis formandis* (Strasbourg, 1510), *Lecturae in tres libros* (Venice, 1514), and *Lecturae in digestum novum* (Lyons, 1552).

ODONATA, an order of insects (*q.v.*) comprising the dragonflies (*q.v.*).

O'DONNELL, the name of an ancient and powerful Irish family, lords of Tyrconnel in early times, and the chief rivals of the O'Neills in Ulster. Like the family of O'Neill (*q.v.*), that of O'Donnell was descended from Niall of the Nine Hostages, king of Ireland at the beginning of the 5th century; the O'Neills, or Cinel Owen, tracing their pedigree to Owen (Eoghan), and the O'Donnells, or Cinel Connell, to Conall Gulban, both sons of Niall. Tyrconnel, the district named after the Cinel Connell, where the O'Donnells held sway, comprised the greater part of the modern county of Donegal except the peninsula of Inishowen; and since it lay conterminous with the territory ruled by the O'Neills of Tyrone, who were continually attempting to assert their supremacy over it, the history of the O'Donnells is for the most part a record of tribal warfare with their powerful neighbours, and of their own efforts to make good their claims to the overlordship of northern Connaught.

The first chieftain of mark in the family was Goffraidh (Godfrey), son of Donnell Mor O'Donnell (d. 1241). Goffraidh, who was "inaugurated" as "The O'Donnell," *i.e.*, chief of the clan, in 1248, successfully raided Tyrone and Connaught, and was severely wounded in the battle of Roscede (1257). In the following year he defeated Brian O'Neill, but died soon after from his old wounds. He was succeeded in the chieftainship by his brother Donnell Oge.

In the 16th century, when the English began to make determined efforts to bring the whole of Ireland under subjection to the Crown, the O'Donnells of Tyrconnel played a leading part, cooperating at times with the English, especially when such cooperation appeared to promise triumph over their ancient enemies the O'Neills, at other times joining with the latter against the English authorities.

MANUS O'DONNELL (d. 1564), son of Hugh Dubh O'Donnell, was left to rule Tyrconnel during his father's pilgrimage to Rome about 1511; and retained the chief authority when Hugh Dubh returned. A family quarrel ensued, but with the help of the O'Neills, Manus established his hold over Tyrconnel. In 1522, however, the O'Neills and O'Donnells were again at war. Conn Bacach O'Neill, 1st earl of Tyrone, determined to subjugate the O'Donnells. Supported by several septs of Munster and Connaught, and assisted by English contingents and the MacDonnells of Antrim, O'Neill took the castle of Ballyshannon, and after devastating a large part of Tyrconnel encamped at Knockavoe, near Strabane. Here he was surprised at night by Hugh Dubh and Manus O'Donnell, and severely defeated. The war continued, however, and in 1531 O'Donnell applied to the English Government for protection, giving assurances of allegiance to Henry VIII. In 1537 Lord Thomas Fitzgerald and his five uncles were executed for rebellion in Munster, and the English Government made every effort to lay hands also on Gerald, the youthful heir to the earldom of Kildare, a boy of 12 years of age who was in the secret custody of his aunt Lady Eleanor McCarthy. This lady, in order to secure a powerful protector for the boy, accepted an offer of marriage by Manus O'Donnell, who on the death of Hugh Dubh in July 1537 was inaugurated The O'Donnell. Conn O'Neill was a relative of Gerald Fitzgerald, and this event accordingly led to the formation of the Geraldine League, a federation which combined the O'Neills, the O'Donnells, the O'Briens of Thomond, and other powerful clans; the primary object of which was to restore Gerald to the earldom of Kildare, but which afterwards aimed at the complete overthrow of English rule in Ireland. In Aug. 1539 Manus O'Donnell and Conn O'Neill were heavily defeated by the lord deputy at Lake Bellahoe, in Monaghan.

In the west Manus continued to assert the supremacy of the O'Donnells in north Connaught, where he compelled O'Conor Sligo to acknowledge his overlordship in 1539. In 1542 he went to England and presented himself, together with Conn O'Neill and other Irish chiefs, before Henry VIII. In his later years Manus was harassed by his son Calvagh, who imprisoned him in 1555, and deposed him from all authority in Tyrconnel. He died in 1564. Manus O'Donnell is also described by the Four Masters

as "a learned man, skilled in many arts, gifted with a profound intellect, and the knowledge of every science." At his castle of Portnatrynod near Strabane he supervised if he did not actually dictate the writing of the *Life of Saint Columbkille* in Irish, which is preserved in the Bodleian library at Oxford. Manus was several times married. His first wife, Joan O'Reilly, was the mother of Calvagh, and two daughters, both of whom married O'Neills; the younger, Margaret, was wife of the famous rebel Shane O'Neill. His second wife, Hugh's mother, by whom he was ancestor of the earls of Tyrconnel (*see* below), was Judith, sister of Conn Bacach O'Neill, 1st earl of Tyrone, and aunt of Shane O'Neill. He died in 1564.

CALVAGH O'DONNELL (d. 1566), eldest son of Manus O'Donnell, in the course of his above-mentioned quarrel with his father and his half-brother Hugh, sought aid in Scotland from the MacDonnells, who assisted him in deposing Manus and securing the lordship of Tyrconnel. Hugh then appealed to Shane O'Neill, who invaded Tyrconnel at the head of a large army in 1557 to secure supremacy over Ulster, and encamped on the shore of Lough Swilly. Calvagh surprised the O'Neills in their camp at night and routed them. Calvagh was then recognized by the English Government as lord of Tyrconnel; but in 1561 he and his wife were captured by Shane O'Neill in the monastery of Kildonnell. His wife, Catherine Maclean, who had previously been the wife of the earl of Argyll, was kept by Shane O'Neill as his mistress and bore him several children, though grossly ill-treated by her savage captor; Calvagh himself was subjected to atrocious torture during the three years that he remained O'Neill's prisoner. He was released in 1564 on conditions which he had no intention of fulfilling; and crossing to England he appealed to Queen Elizabeth. In 1566 Sir Henry Sidney marched to Tyrconnel, and restored Calvagh to his rights. Calvagh, however, died in the same year, and as his son Conn was a prisoner in the hands of Shane O'Neill, his half-brother Hugh MacManus was inaugurated The O'Donnell in his place. Hugh, who in the family feud with Calvagh had allied himself with O'Neill, now turned round and combined with the English to crush the hereditary enemy of his family; and in 1567 he utterly routed Shane at Letterkenny, compelling him to seek refuge with the MacDonnells of Antrim, by whom he was put to death. In 1592 Hugh abdicated in favour of his son Hugh Roe O'Donnell (*see* below); but Niall Garve, second son of Calvagh's son Conn, resented the passing of the chieftainship to the descendants of Manus O'Donnell's second marriage. His elder brother was Hugh of Ramelton, whose son John, an officer in the Spanish army, was father of Hugh Baldearg O'Donnell (d. 1704), known in Spain as Count O'Donnell, who commanded an Irish regiment as brigadier in the Spanish service. This officer came to Ireland in 1690 and raised an army in Ulster to be used in the service of James II., afterwards deserting to the side of William III., from whom he subsequently accepted a pension.

NIALL GARVE O'DONNELL (1569–1626), grandson of Calvagh, made terms with the English Government, to whom he rendered valuable service both against the O'Neills and against his cousin. But in 1601 he quarrelled with the lord deputy, who, though willing to establish Niall Garve in the lordship of Tyrconnel, would not permit him to enforce his supremacy over Cahir O'Dogherty in Inishowen. Charged with complicity in Cahir O'Dogherty's rebellion in 1608, Niall Garve was sent to the Tower of London, where he remained till his death in 1626. He married his cousin Nuala, the sister of Hugh Roe and Rory O'Donnell. When Rory fled with the earl of Tyrone to Rome in 1607, Nuala, who had deserted her husband when he joined the English against her brother, accompanied him, taking with her her daughter Grania. She was the subject of an Irish poem, of which an English version was written by James Mangan from a prose translation by Eugene O'Curry.

HUGH ROE O'DONNELL (1572–1602), eldest son of Hugh MacManus O'Donnell, and grandson of Manus O'Donnell by his second marriage with Judith O'Neill, was the most celebrated member of his clan. His mother was Ineen Dubh, daughter of James MacDonnell of Kintyre; his sister, the second wife of Hugh O'Neill, 2nd earl of Tyrone. These family connections with the Hebridean Scots and with the O'Neills made the lord deputy, Sir John Perrot, afraid of a powerful combination against the English Government, and induced him to establish garrisons in Tyrconnel and to demand hostages from Hugh MacManus O'Donnell, which the latter refused to hand over. In 1587 Perrot conceived a plan for kidnapping Hugh Roe (Hugh the Red), now a youth of 15, who had already given proof of exceptional ability. A merchant vessel laden with Spanish wines was sent to Lough Swilly, and Hugh Roe with some youthful companions was enticed on board, when the ship immediately set sail and conveyed the party to Dublin. The boys were kept in prison for more than three years. In 1591 young O'Donnell escaped; and after enduring terrible privations he made his way to Tyrconnel, where in the following year his father handed the chieftainship over to him.

Red Hugh then led an expedition against Turlough Luineach O'Neill, who was at war with his kinsman Hugh, earl of Tyrone, with whom O'Donnell was in alliance, at the same time assuring the lord deputy of his loyalty. Determined to vindicate the traditional claims of his family in north Connaught, he aided Hugh Maguire against the English, though on the advice of Tyrone he abstained for a time from committing himself too far. When, however, in 1594 Enniskillen castle was taken and the women and children flung into the river from its walls by order of Sir Richard Bingham, the English governor of Connaught, O'Donnell sent urgent messages to Tyrone for help; and while he himself hurried to Derry to withstand an invasion of Scots from the isles, Maguire defeated the English with heavy loss at Bellanabriska (The Ford of the Biscuits). In 1595 Red Hugh again invaded Connaught, putting to the sword all above 15 years of age unable to speak Irish; he captured Longford and Sligo, which placed north Connaught at his mercy. In 1596 he agreed in conjunction with Tyrone to a cessation of hostilities with the English, and met the Government commissioners near Dundalk.

The terms he demanded were, however, refused. He hoped for help from Philip II. of Spain, with whom he and Tyrone had been in correspondence. In the beginning of 1597 he raided Connaught, where O'Conor Sligo had been set up by the English as a counterpoise to O'Donnell. He devastated the country and returned to Tyrconnel with rich spoils; in 1598 he helped to defeat the English at the Yellow Ford on the Blackwater; and in 1599 he defeated an attempt by the English under Sir Conyers Clifford, governor of Connaught, to succour O'Conor Sligo in Collooney castle, which O'Donnell captured, forcing Sligo to submission. The Government now sent Sir Henry Docwra to Derry, and O'Donnell entrusted to his cousin Niall Garve the task of opposing him. Niall Garve, however, went over to the English, making himself master of O'Donnell's fortresses of Lifford and Donegal. While Hugh Roe was besieging Donegal in 1601, he heard that a Spanish force had landed in Munster. He marched rapidly to the south, and was joined by Tyrone at Bandon, but a night-attack on the English besieging the Spaniards in Kinsale having utterly failed, O'Donnell, who attributed the disaster to the incapacity of the Spanish commander, took ship to Spain on Jan. 6, 1602, to lay his complaint before Philip III. He was favourably received by the Spanish king, but he died at Simancas on Sept. 10 in the same year.

RORY O'DONNELL, 1st earl of Tyrconnel (1575–1608), second son of Hugh MacManus O'Donnell, and younger brother of Hugh Roe, accompanied the latter in the expedition to Kinsale; and when his brother sailed for Spain he transferred his authority as chief to Rory. In 1602 Rory gave in his allegiance to Lord Mountjoy, the lord deputy; and in the following summer he went to London with the earl of Tyrone, when James I. created him earl of Tyrconnel. In 1605 he was made the king's lieutenant in Donegal. But the arrangement between Rory and Niall Garve insisted upon by the Government displeased both O'Donnells, and Rory, like Hugh Roe before him, entered into negotiations with Spain. His country had been devastated by famine and war, and his own extravagance had plunged him in debt. These circumstances and the fear that his designs were known to the Govern-

ment induced him to leave Ireland. In Sept. 1607 "the flight of the earls" (*see* O'NEILL) took place, Tyrconnel and Tyrone reaching Rome in April 1608, where Tyrconnel died on July 28. His wife, the beautiful daughter of the earl of Kildare, was left behind in the haste of Tyrconnel's flight, and lived to marry Nicholas Barnewell, Lord Kingsland. By Tyrconnel she had a son Hugh; and among other children a daughter Mary Stuart O'Donnell, who, born after her father's flight from Ireland, was so named by James I. after his mother. This lady, after many romantic adventures, married a man called O'Gallagher and died in poverty on the Continent.

Rory O'Donnell was attainted by the Irish parliament in 1614, but his son Hugh, who lived at the Spanish court, assumed the title of earl; and the last titular earl of Tyrconnel was this Hugh's son Hugh Albert, who died without heirs in 1642, and who by his will appointed Hugh Baldearg O'Donnell (*see* above) his heir, thus restoring the chieftainship to the elder branch of the family. To a still elder branch belonged Daniel O'Donnell (1666–1735), a general of the famous Irish brigade in the French service, whose father, Turlough, was a son of Hugh Dubh O'Donnell, elder brother of Manus, son of an earlier Hugh Dubh mentioned above. Daniel served in the French army in the wars of the period, fighting against Marlborough at Oudenarde and Marlplaquet at the head of an O'Donnell regiment. He died in 1735.

The famous Cathach, or Battle-Book of the O'Donnells, was in the possession of General Daniel O'Donnell, from whom it passed to more modern representatives of the family, who presented it to the Royal Irish Academy, where it is preserved. This relic, of which a curious legend is told (*see* P. W. Joyce, *A Social History of Ancient Ireland*, 1903, vol. i. p. 501), is a Psalter said to have belonged to St. Columba, a kinsman of the O'Donnells, which was carried by them in battle as a charm or talisman to secure victory. Two other circumstances connecting the O'Donnells with ancient Irish literature may be mentioned. The family of O'Clery, to which three of the celebrated "Four Masters" belonged, were hereditary Ollaves (doctors of history, music, law, etc.) attached to the family of O'Donnell; while the "Book of the Dun Cow" (*Lebor-na-h Uidhre*), one of the most ancient Irish mss., was in the possession of the O'Donnells in the 14th century; and the estimation in which it was held at that time is proved by the fact that it was given to the O'Connors of Connaught as ransom for an important prisoner, and was forcibly recovered some years later.

See O'NEILL, and the authorities there cited.

O'DONNELL, LEOPOLD (1809–1867), duke of Tetuan, Spanish general and statesman, was born at Santa Cruz, Teneriffe, on January 12, 1809. General of division in the army of Queen Christina, he accompanied her into exile in 1840; attempted unsuccessfully a rising in her favour at Pamplona in 1841, helped in the overthrow of Espartero (1843) and from 1844–48 served the new government in Cuba. War minister (1854) under Espartero, he plotted successfully against his chief in 1856 and became head of the cabinet from the July revolution until October, and again in July 1858. He took command of the expedition to Morocco (Dec. 1859) and was made duke after the surrender of Tetuan. He resigned office in 1863 until 1865, resumed it and resigned again in favour of Narvaez in 1866. He died at Bayonne, Nov. 5, 1867.

See C. Navarro y Rodrigo, *O'Donnell y su tiempo* (Madrid, 1869).

O'DONNELL, PATRICK (1856–1927), cardinal archbishop of Armagh, Ireland, was born of humble parents at Kilraine, Donegal, on Nov. 28, 1856, and was educated locally, then at the Catholic university at Dublin, and finally at Maynooth, where he took priest's orders in 1880. Eight years later he became bishop of Raphoe, a see which he held for 34 years, during which he transformed the diocese set in the wild highlands of Donegal. Dr. O'Donnell was a strong constitutional nationalist and one of the wisest men in the party. Perhaps his supreme gift to Ireland was his sense of the importance of substituting peace for the violent religious hatred prevailing in northern Ireland. He believed in good-will for the modification of existing differences due to territorial and religious conditions. He was a member of the Irish convention 1917–18.

In 1923 the pope nominated him coadjutor to Cardinal Logue, archbishop of Armagh, whom he succeeded in the primacy in the following year. In 1925 he received the cardinalate. In 1927 he held a plenary synod of the Irish hierarchy, at which far-reaching reforms were undertaken. The cardinal spoke Gaelic from his childhood and promoted the use of the vernacular. He died on Oct. 22, 1927, at Carlingford.

ODONTOGLOSSUM, a genus of epiphytic plants of the orchid family (Orchidaceae), comprising about 100 species native to the mountains of tropical America. Many species are well known in greenhouse cultivation, including numerous hybrids. *O. grande*, the baby orchid, has showy yellow flowers, barred with cinnamon-brown, 5 in. to 6 in. across. (*See* ORCHIDS.)

ODONTORNITHES, the term proposed by O. C. Marsh for birds possessed of teeth (Gr. *ὀδούς*, tooth, *ὄρνις*, *ὄρνιθος* bird), notably the genera *Hesperornis* and *Ichthyornis* from the Cretaceous deposits of Kansas. In 1875 he divided the "sub-class" into *Odontolcae*, with the teeth standing in grooves, and *Odontotormae*, with the teeth in separate alveoles or sockets. In his magnificent work, *Odontornithes: A monograph on the extinct toothed birds of North America* (New Haven [Conn.], 1880), he logically added the Saururae, represented by *Archaeopteryx*, as a third order. As it usually happens with the selection of a single anatomical character, the resulting classification was unnatural. The Odontornithes, as a matter of fact, are a heterogeneous assembly, and the fact of their possessing teeth proves nothing but that many types of birds still possessed them in Cretaceous times. These teeth are heritages from their reptilian ancestry, of which abundant evidence is found in various parts of the skeleton. No fossil birds of later than Cretaceous age are known to have teeth, and recent birds possess not even embryonic vestiges.

The best known of the Odontornithes are *Hesperornis regalis*, standing about 3ft. high, and the somewhat taller *H. crassipes*. Both show the general configuration of a diver, but whether *Hesperornis* can be regarded as ancestral to the Colymbiformes or whether the many points of resemblance to this group are due to "convergence" is a moot point. There are about 14 teeth in a groove of the maxilla and about 21 in the mandible; the vertebrae are typically heterocoelous; of the wing-bones nothing but the humerus, or upper arm-bone, remained and this was reduced to a vestigial condition; clavicles slightly reduced; coracoids short and broad, movably connected with the scapula; sternum very long, broad and quite flat, without the trace of a keel. Hind limbs very strong and of the Colymbine type, but the outer or fourth capitulum of the metatarsus is the strongest and longest, an unique arrangement in an otherwise typically steganopodous foot. The pelvis shows much resemblance to that of the divers, but there is still an incisura ischiadica instead of a foramen. The tail is composed of about twelve vertebrae, without a pygostyle. *Enaliornis* of the Cambridge Greensand of England, and *Baptornis* of the mid-Cretaceous of North America, are probably allied, but imperfectly known. The vertebrae are biconcave, with heterocoelous indications in the cervicals; the metatarsal bones appear still somewhat imperfectly anchylosed. The absence of a keel led the earlier naturalists to regard *Hesperornis* as one of the Struthious birds, and it has even been described as a "swimming ostrich." But there can be no doubt but that it is to be reckoned as one of the Neognathae which, becoming flightless, lost the keel of the sternum, as some of the land-birds have also done—*e.g.*, the kakapo (*q.v.*) of New Zealand.

There remain the *Odontotormae*, notably *Ichthyornis victor*, *I. dispar*, *Apatornis* and *Graculavus* of the middle and upper Cretaceous of Kansas. The teeth stand in separate alveoli. The vertebrae are amphicoelous, but at least the third cervical has somewhat saddle-shaped articular facets. Tail composed of five free vertebrae, followed by a rather small pygostyle. Shoulder girdle and sternum well developed and of the typical carinate type. Pelvis still with incisura ischiadica. Marsh based the restoration of *Ichthyornis*, which was obviously an aquatic bird possessing full powers of flight, upon the skeleton of a tern, though there is no natural affinity between them. The teeth, vertebrae, pelvis and small brain are all primitive so that the Odontotormae may form a separate order of the Neognathae, near the Colymbomorphous Legion. (W. P. P.)

See G. Hellman, *The Origin of Birds* (1927).

ODO OF BAYEUX (*c.* 1036–1097), Norman bishop and English earl, was a uterine brother of William the Conqueror, from whom he received, while still a youth, the see of Bayeux (1049). But his active career was that of a warrior and statesman. He found ships for the invasion of England and fought in person at Senlac; in 1067 he became earl of Kent, and for some years he was a trusted royal minister. At times he acted as viceroy in William's absence; at times he led the royal forces to chastise rebellions. But in 1083 he was suddenly disgraced and imprisoned for having planned a military expedition to Italy. He was accused of desiring to make himself pope; more probably he thought of serving as a papal condottiere against the emperor Henry IV. The Conqueror, when on his death-bed, reluctantly permitted Odo's release (1087). The bishop returned to his earldom and soon organized a rebellion with the object of handing over England to his eldest nephew, Duke Robert. William Rufus, to the disgust of his supporters, permitted Odo to leave the kingdom after the collapse of this design (1088), and thenceforward Odo was the right-hand man of Robert in Normandy. He took part in the agitation for the first crusade, and started in the duke's company for Palestine, but died on the way, at Palermo (Feb. 1097). Little good is recorded of Odo. His vast wealth was gained by extortion and robbery. His ambitions were boundless and his morals lax. But he was a patron of learning and, like most prelates of his age, a great architect. He rebuilt the cathedral of his see, and may perhaps have commissioned the unknown artist of the celebrated Bayeux tapestry.

Odo must be distinguished from two English prelates of the same name and also from an English earl. Odo or Oda (d. 959), archbishop of Canterbury, was bishop of Ramsbury from 927 to 942, and went with King Aethelstan to the battle of Brunanburh in 937. In 942 he succeeded Wulfhelm as archbishop of Canterbury, and he appears to have been an able and conscientious ruler of the see. He had great influence with King Edwy, whom he had crowned in 956. Odo (d. 1200), abbot of Battle, was a monk of Christ Church, Canterbury, and was prior of this house at the time when Thomas Becket was murdered. In 1175 he was chosen abbot of Battle, and on two occasions the efforts of Henry II. alone prevented him from being elected archbishop of Canterbury. Odo or Odda (d. 1056), a relative of Edward the Confessor, during whose reign he was an earl in the west of England, built the minster at Deerhurst in Gloucestershire.

See the authorities cited for WILLIAM I. and WILLIAM II., the biographical sketch in *Gallia Christiana*, xi. 353–360; H. Wharton, *Anglia Sacra*, i. 334–339 (1691); and F. R. Fowke, *The Bayeux Tapestry* (1898). (H. W. C. D.)

ODORIC (*c.* 1286–1331), styled "of Pordenone," one of the chief travellers of the later middle ages, and a *Beatus* of the Roman Church, was born at Villa Nuova, a hamlet near the town of Pordenone in Friuli, in or about 1286. According to the ecclesiastical biographers, in early years he took the vows of the Franciscan order and joined their convent at Udine, the capital of Friuli.

Friar Odoric was despatched to the East, where a remarkable extension of missionary action was then taking place, about 1316–18, and did not return till the end of 1329 or beginning of 1330. He was in western India soon after 1321 (pretty certainly in 1322) and he spent three years in China between the opening of 1323 and the close of 1328. His route to the East lay by Trebizond and Erzerum to Tabriz and Sultanieh, in all of which places the order had houses. From Sultanieh he proceeded by Kashan and Yázd, and turning thence followed a devious route by Persepolis and the Shiraz and Baghdad regions, to the Persian gulf. At Hormuz he embarked for India, landing at Thana, near Bombay. After visiting many parts of India he sailed in a junk to Sumatra, visiting various ports on the northern coast of that island, and thence to Java, to the coast (it would seem) of Borneo, to Champa (South Cochin-China), and to Canton, at that time known to western Asiatics as *Chin-Kalan* or Great China (Mahachin). He travelled extensively in China, and visited Hangchow, then renowned, under the name of *Cansay*, *Khanzai*, or *Quinsai* (*i.e.*, *Kingsze* or royal residence), as the greatest city in the world, of whose splendours Odoric gives details.

At Peking he remained for three years, attached, no doubt, to one of the churches founded by Archbishop John of Monte Corvino, at this time in extreme old age. Returning overland across Asia, through the Land of Prester John and through Casan, the adventurous traveller seems to have entered Tibet, and even perhaps to have visited Lhasa. He then returned to Venice *via* Persia and Asia Minor. During a part at least of these long journeys the companion of Odoric was Friar James, an Irishman. After his return Odoric went to the Minorite house attached to St. Anthony's at Padua, and there, in May 1330, he related the story of his travels, which was taken down in homely Latin by Friar William of Solagna. Odoric died at Udine on Jan. 14, 1331. The fame of his vast journeys appears to have made a much greater impression on the laity of his native territory than on his Franciscan brethren.

Popular acclamation made him an object of devotion, the municipality erected a noble shrine for his body, and his fame as saint and traveller had spread far and wide before the middle of the century, but it was not till four centuries later (1755) that he was formally beatified.

Odoric's credit was not benefited by the liberties which Sir John Mandeville took with it. The substance of that knight's alleged travels in India and Cathay is stolen from Odoric, though amplified with fables from other sources and from his own invention, and garnished with his own unusually clear astronomical notions. There are many details in Odoric's narrative which prove its genuineness.

The best editions of Odoric are by G. Venni, *Elogio storico alle gesta del Beato Odorico* (Venice, 1761); H. Yule in *Cathay and the Way Thither* (1866), vol. i., pp. 1–162, vol. ii. appendix, pp. 1–42, and H. Cordier, *Les Voyages . . . du . . . frère Odoric . . .* (1891) (edition of Old French version of *c.* 1350). The edition by T. Domenichelli (Prato, 1881) may also be mentioned; likewise those texts of Odoric embedded in the *Storia universale delle Missione Franc scane*, iii. 739–781, and in Hakluyt's *Principal Navigations* (1599); ii. 39–67. *See* also John of Viktring (Joannes Victoriensis) in *Fontes rerum Germanicarum*, ed. J. F. Boehmer; vol. i. ed. by J. G. Cotta (Stuttgart, 1843), p. 391; Wadding, *Annales Minorum*, A.D. 1331, vol. vii., pp. 123–126; Bartholomew Albizzi, *Opus conformitatum . . . B. Francisci . . .*, bk. i. par. ii. conf. 8 (fol. 124 of Milan ed. of 1513): John of Winterthur in Eccard, *Corpus historicum medii aevi*, vol. i. cols. 1894–97, especially 1894; C. R. Beazley, *Dawn of Modern Geography* (1897, etc.), iii. 250–287, 548–549, 554, 565–566, 612–613, etc.

ODYSSEUS (also ODYSEUS, OLYS[S]EUS, Lat. VLIXES, whereof ULYSSES is a mis-writing), one of the best-known Greek heroes.

(1). In Homer, he is son of Laërtes, king of Ithaca, and Anticleia his queen; he succeeds his father as king, is husband of Penelope (*q.v.*) and father of Telemachus. During the Trojan War (*Iliad*) he is prominent as a brave and skilful fighter, but still more as a giver of shrewd counsel and for his daring and cunning enterprises, alone or with Diomedes. After the war he starts to go home, but is driven off his course by unfavourable winds (*Odyssey*), successively visiting numerous unknown regions, (*see* CIRCE, CYCLOPES, LAESTRYGONES, LOTUS-EATERS, SCYLLA), till, losing all his ships and men, he arrives alone on the island of Calypso (*q.v.*). After eight years he is let go, and is wrecked on the coast of the Phaeacians, who receive him hospitably and send him home in one of their ships. All these places are out of the known world, although later writers in antiquity identified them with various regions known to them and have been followed by some moderns. Arrived home, he finds his wife Penelope beset with a number of suitors who are devouring his substance. With the help of Athena, Odysseus and Telemachus, aided by two faithful thralls, kill them all.

(2). After Homer, the character of Odysseus degenerates from a cunning to a wholly unscrupulous and dishonourable man. He tries to shirk service at Troy by pretending to be mad; but Palamedes discovers the trick. In revenge, Odysseus brings about his ruin and death (*see* PALAMEDES). He and Diomedes steal the Palladium (*q.v.*) and in some accounts he tries to murder Diomedes, to get all the credit for himself. After the death of Achilles, Odysseus and Ajax contend for his armour, which is adjudged to the former (*see* AJAX I.). He is at length accidentally killed by

Telegonus, his son by Circe or Calypso; this story is worked up from hints in the *Odyssey*. A common legend makes Odysseus son of Sisyphus (*q.v.*), thus bringing the two notorious rogues together.

There is no need whatever to suppose Odysseus other than a real man, renowned for his skill and resource, about whom in the course of centuries numerous fictions have gathered. The plot of the *Odyssey* is a well-known *märchen*, however, and not a saga; *see* M. P. Nilsson, *History of Greek Religion*, p.38. His name is not Greek, and probably belongs to a prehellenic speech.

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(H. J. R.)

OECOLAMPADIUS, JOHN (1482–1531), German Reformer, whose real name was Hussgen or Heussgen[1], was born at Weinsberg, a small town in Württemberg, but then belonging to the Palatinate. He went to school at Weinsberg and Heilbronn, and then, intending to study law, he went to Bologna, but soon returned to Heidelberg and betook himself to theology. He passed from the study of Greek to that of Hebrew, taking his bachelor's degree in 1503. He became cathedral preacher at Basle in 1515, serving under Christopher von Uttenheim, the evangelical bishop of Basle. From the beginning the sermons of Oecolampadius centred in the Atonement, and his first reformatory zeal showed itself in a protest (*De risu paschali*, 1518) against the introduction of humorous stories into Easter sermons. In 1520 he published his *Greek Grammar*. The same year he was asked to become preacher in the high church in Augsburg. Germany was then ablaze with the questions raised by Luther's theses, and his introduction into this new world, when at first he championed Luther's position especially in his anonymous *Canonici indocti* (1519), seems to have compelled Oecolampadius to severe self-examination, which ended in his entering a monastery for a short time. But in Feb. 1522 he made his way to Ebernburg, near Creuznach, where he acted as chaplain to the little group of reformers who had settled there under the leadership of Franz von Sickingen.

The second period of Oecolampadius's life opens with his return to Basle in Nov. 1522, as vicar of St. Martin's and (in 1523) reader of the Holy Scripture at the university, and after more than a year of earnest preaching and four public disputations in which the popular verdict had been given in favour of Oecolampadius and his friends, the authorities of Basle began to see the necessity of some reformation. They began with the convents, and Oecolampadius was able to refrain in public worship on certain festival days from some practices he believed to be superstitious. Basle was slow to accept the Reformation; the news of the Peasants' War and the inroads of Anabaptists prevented progress; but at last, in 1525, it seemed as if the authorities were resolved to listen to schemes for restoring the purity of worship and teaching. In the midst of these hopes and difficulties Oecolampadius married, in the beginning of 1528, Wilibrandis Rosenblatt, the widow of Ludwig Keller, who proved to be *non rixosa vel garrula vel vaga*, he says, and made him a good wife. After his death she married Capito, and, when Capito died, Bucer. She died in 1564. In Jan. 1528 Oecolampadius and Zwingli took part in the disputation at Berne which led to the adoption of the new faith in that canton, and in the following year to the discontinuance of the Mass at Basle. The Anabaptists claimed Oecolampadius for their views, but in a disputation with them he dissociated himself from most of their positions. He died on Nov. 24, 1531.

Oecolampadius was not a great theologian, like Luther, Zwingli or Calvin, and yet he was a trusted theological leader. With Zwingli he represented the Swiss views at the unfortunate conference at Marburg. His views on the Eucharist upheld the metaphorical against the literal interpretation of the word "body," but he asserted that believers partook of the sacrament more for the sake of others than for their own, though later he emphasized it as a means of grace for the Christian life. To Luther's doctrine of the ubiquity of Christ's body he opposed that of the presence and activity of the Holy Spirit in the church. He did not minutely analyse the doctrine of predestination as Luther, Calvin and Zwingli did, contenting himself with the summary "Our Salvation is of God, our perdition of ourselves."

[1]Changed to Hausschein and then into the Greek equivalent.

See J. J. Herzog, *Leben Joh. Oecolampads u. die Reformation der Kirche zu Basel* (1843); K. R. Hagenbach, *Johann Oecolampad u. Oswald Myconius, die Reformatoren Basels* (1859). For other literature *see* W. Hadorn's art. in Herzog-Hauck's *Realencyklopädie für prot. Rel. u. Kirche*.

OECUMENICAL, a word chiefly used in the sense of belonging to the universal Christian Church. It is thus specifically applied to the general councils of the early church (*see* COUNCIL). In the Roman Church a council is regarded as oecumenical when it has been summoned from the whole church under the presidency of the pope or his legates; the decrees confirmed by the pope are binding. The word has also been applied to assemblies of other religious bodies, such as the Oecumenical Methodist Conference, which met for the first time in 1881.

OEDIPUS, the central figure of the Theban saga (Gr. *Oidipous*, probably "Swell-foot"). In Homer we are told that he unwittingly killed his father and married his own mother, Epikaste (the Jocasta of later writers), and that she hanged herself when the matter became known. Oedipus continued, though in great tribulation, to reign in Thebes, apparently until his death. (*Odyssey* xi. 271 *et seq.*, *Iliad*, xxiii, 679). According to the post-Homeric story, Laius, king of Thebes, received an oracle that his son should slay him; therefore, when his wife Jocasta bore a son, he exposed him on Mt. Cithaeron, with a spike driven through his feet. He was saved, however, and was adopted by the childless Polybus, king of Corinth. Reaching manhood, he had occasion to visit Delphi, where he was told that he would slay his father and wed his mother. Departing in great horror, and resolving never to return to Corinth, he met Laius, whom he did not recognize, and killed him in a quarrel. Coming to Thebes, he found the city plagued by the Phix or Sphinx, a winged monster, usually represented with the head of a woman, who asked all passers-by a riddle, killing them if they could not answer. Oedipus solved the riddle, the Sphinx killed herself in disgust, and he was rewarded, according to the promise made by the regent, Creon, son of Menoeceus, with the kingdom and the hand of his sister, the widowed queen. They had two sons, Eteocles and Polyneices, and two daughters, Antigone and Ismene. But later, the whole story came to light; Jocasta hanged herself, Oedipus put out his own eyes, and then lived shut up in a room of the palace (ordinary version), or went into exile, ultimately dying at Colonus and becoming a protecting hero of Attica (Athenian version, *see* Sophocles, *Oedipus Coloneus*). His sons proved undutiful and he cursed them. Therefore they quarrelled over the kingship, finally agreeing to reign alternately. Eteocles' turn came first; Polyneices went into temporary exile, and married Argeia, daughter of Adrastus, king of Argos, whose other daughter, Deiphyle, married Tydeus of Calydon. The latter had gone into exile for homicide; he and Polyneices met and quarrelled, and Adrastus recognized them, by their dress or their shield-devices, as the lion and boar to whom the gods had bidden him betroth his daughters. At the end of a year, Polyneices claimed to rule Thebes in his turn; Eteocles refused, and Adrastus gathered an army to restore his son-in-law. The chieftains, besides the three already named, were Capaneus, Amphiaraus (*q.v.*), Eteoclus, and Parthenopaeus, son of Atalante. Of these, known as the Seven against Thebes, only Adrastus returned. Tydeus would have been made immortal for his valour, but Athena saw him gnaw the head of a slain enemy as he lay dying, and in disgust withheld the intended gift. Amphiaraus was swallowed up in the ground, and in later times was much revered as an oracular hero or god. Polyneices killed Eteocles and was killed by him. Creon now became king; he ordered the bodies of the dead Argives to be left unburied, but Antigone secretly buried her brother, Polyneices. For this, despite the entreaties of his son, Haemon, to whom she was betrothed, Creon walled her up in a tomb (a form of ordeal; the gods might save her if they approved of her conduct). She

hanged herself, Haemon, who had broken into the tomb, killed himself, and so did Creon's wife Eurydice, on hearing the news (so Sophocles; in Euripides, Antigone escaped and lived happily with Haemon, at least for some years; *see* the fragments of his *Antigone* in Nauck). According to an Attic legend, Theseus (*q.v.*) attacked Thebes at the prayer of the mothers of the slain, and forced the Thebans to bury them; Creon was killed by Theseus in the battle. Another story represents him as surviving for many years, to be ultimately killed by the usurper Lycus (so Euripides, *Herc. Fur.*, 33). Oedipus died before, or not long after, the end of the war.

Adrastus bided his time, and when the sons of the Seven (known as the *Epigonoi*, or second generation; hence the application of the word to successors of the *Diadochi* (*q.v.*), the immediate successors of Alexander the Great) came to manhood, he once more attacked the city. On the advice of Teiresias (*q.v.*) the Thebans evacuated the place by night. Adrastus led his army back, but died on the way, at Megara, from grief at the death of his son Aigialeus, the only one of the *Epigonoi* to fall in the campaign.

There is no reason to doubt that this legend has a historical basis, probably in the events of Minoan-Mycenaean times. Gems from Thisbe show incidents strongly resembling the fight between Oedipus and Laius, and the former's encounter with the Sphinx; *see* Sir A. Evans in *Journ. Hell. Stud.* xlv. (1925), p. 27 *et seq.* Several incidents, such as the prophecies and the incestuous marriage, are patently folk-tales.

For further details, and the various attempts to make Oedipus a "faded" god of one sort or another, *see* the relevant articles in Roscher's *Lexikon* and Pauly-Wissowa, *Realencyklopädie*, also Preller-Robert, *Gr. Mythologie*, ii., p. 130; 876 *et seq.*; Farnell, *Hero-Cults*, p. 332 *et seq.*

Mediaeval Legends.—In the *Golden Legend* of Jacobus de Voragine (13th century) and the *Mystère de la Passion* of Jean Michel (15th century) and Arnoul Gréban (15th century), the story of Oedipus is associated with the name of Judas. The main idea is the same as in the classical account. The Judas legend, however, never really became popular, whereas that of Oedipus was handed down both orally and in written national tales (Albanian, Finnish, Cypriote). The Theban legend, which reached its fullest development in the *Thebais* of Statius and in Seneca, reappeared in the *Roman de Thèbes* (the work of an unknown imitator of Benoît de Sainte-More). Oedipus is also the subject of an anonymous mediaeval romance (15th century), *Le Roman d'Oedipus, fils de Layus*, in which the sphinx is depicted as a cunning and ferocious giant. The Oedipus legend was handed down to the period of the Renaissance by the *Roman* and its imitations, which then fell into oblivion. The legend has survived amongst the modern Greeks, without any traces of the influence of Christianity (B. Schmidt, *Griechische Märchen*, 1877). The works of the ancient tragedians (especially Seneca, in preference to the Greek) came into vogue, and were followed by modern imitators down to the 17th century.

See L. Constans, *La Légende d'Oedipe dans l'antiquité, au moyen âge, et dans les temps modernes* (1881); D. Comparetti's *Edipo* and Jebb's introduction to his ed. of Sophocles, *Oedipus Tyrannus*; for the "Oedipus Complex" *see* Psychology. (H. J. R.)

OELS, a town in the Prussian province of Silesia, on the Oelsbach, 20 m. N.E. of Breslau by rail. Pop. (1925) 14,418. Oels was founded about 940, and became a town in 1255. It appears as the capital of an independent principality at the beginning of the 14th century. The principality, with an area of 700 sq.m. and about 130,000 inhabitants, passed through various hands and in 1884 it lapsed to the crown of Prussia. The château, dating from 1558, was restored in 1891–94. Of its three Evangelical churches, the Schlosskirche dates from the 13th century, and the Propstkirche from the 14th. The inhabitants are chiefly engaged in making shoes, furniture and machines.

OELWEIN, a city of Fayette county, Iowa, U.S.A., in the north-eastern part of the State; served by the Chicago Great Western and the Rock Island railways. Pop. (1925 State census) 8,058. It is in a rich farming, dairying and stock-raising region, and has large railroad shops and various other manufacturing industries. The city was founded in 1873, by August Oelwein; was incorporated in 1888, and chartered as a city in 1897.

OENOMAÜS in Greek legend, son of Ares and Harpinna, king of Pisa in Elis and father of Hippodameia. It was predicted that he should be slain by his daughter's husband. His father gave him winged horses and Oenomaüs promised his daughter to the man who could carry her off in a chariot; he himself was to drive after, and spear the suitor if he could catch him. This may be founded on some marriage rite of simulated capture. Thirteen aspirants having thus perished, Pelops (*q.v.*) arrived, and won, having winged horses which Poseidon had given him. He is usually said to have bribed Oenomaüs' charioteer Myrtilus to take out his master's linch-pins and substitute wax dummies; Oenomaüs was thus thrown and killed.

See Diod. Sic. iv. 73; Pausanias vi. 21, and elsewhere; Sophocles, *Electra*, 504, with Jebb's note; Hyginus, *Fab.* 84. 253.

OENONE, in Greek legend, daughter of the river-god Cebren and wife of Paris, who deserted her to kidnap Helen (*q.v.*). Just before the capture of the city, Paris, wounded by Philoctetes, sought the aid of Oenone, who had told him that she alone could heal him if wounded. She refused to help him, and Paris returned to Troy and died of his wound. Oenone soon repented and hastened after him, but finding that she was too late to save him slew herself from grief at the sight of his dead body.

OENOTHERA, the generic name of the evening primrose, several species of which are favourite garden plants. The genus, which comprises numerous species, is confined to America and belongs to the family Onagraceae. The evening primrose acquired importance in connection with H. de Vries' theory of mutations. (*See* Primrose, Mutation, Heredity.)

OESEL: *see* Saare Maa.

OESOPHAGUS, DISEASES OF. (*See* Alimentary Canal.) The human oesophagus is liable to certain accidents and diseases, from its function and its situation. One of the commonest accidents is the lodgment of foreign bodies. An impacted substance may be removed by the oesophageal forceps, or a coin-catcher or may be pushed down into the stomach. A purgative should never be given, but soft food such as porridge. Should gastric symptoms develop operation may be necessary. Charring and ulceration of the oesophagus may occur from the swallowing of corrosive liquids, strong acids or alkalis, or even of boiling water. Stricture of the oesophagus may be spasmodic, fibrous or malignant. *Spasmodic stricture* usually occurs in young hysterical women; under an anaesthetic a bougie will slip down easily. *Fibrous stricture* is usually situated behind the cricoid cartilage, and results from swallowing corrosive fluids or the healing of a syphilitic ulcer. Occasionally it is congenital. The ordinary treatment is repeated dilatation by bougies. *Malignant strictures* are usually squamous cell carcinoma (*see* Tumours) and chiefly occur in males between the ages of 40 and 70 years. An X-ray photograph taken after the patient has swallowed a preparation of bismuth will show the situation of the growth, and Killian and Brünig have introduced the oesophagoscope, which makes direct examination possible. Dilatation by bougies must not be attempted, the oesophagus being so softened by disease that perforation might take place. Radium treatment, so far, has not been successful. The method of transpleural approach to the thoracic oesophagus and insertion of radium into the wall of the tube has been introduced, but as yet it is too early to evaluate the results. The most satisfactory treatment is the operation of gastrotomy, a permanent artificial opening being made into the stomach through which the patient can be fed.

OETA (mod. *Katavothra*), a mountain in Greece, 7,080 ft. high, to the S. of Thessaly, between the valleys of the Spercheius and the Boeotian Cephissus. Its east end, Callidromus, overhangs the sea at the famous pass of Thermopylae (*q.v.*). There was also a high pass W. of Callidromus into the upper Cephissus. In mythology Oeta is the scene of the death of Heracles.

OFFA (d. 796), king of Mercia, obtained that kingdom in A.D. 757, after driving out Beornred, who had succeeded a few months earlier on the murder of Aethelbald. He traced his

descent from Pybba, the father of Penda, through Eowa, brother of that king, his own father's name being Thingferth. In 779 he was at war with Cynewulf of Wessex from whom he wrested Bensington. It is not unlikely that the Thames became the boundary of the two kingdoms about this time. In 787 the power of Offa was displayed in a synod held at a place called Cealchyth. He deprived Jaenberht, archbishop of Canterbury, of several of his suffragan sees, and assigned them to Lichfield, which, with the leave of the pope, he constituted as a separate archbishopric under Hygeberht. He also took advantage of this meeting to have his son Ecgferth consecrated as his colleague, and that prince subsequently signed charters as *Rex Merciorum*. In 789 Offa secured the alliance of Berhtric of Wessex by giving him his daughter Eadburg in marriage. In 794 he appears to have caused the death of Aethelberht of East Anglia, though some accounts ascribe the murder to Cynethryth, the wife of Offa. In 796 Offa died after a reign of 39 years and was succeeded by his son Ecgferth.

It is customary to ascribe to Offa a policy of limited scope, namely the establishment of Mercia in a position equal to that of Wessex and of Northumbria. This is supposed to be illustrated by his measures with regard to the see of Lichfield. It cannot be doubted, however, that at this time Mercia was a much more formidable power than Wessex. Offa, like most of his predecessors, probably held a kind of supremacy over all kingdoms south of the Humber. He seems to have entertained the design of putting an end to the dependent kingdoms. At all events we hear of no kings of the Hwicce after about 780, and the kings of Sussex seem to have given up the royal title about the same time. Further, there is no evidence for any kings in Kent from 784 until after Offa's death. To Offa is ascribed by Asser, in his life of Alfred, the great fortification against the Welsh which is still known as "Offa's dike." It stretched from sea to sea and consisted of a wall and a rampart. An account of his Welsh campaigns is given in the *Vitae duorum Offarum*, but it is difficult to determine how far the stories there given have an historical basis.

See *Anglo-Saxon Chronicle*, ed. J. Earle and C. Plummer (1899), *s.a.* 755, 777, 785, 787, 792, 794, 796, 836; W. de G. Birch, *Cartularium Saxonicum* (1885–93), vol. i.; Asser, *Life of Alfred*, ed. W. H. Stevenson (1904); *Vitae duorum Offarum* (in works of Matthew Paris, ed. W. Wats, 1640).

OFFA, the most famous hero of the early Angli. He is said by the Anglo-Saxon poem *Widsith* to have ruled over Angel, and the poem refers briefly to his victorious single combat, a story which is related at length by the Danish historians Saxo and Svend Aagesen. Offa (Uffo) is said to have been dumb or silent during his early years, and to have only recovered his speech when his aged father Wermund was threatened by the Saxons, who insolently demanded the cession of his kingdom. Offa undertook to fight against both the Saxon king's son and a chosen champion at once. The combat took place at Rendsburg on an island in the Eider, and Offa succeeded in killing both his opponents. According to *Widsith* Offa's opponents belonged to a tribe or dynasty called Myrgingas, but both accounts state that he won a great kingdom as the result of his victory. A somewhat corrupt version of the same story is preserved in the *Vitae duorum Offarum*, where, however, the scene is transferred to England. It is very probable that the Offa whose marriage with a lady of murderous disposition is mentioned in Beowulf is the same person; and this story also appears in the *Vitae duorum Offarum*, though it is erroneously told of a later Offa, the famous king of Mercia. Offa of Mercia, however, was a descendant in the 12th generation of Offa, king of Angel. It is probable from this and other considerations that the early Offa lived in the latter part of the 4th century.

See H. M. Chadwick, *Origin of the English Nation* (1907), where references to the original authorities will be found.

OFFALY COUNTY, a county of Ireland in the province of Leinster, bounded north by Meath and Westmeath, west by Roscommon, Galway and Tipperary (the boundary with the first two counties being the river Shannon); south by Tipperary and Leix County, and east by Kildare. The area is 493,999 acres or about 772 sq.m. Pop. (1926) 52,521. The greater part of the county is included in the Carboniferous Limestone plain of central Ireland. In the south-east the Slieve Bloom Mountains, composed largely of Old Red Sandstone, form the boundary between Offaly County and Leix County, and run into the former county from south-west to north-east for a distance of about 20 m. consisting of precipitous crags through which there are two narrow passes, the Black Gap and the Gap of Glandine. In the north-east, basic volcanic rocks rise in Croghan Hill to a height over 700 ft. In the centre of the county from east to west a large portion is occupied by the Bog of Allen. Here and there drier deposits of esker-gravels rise as green hills above the clay soils and bogs of the plain. The county shares in the advantage of the navigation of the Shannon, which skirts its western side. The Brosna, which issues from Loch Ennell in Westmeath, enters the county near the town of Clara, and joins the Shannon after receiving the Clodagh and the Broughill. A small portion of the north-eastern extremity is skirted by the upper Boyne. The Barrow forms the south-eastern boundary with Leix. The Little Brosna, which rises in the Slieve Bloom Mountains, forms the boundary of Offaly County with Tipperary, and flows into the Shannon.

Offaly County, with portions of Tipperary, Leix County and Kildare, at an early period formed one kingdom under the name of Offaly, a title which it retained after the landing of the English. Subsequently it was known as Glenmallery, Western Glenmallery corresponding closely to the present Offaly County, and Eastern Glenmallery to Leix County. These two divisions were formed into shires in 1556, being then known as King's County and Queen's County respectively.

In the Slieve Bloom Mountains is a pyramid of white stones called the Temple of the Sun or the White Obelisk. There are many Danish raths, and a chain of moats commanding the passes of the bogs extended throughout the county. On the borders of Tipperary is an ancient causeway leading presumably to a crannog or lake-dwelling. The most important ecclesiastical ruins are those of the seven churches of Clonmacnoise (*q.v.*) on the Shannon in the north-west of the county, where an abbey was founded by St. Kieran in 648, and where the remains include those of churches, two round towers, crosses, inscribed stones and a castle. Other famous religious houses were Durrow Abbey, founded by St. Columba in 550; Monasteroris founded in the 14th century by John Bermingham, earl of Louth; and Seirkyran Abbey, founded in the beginning of the 5th century. The principal old castles are Rathmore, probably the most ancient in the county; Banagher, commanding an important pass on the Shannon; Leap Castle, in the Slieve Bloom Mountains; and Birr or Parsonstown.

The whole of the county would appear to have been covered formerly by a vast forest, and the district bordering on Tipperary is still richly wooded. The soil is generally either a deep bog or a shallow gravelly loam. On the borders of the Slieve Bloom Mountains there are some very rich pastures, and there are also extensive grazing districts on the borders of Westmeath, chiefly occupied by sheep. Along the banks of the Shannon there is good meadow land. With the exception of the tract occupied by the Bog of Allen, the county is nearly all under tillage, the most productive portion being that to the north-west of the Hill of Croghan. Oats, barley and rye, potatoes and turnips, are all considerably grown; wheat is almost neglected, and the acreage of all crops has a decreasing tendency. Cattle, sheep, pigs and poultry are bred increasingly; dairies are numerous in the north of the county, and the sheep are pastured chiefly in the hilly districts.

The county is traversed from south-east to north-west by the Portarlington, Tullamore, Clara and Athlone line of the Great Southern railway, with a branch from Clara to Banagher; other branches run from Roscrea (Co. Tipperary), to Parsonstown (Birr), from Enfield (Co. Kildare) to Edenderry, and from Streamstown (Co. Westmeath) to Clara. The Grand Canal runs through the county from east to west, entering the Shannon at Shannon harbour.

The administrative counties of Leix and Offaly together return 5 members to Dáil Eireann.

OFFENBACH, JACQUES (1819–1880), French composer of *opéra bouffe,* was born at Cologne, of German Jewish parents, on June 21, 1819. In 1833 he was sent to Paris to study the violoncello at the conservatoire. As a member of the orchestra of the Opéra Comique, he turned his opportunities to good account and eventually was made conductor at the Théâtre Français. His first complete work, *Pepito* (Opéra Comique, 1853), was followed by a crowd of light dramatic pieces of a light character, which effected a complete revolution in the popular taste of the period. Offenbach obtained a lease of the Théâtre Comte in the Passage Choiseul, reopened it in 1855 under the title of the Bouffes Parisiens, and produced a succession of brilliant, humorous trifles. Ludovic Halévy, the librettist, was associated with him from the first, but still more after 1860, when Halévy obtained Henri Meilhac's collaboration (*see* HALÉVY). Beginning with *Les Deux Aveugles* and *Le Violoneux,* the series culminated in 1867 with *La Grande Duchesse de Gérolstein,* perhaps the most popular *opéra bouffe* that ever was written, not excepting even his *Orphée aux enfers,* produced in 1858. In 1866 his own connection with the Bouffes Parisiens ceased, and he wrote for various theatres. In twenty-five years Offenbach produced no less than sixty-nine complete dramatic works, some of which were in three or even in four acts. Among the latest of these were *Le Docteur Ox,* founded on a story by Jules Verne, and *La Boîte au lait,* both produced in 1877, and *Madame Favart* (1879). Offenbach died at Paris on Oct. 5, 1880. *Les Contes d'Hoffmann,* posthumously published, was revised by Léo Delibes, and has proved, as he himself prophesied, the most popular of all his works.

See P. Bekker, *Jacques Offenbach* (1909); E. Rieger, *Offenbach und Seine Wiener Schule* (1920); L. Schneider, *Offenbach* (Paris, 1923).

OFFENBACH, a town of Germany, in the republic of Hesse, on the left bank of the Main, 5 m. E.S.E. of Frankfort-on-Main, with which it is connected by the railway to Bebra and by a local electric line. Pop. (1925) 79,362. The earliest mention of Offenbach is in a document of 970. In 1486 it came into the possession of the counts of Isenburg, and in 1816, when their lands were mediatized, it was assigned to Hesse. French Protestant refugees settled here at the end of the 17th, and the beginning of the 18th century, and brought prosperity which increased with the accession of Hesse to the German Zollverein in 1828. The most interesting building in the town is the Renaissance château of the counts of Isenburg. Offenbach is the principal industrial town of the republic, and manufactures include chemicals, boilers, machines, wire goods and celluloid. Its characteristic industry, however, is the manufacture of fancy goods in leather.

OFFENBURG, a town of Germany, in the republic of Baden, 27 m. by rail S.W. of Baden, on the river Kinzig. Pop. (1925) 16,613. Offenburg is first mentioned about 1100. In 1223 it became a town; in 1248 it passed to the bishop of Strassburg; and in 1289 it became an imperial free city. Soon this position was lost, but it was regained about the middle of the 16th century, and Offenburg remained a free city until 1802, when it became part of Baden. The chief industries are dyeing and the making of cotton, linen, silk, cement, machinery, cigars and glass.

OFFICE, a duty or service, particularly the special duty cast upon a person by his position; also a ceremonial duty, as in the rites paid to the dead, the "last offices." The term is thus especially used of a religious service, the "daily office" of the English Church or the "divine office" of the Roman Church (*see* BREVIARY). It is also used in this sense of a service for a particular occasion, as the Office for the Visitation of the Sick, etc. For the "Holy Office" *see* INQUISITION.

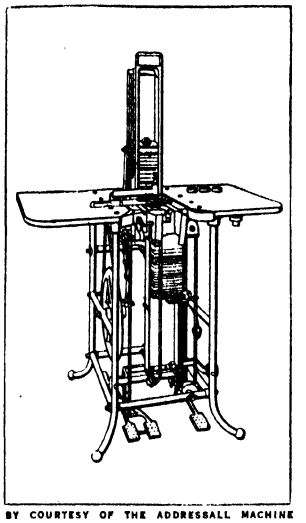
OFFICE APPLIANCES. Many office tasks, being of a repetitive character, naturally adapt themselves to the principle of "division of labour," and consequently to the use of machinery also. But these facts alone are not sufficient justification for the purchase of appliances. Four purposes are considered by good office management in deciding when the use of machinery is advisable. These are:—

Objects of the Appliances.—(1) To save labour. This saving should be evidenced in a reduced pay roll. Hypothetical savings of "half a man" are seldom realized.

(2) To save time. In many cases this is more important than the saving of labour; to speed up a slow routine, extra expenditure is often an economic advantage.

(3) To promote accuracy. Mechanical methods are advisable when accuracy is vitally important and otherwise difficult to obtain.

(4) To avoid monotony. The substitution of a machine for manual repetitive movements will usually achieve this.



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Inventive skill and genius have not been lacking to meet these needs, and the list of available devices is very long, machinery being now extensively used.

Adding and calculating machines are largely used for the promotion of accuracy, and save time by avoiding extended search for errors. The ordinary clerk is usually incapable of correctly handling a large amount, even of simple calculations, with a fair degree of accuracy by the mental-manual method, and these machines have therefore become a practical necessity for the modern business office.

Adding Machines.—All adding machines may be used for addition, subtraction, multiplication and division; but as certain types are better adapted for multiplication and division, a technical distinction has grown up in the trade between adding and calculating machines, the latter being used more extensively for multiplication and division.

There are two principal types of adding machines: those which print on paper the amount being added, and those which do not—the former being known as listing, and the latter as non-listing machines. The listing machines are again divided into two classes, the first being the full keyboard model carrying a row of keys numbered from 1 to 9 for each column, and the machine of the second class having ten keys arranged in two or three rows. Each of these keys represents a digit, and the depression of a key for an item automatically causes progressive columnar position. Thus, if 23 is to be added, the 2 is first depressed, then the 3 and the mechanism takes care of the numerical order. The items are printed either on a roll of narrow paper or on a wide form held in the carriage of the machine.

Some models have two sets of adding dials—one for accumulating individual totals, the other for accumulating a grand total. On some machines a "split" feature provides for splitting the printing mechanism into two or more sections, so that several columns may be listed and added at the same time and the total of one or more columns printed. On others, subtraction is accomplished by means of complementary numbers, a "complement" being any number which, added to another, makes a full number. Thus if the digits are changed to 9's—as 9, 99, 999 and so on—and a 1 then added, we can convert any number into a full or complementary number on the keyboard of any adding machine. The complementary numbers are usually indicated by small figures on the keys, the two digits on a key, if added, invariably making nine. Other machines perform subtraction by depressing a subtract key. Multiplication is consecutive addition. Thus, if 26 is to be multiplied by 5, it is merely added five times. For division, the divisor is subtracted from the dividend as many times as it is contained in that dividend, the number of subtractions being automatically registered on the counting wheels as a quotient. There is also a small portable adding machine, weighing about 7 lb., operated with a pull-down lever keyboard. A very small adding device, known as a vest pocket machine, is operated by inserting a pick or stylus, in positions for the

amounts.

Calculating Machines.—Where rapid addition, multiplication, subtraction and division are required, and no need for a printed record exists, calculating machines are used. They do not print a record of the items, but indicate the result on total dials. One type, known as the key-driven, causes the items to appear immediately on the dials when the keys are depressed, the operation of a crank clearing the figures off the dial faces again. As with adding machines, the four arithmetical operations are all performed as variations of simple addition. In another type, known as the key-set, the amounts are first set up on the keyboard and operation of the machine, either by hand or by motor, effects the calculation. The total dials, situated in the laterally moving carriage above the keyboard, show the total in addition, the product in multiplication, the minuend or remainder in subtraction and the quotient in division. Proof dials, placed in, above or below the carriage, show the multiplier in multiplication and the divisor in division. An extra set of dials is sometimes provided, which furnish an additional check for accuracy by showing the amounts set up on the keyboard. The dials are cleared by various means, distinctive with each make of machine.

For subtraction, the amount from which the deduction is to be made is set up, the operation of the machine causing that figure to appear on the total dials. The figure to be subtracted is then set up and the machine operated and the answer appears on the total dials. Multiplication is consecutive addition, though in some models multiplication is by means of a plus bar; in others, by means of an extra row of multiplying keys. Division is consecutive subtraction, some models dividing by means of a minus key, while another model provides for setting up amounts by means of levers pulled down to the desired numbers, this machine otherwise conforming to the key-set type.

A recent invention is a tape-printing calculating machine which prints the factors, figures and prints the answer and accumulates a total of all answers, all on a single operating stroke. It is primarily designed for accomplishing calculations in multiplication at high speed (20 multiplications a minute) by a direct, single cycle operation, and to provide printed totals of resulting products automatically. It is equally suitable for performing division by reciprocals; as an adding machine, it is equipped to subtract directly. The production speed, after the factors are set up, is uniformly 2½ or 3 seconds per calculation (depending upon the timing of the mechanism) regardless of the size of the factors; that is, a problem such as 649,538×369,486 is as speedily computed as 2×2. The decimal place in the printed answer is automatically positioned. Its adding feature is not as rapid as with some of the standard adding machines. There are two keyboards with a capacity of six columns; the product or totaling capacity is 14 places. The multiplicand is set up on the left keyboard, the multiplier on the right. The machine, being motor driven, merely needs the depression of the motor control to multiply one factor by the other and print them side by side, together with the product, in a straight line on a detail strip.

Book-keeping Machines.—The so-called book-keeping machine is in reality a device for posting on loose ledger sheets or cards. The amount is not merely entered to the account as in hand book-keeping—to be added and balanced at a specified period—but a balance is struck each time a posting is made. The original entry from which the account is posted is usually a sales ticket, credit slip or copy of the invoice. (*See* BOOK-KEEPING.)

All such machines are designed to print and add an old balance, print and add debit items, print and subtract credit items and compute the new balance, in some cases printing it automatically, in others showing it in the adding and subtracting mechanism so that it may be copied in the proper column by the operator. Proof of the correctness of posting varies with the type of machine. One type is an adding machine which subtracts directly; it is equipped with means for printing dates, folio numbers, characters and abbreviations, and with a tabulating carriage which moves automatically to the next column as each amount is computed and printed, and in some cases returns automatically to any required position on the printing line. Both vertical and horizontal columns are added, subtracted and computed. Items are set up as on an adding machine, the operation of the motor causing them to be printed, added or subtracted. When a new balance is printed, the accumulator clears, ready for the next operation. Some models have two counters, thus making it possible to compute individual balances and accumulate a total of all postings. The keyboard may be split into two sections so that both ledger and statement can be inserted in the carriage and posted at the same operation—that posting being automatically repeated.

The design of a second class of book-keeping machine embodies a typewriter—on which any description may be typed—and a calculating machine, built as one unit. Some machines add and subtract in vertical columns; others compute amounts across the sheets as well. The typewriter carriage moves to correct column positions by means of a decimal tabulator. Typing the amounts on the number keys effects addition or subtraction. The amounts are visible in registers or totalizers placed either on the carriage truck, in positions corresponding to the columns to be added or subtracted, or at the front of the machine below the keyboard. In posting, a new balance is computed, and the operator types in the proper column the amount appearing in the register which functions to compute across the sheet. If the typing is correct, this register clears. Ledger and statement are made at the same time, in some cases by means of a carbon and in others by the split-platen method, one machine of this class being unique in that its typewriter section is mounted on a carriage which moves from left to right across a flat printing surface on which the forms are held, a back and forward motion providing line spacing. Registers are mounted on the rear of the typewriter section, and ledger and statement are posted at one operation by means of carbon.

A third class of machine carries, below the typewriter keyboard, a 10-key keyboard which controls the calculating mechanism. Here the split-platen method is used for making ledger and statement at the same time. Still another class, used for ledger posting and instalment accounts, follows cash register design, amounts being set up on a push-in key-set keyboard and turned into the mechanism by the operation of the motor. There is a sliding printing table on which the forms to be posted are inserted. Two forms may be posted at the same time, the amount being printed on one and repeated on the other. This machine automatically computes and prints the amount of the balance outstanding on each account. Debits and credits are classified and a total of each is accumulated, as many as 18 individual and two group totals being obtainable. A detailed record of all postings is printed on a strip of paper inside the machine.

Billing Machines.—The writing of an invoice for goods sold, by means of a carbon duplication, can be made to serve other purposes also, and it is quite common at one writing to make the invoice, the original sales record, the shipping notice, the shipping record and other memoranda required for various kinds of business. By means of calculating devices, the amounts of the items may be computed and totals accumulated for controlling accounts. Combination typewriters designed to do this work are known as billing machines. These are designed to write, at one operation, the several necessary copies of orders, invoices, bills of lading and other forms and in some cases to compute amounts as they are written. Cut forms, printed and padded in individual sets so that each set is torn off and loose carbon inserted between the sheets to make the necessary copies, are used with some machines. Others use continuous-length forms, which provide multiple copies of the same or related forms, in rolls or folded flat, these forms being fed through the machine with the carbon interleaved between the copies, so that it is not necessary to insert new forms after writing each set.

Among the billers which write, but do not compute, is an ordinary correspondence typewriter equipped with an inbuilt carbon-changing device which removes the carbons from a set of continuous-length forms just written and inserts them in another set. Another non-computing biller has a standard keyboard typewriter mounted on a carriage which moves from left

to right across the flat writing surface over which the forms are fed. Cut forms may be used with this machine, and it may be equipped to add in vertical columns and to cross compute as well. Book-keeping machines which combine a typewriter with a calculating mechanism have been adapted to billing work which requires the adding or subtracting of amounts as they are typed. One such has an inbuilt carbon-changing device which provides for the use of continuous-length forms; another uses cut forms and may be equipped with a split cylinder so that billing and ledger posting can be done simultaneously.

Still another embodies a typewriter and a calculating mechanism which handles addition, subtraction and multiplication, and is operated from a separate 10-key keyboard below the typewriter keyboard. By means of a split-platen, billing and ledger posting can be done at the same time.

Accounting and Tabulating Machines.—The preparation of statistics requires, first, the sorting of data and, second, the accumulation, by classes, of the amounts involved. Machines for this work were first used by the U.S. Census Bureau, but are now being rapidly adapted to business uses, such as cost work, sales analysis and similar work.

Cards printed with vertical columns numbered from 0 to 9, or from 0 to 12, and separated into fields of one or more columns, each field representing an item, such as department, job number and so forth, form the basis of two systems. Facts are expressed in figures, letters or symbols, and are recorded by perforations on the card at the proper numerical positions, made by a punching machine which operates like a typewriter. The cards are then arranged by a sorting machine, according to a predetermined classification. Contact—electrical or mechanical, depending on the make of the machine—sets the mechanism in motion. The cards are next fed through the tabulating machine, which makes a printed final report, in multiple if so desired. Contact through the perforations causes the machine to designate and add what has been perforated into the cards—listings, sub-totals, totals or grand totals being obtained, depending upon the arrangement desired for the report.

Alphabetical Machines.—A recent improvement is a machine fitted to print a condensed alphabet by symbols as well as figures. This improvement makes it possible to perform automatically many operations, such as the writing of invoices of standard products, keeping stock records and the like. When detailed listing and printing is not required, a non-printing tabulator registers the quantities in counters which accumulate the totals, the figures being posted by hand to report forms. The 80 column card now available permits finer classification and enables a greater number of products or facts to be recorded.

Another type of machine is built on the same principle as the book-keeping machine of cash-register design. Twenty-seven keys, each representing a classification, accumulate individual totals and as many as three grand totals can be obtained and the number of items in each classification counted. A continuous permanent record of all operations is made within the machine on a roll of paper called a visible audit sheet, and notations may be hand-written opposite any printed item. This record may be used as a posting medium, a proof sheet or a permanent record. A ticket may be issued on any operation, showing the date, serial number, identifying numbers, symbols for the totals used and the amount. It may be used as a voucher, pay ticket, receipt, requisition or posting medium or for filing purposes. The same information may be printed on any form inserted in the printing-table.

Duplicating Machines.—In offices there is much need for devices that will quickly produce multiple copies of typewriting or handwriting, for the time and labour thus saved is an important economy. Sometimes only a few copies are needed, sometimes many. For a limited number of copies, say up to five or six, the carbon method of duplication is perhaps the cheapest in most cases; but where from 5 to 100 copies are required, the hektograph process is preferable.

Stencils.—For a still larger number of copies, the stencil methods and type methods are available. With the former, the stencil was originally made on a sheet of wax-covered paper, which was written upon either with a stylus or with a typewriter from which the ribbon was removed—a system that had many defects. The modern method utilizes a specially prepared sheet of tough, flexible tissue, which can be filed away after using and used many times. One manufacturer provides a glass-topped, electrically illuminated table for making stencils by hand with a stylus. Typewriting, handwriting and drawing may all be combined on one stencil sheet. The duplicator consists of a hollow revolving cylinder, partially covered by an ink pad, over which the stencil is fastened. Each revolution brings the stencil sheet in contact with the paper, and the ink, passing through the character or design, makes the impression. From 1,500 to 5,000 copies can be made in an hour, depending on whether the model is hand- or motor-operated and whether it is automatically fed.

Hektographs.—The hektograph is many years old, and its operation is based on the principle of absorption. The original writing is done on a sheet of hard bond paper with a water-soluble ink or with a typewriter ribbon impregnated with such ink. This sheet is then placed in contact with a moist surface of gelatin or clay composition, and the writing is absorbed from the paper and appears in reversed form on the gelatin or clay surface. Then, by placing a sheet of blank dry paper on this moist surface, the impression is transferred to the paper. The gelatin was originally used in flat tin pans, and in this form the hektograph was of little use in the office, as registration was difficult. The clay form of hektograph was, and is, extensively used for the reproduction of drawings by architects and draftsmen, because it is a simple matter to prepare this composition for large sizes of work. The modern hektograph uses the old principle, but the gelatin is coated on a long band, a small portion of which is exposed at a time. This band runs over a flat iron surface. Registration is accomplished by a special feeding device. The unique feature of the hektograph duplicator is its use in routines of order or billing systems, in which from 10 to 15 copies of the same writing (or any portion of it) may be transferred to sheets of various sizes and shapes. Such copies are much clearer than carbons, and the paper does not have to be thin. The hektograph can also be used for bulletins of which 100 or less copies are desired.

Type Reproduction.—There are several devices which duplicate from type, the principal feature of most being a simple method of setting the type, which does not require a trained typesetter, the printing also being simplified by means of a revolving drum. The style of type most used is the imitation typewriter face, and the chief use is for the reproduction, through a ribbon, of facsimile typewritten letters, there being also a special device which may be used for the reproduction of the signature. A printing-ink attachment makes possible the use of printer's type and of electrotypes or stereotypes curved to fit the drum. Some models are hand-fed and operated; those which are automatically fed and motor driven attain a speed of 2,400 to 4,800 pieces an hour. Another machine produces letters from typewriter type cast on a linotype machine, at the same time filling in the name, address and salutation from slugs—one for each name on the mailing list—which change automatically as each letter is printed through a ribbon, the slugs being filed for future use. The speed is 1,000 letters and envelopes an hour, the latter being addressed from the same slugs. Certain machines which print from typewriter type are really small presses adapted to the printing needs of the layman, and print from printer's type, electrotypes, linotype, monotype, flat zincs and half-tones.

Automatic Typewriters.—The automatic typewriter is designed to produce actual typewritten letters at three times the average speed of a typist. Its mechanical movements are controlled by a paper roll, similar to that of a player-piano, in which perforations representing characters on the typewriter keys are made by a perforator. When an entire letter has been thus perforated, the paper is cut from the roll, and its ends are cemented together to form an endless belt, which is then placed over the drum of the automatic typewriter. The operator writes by hand the name and address and starts the automatic device. Pins

dropping through the perforations into slots, as the roll is carried forward by the revolution of the drum, actuate the typewriter keys, causing the typing of the words; when all the perforations have passed over the drum, the operator removes the finished letter and then repeats. Insertions of special words or sentences may be made by hand at any desired point.

Photocopying Machines.—A special photographic machine, in which a roll of sensitised paper coated on rag stock is used as a negative, photographing directly without the intervention of plates, has of late years been highly developed and used extensively as an office device. It offers a means of quickly producing a fac-simile copy of any document, and has therefore to a great extent eliminated the laborious hand copying of records, deeds, insurance applications, contracts and the like. The equipment consists of a large camera combined with a developing machine, so that after an exposure is made the sensitised paper is carried first to the developing bath and then to the fixing bath. Dials and levers control all operations, and the machine is so scientifically adjusted that an office boy can turn out perfect copies. The colours are reversed in the first print, called a "black print"; that is, the whites in the original are black and the blacks are white. As the photograph is made through a reversing prism, the letters appear exactly as in the original. A white positive print is made by re-photographing the black print. By continuing to photograph the original, as many black prints as desired can be made; and as many positives as required can be made by photographing the black prints. It is also possible, by using a special kind of paper, coated on both sides, to print two sides of a page simultaneously and have the photograph with an image on each side.

Addressing Machines.—These are in reality devices designed for duplicating small pieces of writing. Originally designed for duplicating names and addresses—hence the name—they now have many other uses, such as the making of invoices, statements, receipts and other office records. They are of especial value in businesses where the same list of names and addresses must be repeatedly used. Each name and address must first be impressed upon a metal plate, cut on a fibre stencil or set in type, according to the character of the machine. The metal plate is prepared by an embossing machine operated by hand or electric motor; a blank plate is inserted in the machine, and the required characters are selected by an indicator and stamped into the metal. Some embossers have a typewriter keyboard, the embossing being performed by depressing the keys. Some metal plates carry a name card and others a record card for recording relevant data. A fibre stencil consists of a frame in which is mounted a panel of semi-transparent paper coated with a gelatinous material, some frames having spaces for the insertion of relevant data. The name and address are cut by means of a typewriter from which the ribbon has been removed, a special device holding the stencil while it is cut. When printer's type is used, names and addresses are cast on a linotype machine.

Addressing machines, despite many structural differences, operate on the same general principle. The metal plates, stencils or slugs are fed from a magazine to the printing point where the envelope or other matter to be addressed is placed either by hand or by a mechanical device. Directly over the printing point is a stamping arm which comes down on the envelope when the machine is operated, thereby bringing it into contact with the plate, stencil or slug either directly, in case ink is used, or through a ribbon. As the arm rises, another plate comes to the printing point, the one just used passing to a receiving machine, where it re-files itself in original order. Models are hand, foot-treadle or motor operated, the speed varying from 1,000 to 15,000 impressions an hour. Special models are designed for publishers addressing on large envelopes, on mailer strip or directly on the margins of newspapers and magazines. The adaptability of addressing machines is greatly increased by attachments, some of which are so common as to be considered standard equipment. The metal plates and fibre stencils are filed like index cards in drawers kept in cabinets, slugs being filed in galleys and stored in cabinets. One machine is unique in that its metal plates are linked together to form an endless chain; they pass to the printing point from a reel on which they are wound and they are then re-wound on another reel, the reels being stored in cabinets.

Hand Stamp Affixers.—Stamps provided in rolls of 500 by the post-office are locked in a stamp affixer and applied to envelopes by the downstroke of a plunger, moisture being applied in some cases to the stamp, in others to the envelope. Extra containers, allowing for quick change from one denomination to another, are furnished with some models. Some machines are spring-locked; others are key-locked to guard against unauthorized operation; still others count the stamps used.

Sealing Machines.—These are designed for the rapid sealing of large quantities of envelopes. The envelopes are fed to the machine one at a time, either by hand, semi-automatically by holding them against revolving feed rollers or automatically from a hopper—depending on the type of machine. The gummed flaps come in contact with a moistening device—a wick, a roller or a metal disk—which receives its water-supply from a reservoir or by a position feed suction. The envelopes then pass between sealing rollers and are ejected from the machine. Letter opening machines are frequently used in offices. In many mail order houses and similar establishments these are considered a necessity. Their principles of operation usually include mechanism for placing, cutting and sorting various sizes of letters.

Permit Mailing Machines.—An office having occasion to mail a thousand or more letters a day could greatly expedite their passage through the routine of mailing if the office were permitted to cancel the stamps or to print some indication that postage was paid. For this purpose, a U.S. post office regulation, passed in 1920, provides for the printing of the permit, or indicia, as it is called, directly on the envelope in the office of the mailer. Permit mail is of two kinds—metered and non-metered; for either, the licence must be obtained from the Post Office Department through the local postmaster, the mail being delivered to the post office by the sender, as such mail is handled separately. Machines which handle non-metered mail print the indicia, seal the envelopes and count the pieces. The impression must show the postmark—city and state, month, day and year, denomination and sender's permit number. The number shown in the counter of the machine after a mailing is completed, multiplied by the denomination, gives the amount of postage to be paid. Payment is made either with each individual mailing or by a cash balance carried at the post office. Certain machines will print the indicia without sealing, seal without printing, or count without either sealing or printing.

The basis of the meter system is a printing and recording mechanism demountable from the machine with which it is used, so that it can be taken to the post office to be set for a given number of impressions, payment being made at that time, and the mechanism locked and sealed. Two sets of registers indicate how much postage has been used. A separate meter is used for each denomination, and any number of meters can be secured for one machine. The indicia are the same as those printed by the non-metering type, except that the sender's meter number is shown. The speed of such machines varies from 150 to 200 a minute. One type of machine is adapted for use with either the metered or the non-metered system. In 1924 the U.S. Post Office Department issued a regulation permitting first-class mail to be sent out with pre-cancelled stamps attached. The stamps, obtained in coils from the post office, are applied by a hand stamp-affixer and the envelopes are then passed through a non-metering permit machine which seals and counts them and prints the postmark and additional cancellation required. Where bulk of mail does not warrant a permit machine, the postmark and additional cancellation are applied by a rubber stamp bearing a changeable date. One sealing machine is adapted to metered, non-metered and pre-cancelled systems, without mechanical alteration.

Cash Registers (*q.v.*).—Motor-driven models have now become available.

Autographic Registers.—On many occasions it is necessary to make by the carbon method several copies of pencil memoranda. The autographic register is a device for making at one writing an original and from one to six copies of sales slips, bills

of lading, requisitions and other business records on continuous forms. These, interleaved with carbon, are retained within the register and fed across a writing table or platen. Some registers use rolled forms, one roll for each copy of the record; others use flat folded forms. Various types of registers have various methods of aligning the several copies that make up a set. As a written set is issued from the register, either by pulling out by hand or by the turn of a crank, and is torn off against a knife edge, another set, automatically leaved with carbon, is brought into a writing position.

Coin-handling Devices.—In all business houses where large amounts of coin are handled and packaged daily, the use of mechanical devices for sorting, counting and packaging saves time and labour. Coin-counters simply sort mixed coins into denominations. The usual type of machine has a disk revolving in a hopper and the coins are carried by the disk to a rail finger from which they roll by gravity and are sorted by dropping through slots of various diameters into separate boxes. From 1,000 to 12,000 coins can be separated in a minute, depending on whether the model is hand or motor operated. Coin-counting and packaging machines count the coins and deliver them into bags or wrappers, and, in specific cases, check pre-determined amounts into bags. One denomination of coin is dumped into the machine and a revolving disk throws the coins to the outer edge of the hopper, where they pass under a register which counts them.

In some models the coins fall through a stem into a tubular wrapper which the operator has previously placed there; other models wrap with continuous rolls of paper, fed down as the coins are counted; when the required number of coins are in place, they are carried over to the paper and tightly wrapped, the machine automatically locking off further passage of coins. Coin-counters and separators serve the dual purpose of counting and sorting coins of mixed denominations at the same operation. The registering devices of some machines provide for a totalled sum in connection with each separate adding counter; others have a sub-total and a total register. Other coin-handling devices are bag-loading machines; proving and bagging machines which recount and bag coins that have been previously separated; continuous counting and bagging machines, which count and bag coins at a high rate of speed; counting machine heads, which handle one denomination at a time and handle metal tokens also; manual counters and packagers, which combine in one operation hand-counting and wrapping.

Dictating Machines.—By means of the cylinder phonograph the time of a stenographer taking notes may be saved. The executive who uses this system speaks into the mouthpiece of a small machine which records his voice by engraving on a revolving wax cylinder. He may pause in his dictation, correct an error, and at any time listen back to what he has said. When the cylinder is full, a typist puts it in a transcribing machine placed alongside her typewriter, and the reproduction of what has been dictated is carried to her by receivers placed over her ears, she typing the words as she hears them. The engraved surface of a used cylinder is removed by a shaving machine so that it may be used again and again.

Phone Recorder.—It is also possible—and several devices are available for the purpose—to record automatically an entire telephone conversation. As the conversation proceeds, it is recorded on the wax cylinder of the device which is attached to the telephone.

Typewriters (*q.v.*).—One type of machine which has been on the market a comparatively short time is practically noiseless in operation, because the principle of pressure printing instead of percussion printing is utilized. Another is electrically powered and can be operated either from a direct or an alternating current; the keys are touched lightly—about one-quarter of an inch depression—and electricity takes up the burden. Portable typewriters serve the need of the individual for a personal writing machine. Their construction embodies many features of standard office typewriters. The machine is usually secured to the bottom of the case in which it is carried, a permanent base being thus provided, making its use convenient under all conditions. The weight varies from 7 to 12 pounds. A wide selection of special keyboards and type arrangements for engineers, doctors, chemists and all those requiring special symbols and extra characters is available.

Cheque Writers and Protectors.—Besides writing the permanent and unchangeable amounts on cheques, thereby protecting, as far as it is mechanically possible, against losses from raised and forged cheques, these devices save time and labour in concerns which issue large quantities of payroll cheques and in banks and establishments which issue dividend cheques periodically. Protection is afforded by printing, by shredding or by perforating the amount, using acid ink in one or two colours. The amount is written in words, in figures or in words and figures. Certain models protect the payee's name as well, by "crimping" or shredding an un-inked design over it. After a cheque is inserted in the machine, the amount to be written is selected by slide levers set in vertical columns, by a hand-wheel or by an indicator on the dial, depending on the type of machine. Some models require one stroke of the operating handle for each word or number; others print the whole amount at one operation. In some models the amount is visible before and after printing, and in certain cases the name of the user is also printed. Repeated writing of the same amount on a number of cheques, without change of set-up, is a feature of some cheque writers. An interesting development is the cheque writer with many combinations of foreign denominations for use in foreign banking.

Cheque Certifiers.—These devices print a form of acceptance on cheques, either through a ribbon from a bronze die or from steel wheels inked by a felt pad. Some number the cheques with consecutive serial numbers. Certain models are locked against unauthorized operation.

Cheque Endorsers.—Motor-driven machines are used for endorsing large numbers of cheques. Impressions are made from either a rubber or a metal die inked from rollers and having movable type for dates and batch numbers. Cheques are fed by hand, one at a time, to those models designed for use alongside an adding machine, so that as each cheque is listed for clearing-house, transit or deposit, the operator turns it over and drops it into the endorser, which prints the endorsement and places the cheque in its original order in a tray beneath the machine. Other models provide for feeding a large number of cheques held at the feeder guide by the operator's hand.

Cheque Cancellers.—Enduring and inerasable evidence that a cheque has been paid, together with the date of payment, is provided by machines which perforate the cancellation through cheques, and if desired, the bank's American Bankers Association number. Dating of deposit slips, notes, mortgages and other papers may also be done. Hand models cancel from 100 to 225 cheques a minute; motor-driven models are speedier.

Cheque Signers.—Pay-cheque signing is speeded by devices which sign from five to ten cheques at once. A sheet of cheques is placed on an extension table under a writing frame to which are attached five to ten fountain pens controlled by a monitor penholder. As the operator signs a sheet of cheques they are pushed into a tray and another sheet is brought into position.

Finding and Filing Devices.—Simplification of filing and locating data compiled in digest form is achieved by three mechanical devices differing in construction, operation and purpose. The purpose of one is to find a single card by number. It is a metal, desk-like affair, in the top of which are ten trays, each holding numerically filed cards numbered from 0 to 999—1,000 in all. A card is found and filed according to its number. By depressing the proper number-keys of the finding mechanism, the corresponding card is instantly raised above the others in the file. In filing a card, the operator raises the card immediately following to indicate the filing position. Means are provided for finding misfiled cards.

Another device finds a single card by means of the general class or name under which it has been classified. This system uses a steel drawer, on the front of which are two rows of keys marked with the classifications, such as "Farm Lands," "West

Side Property," etc. The keys are connected with rods extending back through the drawer. One card can be filed under many classifications, by means of clips placed in position along its lower edge, which correspond to the classifications desired. Pressure on the proper key raises the desired card, together with all those having a clip corresponding to the key. A tap returns the card to position.

A third system provides for the automatic selection and segregation of cards according to any number of classifications, the basis of the system being the card. The top carries a brief summary of the record, or can be extensive enough for a posting record. The body of the card is perforated, two vertical perforations constituting a "position" to which some classification is assigned. Each card is prepared for automatic selection by converting the two holes of significant positions into a slot by means of a hand-operated slotting punch. The cards are placed in a file drawer, which has a brass front perforated to conform to the cards. If, for example, the device is used for a list of garages, and all garage cards are to be selected, a steel rod is placed in the position designating garages. If all garages having service stations for a particular motor-car are to be selected, another rod is placed in the position designating that information. The more rods, the finer the classification. The drawer is then inverted, and the cards that are suitably slotted drop down. A rod inserted at the bottom of the drawer locks them in place, and when the drawer is held upright, the desired cards are held above the others in the file. When the work is finished, the locking rods are removed and the cards fall into place.

Visible Index Systems.—An operation on a card system may be divided into several parts: (1) locating and removing the card; (2) making the record or noting the information; and (3) returning the card to place. If the second part is a small proportion of the whole time required, the total operation may be greatly simplified by using the so-called visible system.

The cards are usually mounted on panels in such manner that they overlap, showing only the title line, a slight lifting movement revealing the whole card. The panels are housed in several ways. Sometimes they fit into steel cabinets and may be pulled out at a convenient angle for posting or removed entirely. In other cases, the panels—with cards inserted on both sides—are hung vertically, either on a circular track which rotates at the touch of a finger to bring the panel with the desired card before the eye or on a straight track so that they turn like the pages of a book. Another type of visible index is in book form, the cards being either held on panels inserted between the covers or fastened into the binder, as in a loose-leaf binder. Still another kind, which looks like a card drawer with the sides and ends cut down, consists of an aluminium tray in which cards tabbed at different heights so that a portion of each tab is always visible are held by a lock rod. Aluminium guides permit indexing. Pulling forward a guide exposes the tabs of a group of 24 cards, and the full surface of any one is visible when the intervening ones are thrown over. With each type of visible index colour signal systems may be used to call attention to pertinent facts.

Electric Paging Systems.—By audible code signals sounded throughout the premises, this equipment immediately locates individuals who are away from their desks. The central station is usually placed near the telephone switchboard, and the telephone operator sends the signals.

Telegraph Typewriter.—An electrically operated typewriter used in hotel offices, banks and other businesses where information is daily transmitted to distant points, transmits messages in written form to any number of distant stations. As the message is typed on the sending typewriter, the words are written simultaneously and automatically by the distant receiving typewriter. The paper is fed from a roll mounted on a frame behind the typewriter. Tabulated forms and duplicated copies can be written. The telautograph is used for a similar purpose, but the message is handwritten instead of typed.

Credit Authorizing Systems.—Three distinct types of systems are used for transmitting to a department making a charge sale the credit department's O.K. on the sale. One is an electric telephone system with a switchboard in the credit department and a telephone in each sales department. As the sales person calls the credit department, she places the slip in an aperture in the telephone, and the credit authorizer causes his approval to be printed on it if the sale is approved. (W. H. Le.)

OFFICE MANAGEMENT. The office is that part of an enterprise which is devoted to the direction and co-ordination of the various activities of the enterprise. It is characterized by the gathering, classification and preservation of data of all sorts; the making, using and preservation of all kinds of records; the analysis and utilization of these data in planning, executing and determining the results of operation; the preparation, issuing and preservation of instructions and orders and the composition, copying and filing of written messages.

Though clerks and clerical work have existed for centuries and large groups of clerks for decades, it is only in recent years that the management of clerks or office management, has become a problem of importance. This is wholly due to the rapidity of industrial change, which is best shown in the United States. In 1880, when there were but 172,575 clerks in that country, mostly book-keepers and accountants, the problem might be considered as practically non-existent; but in 1920, when the number of clerical workers of all kinds had grown to 2,951,008, it assumed proportions that could not be ignored. In 1920, one in ten of all persons engaged in "gainful occupations" was a clerical worker. The change was necessitated by the exigencies of an ever-growing large-scale industry. While business organizations were small, and direct contact existed between producer and consumer, beyond simple book-keeping few records were required, there was little written communication between sections of an organization, and consequently few clerks were needed. All this has changed, and to-day the office has attained a position of major importance in business.

Many offices employ more than 100 clerks each and a considerable number employ several thousands. Evidently the employment of such numbers of workers requires management of a high order, yet it is only recently and among the most progressive companies that the subject has received the attention it deserves. Ingenious systems of record keeping and filing have been invented, scores of clever appliances and marvellous office machines are available (*see* Office Appliances), but the problem of securing the greatest result for the least expenditure of effort has not been given the attention in the office that it has in other lines of endeavour. This is due to the newness of the problem, but there are signs that this condition is sure to change as time passes.

Frederick Winslow Taylor (*q.v.*), the "father of scientific management," was himself probably the first person to apply—at least in a limited measure—scientific principles to office work. In Copley's biography of Taylor is shown a "Time Note," dated about 1885, giving "piece-work" rates on 17 clerical operations, the implication being that Taylor had at least studied these operations, found the best method of performing them and controlled them to the extent that he offered an incentive wage for their accomplishment.

THE HUMAN ELEMENT

The major divisions of office work are given herewith, but not necessarily in the order of their importance.

Organization.—The most essential factor here is clearly defined lines of authority, and its lack is the greatest defect to be found in many companies. In the struggle for advancement it seems difficult to prevent officers from claiming more authority than is granted them, and where confusion of this kind exists, loss of morale invariably results. Functionalization—one of the leading principles of scientific management—is as efficacious in the office as elsewhere. The office manager himself holds a functional position—that of managing clerks, wherever placed. Where this principle is fully carried out, work, instead of being departmentalized, will be functionalized, and therefore performed much more effectively. Thus, a stenographer employed exclusively in taking notes and transcribing letters, will do much more effective work than one who also keeps and files records, answers telephone calls

and performs other miscellaneous work. Functionalization, however, is to its fullest extent only feasible in large offices. It is uneconomical to have too many departments under the charge of one officer. A chart of the organization, and an organization diagram, both giving not only the position of each individual in the office but his duties and relation to others, are necessities. Also there should be standard methods for performing each task, and written standard practice instructions so that the carefully devised methods may be perpetuated. Otherwise great loss of output will result.

Personnel Methods.—Progressive records of each employee's performance are necessary as they serve as a basis for future advancement. Special tests for ascertaining the ability of new employees will prevent to a large extent the great wastage of continuous hiring and discharging. Many psychological tests, special ability and trade tests have been prepared, extensively used and found advantageous. (*See* INTELLIGENCE TESTS.) While there are many clerical positions which demand the very highest intelligence, all clerical work does not, and much of the simpler clerical work is found irksome when allotted to those capable of a higher grade of activity. Training is extremely important, though often sadly neglected. In some offices the various lines of promotion are laid down and made known to all employees, so they can prepare themselves for advancement. Some offices also have officers who devote their activities wholly to employment, and all persons who are to be discharged are referred for final adjudication to this officer—the employment manager. The advantage here is that competent employees are not lost to the organization solely because of the personal pique of some hasty or temperamental officer. The employment manager also ascertains by tactful questioning the reasons why employees leave, and by a careful, classified record of such reasons is enabled to check bad practices, and to determine any other causes for dissatisfaction.

Turnover.—The "rate of turnover," that is, the ratio of employees leaving to those on the pay roll, is a most important factor in good office management. An average cost of over $100 is represented in the training of a new employee who replaces one who has left, so that it is evidently desirable to retain employees for long periods. Turnover is dependent upon many factors. If employees are not properly selected, many replacements will be needed; if salaries are not right, physical conditions bad, or the relations of officers not as they should be, there will be many voluntary separations. A minimum turnover is considered to be about 10% annually. Length of service depends upon much the same conditions as rate of turnover.

Routines and Methods.—A routine is a collection of separate operations through which a piece of work successively passes. Division of labour has been highly developed in office work, and few operations are complete in themselves. Routines as a rule are seldom consciously developed but come into existence gradually through the use of machinery combined with hand-work. As a result, operations wholly or partially useless and of little or no value to the "finished product"—the result desired—are frequently found. Methods also have generally speaking a similar evolution, and yield great results from scientific research. Unless both routines and methods are carefully studied, there is apt to be much waste.

Control of Output.—To secure maximum results for minimum effort, a continuous and uninterrupted flow of work is necessary, and this is one of the most difficult achievements in office work. In the manufacturing of any material commodity the work can be precisely scheduled, step by step, and the maintenance of a steady flow is largely a mechanical problem, as every piece of similar character goes through precisely the same steps. But in the office there is the added difficulty that office work of similar character does not always take the same course; and even in some work of exactly the same nature, the flow is governed by conditions beyond the control of the office manager. Because of this fact it was, until very recently, considered impossible to plan and schedule office work. Peaks, that is, periods demanding intensified and additional work, were handled either by overtime work, or by the permanent maintenance of a sufficient force of clerks to handle them, both plans being evidently wasteful. Analysis of this matter, however, showed that in many cases they could be adequately met by pre-planning. The office force should be well balanced, and sufficiently large to handle average conditions; but a sufficient number of clerks should be trained in several operations. Then by utilizing the idea of the "flying squadron"—a selected group of clerks that can be used almost anywhere in an emergency—most of the minor peaks can be handled without difficulty. Major peaks can be dealt with by a re-adjustment of working force and the employment of extra clerks for positions which require only a minimum of training.

Clerical Output.—On this subject all the major factors of office management converge, and all have a bearing upon it. Under conditions where all factors have been scientifically studied, clerical output is invariably much greater than in organizations in which they are largely ignored. Thus in the office of the latter character the average output of a stenographer will rarely exceed 100 sq.in. per hour, while in a scientifically managed office this particular output will be increased to an average of 200 sq.in. per hour. The maintenance of the latter rate does not depend alone upon the skill and application of the stenographer—for 200 sq.in. per hour is but 30 words a minute, while the world's typewriting record is over 800 sq.in. per hour—but largely upon other factors outside the control of the operator and decidedly within that of the office manager. As with typewriting, so it is with all other clerical operations; the output usually depends much more upon the efforts of the management than upon those of the individual clerk. The effort should not be to obtain the highest possible output from any individual, but that which should be expected from a first-class worker.

The Incentive Wage.—Still another factor which aids in obtaining a high clerical output is an incentive wage of some kind, wherever it is possible to measure the work. The various methods of incentive wage used in other lines of business endeavour have all been tried in the office, some with considerable success, others with disastrous results. In the cases of failure the main causes generally are that (1) work was not properly standardized; (2) not properly measured; (3) steady flow not obtained; (4) work not properly controlled; and (5) no adequate check upon its quality. Piece-work in the office is not so generally applicable, because the worker must have a guaranteed minimum wage, and it is not always possible to supply him with sufficient work to make that wage on a piece-work basis.

THE MECHANICAL SIDE

The preceding factors deal almost wholly with the management of the human element, and now other factors must be considered—those physical factors without which efficient management is not possible.

Arrangement.—The physical arrangement of an office affects all other factors of management. As most offices are in large cities, rentals are high and therefore space must be conserved. For this reason the cubicles of the old-fashioned office are giving way to the open office. Departments having relations with each other should be contiguously situated, and the seating of the workers in each department be regulated also on this principle. Work should flow in straight lines. Adequate light, both daylight and artificial, should be provided, the standard of the latter being placed by experts at not less than 10 foot-candles. (*See* ILLUMINATION ENGINEERING.) The completely indirect system, in which the light is thrown from its source to the ceiling, and thence reflected down, is considered the best. Ventilation is an important matter also. Experiments show that the best ventilating system is that which brings in fresh air from the outside without altering it in any way, this being superior to the elaborate washed and heated air systems. (*See* HEATING AND VENTILATION.) Excessive noise is also detrimental to good work, and noisy machines, if numerous, should be segregated.

Equipment.—Under this head are included desks, tables, chairs, filing cabinets and similar furnishings. The old-fashioned roll-top desk is being rapidly eliminated, and as the present tend-

ency is to the extended use of small loose-leaf books and cards, the high-standing book-keeper's desk has largely disappeared. At present the usual office desk is too large and contains too many drawers, and as clerks have little need for more than one or two drawers, a table is generally preferable. The size of a desk depends naturally upon the character of the work, but a desk larger than 54×30 in. is rarely needed, though no desk should be smaller than 40×30 inches. Chairs to be comfortable require designing to fit the human anatomy in an upright seated position. A few good anatomical chair types are available, but most of the others are uncomfortable.

Office Machinery.—Here the greatest development has taken place, office appliances being now available for almost every occasion. (*See* OFFICE APPLIANCES.) There was a tendency to use machines to the exclusion of competent brainwork, but office managers are beginning to see that this is a mistake.

Correspondence.—This is naturally an extremely important part of office management, not only between the company and outside correspondence, but within the organization itself. The present tendency is toward brevity and clarity, and the florid style and redundant expressions of the so-called "business English" are in process of elimination.

Filing.—The vertical system of filing has almost entirely superseded the old-fashioned flat file, and elaborate systems have been greatly simplified. Its greatest present misuse is the filing of valueless and superfluous material. The filing problem requires not only adequacy in equipment and system, but also accuracy, which necessitates adequately trained operators, for misfiled papers may easily cause great loss.

Stock-keeping.—In a large office the maintenance and issue of an adequate stock of all forms in use becomes a problem in scientific stock-keeping. Order and neatness are necessary, and an adequate location system, so that material can be found with a minimum loss of time. Stores should be classified according to some well-devised system, and there should be a perpetual inventory and a systematic method of issuing stores to, or on the order of, authorized persons.

Intercommunications.—This factor is a most important one in large offices. The telephone is of course the most common method, but there is usually a large transfer of papers from one part of the organization to another, and this must be taken care of by well-organized messenger systems with regularly scheduled trips. In many offices automatic belt systems or other forms of conveyors are used. Mechanical devices of other kinds are automatic signalling systems, automatic telephones and so forth.

Forms.—Most office work is performed by writing upon some kind of blank form, whether they be detached or loose-leaf forms. The quality of paper selected for any form should be governed by the use to which it is put. If it is to be written upon with pencil it is wasteful to use a high-grade paper designed for writing with ink. When forms have a temporary value only, the paper should be of a cheaper quality than that of forms to be kept for a number of years. Selecting standard qualities of paper for these various purposes requires considerable study. A large variety of colours should not be used, as many of them—particularly the reds and blues with their varying shades—are difficult to read under artificial light. Not more than nine standard sizes of forms are usually needed.

Salary Standards.—In most offices salaries vary widely and often unreasonably, clerks doing similar work frequently receiving widely different salaries. Some of the best-managed organizations have made a careful gradation of salaries, with a maximum and minimum for each class of worker. The minimum is that salary which a clerk is entitled to as soon as he is assigned his position, and the maximum the highest salary which the company can afford to pay for that type of work. Such gradation eliminates gross inequalities, gives more equitable payment for results and minimizes dissatisfaction among the office force.

SUMMARY

Office management is highly complicated, and requires a specialist—a manager of high order who at the same time thoroughly understands clerical work. The scientific approach to the factors of office management may be briefly defined. First it is necessary to define thoroughly the purpose of any work about to be undertaken, for if this is neglected the path of the subsequent investigation is likely to follow incorrect lines. Then the problem should be carefully analysed by dividing it into its factors. These preliminary steps, though simple in a statement, are by no means so simple in fact. The next step involves a careful search for all the facts in the situation which govern each and every factor in the analysis. It is a very common oversight to gather an abundance of facts on one part of a problem, and ignore or minimize other parts. To infer, without investigating, is a most prolific source of error, the method of actual test being by far the best. These three steps are precisely those of experimental science, and may be called the scientific method of thinking out a problem. By its use, the office manager can correctly approach each problem and devise the right method, otherwise known in management as "the one best way." With the best method secured, it is then necessary to select the person best fitted to perform it, for all cannot be equally proficient in the same things. The person best fitted for any particular task will invariably produce better results than the so-called "average" person. When found, it then becomes necessary to teach the person who has been thus selected.

These six steps constitute the basic procedure in any form of scientific management and lead up to the seventh, which is planning. Without careful planning, all the scientifically designed work which has gone before will be wasted. Finally, to secure the best results it is vitally important to win the co-operation of the workers. An office force labouring without interest or enthusiasm will accomplish some results, but certainly not of the type desired by a competent office manager. The management which does not and cannot secure co-operation is necessarily defective. These eight steps cover the basic principles of scientific management in all activities. There is also a considerable tendency toward the simplification of office methods and the entire elimination of much that has been done in the past, on the ground that it is either superfluous or not worth the effort expended. These tendencies are continuously accelerated by economic conditions. Scientific management will be the principal means of reducing the numerical growth of office workers.

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OFFICERS. The employment of the word "officer" to denote a person holding a military or naval command as representative of the State, and not as deriving his authority from his own powers or privileges, marks an entire change in the character of the armed forces of civilized nations. Originally signifying an official, one who performs an assigned duty (Lat. *officium*), an agent, and in the 15th century actually meaning the subordinate of such an official (even to-day a constable is so called), the word seems to have acquired a military significance late in the 16th century. (At sea the relatively clear partition of actual duties amongst the authorities of a ship brought about the adoption of the term "officer" somewhat earlier.) It was at this time that armies, though not yet "standing," came to be constituted almost exclusively of professional soldiers in the king's pay. Mercenaries, and great numbers of mercenaries, had always existed, and their captains were not feudal magnates. But the bond between mercenaries and their captains was entirely personal, and the bond between the captain and the sovereign was of the nature of a contract. The non-mercenary portion of the older armies was feudal in character. It was the lord and not a king's officer who commanded it, and he commanded in virtue of his rights, not of a warrant or commission.

HISTORICAL

European history in the late 15th century is the story of the

victory of the Crown over the feudatories. The instrument of the Crown was its army, raised and commanded by its deputies. But these deputies were still largely soldiers of fortune and, in the higher ranks, feudal personages, who created the armies themselves by their personal influence with the would-be soldier or the unemployed professional fighting man. Thus the first system to replace the obsolete combination of feudalism and "free companies" was what may be called the proprietary system. Under this the colonel was the proprietor of his regiment, the captain the proprietor of his company. The king accepted them as his officers, and armed them with authority to raise men, but they themselves raised the men as a rule from experienced soldiers who were in search of employment, although, like Falstaff, some captains and colonels "misused the King's press damnably." All alike were most rigorously watched lest by showing imaginary men on their pay-sheets they should make undue profits. A "muster" was the production of a number of living men on parade corresponding to the number shown on the pay-roll. An inspection was an inspection not so much of the efficiency as of the numbers and the accounts of units. A full account of these practices, which were neither more nor less prevalent in England than elsewhere, will be found in J. W. Fortescue's *History of the British Army*, vol. i. So faithfully was the custom observed of requiring the showing of a man for a man's pay, that the grant of a special allowance to officers administering companies was often made in the form of allowing them to show imaginary John Does and Richard Roes on the pay-sheets. The next step was taken when armies, instead of being raised for each campaign and from the qualified men who at each recruiting time offered themselves, became "standing" armies fed by untrained recruits. During the late 17th and 18th centuries the Crown supplied the recruits, and also the money for maintaining the forces, but the colonels and captains retained in a more or less restricted degree their proprietorship.

Thus, the profits of military office without its earlier burdens were in time of peace considerable, and an officer's commission had therefore a "surrender value." The practice of buying and selling commissions was a natural consequence, and this continued long after the system of proprietary regiments and companies had disappeared. In England "purchase" endured until 1873, nearly 100 years after it had ceased on the Continent of Europe and more than 50 after the clothing, feeding and payment of the soldiers had been taken out of the colonels' hands. The purchase system, it should be mentioned, did not affect artillery and engineer officers, either in England or in the rest of Europe. These officers, who were rather semi-civil than military officials until about 1715, executed an office rather than a command—superintended gun-making, built fortresses and so on. As late as 1780 the right of a general officer promoted from the Royal Artillery to command troops of other arms was challenged. In its original form, therefore, the proprietary system was a most serious bar to efficiency. So long as war was chronic, and self-trained recruits were forthcoming, it had been a good working method of devolving responsibility. But when drill and the handling of arms became more complicated, and, above all, when the supply of trained men died away, the State took recruiting out of the colonels' and captains' hands, and, as the individual officer had now nothing to offer the Crown but his own potential military capacity (part of which resided in his social status, but by no means all), the Crown was able to make him, in the full sense of the word, an officer of itself. This was most fully seen in the reorganization of the French army by Louis XIV. and Louvois. The colonelcies and captaincies of horse and foot remained proprietary offices in the hands of the nobles but these offices were sinecures or almost sinecures. The colonels, in peace at any rate, were not expected to do regimental duty. They were at liberty to make such profits as they could make under a stringent inspection system. But they were expected to be the influential figure-heads of their regiments and to pay large sums for the privilege of being proprietors. This classification of officers into two bodies, the poorer, which did the whole of the work, and the richer, upon which the holding of a commission conferred an honour that birth or wealth did not confer, marks two very notable advances in the history of army organization, the professionalization of the officer and the creation of the prestige attaching to the holder of a commission *because* he holds it and not for any extraneous reason.

The distinction between working and quasi-honorary officers was much older, of course, than Louvois's reorganization. Moreover, it extended to the highest ranks. About 1600 the "general' of a European army, except in the Italian republics, was always a king, prince or nobleman. The lieutenant-general, by custom the commander of the cavalry, was also, as a rule, a noble, in virtue of his command of the aristocratic arm. But the commander of the foot, the "sergeant-major-general" or "major-general," was invariably a professional soldier. It was his duty to draw up the army (not merely the foot) for battle, and in other respects to act as chief of staff to the general. In the infantry regiment, the "sergeant-major" or "major" was second-in-command and adjutant combined. Often, if not always, he was promoted from amongst the lieutenants and not the (proprietary) captains. The lieutenants were the backbone of the army. Seventy years later, on the organization of the first great standing army by Louvois, the "proprietors," as mentioned above, were reduced to a minimum both in numbers and in military importance. The word "major" in its various meanings had come, in the French service, to imply staff functions. Thus the sergeant-major of infantry became the "adjutant-major." The sergeant-major-general, as commander of the foot, had disappeared and given place to numerous lieutenant-generals and "brigadiers," but as chief of the staff he survived; and in modern times the chief of staff of a French army is known by the title of "the major-general."

Moreover, a new title had come into prominence, that of "marshal" or "field-marshal." This marks one of the most important points in the evolution of the military officer, his classification by rank and not by the actual command he holds. In the 16th century an officer was a lieutenant *of*, not *in*, a particular regiment, and the higher officers were general, lieutenant-general and major-general *of* a particular army. When their army was disbanded they had no command and possessed therefore no rank—except of course when, as was usually the case, they were colonels of permanent regiments or governors of fortresses. Thus in the British army it was not until late in the 18th century that general officers received any pay as such. The introduction of a distinctively military *rank* of "marshal" or "field-marshal," which took place in France and the empire in the first years of the 17th century, meant the establishment of a list of general officers, and the list spread downwards through the various regimental ranks, in proportion as the close proprietary system broke up, until it became the general army list of an army of to-day. At first field-marshals were merely officers of high rank and experience, eligible for appointment to the offices of general, lieutenant-general, etc., in a particular army. On an army being formed, the list of field-marshals was drawn upon, and the necessary number appointed. Thus an army of Gustavus Adolphus's time often included six or eight field-marshals as subordinate general officers. But soon armies grew larger, more mobile and more flexible and more general officers were needed. Thus fresh grades of general arose. The next rank below that of marshal, in France, was that of lieutenant-general, which had formerly implied the second-in-command of an army, and a little further back in history the king's lieutenant-general or military viceroy. Below the lieutenant-general was the *maréchal de camp*, the heir of the sergeant-major-general. In the imperial service the ranks were field-marshal and lieutenant field-marshal (both of which survived up to the World War) and major-general. A further grade of general officer was created by Louis XIV., that of brigadier, and this completes the process of evolution, for the regimental system had already provided the lower titles. (X.)

MODERN ARMY OFFICERS

The ranks of officers of a modern army are therefore as follows:—

(*a*) *Field-Marshal:*—In Spain, *Capitan-General;* in France, *maréchal*[1]; in Germany, *Generaloberst.*

(*b*) *General:*—In the British army this officer is not identified with any particular arm but generally commands an army, of all arms. In Germany, however, he is general of infantry, general of cavalry or general of artillery. In France, the highest grade of general officer is the general of division.[2] In the United States, before the World War, the grade of full general had only been held by Washington, Grant, Sherman and Sheridan. In 1917 Pershing was selected to command the U.S. army in Europe, and he was made a general in Oct. 1917. He was confirmed in the permanent rank of general by the U.S. Senate on Sept. 1, 1919.[3]

(*c*) *Lieutenant-General* (except in France):—In the U.S. army the title lieutenant-general before the 20th century was comparatively rare. It was abolished as an American rank in 1907, but during the World War the army commanders were made temporary lieutenant-generals. In the British army a lieutenant-general commands a corps. *Général de division* is the relative rank in France; in Germany, *Generalleutnant.*

(*d*) *Major-General* (in France, general of brigade):—This is the highest grade normally found in the U.S. army, generals and lieutenant-generals being promoted for special service only.[4] In the British service a major-general commands a division in war and either a division or an "area" in peace; in Germany, *General-major.*

(*e*) *Brigadier-General:*—In British and U. S. service, before and during the World War, commander of a brigade; also served on the staff of corps and higher formations. In France, *général de brigade;* Germany, *Oberst.* In Great Britain, this rank was superseded by *colonel-commandant* after the World War, but from June 1, 1928, the latter has been superseded by "brigadier." (*See* BRIGADIER.)

The above are the ranks of the higher commanders and, with the exception of the colonel-commandant, are termed general officers. With slight modifications their duties are practically the same in all the chief countries; viz., field-marshals and generals command groups of armies, generals command armies, lieutenant-generals command corps, major-generals command divisions, and brigadier-generals command brigades. Each country has, however, some peculiarity of its own either in the rank of the commander or the composition of his command.

The next class of officers in seniority to general-officers is field-officers (France, *officiers supérieurs;* Germany, *Stabsoffiziere*); they are as follows:—

(*a*) *Colonel:*—This rank exists in its primitive significance in almost every army, and denotes a regimental commander, or an officer of equal status on the staff. In Great Britain, however, regiments of infantry do not work as units, and the executive command of battalions, regiments of cavalry and brigades of artillery is in the hands of lieutenant-colonels, and when brigaded are under a brigadier. In the British service the colonel of the regiment or colonel commandant of a corps holds a quasi-honorary appointment, and is usually a royal personage or general officer, and sometimes, though rarely, a colonel. The holders of these appointments now vacate them on reaching the age of 70. Some regiments and corps have colonels-in-chief who are invariably royal personages.

(*b*) *Lieutenant-Colonel:*—In Great Britain, the commanding officer of a battalion of equivalent unit; in the United States and elsewhere, where the regiment and not the battalion is the executive unit, the second in command and sometimes commander of one of the battalions. In Germany, *Oberstleutnant.*

(*c*) *Major:*—In France, *chef de bataillon* or *chef d'escadron,* colloquially *commandant.* In the British infantry he preserves some of the characteristics of the ancient sergeant-major as a second-in-command with certain administrative duties. The junior majors command companies. In the cavalry the majors, other than the second-in-command, command squadrons; in the artillery they command batteries. In armies which have the regiment as the executive unit, majors command battalions ("wings" of cavalry, "groups" of artillery).

Lastly, the company officers (called in France and Germany, subaltern officers) are as follows:—

(*a*) *Captain* (Germany and Austria all arms except cavalry, *Hauptmann;* cavalry, *Rittmeister;* in Belgium, *le commandant de compagnie*). In the infantry of most countries he is the company commander, and in the British Service a captain is also second in command of a company. Under the captain, with such commands and powers as are delegated to them, are the subalterns usually graded as:—

(*b*) *Lieutenant* (first lieutenant in the United States, *Oberleutnant* in Germany and Austria, in Belgium *le chef de peloton*).

(*c*) *Sub-lieutenant* (*sous-lieutenant* in France, second-lieutenant in Great Britain and the United States, *Leutnant* in Germany and Austria).

(*d*) *Aspirants,* or probationary young officers, not of full commissioned status.

[1]The full title is "maréchal de France."

[2]In France, the ranks of "général de corps d'armée" and "général d'armée" are likely to be created soon. In war, the rank of "général de groupe d'armées" will be created.

[3]Under the Army Reorganization Act 1920 a "general of the army" is allowed for.

[4]In the Confederate service the grades were General for army commanders, lieutenant-general for corps commanders, major-general for divisional commanders and brigadier-general for brigade commanders.

BRITISH ARMY

Methods of Entry into the Regular Army.—There are two methods of obtaining admission to the cadet colleges, *i.e.,* Royal Military academy, Woolwich, and Royal Military college, Sandhurst: (1) By successful competition at Army entrance examination. (Provided they fulfil other conditions, the following enter without competition:—King's cadets, honorary King's cadets, King's India cadets, honorary King's India cadets, and pages of honour, the three latter to Royal Military college only.) (2) On the nomination of the Army Council. As to general qualifications, a candidate must be unmarried; he must also be a British subject and the son of British subjects, and of pure European descent. No candidate is accepted unless the Army Council consider he is suitable in all respects to hold a commission in the army; must have attained the age of 18 but not 19. The Army entrance examination is conducted by the civil service commissioners, and a fairly high standard of education is essential. All candidates for *nomination* sit for the competitive army entrance examination and are required to fulfil various conditions. From the 18th century warrant officers, n.c.o.'s and men have been promoted to commissioned rank during war, but since the World War a limited number of specially selected n.c.o.'s under the age of 23 can, in peace, obtain cadetships under certain conditions.

Candidates for cadet colleges come under three headings: (*i.*) Those from approved schools, *i.e.,* public or secondary schools approved by the Army Council; (*ii.*) Candidates recommended to the Army Council by the secretary of State for the colonies, the governors-general of the dominions and certain governors. (*iii.*) Certain naval officers, midshipmen and cadets recommended by the lords commissioners of the Admiralty; in such cases the upper age limit is raised to 21 years.

Cadet Colleges.—The course of instruction is designed (*a*) to lay the foundation of military and academic knowledge upon which the future military studies of an officer can be built, (*b*) to ensure that a gentleman cadet joins his unit so thoroughly grounded in drill, weapon training, equitation and physical training as a private soldier that no further instruction of this kind is required.

Appointment to Commissions and Choice of Regiments.—Cadets on passing out receive seniority according to their places on the passing-out list. Appointment to particular regiments is governed by the existing vacancies and the requirements of the service. Subject to these conditions, cadets passing out highest receive first choice of regiments, but territorial and special family claims are also considered irrespective of position on the list.

Commissions Granted to Candidates from Certain Universities.—Commissions are granted to duly qualified candidates nominated each half-year by certain universities. The universities, which must be "recognized" by the Army Council, are in two groups: (*i.*) Those with established courses of military study—

Oxford, Cambridge, London, Edinburgh, Manchester, McGill (Montreal) and Sydney (New South Wales), and (*ii.*) those without established courses of military study—St. Andrews, Glasgow, Aberdeen, Durham, Wales, Birmingham, Liverpool, Leeds, Belfast, Bristol, Sheffield, Dublin (Trinity College), Toronto. Candidates from group (*i.*) are commissioned senior to those from group (*ii.*).

Training of Officers.—A cadet becomes an officer from the date of his commission as published in the *London Gazette*. The training of officers in the various branches of the army differs considerably, and the officers of each branch might be regarded as specialists in their own particular line. Before the World War the infantry weapons were simply the rifle and bayonet, but now, in addition, an efficient officer is required to possess expert knowledge of the various kinds of grenades, machine guns, Lewis guns and gas. Even with this diversity of specialized training, there are some basic features common to all arms, such as drill, physical training, duties in barracks and on the march, dress and certain elements of discipline and military law which are fairly common to the everyday life of the army. This elementary instruction is carried out at the regimental or corps depôt or with the home service unit, and usually occupies the first six months of the officer's service. Having completed his recruit's course, the young officer is drafted to a service unit, where his training is continued on a higher level, his responsibilities increasing with efficiency. For the first few weeks he carries out the various duties as "supernumerary" to another officer until he is considered fit to undertake the duties by himself. Not the least part of his training is that of entering into the games of his men.

According to the *King's Regulations:* "Every officer is expected, if he has been two years in the service, to be capable of commanding and exercising a company, etc., in every situation, and to be perfectly acquainted with its interior management, economy and discipline." Also, "Officers above the rank of 2nd Lieutenant will be required to pass professional tests comprising examinations or courses of instruction for each step of substantive promotion up to and including the rank of Lieutenant-Colonel." The courses have for their object the specialized training of selected officers and other ranks, and are carried out at schools set apart for the purpose, and an official programme of the *Courses of Instruction* is published annually.

Advanced Training.—During the young officer's first few years he is absorbing knowledge and experience from the above-mentioned sources, in addition to special lectures arranged by the higher commands and delivered by experts on some particular phase of military science. Not only the young officer but officers generally are kept busy in an endeavour to keep abreast with the development of modern fighting methods. The mechanization of the army, the development of the tank, and the various kinds of grenades, guns, etc., all demand constant attention. The views of officers on military topics find expression in "service" journals under the control of unofficial bodies, the chief being *The Journal of the Royal United Institution, The Army Quarterly, Fighting Forces, The Cavalry Journal, Journal of the Royal Artillery* and other corps journals.

The regulations for promotion examinations are contained in the *King's Regulations*, and are divided into two parts, written and practical. The result of any examination may fall under one of the following three heads: "fail," "pass," or, higher still, "special certificate." Officers awarded the "special certificate" become eligible for special consideration for advancement and employment. Second lieutenants are not required to pass an examination for lieutenant but must receive satisfactory reports from the three senior officers present with the corps. An officer who fails twice in "duties in the field" is not, as a rule, permitted to remain in the service.

An officer below the rank of substantive lieutenant-colonel is required, before promotion to higher substantive rank (lieutenant-colonel or colonel) to undergo a course at the senior officers' school.

The Staff Colleges.—The staff colleges at Camberley and Quetta (India) are maintained for the purpose of affording selected officers instruction in the higher branches of the science of war and in the duties of the staff. The course lasts two years. An officer who graduates at either college has the letters "p.s.c." recorded after his name in the *Army List* and is eligible for employment on the staff. Both colleges are open to officers of all arms, including the Indian army and the Royal Marines, but that at Quetta is limited to officers borne on the Indian establishment. The entrance examination for both colleges is identical. A limited number of officers of the permanent staff of the permanent forces of the dominions selected by their respective Governments are permitted to undergo the course. For instructional purposes the staff college is divided into two divisions—senior and junior—each under a general staff officer, first grade. The junior division comprises students in their first year and the senior division students in their second year. Instruction is given by means of lectures, conferences, indoor exercises, sand models, practical work on the ground, and by visits to the other services and various technical schools and colleges. During the vacations the students are attached to arms of the service other than their own.

Promotion from the Ranks in Time of War.—On active service soldiers are promoted to commissioned rank direct from private, n.c.o. rank or warrant officer rank "for service in the field." In such cases they are not required to pass any examination. In addition to this type of war-time promotion from the ranks, there are cadet schools to which promising n.c.o.'s are sent for a course of instruction at home, usually lasting six months. Successful students are granted commissions into regiments where their services are required. Any soldier who shows ability has, therefore, an opportunity of rising to commissioned rank, and though he may not have a field-marshal's bâton in his knapsack, he has a splendid opportunity of commanding a company and even a battalion. Quartermasters and equivalent grades are invariably promoted from the ranks, and such promotion only comes at the end of many years of faithful service.

FRANCE

Physical training is compulsory in all primary schools and forms part of the curriculum of the great majority of secondary schools. The military preparation of the youth of France may, therefore, be said to commence at the age of seven to ten, according to whether a boy goes to a primary or secondary school, and is continued up to the time of incorporation in the army. Up to the age of 15 the training is chiefly of a physical nature, but from 16 onwards his education in definitely military subjects is undertaken in addition. Military preparation is arranged in two degrees, for each of which certificates are granted to those successful in the respective tests and examinations. The *certificat de préparation militaire* is the lower of the two, and the tests entailed are such as will enable those successful therein rapidly to become efficient soldiers on joining the colours. The *brevet de préparation militaire supérieure* (B.P.M.S.) is the higher, and successful competitors are qualified to join one of the special units for the training of prospective reserve officers. In addition to these two certificates there are certain *brevets de spécialité* or special diplomas, which may be obtained by individuals who care to specialize in various branches of training, and are designed especially to attract young men of intelligence to become officers of the reserve.

Cadet Colleges.—(*a*) The *École Spéciale Militaire* at St. Cyr, founded by Napoleon in 1808, situated close to Versailles. It trains candidates for appointment to commissions in the infantry, colonial infantry, cavalry, tanks and aviation of the *active* army and prospective *reserve* officers for the infantry and colonial infantry. Entrance to the college is by competitive examination, which may be taken by candidates of not less than 18 years of age, and not more than 22 on Dec. 31 preceding the examination. Candidates for examination must be in possession of the certificate of the *baccalauréat secondaire*, obtained by passing an examination comparable with the Oxford and Cambridge local examinations.

Choice of Arms by Candidates.—An annual decree enumerates the units in which vacancies will exist for those successfully passing out of St. Cyr. This is communicated to the candidates on the occasion of the oral part of the examination for entrance

to the college who submit to the president of the board their wishes as to the arm in which they prefer to serve. The duration of the course is, normally, two years. The subjects taught are similar to those of the Royal Military college, Sandhurst.

(*b*) *The École Polytechnique, Paris*, established in 1794, and, although under the War Ministry, is not designed exclusively for the training of candidates for the army. The conditions of entry are similar to those of St. Cyr. The course lasts two years. A greater number of non-military subjects are taught than at St. Cyr. Successful students are given their choice of appointments existing in the various public services for which the course qualifies them. Those who do not succeed in obtaining an appointment in the army or navy, and those who select an appointment in the services other than the army or navy, are compelled to perform one year of service as second lieutenants of the reserve.

(*c*) *The St. Cyr Marocain.*—At the end of 1918 Marshal Lyautey created a Corps of Moroccan officers, recruited from amongst the élite belonging to the best class in Morocco, so that the *Goums, tirailleurs* and *spahis* should have officers in command of them endowed with that prestige which belongs to those bearing a name which the traditions of the country associate with the sons of leading Arab chiefs. In June 1919 was formed the first "promotion" of 11 students. These officers are confirmed in their native rank in the same way as other Tunisian or Algerian officers. North African officers, however, are always promoted in separate lists to French officers, and cannot rise above the rank of captain.

Schools of Instruction for N. C. O. Candidates for Commissioned Rank.—These schools are (*a*) infantry and tanks at St. Maixent; (*b*) artillery at Fontainebleau; (*c*) cavalry at Saumur; (*d*) engineers and air service at Versailles. Entry is by competitive examination. European n.c.o.'s of the metropolitan and colonial armies are allowed to compete, who must have performed two years' service as n.c.o.'s (sergeant and upwards). The course lasts one year and is divided into two parts—general instruction and military instruction. After leaving their schools, candidates go to the *École d'application* for their arm of the service, except in the case of infantry students, who join the unit to which they are posted after completing their two months' leave.

École d'Administration Militaire at Vincennes.—This school is designed for the instruction of n.c.o.'s recommended for appointment as officers in the *service d'administration.*

Training of Officers of the Active Army.—The whole of the French military educational system is directed towards the formulation and propagation of one common doctrine, and from the moment when a prospective officer comes under the influence of military teaching to the time when he leaves the army, even though he rises to the highest rank, his education is continuously and progressively assured and his thought and action kept within accepted bounds by the precepts of the common doctrine. This training is provided at courses and schools for specialists dealing exclusively with one arm of the service or with some special branch of instruction.

Cycles d'information (courses for senior officers).—Officers of the rank of colonel and upwards attend courses which consist of a series of visits to the principal schools and centres of instruction. These courses occupy about six weeks and are attended by officers of all branches of the service.

École Supérieure de Guerre (Staff College).—The course at the school is designed, first and foremost, as one at which the higher art of war is taught, as opposed to a course devoted exclusively to the study of staff duties. The entrance examination is open to majors, captains and subalterns of all arms of the metropolitan and colonial armies who are between 28 and 38 years of age.

THE UNITED STATES ARMY

Appointment of Officers.—Appointments of second lieutenants in the active army are made from (*a*) graduates of the military academy at West Point; (*b*) warrant officers and enlisted men of the regular army with at least two years' service; (*c*) officers of the Officers' Reserve Corps, and officers, warrant officers and enlisted men of the National Guard; (*d*) members of the Enlisted Reserve Corps; (*e*) graduates of certain technical institutions approved by the secretary of war. Candidates from categories (*b*), (*c*), (*d*) and (*e*) must be within the ages of 21 and 30 years. Original appointments in the judge-advocate-general's department are made in the rank of captain under separate regulations. Appointments to the medical, dental, veterinary, medical administrative and chaplain's corps are also governed by special regulations. Appointments as second lieutenants in the Philippine Scouts are open to citizens of the Philippine Islands only, between the ages of 21 and 30 years.

(*a*) *The Military Academy at West Point.*—This is the only purely military cadet college in the United States. Candidates must, at the date of admission, be between the ages of 17 and 22 years. All cadets are appointed by the President. On conclusion of the four-year course the successful cadets are assigned to branches of the service as far as possible in accordance with their choice, and take their place on the promotion list as second lieutenants in the order obtained by them on leaving the academy. Each cadet on entry into the academy is required to give a written undertaking that he will serve at least four years in the army after obtaining his first commission. The number of cadets at the academy is usually about 1,250, of whom roughly one-quarter graduate each year.

(*b*) *From Warrant Officers and Enlisted Men.*—Warrant officers and enlisted men must establish their fitness for appointments to commissions as second lieutenants by taking the prescribed examination. Those who qualify in this examination are commissioned ahead of all other applicants examined at the same time.

(*c*) and (*d*).—The conditions for candidates in categories (*c*) and (*d*) are as for category (*b*).

(*e*) *Graduates of Technical Institutions Approved by the Secretary of War.*—The approved institutions are those which maintain the full equivalent of a four years' course of instruction in technical or scientific subjects, the successful completion of which entitles a graduate to a degree in a recognized technical subject. Any candidate who has graduated or who will graduate within six months from a technical course in any recognized college is considered eligible for appointment to the army.

Promotion of Officers.—All officers of the combatant arms and supply departments are included on a "single list" for promotion; those of the medical, chaplains, etc., departments belong to what is called the "non-single list." Promotions from colonel to brigadier-general and from brigadier-general to major-general are made from an eligible list prepared annually by a board of not less than five general officers. The examination of officers for promotion in technical subjects is the function of the corps area or department commanders, except in the case of the medical, dental, and veterinary corps, in which promotion takes place after stated periods of service.

GERMANY

Officers of the combatant branches of the German army are taken from the ranks. This does not, however, in practice involve any lowering of the social scale of the officers' corps, as candidates for commissions are youths of good family recruited with a view to their adoption of an officer's career. Candidates for commissions volunteer direct to regimental commanders during the recruiting period, April 1 to Oct. 1 each year. Candidates for commissions who, on enlistment, are in possession of an education certificate from a "higher school" (*höhere Schule*) of at least nine classes, receive preferential treatment. The candidate, at the end of his first year's service, if recommended for a commission by his commanding officer, undergoes an examination on general and elementary military subjects (officer probationer's examination: *Offizieranwartenprüfung*). On passing this, he is, in the course of his second year's service, promoted to lance-corporal (*Gefreiter*) and then to corporal (*Unteroffizier*) as vacancies in his unit permit. At the end of his second year (whatever his arm or branch) he proceeds to the infantry school at Dresden to undergo a course of instruction as corporal and officer probationer (*Unteroffizier* and *Offizierwarter*) for 10½ months, at the end of which period he sits for the ensign's examination (*Fähnrichsprüfung*). If he passes

this examination he is promoted to ensign (*Fähnrich*) and undergoes a course of 10½ months at the special school of his arm, which culminates in the officers' examination (*Offiziersprüfung*). On passing the officers' examination he is immediately promoted to senior ensign (*Oberfähnrich*). He is simultaneously posted to his regiment, where he serves as senior ensign, until the following March, when, with the permission of his commanding officer, he comes up for election to a commission as second lieutenant (*Leutnant*) by the officers' corps of his regiment.

In the case of candidates without school certificates the minimum training from enlistment to promotion to senior ensign is six years. For the first two years the candidate continues to serve in the ranks. In the third year he undergoes a preliminary examination in general subjects. In the fourth year he must sit for a second examination in general subjects, and, if successful, for the officers' probation examination. From this point his training continues under the same conditions as those described above for candidates with school certificates until his promotion of senior ensign at the end of the sixth year.

Reserve of Officers.—No official reserve of officers is permitted by the Treaty of Versailles. A considerable number of ex-officers of the imperial army are, however, still (1928) of military age, and these, together with officers who have retired from the present army, would be available in case of war. Ex-officers are forbidden to assist at manoeuvres, and to take part in training of any kind with the army. They do, however, keep in close touch with those units of the present army which maintain the traditions of their respective regiments.

Reports on Officers.—A confidential report (*Qualifikationsbericht*) is written every two years on second lieutenants and lieutenants and annually in the case of all other officer ranks.

ITALY

Officers are recruited from two sources: (*a*) cadets from military colleges at Rome and Naples, who leave these colleges at the age of 17 or 18, and (*b*) youths with the necessary educational qualifications who apply for commissions shortly before they are called up for conscript service at the age of 20. Both categories go through the same process of further education before they are commissioned. First, they attend an army corps cadet school for student reserve officers, one of which is established in each army corps area, for seven or eight months; then they are attached to a regiment for three months, which qualifies them as second lieutenants of reserve (*di complemento*), with which rank they can then return to civil life if they like. Finally, if they carry out their original intention of taking regular commissions, they go to the military school at Modena for two or three years, or, if entering the artillery or engineers, to the military academy at Turin for four years. On passing out, all officers are commissioned as first lieutenants in the regular army. Artillery and engineer officers are antedated a year for seniority when they pass out, to put them on an equality with those passing out at Modena. A certain number of commissions as second lieutenants in the Commissariat and Administrative Corps are given to under-officers (*i.e.*, n.c.o.'s) of the corps and to civilians.

Categories of Officers.—Officers of the Italian army are nominated by royal decree but do not hold documentary "commissions," as in the British army. Honorary nominations and honorary ranks do not exist. All officers are classified into two groups, each of which is divided into certain categories. The first group is known as "*ufficiali in servizio altivo permanente*" (officers in permanent service), and corresponds approximately to the British "active list." The second group is called "*ufficiali in congedo*," a term for which no correct British equivalent exists. The verbal translation is "officers on furlough," but as this group forms the reserve of officers of the Italian army, the latter term has been adopted.

The system of training is similar to that of the British service, and similarly there are schools of instruction and courses for every kind of specialist training.

Promotion.—During peace, promotion is carried out partly by selection and partly by seniority throughout the army, a general list being kept for each arm up to and including a certain rank, which varies with each arm, *e.g.*, in the Carabinieri up to general of division, but in the Commissariat Corps up to lieutenant-colonel. In order to qualify for promotion, officers must serve a minimum period of (*a*) three years as a lieutenant, (*b*) four years as a captain, and (*c*) two years in all other ranks. In addition to this time qualification confidential reports have to be rendered on all officers concerning their general efficiency. Up to and including majors, these reports are rendered separately by three senior officers, and on officers above this rank by two senior officers and a central promotion commission. This body exists for the purpose of considering promotions to the rank of colonel and to the various ranks of general. It consists of the chief of staff and the four army commanders designate. Other senior officers may also be co-opted to give evidence for or against the promotion of an officer under their command, but such officers have no vote. The decisions of the C.P.C. are final, provided they are approved by the minister of war. If they are not approved, or if there is an equality of votes, the final decision rests with the minister of war.

BELGIUM

The combatant officers are drawn from a very wide social class. Entry can be effected through the ranks or by direct appointment to the *École militaire*. In both cases a preliminary examination is compulsory. Examinations are held yearly for entrance to the *École militaire*, the equivalent to Sandhurst and Woolwich. Candidates are drawn from three sources: (*a*) private life, (*b*) the *École des Pupilles*, and (*c*) n.c.o.'s and men of the active army, who have a special examination and are afforded facilities for study with a view to passing it.

Reserve of Officers.—This is a most difficult problem in the Belgian army owing to the absence of a statute defining the exact status and duties of reserve officers and the dislike of the average citizen to undertaking a duty which means giving up his business or his holidays for training. The supply of officers in war emanates from the following sources: (*a*) actual army, (*b*) regular officers unattached, on half-pay, or in the Congo, (*c*) retired regular officers, under the age limit and fit, (*d*) *École militaire* and *École d'Application* students, (*e*) voluntary engagements of retired officers, not subject to recall, (*f*) men specially selected, (*g*) promoted n.c.o.'s.

Reports on Officers.—After passing the schools prior to commission, officers have no further examination until they come up for promotion to field rank. They are, however, reported upon periodically by their commanding officers.

SWITZERLAND

All officers pass through the ranks prior to commission, and have attended certain definite courses of instruction in each rank. The training of recruits and cadres (officers and n.c.o.'s) is carried out at courses of instruction, specially held for that purpose, by a small permanent body of officers and n.c.o.'s, called the corps of instructors. As a general rule, officers of each rank must have held that rank for four years before they can be promoted. They must prove their fitness for promotion by obtaining a certificate of efficiency. Promotion to lieutenant is by seniority, to all other ranks by selection.

POLAND

All citizens of the Polish State can become officers; thus Jews, or men of Russian or German nationality who are citizens of Poland, are equally eligible, with the native Pole, to become officers. As a general rule, only men of good social position are taken into the cavalry and horse artillery. The corps of officers is divided into several branches, but all have equal rights and stand on an equal footing. All officers who were previously officers in the old Russian, Austrian or German armies were accepted into the Polish army in the same rank as they held in their previous army. A young man may become a regular officer either by direct entry or by passing through the ranks. Young men wishing to obtain a direct commission must pass through the *podchorgzy* or officers' school. N.c.o.'s who desire to obtain commissions

must complete three years' service as n.c.o.'s, have reached the rank of *plutonowy* (sergeant), be specially recommended, and have passed certain middle school classes or have war service. Selected n.c.o.'s are sent for a two years' course at the officers' school for n.c.o.'s at Bydgosc. Promotion is by selection and seniority; second lieutenants are promoted lieutenant after two years' service; further promotion is governed by length of service and selection.

BALTIC STATES

Estonia, Latvia and Lithuania.—Officers are obtained solely from cadet schools, which in Estonia and Latvia are the smartest and most efficient institutions in the army. The cadets are drawn mainly from the secondary schools and universities. They do a two years' course of training (in Estonia three years, for all except infantry). The cadet schools contain in Estonia about 300 cadets, in Latvia 200, in Lithuania 400. All officers on retirement, except in special circumstances, are held to serve in the reserve.

THE NETHERLANDS

Officers are obtained from (*a*) cadets from the Royal Military college at Breda, (*b*) n.c.o.'s who have graduated at the *Hoofd cursus* or final course at Kampen; such n.c.o.'s must previously have passed through the instructional battalion. The training of officers is on the same general lines as other European armies. The staff college (*hoogere krijgsschol*) at The Hague trains officers for the staff, the course being of three years' duration. There are various schools of instruction for specialized training.

THE AIR SERVICES

The systems of appointment to commissions in the air services differ under the various governments and are dealt with accordingly under the headings of their several countries.

GREAT BRITAIN—THE ROYAL AIR FORCE

Methods of Entry.—There are three methods of entry into the general duties branch: (*i.*) By passing through Cranwell Cadet college by means of a competitive examination similar to Sandhurst and Woolwich. The course lasts two years and the training is on lines similar to Sandhurst and Woolwich. In addition, the flight-cadet receives training in the elements of engineering and is taught to fly a service aeroplane. As physical fitness is an essential for efficient piloting, the closest attention is given to athletics. (*ii.*) By direct entry of university candidates similar to the army system. (*iii.*) By obtaining a short service commission of five years' duration, offered to candidates between the ages of 18 and 30. On appointment, these officers are posted direct to a flying training school to undergo a 12 months' course, which includes training in discipline, administration, aero engines, meteorology, navigation, armament, signals and photography. In addition, they are taught to fly a service aeroplane.

Training.—On leaving Cranwell on first commissioning, the young officer is posted to a service unit for four to five years, during which he carries out his duties as a pilot. At the end of this time he is expected to specialize in one of the several branches, and along one of these channels he looks for promotion. An officer who does not specialize has little prospect, if any, of promotion above the rank of squadron leader. Flying is carried out as an essential part of normal duties. On successfully passing out of the flying training school short-service commission officers are confirmed in their rank and posted to service units for four years. At the end of their five years' engagement they are transferred to the reserve for a further four years, during which they undergo periodical training in flying. Those who remain efficient may have their reserve service extended, four years at a time, up to the age of 40.

The Air Force Staff College, situated at Andover, is for training officers in staff duties. Entry is made by selection from successful candidates after a qualifying examination. The course lasts one year.

General Training.—R.A.F. officers undergo various courses of instruction, one of the most important being the engineering course. This starts with a period of two years at the home aircraft depôt at Hendon, followed, in some cases, by a two years' course at Cambridge. A few of the most successful are selected to undergo a final course of 10 months at the Imperial college. Other courses are for wireless at Flower Down; armament at Eastchurch; photography at Farnborough; navigation at Calshot.

UNITED STATES OF AMERICA

Aviation in the United States is in three distinct branches, the army, the navy and the post office air mail services. The army air service is administered by the office of the chief of the air service, who is a subordinate of the chief of staff. There are two methods of entry to commissioned rank: (*i.*) direct entry through West Point or by competitive examination from civil life; (*ii.*) by transfer from another arm of the army. Other ranks are obtained by voluntary enlistment. The army air service training establishments are under the training division, which embraces schools for primary flying, advanced flying, mechanics, communication, photography, tactics, engineering, flight surgeons, balloons and airships. Officers on joining pass through the primary and advanced flying schools, after which they are available for duty in a unit as pilots. There is no specified duration for the courses. To become an observer, an officer must first qualify as a pilot. Technical training is carried out at the technical school group (mechanics, communications and photography), where there are numerous courses of varying duration for the specialist trades required. The higher technical training of officers is carried out at the engineering division, McCook Field, Dayton.

FRANCE

The French military air service is an integral part of the army. The service relies to a very large extent on non-commissioned personnel for its pilots, and the proportion of officer pilots is small, which is rather an assurance that an officer can make a career in that service. Officers are drawn from three sources: (*i.*) École Militaire de St. Cyr, (*ii.*) École Polytechnique, (*iii.*) by promotion from the ranks. The n.c.o. ranks are divided into three branches: (*i.*) flying personnel, (*ii.*) skilled ground personnel, (*iii.*) unskilled ground personnel. The flying personnel is recruited from those who obtain a pilot's bursary (*i.e.*, are allowed to joint the colours a year before their due date and are trained at the Government's expense) and by enlistment into the flying branch of the service. The skilled ground personnel is recruited from men who obtain a mechanic's bursary by enlistment or re-enlistment and by the incorporation of conscripts. The unskilled ground personnel is recruited by the incorporation of conscripts. Warrant officers, n.c.o.'s or soldier pilots receive the same rates of "flying pay" as officers.

GERMANY

By the aeronautical clauses of the Treaty of Versailles, Germany is forbidden to maintain a military or naval air service. In 1926, however, the terms of these clauses were modified and Germany is now permitted to construct aircraft of certain patterns. Not more than six members of the fighting forces (army and navy) per annum may be trained as pilots up to a total of 36; thereafter three per annum may be trained as replacements. Such training is to be undertaken at the private expense of the pupil and must not include instruction in military aviation.

BELGIUM

The military aviation service is under the Ministry of National Defence. Only officers, *sous-officiers* and corporals are held on the permanent establishment. All officer personnel are only attached to the air service, being seconded from their regiments. During their term in the air service they receive special promotion according to the most favoured arm. If, however, they revert to regimental duty, they return to their permanent rank according to regimental seniority.

Officers are drawn from the following sources: (*i.*) Officers transferred during 1914–18; these are chiefly senior officers employed on administrative duties; (*ii.*) young officers seconded from other arms for an indefinite period, who must, prior to trans-

fer, pass all the military tests for an observer and a balloon or aeroplane pilot; (*iii.*) adjutants of the aviation troops; (*iv.*) *sous-lieutenants de réserve,* who are chosen from volunteers; (*v.*) reserve officers. Other ranks: Any unmarried Belgian, civilian or *milicien* performing, or having performed, his active service, and between 18 and 25 years of age and able to pass certain physical and educational tests, can become a candidate n.c.o. in the navigating branch of the aviation service. If a civilian, he enlists for two years. Balloonists, observers and bomber n.c.o.'s are trained under similar conditions. Training beyond that carried out in the squadrons is organized as follows: (*i.*) the civilian flying schools train 100 pilots annually; (*ii.*) the military flying school at Courtrai takes all the officers, *sous-officiers* and corporals required for training yearly; (*iii.*) the école de sous-lieutenants de reserve attached to (*ii.*) trains 40 pupils yearly; (*iv.*) the school for mechanics deals with *miliciens.* There is no air staff college.

JAPAN

The air forces of the army and navy are quite distinct. That of the army is administered by the war department. Officers for flying duties are recruited from young officer volunteers of all arms who have at least one year's service. The majority of senior officers have been selected for command and for administrative purposes, from other arms. Other ranks are recruited from those possessing general intelligence and experience in mechanical trades.

SWITZERLAND

(*a*) The Swiss air service is under the general staff. The service is composed of all classes, subject to military duty, and all ranks belonging to it are liable to the same periods of training and musketry as other troops. Officers are either promoted from flying duties or recruited from young officer volunteers of all n.c.o.'s and men are recruited in the ordinary way. Training is carried on at schools of instruction chiefly at Dübendorf and Thun, the curriculum being similar to that of other countries.

NETHERLANDS

The air services of the army and navy are separate. The air service of the colonial army is, like that army, under the Colonial Office. The headquarters of the air service is at Soesterberg, where the main workshops, training schools and other services are situated. There are schools for every form of specialized training.

POLAND

The air force is part of the regular army under the Ministry of War. The force is organized into aeroplane regiments. Recruiting and terms of service for aviation are identical with those for the rest of the army. Officers are obtained either from cadets or from officers transferring from other arms. The officers' aviation school is at Deblin, where they undergo a two years' course. There are schools for specialized subjects at Lida and Bydgoszcz.

CZECHOSLOVAKIA

The air service is an integral part of the army under the Ministry of National Defence. It is organized in regiments, each consisting of four wings, viz., reconnaissance, fighting, bombing and training. The majority of pilots are n.c.o.'s. The normal channel of recruitment of officers is from the academy at Hranice or by transfer from other arms. N.c.o.'s are eligible for promotion to commissioned rank. Schools exist for training in specialized subjects.

YUGOSLAVIA

The air service is a part of the army. It is organized in regiments. Officers are recruited from the military academy at Belgrade, who have served at least one year in a unit. N.c.o.'s form a special body and generally serve for 15 years with the force. No commissions are given to n.c.o.'s in air regiments. Training in specialized subjects is carried out at schools at Novi Sad, Mostar and Sarajevo.

BALTIC STATES

The air forces of the three States (Estonia, Latvia and Lithuania) were founded in 1918. In Estonia the air force is a separate service, but in Latvia and Lithuania the air forces are an integral part of the army. In Estonia, the junior officers are regulars, who are posted from other arms or join direct from the military cadet school. The other ranks are conscripts. Preliminary training is carried out at Reval. In Latvia, the officer personnel is obtained either by direct entry or by attachment from the army. Other ranks are selected conscripts, and in Lithuania officers and n.c.o.'s are selected from the army.

Corresponding Ranks in the British Services

Army	Navy	Royal Air Force
Field-marshal	Admiral of the fleet	Marshal of the Royal Air Force.
General	Admiral	Air chief marshal.
Lieutenant-general	Vice-admiral	Air marshal.
Major-general	Rear-admiral	Air Vice-marshal.
Brigadier	Commodore (1st and 2nd class)	Air commodore.
Colonel	Captain	Group captain.
Lieutenant-colonel	Commander	Wing commander.
Major	Lieutenant-commander	Squadron leader.
Captain	Lieutenant	Flight lieutenant.
Lieutenant	Sub-lieutenant	Flying officer or observer officer.
Second-lieutenant	Commissioned officer from warrant officer	Pilot officer.

(T. J. E.)

OFFICIAL SECRETS. Except in so far as acts against the safety of the realm could be brought within the law relating to treason, no statutory authority for preventing and punishing the disclosure of official secrets existed in England until 1889. In that year the Official Secrets Act was passed, but that statute was repealed in 1911 and the Official Secrets Act of that year substituted. During the World War the Defence of the Realm Regulations dealt with the disclosure of official documents and information. But these were only war measures, and in 1920 the Official Secrets Act of that year was passed, which amended the Act of 1911, and at the present time the law is to be found in the Official Secrets Acts of 1911 and 1920. Penalties are imposed for spying, and for the wrongful communication or use of information which has been obtained in contravention of the Acts, or which has been entrusted in confidence to anybody by any person holding office under his majesty, or which has been obtained or to which a person has access owing to his position as a person who holds or has held office under his majesty. Power is also given to issue search warrants where there is reasonable ground for suspecting that an offence has been or is about to be committed. The prosecution for an offence cannot be instituted except by or with the consent of the attorney-general, but this consent may be given after arrest.

Felony under the Acts is punishable by penal servitude of not less than 3 years and not exceeding 14 years; a misdemeanour on conviction on indictment to imprisonment with or without hard labour for a term not exceeding two years. Where the conviction is under the Summary Jurisdiction Acts the imprisonment is limited to three months or to a fine not exceeding £50 or both, but no misdemeanour can be dealt with summarily except with the consent of the attorney-general. It is further provided that, if in the course of the proceedings application is made by the prosecution, on the ground that the publication of any evidence to be given or of any statement to be made in the course of the case would be prejudicial to the national safety, all or any portion of the public shall be excluded during that part of the hearing, the court can make an order to that effect, but the passing of sentence must take place in public. (W. DE B. H.)

OFFSET, a term expressing the distance between two parallel planes, or between two parallel axles in a machine; also used in plumbing work to describe a connection between a large and a small pipe, in which the opening of the smaller pipe is eccentrically placed, so that the axes of the pipes, although parallel, are not in the same line. In architecture, an offset is a slanting plane, forming a transition between a thin wall above and a thick wall below, or between varying depths of a buttress; an offset buttress

is one deeper at the bottom than at the top, with the difference between the upper and lower faces taken up by one or more offsets.

OFFSET PRINTING: *see* PRINTING.

OGASAWARA JIMA form a group of 27 small islands having a total area of but 29sq.m. and lying in the Western Pacific 27°N. 143°E. The whole coast of Eastern Asia is fringed by island arcs, the innermost of which consist of large islands such as Japan, Formosa and the Philippines, but the outermost of small islands alone. The Ogasawara Jima form part of one outer festoon which stretches from the central volcanic zone of Japan through the Volcano, Marianne, Mackenzie, Yap and Pelew Is. to the Moluccas and which, originating in the latter stages of the "Alpine" fold movements, is still unstable. The northern end of the arc passes into central Honshu, that part of Japan where earthquakes are most frequent, and in the Ogasawara group tiny islands appear and disappear. The arc has an important strategic position with regard to the Pacific approaches of the Far East and, with a single exception, the whole is administered by Japan either in her own right or as a mandatory power. The exception, Guam, the most southerly of the Marianne group, belongs to the United States for it lies on the route to her possessions in the Philippines.

Although known to several explorers, each of whom gave the group a different name, these islands, originally called Bonin, were not permanently settled, so far as is known, until 1830. The term "Bonin" is a corruption of the Japanese "Munin To" meaning "empty of men," but the Japanese themselves term them "Ogasawara Jima" after Ogasawara, their first discoverer in 1593. Japan asserted her claim to them in 1861 and has since established regular steamship communications with Yokohama. The vegetation is of a most tropical luxuriance—palms, wild pineapples and ferns growing profusely, and the valleys being filled with wild beans and patches of taro. The valuable timber wealth includes cedar, rose-wood, iron-wood, box-wood, sandal and white oak. The population, which is of very mixed origins—as in so many Pacific islands to-day—numbers about 5,000.

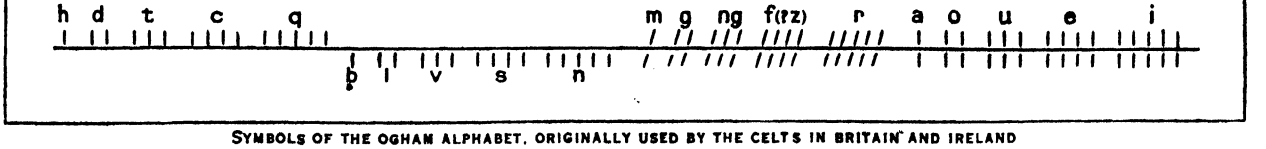
OGDEN, a city of Utah, U.S.A., 35 m. N. of Salt Lake City, at the confluence of the Ogden and the Weber rivers and the foot of the Wasatch mountains; the county seat of Weber county and the second city of the State in size. It is on Federal highways 30S and 91; has a municipal airport; and is served by the Denver and Rio Grande Western, the Southern Pacific, the Union Pacific, and several electric railways. The population was 32,804 in 1920 (84% native white) and was estimated locally at 47,000 in 1928. Ogden is 15 m. E. of the point on Great Salt lake where the Lucin cut-off begins (the railroad trestle 32 m. long, completed in 1903). It lies 4,300 ft. above sea-level, on an alluvial fan or semi-circular delta, formed under the water of the ancient Lake Bonneville. Mt. Ogden (10,100 ft. high, from which the entire shore line of the ancient lake, covering 19,750 sq.m., may be clearly seen) and Mt. Ben Lomond (10,900 ft.) rise abruptly on the east, and between them the Ogden river makes its way through one of the most picturesque canyons in America. In a broad valley 10 m. up the canyon is Artesian park, where a cluster of 43 fountains spout water that is chemically pure, from a depth of 150 ft., for the municipal supply. Ogden is the principal railroad centre of the region between the Rockies and the coast. Four roads maintain roundhouses and repair shops within its limits, and it is headquarters for much of the construction work in the western States. Its manufacturing industries are important, with an aggregate output valued at $17,112,645 in 1925. Chief among them are flour-milling, meat-packing, vegetable-canning, and the manufacture of beet-sugar, candy, tin cans, cement, butter and powdered milk. A large oil refinery was established in 1927. The city's assessed valuation for 1927 was $40,046,381. Bank debits for 1926 totalled $249,248,000.

Ogden was settled by the Mormons in 1847; was laid out under the direction of Brigham Young in 1850; and was incorporated in 1851. It had long been known as Ogden's Hole, from the cache which the trapper, Peter Skene Ogden, had located here in 1826. The northern end of the city was a grassy meadow, where the Indians met for games and races and to trade with the white men.

OGDENSBURG, a city of St. Lawrence county, New York, U.S.A., on the St. Lawrence river at the mouth of the Oswegatchie, 50 m. from Lake Ontario. It is served by the New York Central and the Rutland railways and lake and river steamers, and is connected by passenger and car ferry with the Canadian Pacific and the Grand Trunk railways at Prescott, Ontario, on the opposite bank of the St. Lawrence. Pop. (1920), 14,609 (81% native white); 1928 local estimate, 17,000. The city lies on high ground above the river, which is a mile wide here. It has a fine harbour, open throughout the year, and is an important shipping and transfer point, especially for lumber, grain and coal. The traffic of the harbour in 1925 amounted to 660,121 tons by lake vessels and 906,480 tons by car-ferry. With the completion of the Welland canal in 1930 it will be accessible to the largest lake vessels. Ogdensburg is a port of entry, headquarters of the St. Lawrence customs district, which in the fiscal year 1927–28 exported goods to the value of $78,196,568 and received imports valued at $137,751,982. In the same period 47,650 automobiles and 454,617 persons were transferred through the port. The city's manufactures (including silk, shade-rollers, paper and pulp) were valued in 1925 at $23,979,049. It is the seat of a State hospital for the insane; a State armory; and the Remington Art memorial, containing the collection of Indian relics and many of the paintings and statuettes of Frederic Remington, who was born in Canton, the county seat. The Thousand islands of the St. Lawrence lie about 30 m. south-west. Ogdensburg was the site of the Indian settlement of La Présentation, founded in 1749 by the Abbé François Piquet for converted Iroquois, and of Ft. Presentation, built by the British at the outbreak of the Revolution and held by them until 1796. The settlement that grew up about the fort was named after Abraham Ogden (1743–98), a New Jersey lawyer who bought land here. During the early part of the War of 1812 it was an important point on the American line of defence, and on Feb. 22, 1813, both fort and village were captured and partly destroyed by the British. Ogdensburg was incorporated as a village in 1818 and as a city in 1868.

OGEE, in architecture, a curve of double curvature, concave below and convex above. Thus an ogee arch is a pointed arch in which each side has an ogee curve; also applied to the moulding (*q.v.*) more commonly known as a *cyma reversa.*

OGHAM LANGUAGE. The language of the Ogham inscriptions is the oldest form of Goidelic with which we are acquainted. Some 300 inscriptions have been discovered in this alphabet, the majority of them hailing from the south-west of Ireland (Kerry and Cork). In Scotland 22 are known, whilst in England and Wales about 30 have turned up. Most of the latter are in South Wales, but odd ones have been found in North Wales, Devon and Cornwall, and one occurs in Hampshire. The Isle of Man possesses two. The letters in the oldest inscriptions are formed by strokes or notches scored on either side of the edge of an



SYMBOLS OF THE OGHAM ALPHABET, ORIGINALLY USED BY THE CELTS IN BRITAIN AND IRELAND

upright stone. Thus we obtain the alphabet on the preceding page.

This system, which was eked out with other signs, would seem to have been framed in the south-west of Ireland by a person or persons who were familiar with the Latin alphabet. Some of the inscriptions probably go back to the 5th century and may even be earlier. The simplest forms of Ogham inscriptions are: *Doveti maqqi Cattini, i.e.* "(the stone) of Dovetos son of Cattinos"; *Trenagusu Maqi Maqi-Treni* is rendered in Latin *Trenegussi Fili Macutreni hic jacit; Sagramni Maqi Cunatami,* "(the stone) of Sagramnos son of Cunotamos"; *Ovanos avi Ivacattos,* "(the stone) of Ovanus descendant of Ivacattus."

In the oldest of these inscriptions *q* is still kept apart from *k* (*c*), and the final syllables have not disappeared (cf. *maqqi*, O.Ir. *maicc*); but it appears certain that in Oghamic writing stereotyped forms were used long after they had disappeared in ordinary speech. Several stones contain bilingual inscriptions, but the key to the Ogham alphabet is supplied by a treatise on Oghamic writing contained in the Book of Ballymote, a manuscript of the late 14th century.

See R. R. Brash, *The Ogham Inscribed Monuments of the Gaedhil* (1879); R. A. Stewart Macalister, *Studies in Irish Epigraphy* (3 vols., 1897–1907), and *Archaeology of Ireland* (1928). Welsh inscriptions are given in J. Rhys, *Lectures on Welsh Philology* (1879). The Scottish stones have also been treated by Rhys in the *Proceedings of the Scottish Society of Antiquaries* (Edinburgh, 1892). *See* also G. M. Atkinson for the tract in the Book of Ballymote, *Kilkenny Journal of Archaeology* (1874). The Irish Christian inscriptions were published by Margaret Stokes as the annual volumes of the Roy Hist. and Archaeol. Association of Ireland (1870–77), and have been republished by R. A. Stewart Macalister.

OGIER THE DANE, a hero of romance, identified with the Frankish warrior Autchar (Autgarius, Auctarius, Otgarius, Oggerius) who in 771 or 772 accompanied Gerberga, widow of Carloman, Charlemagne's brother, and her children to the court of Desiderius, king of the Lombards, with whom he marched against Rome. In 773 he submitted to Charles at Verona. He finally entered the cloister of St. Faro at Meaux. Colour is lent to the theory of the Bavarian origin of the Ogier of romance by the fact that he, with Duke Naimes of Bavaria, led the Bavarian contingent at Roncevaux.

In the romances of the Carolingian cycle he is, on account of his revolt against Charlemagne, placed in the family of Doon de Mayence, being the son of Gaufrey de "Dannemarche." Ogier, who was the hostage for his father at Charlemagne's court, gained the emperor's favour by his exploits in Italy. One Easter at the court of Laon, however, his son Balduinet was slain by Charlemagne's son, Charlot, with a chess-board. Ogier in his rage slew the queen's nephew Loher, and would have slain Charlemagne himself but for the timely intervention of the knights. In his stronghold at Castelfort he resisted the imperial forces for seven years, but was at last taken prisoner. He was eventually released to fight the Saracen chief Bréhus or Braihier, who had defied Charlemagne to single combat. Ogier, after marrying an English princess, received from Charlemagne the fiefs of Hainaut and Brabant.

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OGILBY, JOHN (1600–1676), British writer, was born in or near Edinburgh in Nov. 1600. He accompanied Thomas Wentworth, earl of Strafford, when he went to Ireland as lord deputy, and became tutor to his children. Strafford made him deputy-master of the revels, and he built a little theatre in St. Werburgh Street, Dublin, which was very successful. The outbreak of the Civil War ruined his fortunes, and in 1646 he returned to England. Finding his way to Cambridge, he learned Latin from kindly scholars who had been impressed by his industry. He then ventured to translate Virgil into English verse (1649–50), which brought him a considerable sum of money. Ogilby learnt Greek from David Whitford, who was usher in the school kept by James Shirley the dramatist. *Homer his Iliads translated . . .* appeared in 1660, and in 1665 *Homer his Odysses translated . . .* Anthony à Wood asserts that in these undertakings he had the assistance of Shirley. At the Restoration Ogilby received a commission for the "poetical part" of the coronation. His property was destroyed in the Great Fire of 1666, but he rebuilt his house in Whitefriars, and set up a printing press, from which he issued many magnificent books; the most important were a series of atlases by Hollar and others. He died in London on Sept. 4, 1676.

Ogilby also translated the fables of Aesop, and wrote three epic poems. His bulky output was ridiculed by John Dryden in *MacFlecknoe* and by Alexander Pope in the *Dunciad.*

OGILVIE (or OGILBY), **JOHN** (*c.* 1580–1615), English Jesuit, was born in Scotland and educated mainly in Germany, where he entered the Society of Jesus, being ordained priest at Paris in 1613. As an emissary of the society he returned to Scotland in this year disguised as a soldier, and in Oct. 1614 he was arrested in Glasgow. He defended himself stoutly when he was tried in Edinburgh, but he was condemned to death and was hanged on Feb. 28, 1615.

A True Relation of the Proceedings against John Ogilvie, a Jesuit (Edinburgh, 1615), is usually attributed to Archbishop Spottiswoode. *See* also James Forbes, *L'Église catholique en Ecosse: martyre de Jean Ogilvie* (Paris, 1885); and W. Forbes-Leith, *Narratives of Scottish Catholics* (1885).

OGILVY, the name of a celebrated Scottish family of which the earl of Airlie is the head. The family was probably descended from a certain Gillebride, earl of Angus, who received lands from William the Lion. The earldom of Findlater, bestowed on James Ogilvy, Lord Ogilvy of Deskford, in 1638, was united in 1711 with the earldom of Seafield and became dormant after the death of James Ogilvy, the 7th earl, in October 1811.

James Ogilvy (*c.* 1593–1666), was created earl of Airlie by Charles I. at York in 1639. A loyal partisan of the king, he joined Montrose in Scotland in 1644 and was one of the royalist leaders at the battle of Kilsyth. The destruction of the earl's castles of Airlie and of Forther in 1640 by the earl of Argyll, who "left him not in all his lands a cock to crow day," gave rise to the song, "The bonny house o'Airlie." His eldest son, James, the 2nd earl (*c.* 1615–*c.* 1704) also fought among the royalists in Scotland. He was three times a prisoner of the English, and was in the Tower of London during most of the years of the Commonwealth. This earl's grandson, James Ogilvy (d. 1731), took part in the Jacobite rising of 1715 and was attainted; consequently on his father's death in 1717 he was not allowed to succeed to the earldom, although he was pardoned in 1725. When he died his brother John (d. 1761) became earl *de jure,* and John's son David (1725–1803) joined the standard of Prince Charles Edward in 1745. He was attainted, and after the defeat of the prince at Culloden escaped to Norway and Sweden, afterwards serving in the French army, where he commanded *"le régiment Ogilvy"* and was known as *"le bel Ecossais."* In 1778 he was pardoned and was allowed to return to Scotland, and his family became extinct when his son David died unmarried in April 1812. After this event David's cousin, another David Ogilvy (1785–1849), claimed the earldom. In 1826 the attainders were reversed by act of parliament and David (d. 1849) became 6th earl of Airlie. The title remains in the hands of his descendants.

See Sir R. Douglas, *Peerage of Scotland,* new ed. by Sir J. B. Paul (1904 fol.).

OGIVE, in architecture, the diagonal ribs of a Gothic vault; in French usage applied to any pointed arch. As a result Gothic architecture is frequently termed in France *le style ogival.*

OGLESBY, a city of La Salle county, Illinois, U.S.A., 100 m. S.W. of Chicago, on the Illinois river at the mouth of the Vermilion, opposite La Salle and Peru. It is on Federal highway 51, and is served by the Chicago, Milwaukee, St. Paul and Pacific, the Illinois Central, and (through La Salle and Peru) the Burlington Route railways. Pop. (1920), 4,135 (35% foreign-born white); estimated locally at over 5,000 in 1928. It is part of the Tri-City industrial district, engaged chiefly in the manufacture of cement

and coal-mining. The city was founded in 1856 and incorporated in 1903. Until 1914 it was called Portland.

OGLETHORPE, JAMES EDWARD (1696–1785), English general and philanthropist, the founder of the State of Georgia, was born in London on Dec. 21, 1696, the son of Sir Theophilus Oglethorpe (1650–1702) of Westbrook Place, Godalming, Surrey. He entered Corpus Christi college, Oxford, in 1714, but in the same year joined the army of Prince Eugène. He became aide-de-camp to the prince, and served in the campaign against the Turks, 1716–17, more especially at the siege and capture of Belgrade. After his return to England he was in 1722 elected member of parliament. With the idea of providing an asylum for persons who had become insolvent, and for oppressed Protestants on the continent, he projected the settlement of a colony in America between Carolina and Florida (*see* GEORGIA). In 1745 Oglethorpe was promoted to the rank of major-general. His conduct in connection with the Scottish rebellion of that year was the subject of a court-martial, but he was acquitted. In 1765 he was breveted general. He died at Cranham Hall, Essex, in 1785.

Sir Theophilus Oglethorpe, the father, had four sons and four daughters, James Edward being the youngest son, and another James having died in infancy. Of the daughters, Anne Henrietta, Eleanor and Frances Charlotte (Bolingbroke's "Fanny Oglethorpe") may be specified as having played rather curious parts in the Jacobitism of their time; their careers are described in the essay on "Queen Oglethorpe" by Miss A. Shield and A. Lang, in the latter's *Historical Mysteries* (1904). *See* also Lives by Harris (1841), Wright (1867), Bruce (1890), and Harriet C. Cooper (1904).

OGOWÉ, a river of West Central Africa, about 750 m. long, rising in 3° S. in the highlands known as the Crystal range, and flowing north-west and west, reaches the Gabun coast of the Atlantic by Cape Lopez, a little south of the equator. Here it forms a considerable delta. In its upper course the Ogowé is much obstructed by rapids as it descends the successive steps of the tablelands. It breaks through the outer chains of the mountainous zone, between 10¾° and 11¾° E. In its lower course the river passes through a lacustrine region in which it sends off secondary channels. These channels, before reuniting with the main stream, traverse a series of lakes, one north, the other south, of the river. These lakes are natural regulators of the river when in flood. Of its tributaries the chief are the Lolo, which joins on the south bank in 12° 20′ E., and the Ivindo, which enters the Ogowé a few miles lower down. Below the Ivindo the largest tributaries are the Ofowé, 400 yd. wide at its mouth (11° 47′ E.), but unnavigable except in the rains, and the Ngunye, the largest southern tributary, navigable for 60 m. to the Samba or Eugénie Falls. Apart from the narrow coast plain the whole region of the lower Ogowé is densely forested and the predominant industry of the region is the timber trade. The fauna includes the gorilla and chimpanzee.

The Ogowé rises in March and April, and again in October and November; it is navigable for steamers at low-water as far as the junction of the Ngunye, and at flood time for a distance of 235 m. to N'Jole. The first person to explore the valley of the Ogowé was Paul du Chaillu, who travelled in the country during 1857–59. The Ogowé lies wholly in French Equatorial Africa (*q.v.*).

For a vivid account of life on the lower Ogowé *see* A. Schweitzer, *On the Edge of the Primeval Forest* (1922).

O'GRADY, STANDISH JAMES (1846–1928), Irish man of letters, was born at Castletown, Co. Cork, on Sept. 18, 1846, the son of a Protestant clergyman, studied at Trinity college, Dublin, and after taking his degree in 1868 was called to the bar in 1872. He died at Shanklin, Isle of Wight, on May 18, 1928. O'Grady was one of the pioneers of the Celtic renaissance in Ireland. His interest in Irish antiquities was roused by the reading of O'Halloran's *History of Ireland,* and he set himself to awaken living interest in the Irish past by telling over again the Irish legends of the heroic age. He himself believed in the historical existence of the heroes of Irish epic, being convinced that primitive singers could not have invented them. His first work, *History of Ireland: the Heroic Period* (Dublin, 1878), was republished, in part, under the title of *Cuculain: an Epic,* in London (1882), and was succeeded by *History of Ireland: Cuculain and his Contemporaries* (Dublin, 1880). From these he developed his cycle of romantic histories: *Finn and his Companions* (1892), *The Coming of Cuculain* (1894), *In the Gates of the North* (Kilkenny, 1901), and the *Passing of Cuculain* (Dublin, 1917). He began a *History of Ireland, Critical and Philosophical,* of which the first volume only was written (Dublin, 1881). He also wrote *Ulrick the Ready* (1896); *The Bog of Stars* (1893); *Red Hugh's Captivity* (1889).

See Standish O'Grady, *Selected Essays and Passages,* with introduction by E. A. Boyd (Dublin, 1918).

OGUNQUIT, a village of York county, Maine, U.S.A., 36 m. S.W. of Portland, and 6 m. S. of Wells Beach, the nearest railway station (on the Boston and Maine railroad). Pop. (1920) 468. It is a summer resort, in one of the most beautiful spots on the Maine coast. The name, according to tradition, is a Natick Indian word meaning "a beautiful place by the sea."

OGYGES or **OGYGUS,** in Greek mythology, the first king of Thebes. During his reign came a great deluge (*see* DEUCALION); this is one of the two Greek versions of the widespread flood-legend. Ogyges is variously described as a Boeotian autochthon, as the son of Cadmus, or of Poseidon.

O'HIGGINS, BERNARDO (1776–1842), soldier and statesman, head of the first permanent national Government of Chile, was born at Chillán on Aug. 20, 1776, the natural son of the Irishman Ambrosio O'Higgins, governor of Chile (1778–95), and viceroy of Peru (1795–1801). Educated in England and Spain, he returned to Chile in 1802, and on the outbreak of the nationalist revolution in 1810 joined the party of Martínez de Rozas and distinguished himself in the early fighting against the royalists. In Nov. 1813, he was appointed to supersede J. M. Carrera in command of the patriot forces, and the rivalry of Carrera eventually resulted in the defeat of the national troops at Rancagua, in Oct. 1814. O'Higgins fled with most of the patriots across the Andes to Mendoza, where José de San Martín (*q.v.*) was preparing a force for the liberation of Chile and Peru. San Martín espoused O'Higgins's part against Carrera, and O'Higgins readily consented to serve under San Martín. His loyalty and energy were an important factor in the success of the campaign, especially in the decisive victories of Chacabuco (Feb. 1817) where O'Higgins's cavalry charge carried the day, and of Maipú (April 1818). After the battle of Chacabuco O'Higgins was entrusted with the administration of Chile; he kept order in the country and co-operated loyally with San Martín in his preparation for the invasion of Peru. But once the overthrow of the Spanish supremacy in Peru had freed Chile from fear of attack, agitation broke out for constitutional government. O'Higgins called a congress which adopted a Constitution (1822) giving him dictatorial powers. The discontent, however, continued; risings occurred in Concepción and Coquimbo, and on January 28, 1823, O'Higgins gave up his post of director-general. He retired to Peru where he was granted an estate, and lived quietly until his death on Oct. 24, 1842. In 1839 the Chilean senate had restored him to his honours and his military rank.

O'HIGGINS, KEVIN CHRISTOPHER (1892–1927), Irish statesman, youngest son of Dr. T. Higgins (who was murdered by unknown men in 1923), of Stradbally, Queen's County, was born in 1892 at Stradbally and educated at Clongowes and St. Patrick's College, Carlow, and in the National University of Ireland. He was articled to his uncle Maurice Healy, a solicitor in Cork. After the Easter rebellion in 1916 he joined the Sinn Fein movement, and was interned. While still in gaol he was elected member for Queen's County (1918). He acted as assistant minister for local government to Mr. Cosgrave, and in 1922 became a member of the provisional government as minister of justice and vice president of the Executive Council. As minister of justice he established the Civic Guard, and put down disorder with a strong hand. He was called to the Irish bar in 1923, and in June 1927 added to his existing duties those of minister for external affairs.

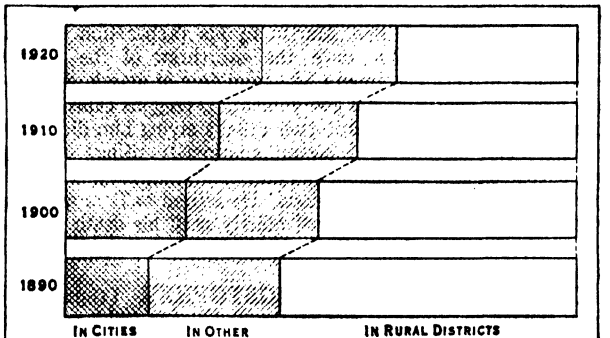
In the midst of the controversy with De Valera over the taking

of the oath in the Dail he was waylaid by three armed men while on his way to mass at Booterstown, outside Dublin, and shot dead (July 10, 1927). It was believed that the crime was connected with the fact that, as minister of justice O'Higgins had been largely responsible for the 77 executions which were carried out in the course of the civil war. He married Bridget Mary Cole, of Dublin, in 1921, who, with the two children of the marriage, survived him.

OHIO, popularly known as the "Buckeye State," is a north central State of the United States of America, lying between latitudes 38° 27′ and 41° 57′ N. and between longitudes 80° 34′ and 84° 49′ W. of Greenwich. It is bounded north by Michigan and Lake Erie, east by Pennsylvania and by the Ohio river, which separates it from West Virginia, south by the Ohio river which separates it from West Virginia and Kentucky and west by Indiana. The State is nearly square in shape, its extremes from north to south and from east to west being about 210 m. and 220 m. respectively. The total area is 41,040.sq.m. of which 300 sq.m. exclusive of its Lake Erie jurisdiction, are water surface.

Physical Features.—The State lies on the borderland between the Prairie plains and the Allegheny plateau. The disturbances among the underlying rocks of Ohio have been slight, and originally the surface was a plain only slightly undulating; stream dissection changed the region to one of numberless hills and valleys; glacial drift then filled up the valleys over large broken areas, forming the remarkably level till plains of north-western Ohio; but at the same time other areas were broken by the uneven distribution of the drift, and south-eastern Ohio, which was unglaciated, retains its rugged hilly character, gradually merging with the typical plateau country farther south-east. The average elevation of the State above the sea is about 850 ft. but extremes vary from 425 ft. at the confluence of the Great Miami and Ohio rivers in the south-west corner; to 1,550 ft. on the summit of Hogues hill about 1½ m. east of Bellefontaine in the west central part.

The main water-parting is formed by a range of hills which are composed chiefly of drift and extend west south-west across the State from Trumbull county in the north-east to Darke county, or about the middle of the west border. North of this water-parting the rivers flow into Lake Erie; south of it into the Ohio river. Passing the village of Cuyahoga Falls the Cuyahoga river descends more than 200 ft. in three miles; a part of its course is between walls of sandstone 100 ft. or more in height, and near its mouth, at Cleveland, its bed has been cut down through 60 ft. of drift. In the middle north part of the State the Black, Vermilion and Huron rivers have their sources in swamps on the water-parting and flow directly to the lake through narrow valleys. The till plains of north-western Ohio are drained chiefly by the Maumee and Sandusky rivers, with their tributaries.



DISTRIBUTION OF POPULATION BETWEEN URBAN AND COUNTRY DISTRICTS, 1890–1920

In the south-west the Great Miami and Little Miami rivers have uniform falls through basins that are decidedly rolling and that contain the extremes of elevation for the entire State. The central and south middle part is drained by the Scioto river and its tributaries. Its basin is about 40 m. wide and only moderately rolling, but toward the mouth of the river the basin becomes narrow and is shut in by high hills. In the eastern part of Ohio the Muskingum river and its tributaries drain an area of about 7,750 sq.m. or nearly one-fifth of the entire State. The Ohio flows for 436 m. through a narrow valley on the southern border of the State, and Lake Erie forms the northern boundary for a distance of 230 miles. At the west end of the lake are Sandusky and Maumee bays, each with a good natural harbour. There are several small lakes on the water-parting, especially in the vicinity of Akron and Canton.

Fauna and Flora.—Opossums, skunks and raccoons are plentiful in some parts of the State; and rabbits and squirrels are still numerous. Most of the song-birds and birds of prey of the temperate zone are plentiful. Whitefish, bass, trout and pickerel are important as food from the waters of Lake Erie, and the land streams and lakes are stocked with game fish.

Ohio is known as the "Buckeye State" from the prevalence of the buckeye chestnut (*Aesculus glabra*). The State was originally covered with a dense forest mostly of hardwood timber, and although the merchantable portion of this has been practically all cut away, there are still undergrowths of young timber and a great variety of trees. The white oak is the most common, but there are 13 other varieties of oak, six of hickory, five of ash, five of poplar, five of pine, three of elm, three of birch, two of locust and two of cherry. Beech, black walnut, butternut, chestnut, catalpa, hemlock and tamarack trees are also common. Wild flowers are well represented. Of native ferns there are many.

Climate.—The mean annual temperature of Ohio is about 51° F; in the north, 49·5°, and in the south, 53·5°. But except where influenced by Lake Erie the temperature is subject to great extremes; at Coalton, Jackson county, in the south-east part of the State, the highest recorded range of extremes is from 104° to −38° or 142°; at Wauseon, Fulton county, near the north-west corner, it is from 104° to −32° or 136°; while at Toledo, on the lake shore, the range is only from 99° to −16° or 115°. July is the warmest month, and in most parts of the State January is the coldest; in a few valleys, however, February has a colder record than January. The normal annual precipitation for the entire State is about 39 inches. It is greatest in the south-east and least in the north-west. At Marietta, for example, it is 42·1 in., but at Toledo it is only 30·8 inches. The prevailing winds in most parts are westerly, but sudden changes, as well as the extremes of temperature, are caused mainly by the frequent shifting of the wind between north-west and south-west.

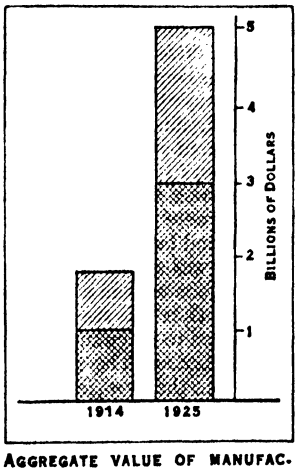
Soil.—In the driftless area, the south-east part of the State, the soil is largely a decomposition of the underlying rocks, and its fertility varies according to their composition; there is considerable limestone in the east central portion, and this renders the soil very productive. In the valleys also are strips covered with a fertile alluvial deposit. In the other parts of the State the soil is composed mainly of glacial drift, and is generally deep and fertile. It is deeper and more fertile, however, in the basins of the Great Miami and Little Miami rivers, where there is a liberal mixture of decomposed limestone and where extensive areas with a clay subsoil are covered with alluvial deposits.

Population.—The population of Ohio on July 1, 1928 was 6,826,000, according to the estimate of the U.S. census bureau. The population of the State at certain of the decennial censuses was: 45,365 in 1800; 581,434 in 1820; 1,519,467 in 1840; 2,339,511 in 1860; 3,198,062 in 1880; 3,672,329 in 1890; 4,157,545 in 1900; 4,767,121 in 1910; and 5,759,394 in 1920—an increase of 20·8% during the decade. Since 1900 Ohio has ranked fourth in population among the States. Of the total population in 1920, 5,571,893 or 96·7% were whites and 187,501 were coloured (186,187 negroes, 941 Chinese, 151 Indians and 130 Japanese). During the decade 1910–20 there was a marked increase in the negro population of the cities owing to immigration from the South; the percentage increased from 2·3 to 3·2 of the total. Of the total white population, 4,893,196 were native-born and 678,697 or 12·18% were foreign-born. Chief among the foreign-born na-

tionalities were: 111,893 native of Germany, 73,181 of Hungary, 67,579 of Poland, 60,658 of Italy, 48,073 of Austria, 43,690 of Russia, 43,140 of England, 42,121 of Czechoslovakia, 30,377 of Yugoslavia, 29,262 of Ireland and 24,176 of Canada. The density of population rose from 117 per square mile in 1910, to 141·4 in 1920; a density of population exceeding that of any State west of the Appalachian mountains. The urban population (in places of 2,500 inhabitants or more) formed 55·9% of the total in 1910 and 63·8% in 1920. There were, in 1920, 50 cities with a population exceeding 10,000. In 1928 the eight cities listed below had a population in excess of 100,000.

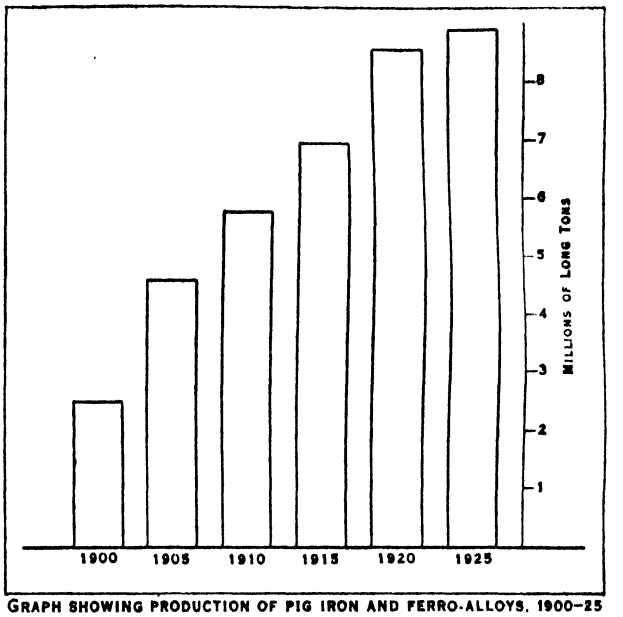
City	1920	1928 estimate
Cleveland	796,841	1,010,300
Cincinnati	401,247	413,700
Toledo	243,164	313,200
Columbus	238,762	299,000
Akron	208,435	...
Dayton	152,559	184,500
Youngstown	132,358	174,200
Canton	87,091	116,800

Government.—Ohio is governed under the Constitution of 1851 as revised by a constitutional convention in 1912 and subsequently amended. An amendment may be proposed at any time by either branch of the general assembly, and if after being approved by ⅔ of the members of both branches it is also approved at a general election by a majority of those voting on the question, it is declared adopted. Under the Constitutions of 1802 and 1851 the suffrage was limited to "white male" citizens of the United States, but by an amendment approved in 1923 these words were stricken out and the Constitution was made to conform with the 15th and 19th amendments to the Federal Constitution. The right of suffrage is bestowed on every United States citizen 21 years of age or over (with certain restrictions), provided he or she has resided within the State one year, in the county 30 days and in the ward or precinct for 20 days previous to the election. All voters living in cities with a population between 11,800 and 100,000 are required to register once in every four years; in the larger cities they must register annually. The Constitution requires that all elections be by ballot. Constitutional amendments, approved in 1912, provide for the use of the initiative and referendum in legislation.



AGGREGATE VALUE OF MANUFACTURED PRODUCTS
Lower half of columns represent value of materials; upper half, value added by manufacture

The executive department consists of a governor, lieutenant governor, secretary of State, auditor, treasurer and attorney general. All are elected in November of even-numbered years for a term of two years; an exception is the auditor, who serves for four years. The right of veto was not given the governor until the adoption of a constitutional amendment in 1903. Bills must be vetoed in their entirety, except that in appropriation bills specific, individual items may be vetoed; a ⅔ vote of all the members of each house is required for re-passage. The governor has full power to grant pardons and reprieves except for treason or conviction after impeachment by the general assembly. If he die in office, resign or be impeached and removed from office, the officers standing next in succession are the lieutenant governor, the president of the senate and the speaker of the house of representatives in the order named. By an administrative reorganization act, passed in 1921, 37 departments, commissions, etc., were combined into eight departments—finance, commerce, highways and public works, agriculture, health, industrial relations, education and public welfare—in which the former departments are known as divisions. Each department has at the head a director who is appointed by the governor and serves during his pleasure; each departmental director receives an annual salary of $6,500. In 1927 the division of public works was separated from the department of highways and made the ninth department with a director at its head. The system of administration thus established is closely analogous to that of the Federal Government.



GRAPH SHOWING PRODUCTION OF PIG IRON AND FERRO-ALLOYS, 1900–25

The general assembly consists of a senate and a house of representatives, the members of which are elected for terms of two years. The ratio of representation in the senate is obtained by dividing the total population of the State by 35, the ratio in the house by dividing the population by 100. The membership in each house, however, is above these figures (37 in the senate and 136 in the house in 1928), because of a system of fractional representation and of the Constitutional amendment of 1903 which allows each county at least one representative in the lower house. The Constitution provides for a reapportionment every ten years beginning in 1861. Biennial sessions are held beginning on the first Monday in January of the odd-numbered years. The Constitution prohibits special, local and retroactive legislation, legislation impairing the obligation of contracts and legislation levying a tax on State, municipal and public school bonds, and it limits the amount and specifies the character of public debts which the legislature may contract.

The judicial department in 1927 was composed of a supreme court of seven judges, nine judicial courts of appeals of three judges each, courts of common pleas, and probate, juvenile, justice of the peace and municipal courts. Under the Constitution of 1802 judges were chosen by the legislature, but since 1851 they have been elected by direct popular vote—the judges of the supreme court being chosen at large. They are removable by a concurrent resolution approved by a ⅔ majority in each house of the general assembly. The terms of supreme court judges, judges of the courts of appeals and judges of the courts of common pleas are six years; that of probate judges and justices of the peace is four years.

The principal units of local government are the county, the township, the city and the village. The chief county authority is the board of commissioners of three members elected for terms of four years. The other officials are the auditor and surveyor, elected for four years, and sheriff, treasurer, recorder, coroner, clerk of courts and prosecuting attorney, elected for two years. The county also has a board of education elected by the qualified voters. This board appoints the county superintendent of schools. The chief township authority is a board of trustees of three mem-

bers, elected by popular vote for two years. The other township officials are the clerk, treasurer, assessor, supervisor of roads, justices of the peace, constables, board of education and board of health. Under the Constitution of 1821, municipal corporations were established by special legislation. The Constitution of 1851, however, provided for a general law, and the legislature in 1852 enacted a "general municipal corporation act," the first of its kind in the United States. The system was changed again in 1912 when the so-called "home rule" amendment was put into the Constitution. This allows each city to make its own charter or constitution. As a result, a variety of charters exist, and the three outstanding types of municipal government—mayor and council, city manager and commission—are found.

In Ohio all State and county officials as well as U.S. senators and representatives are nominated at primaries held in even-numbered years on the second Tuesday in August.

Finances.—The ordinary expenses of the State Government are met entirely by indirect taxation. There was, however, in 1926, a State levy of .25 mills for the redemption of the $25,000,000 issue of World War compensation bonds. These bonds were the only bonded indebtedness of the State; the amount outstanding on June 30, 1926, was $16,250,000. This debt was being redeemed at the rate of $1,250,000 of the principal each six months. The chief sources of the general revenue fund are a one-twelfth of 1% tax on the asset valuation of domestic and foreign corporations, a premium tax on insurance companies, a 4% gross earnings tax on steam railways, a tax of 1.2% of the gross receipts of miscellaneous utilities, an inheritance tax, assessments on banks and finance companies, a franchise tax on new corporations, a 1.2% gross earnings tax on electric railways, a cigarette tax and receipts from various institutions. In 1926 the net receipts for this fund were $31,105,277.69, the disbursements $30,606,005.71, and the balance at the end of the fiscal year $3,112,371.77. The gasolene tax, automobile registration fees and certain other revenues are handled as separate funds. The disbursements of the highway department for the fiscal year were $23,801,459. The total revenue derived from tax levies on the grand duplicate of the State for all divisions for the tax year ending Aug. 31, 1926 was $255,808,459. Of this total tax, $3,108,905 was State (World War compensation bonds); $51,632,960 county; $13,712,878 township; $114,969,009 school; and $72,384,807 municipal. There were, on June 30, 1926, 1,084 commercial and savings banks operating within the State; their total resources were $3,055,640,000 and deposits $2,402,088,000. Of the total number of banking institutions 351 were national banks, and their resources totalled $963,786,000.

Education.—Ohio has an excellent system of public education extending from the kindergarten through college and university work. The basis of Ohio's educational system was laid by an act of Congress in 1785 setting apart 1 sq.m. in each township of 36 sq.m. for the support of education. The public-school system, however, was established in 1825. The legislature in 1837 established the office of State commissioner of common schools. This office was abolished in 1840, but was revived in 1843 and continued to function until displaced by that of the superintendent of public instruction in 1912. After the reorganization of the administrative departments in 1921, the superintendent of public instruction became the chief administrative officer of the department of education with the title director of education. According to the annual report of the director of education the total school revenue receipts for the year ending June 30, 1926, were $117,093,130, and the non-revenue receipts (*i.e.*, sale of bonds, gifts, etc.) amounted to $58,026,511, or a grand total of $175,119,641. The school enrolment in 1925–26, according to the above mentioned source, was 1,255,323. Of this total, 36,751 were in the kindergarten, 979,073 in elementary grades, 214,777 in secondary schools and the remaining 24,722 were in normal, vocational or special schools. The parochial school enrolment for the same year was 115,762 in the elementary schools and 15,074 in the high-school departments. The percentage of illiteracy in Ohio is very low; it was 2.8% in 1920. All children between the ages of 6 and 16 are required to attend school for the full term.

The institutions of higher education supported in whole or in part by the State are: Ohio university at Athens, founded in 1804 on the proceeds derived from two townships granted by Congress to the Ohio company; Miami university (chartered in 1809) at Oxford, which received the proceeds from a township granted by Congress in the Symmes purchase; Ohio State university (1873) at Columbus, which received the proceeds from the lands granted by Congress under the act of 1862 for the establishment of agricultural and mechanical colleges, and reorganized as a university in 1878; and two State normal colleges, one at Bowling Green, the other at Kent. Wilberforce university, for negroes (1856), at Wilberforce, is under the African Methodist Episcopal church; Akron, Cincinnati, Cleveland, Dayton and Toledo support universities; and three, Columbus, Dayton and Warren, support public normal schools. Among the numerous denominational or privately endowed colleges and universities within the State are Western Reserve university at Cleveland, Oberlin college at Oberlin and Ohio Wesleyan university at Delaware.

Charities and Corrections.—The State charitable and penal institutions in 1925 were under the general control of the department of public welfare, this department having superseded the board of administration on July 1, 1921. The director of public welfare has control of hospitals for the insane at Athens, Cleveland, Columbus, Dayton, Lima, Cincinnati (the Longview State hospital), Massillon and Toledo; a hospital for epileptics at Gallipolis; a sanatorium for tubercular patients at Mt. Vernon; an institution for the feeble-minded, a school for the blind and a similar institution for the deaf, at Columbus; a soldiers' and sailors' home at Sandusky; the Madison Home at Madison; the Bureau of Juvenile Research at Columbus; the commission for the blind at Columbus; an industrial home for boys at Lancaster and a similar institution for girls at Delaware; the State penitentiary at Columbus; and others.

Agriculture.—Ohio, in 1926, ranked tenth among the States in the total value of its agricultural products. The estimated value of all farm crops in that year was $299,900,000 as compared with $309,400,000 as an average for the four preceding years. Of its total land surface (26,073,600 ac.), 22,219,248 ac. or 85.2% were, in 1925, included in farms. The number of farms in the State has decreased steadily since 1900, the total in that year being 276,719 as compared with 244,703 in 1925. In acreage per farm, however, there has been a slight increase, the average in 1925 being 90.8 as compared with 88.5 in 1900. The percentage of tenancy in 1925 was 25.5 as compared with 29.5 in 1920 and 28.4 in 1910. The total value of all farm property in 1925 was $2,236,906,636 as compared with $3,095,666,336 in 1920. The farm population, in 1925, was 1,031,718, or approximately 16% of the State's total.

There was a great variety of produce, but the principal crops in 1926 were Indian corn, hay, wheat, oats, potatoes, apples, tobacco and barley. The Indian corn crop was 145,436,000 bu. in 1926; it was grown on 3,591,000 acres. The wheat crop grown on 1,795,000 ac. had a product of 40,384,000 bu. valued at $51,286,000. Oats was the cereal next in importance. The 1,980,000 ac. devoted to its culture produced 75,240,000 bu. of grain valued at $29,344,000. The acreage planted in barley increased from 25,000 ac., the average for 1909–13, to 116,000 ac. in 1926; but during the same period the rye acreage decreased from 65,000 ac. to 50,000 acres. The product of these cereals in 1926 was 3,712,000 bu. of barley and 875,000 bu. of rye. The hay crop, chiefly timothy and timothy mixed with clover, amounted to 4,007,000 tons valued at $56,098,000. The cultivation of tobacco was of little importance in the State until about 1840; but the product increased after 1850 and for a time was one of the State's leading agricultural crops. In 1926 the crop was 38,189,000 lb. grown on 44,000 ac. as compared with 81,948,000 lb. and 94,000 ac., the average for the years 1909–13. The potato crop was 10,058,000 bu. (from 107,000 ac.) valued at $17,099,000. Chief among the fruits were apples (11,900,000 bu.), peaches (2,120,000 bu.) and pears (430,000 bu.).

The live stock and poultry products of Ohio are of great importance. The value of the dairy products alone, in 1924, was $62,125,816. On June 1, 1927, it was estimated that the dairy

cattle within the State numbered 926,000. The 1,749,089 sheep shorn in 1924 produced 14,100,742 lb. of wool valued at $6,185,369. In the number of sheep within the State, Ohio ranks first among the States east of the Mississippi river. The chickens raised and the eggs produced had, in 1924, a value of $59,871,861. The live stock on the farms of the State on Jan. 1, 1927, consisted of 1,630,000 cattle, 2,439,000 swine, 2,080,000 sheep, 568,000 horses and 33,000 mules; their estimated value was $206,114,000.

Mineral Products.—The mineral wealth of Ohio is well distributed both as to products and area. In 1926, clay products, bituminous coal, natural gas and petroleum were the chief products, but the State also ranked high in the production of stone, lime, cement, gypsum, salt and grindstones. The total production was valued at $247,506,588.

The fire-clay mines of Tuscarawas, Jefferson, Columbiana, Stark and Carroll counties supply the raw material for the greater part of the State's pottery, tile and brick industry. The 393 firms engaged in manufacturing clay products, in 1925, had an output valued at $97,991,821 (brick and tile, $57,602,803, and pottery, $40,389,018). The coal-fields, comprising a total area of 10,000 sq.m. or more, are in the eastern half of the State. In 1923, 40,546,433 tons were produced as compared with 28,034,112 tons in 1925 and 29,150,000 tons in 1926. There were, in 1925, 27 counties in which coal was produced, but over 90% of it came from Belmont, Athens, Harrison, Jefferson, Guernsey, Perry and Tuscarawas counties. Natural gas is found in the eastern, central and north-western parts of the State. Most of the fields have been in operation many years but the flow continues strong; the product in 1925 was 43,235,000,000 cu. ft. valued at $22,377,000. In 1896 Ohio produced 23,941,169 bbl. of petroleum, or 39% of the total output in the United States; in 1926 it was 7,322,000 bbl. or slightly over one-half of 1% of the total output in the United States.

The output of the stone quarries in 1925 was valued at $13,084,572. Some of the best sandstone in the country is obtained from Cuyahoga and Lorain counties; it is exceptionally pure in texture and durable. From the sandstone known as Berea grit, a large portion of the country's grindstones, pulpstones and oilstones are obtained. The quantity of Portland cement made in Ohio has increased steadily since its first production about 1890; in 1926 the output was 7,422,720 bbl. valued at $12,793,537. Other important mineral products with their values in 1925 were: lime, $10,970,605; sand and gravel, $8,353,913; gypsum, $6,394,132; salt, $4,116,625; grindstones and pulpstones, $1,065,301.

Manufactures.—Ohio is pre-eminently a manufacturing State. The output of its factories in 1925 was exceeded in value by those of New York and Pennsylvania only. The value of the factory products increased from $748,670,855 in 1900 to $1,782,808,000 in 1914 and to $5,347,522,464 in 1925, or an increase of approximately 200% during the 11 year period 1914–25. The most notable advance was in the production of motor cars and in the manufacture of motor car tires. Ohio ranked first of the States in foundry and machine shop products, rubber tyres and tubes, ornamental iron-work and pottery; and second in iron and steel, motor vehicles and clay products. The most important manufacturing industry is that of iron and steel, established near Youngstown in 1804. The value of the output increased from $138,935,256 in 1900 to $968,264,000 (blast furnace, $178,722,017, and steel works and roller mills, $789,542,038) in 1925. The industry second in importance was the manufacture of rubber tyres and inner tubes for motor vehicles. This industry, in 1925, gave employment to 50,350 wage-earners and had a product valued at $556,262,424. The manufacture of motor vehicles, their bodies and parts, ranked third in importance; the industry gave employment to 43,791 wage-earners and had an output valued at $514,775,843. Foundry and machine-shop products, consisting largely of engines, boilers, tools, stoves and various kinds of machinery, ranked fourth among the State's manufactures; their value increased from $72,399,632 in 1900 to $345,222,837 in 1925. Electrical machinery, apparatus and supplies ranked fifth with a product valued at $181,351,409. Other leading manufactures in 1925 were slaughtering and meat-packing ($128,777,955), printing and publishing newspapers and periodicals ($101,515,510), construction and repair done in steam railway shops ($89,861,317), bakery products ($89,107,013), men's clothing ($78,001,683), paper and wood pulp ($75,923,880), food preparations ($71,525,920), petroleum refining ($63,296,901), paints and varnishes ($58,765,437), brick and tile ($57,566,109), coke, other than gas-house ($57,542,166), printing and publishing books and job work ($56,086,717), butter, cheese and evaporated milk ($53,065,098), structural and ornamental iron-work ($52,630,751), boots and shoes ($51,546,890) and grain-mill products ($51,264,871).

The great manufacturing centres are Cleveland, Akron, Cincinnati, Toledo, Youngstown, Dayton, Columbus, Canton and Springfield. The value of the products of these cities in 1925 amounted to approximately 62% of that for the entire State. A large portion of the iron and steel was manufactured in Cleveland, Youngstown, Steubenville, Lorain, Bellaire, Cleveland Heights, East Youngstown and Irontown. Most of the motor vehicles were manufactured in Cleveland and Cincinnati; most of the cash registers and calculating machines in Dayton; most of the motor tyres and other rubber goods in Akron.

Transportation and Commerce.—The most important natural means of transportation are the Ohio river on the southern border and Lake Erie on the northern border. One of the first great public improvements made within the State was the connection of these waterways by two canals—the Ohio and Erie canal from Cleveland to Portsmouth, and the Miami and Erie canal from Toledo to Cincinnati. The Ohio and Erie was opened throughout its entire length (309 m.) in 1832. The Miami and Erie was completed from Middletown to Cincinnati in 1827; in 1845 it was opened to the lake (250 m. from Cincinnati). A flood in 1913 wrecked these canals, and they had not been restored by 1928. The national Government began in 1825 to extend the National road across Ohio from Bridgeport, opposite Wheeling, West Virginia, through Zanesville and Columbus, and completed it to Springfield in 1837. Before the completion of the Miami and Erie canal to Toledo, the building of railways was begun in this region, and in 1836 a railway was completed from that city to Adrian, Michigan. At the close of 1925 there was a total mileage of 8,812 as compared with 9,159 in 1915, this reduction being a part of a general shrinkage prevalent throughout the country during this period. As the building of steam railways lessened and then ceased, the building of suburban and inter-urban electric railways was begun. These railways were rapidly extended until a maximum of 4,236 m. was reached in 1917, and all the more populous districts were connected by them; in 1925 there were 59 companies operating a total of 3,827 m. within the State. There were on Jan. 1, 1928, 11,000 m. of highway in the State system. Of this total 10,300 m. were surfaced. The total motor vehicle registration for the year ending Dec. 31, 1926, was 1,490,026.

The 15 Lake Erie ports of Ohio had, in 1926, a foreign commerce valued at $35,826,709 and a domestic trade of $461,101,707. Chief among the ports was Cleveland with over 41% of the total. Others of great importance were Toledo, Ashtabula, Conneaut, Sandusky, Fairport and Lorain. Ashtabula, according to the *Annual Report of the Chief of Engineers, U.S. Army*, had over 50% of the foreign trade (imports, $5,079,821 and exports, $13,135,440). Cincinnati is the State's chief port on the Ohio river.

History.—Ohio was the pioneer State of the old North-West Territory, which embraced also what are now the States of Indiana, Illinois, Michigan and Wisconsin and the north-east corner of Minnesota. When explored by Europeans, late in the first half of the 17th century, the territory included within what is now Ohio was a battle-ground of Indian tribes. From the middle to the close of the 17th century the French were establishing a claim to the territory between the Great Lakes and the Ohio river by discovery and occupation.

About 1730 English traders from Pennsylvania and Virginia began to visit the eastern and southern parts of the territory and a conflict approached as a French Canadian expedition under Céleron de Bienville took formal possession of the upper Ohio valley by planting leaden plates at the mouths of the principal streams. This was in 1749 and in the same year George II. char-

tered the first Ohio company, formed by Virginians and London merchants trading with Virginia for the purpose of colonizing the West. This company, in 1750, sent Christopher Gist down the Ohio river to explore the country as far as the mouth of the Scioto river, and four years later the erection of a fort was begun in its interest at the forks of the Ohio. The French drove the English away and completed the fort (Ft. Duquesne) for themselves. The Seven Years' War was the immediate consequence and this ended in the cession of the entire North-West to Great Britain. The former Indian allies of the French, however, immediately rose up in opposition to British rule in what is known as the conspiracy of Pontiac (*see* PONTIAC), and the suppression of this was not completed until Col. Henry Bouquet made an expedition (1764) into the valley of the Muskingum and there brought the Shawnees, Wyandots and Delawares to terms. With the North-West won from the French, Great Britain no longer recognized those claims of her Colonies to this territory which she had asserted against that nation, but in a royal proclamation of Oct. 7, 1763, the granting of land west of the Alleghenies was forbidden and on June 22, 1774 parliament passed the Quebec act which annexed the region to the province of Quebec. This was one of the grievances which brought on the Revolutionary War, during which the North-West was won for the Americans by George Rogers Clark (*q.v.*). During that war also, those States which had no claims in the West contended that title of these western lands should pass to the Union and when the Articles of Confederation were submitted for ratification in 1777, Maryland refused to ratify them except on that condition. The result was that New York ceded its claim to the United States in 1780, Virginia in 1784, Massachusetts in 1785 and Connecticut in 1786. Connecticut, however, excepted a strip bordering on Lake Erie for 120 m. and containing 3,250,000 acres. This district, known as the Western Reserve, was ceded in 1800 on condition that Congress would guarantee the titles to land already granted by the State. Virginia reserved a tract between the Little Miami and Scioto rivers, known as the Virginia Military district, for her soldiers in the Revolutionary War. When the war was over and these cessions had been made, a great number of war veterans wished an opportunity to repair their broken fortunes in the West, and Congress, hopeful of receiving a large revenue from the sale of lands here, passed an ordinance on May 20, 1785, by which the present national system of land-surveys into townships 6 m. sq. was inaugurated in what is now south-west Ohio in the summer of 1786. In March 1786 the second Ohio company (*q.v.*), composed chiefly of New England officers and soldiers, was organized in Boston, Mass., with a view to founding a new State between Lake Erie and the Ohio river. The famous North-West Ordinance was passed by Congress on July 13, 1787. This instrument provided a temporary government for the territory with the understanding that, as soon as the population was sufficient, the representative system should be adopted, and later that States should be formed and admitted into the Union. There were to be not less than three nor more than five States.

On the adoption of the North-West Ordinance the work of settlement made rapid progress. There were four main centres. The Ohio company founded Marietta at the mouth of the Muskingum in 1788, and this is regarded as the oldest permanent settlement in the State. An association of New Jersey people, organized by John Cleves Symmes, secured a grant from Congress in 1788–92 to a strip of 248,540 ac. on the Ohio, between the Great Miami and the Little Miami, which came to be known as the Symmes Purchase. Their chief settlements were Columbia (1788) and Cincinnati (1789). The Virginia Military district, between the Scioto and the Little Miami, reserved in 1784 for bounties to Virginia continental troops, was colonized in large measure by people from that State. Their chief towns were Massieville, now Manchester (1790) and Chillicothe (1796). A small company of Connecticut people under Moses Cleaveland founded Cleveland in 1796 and Youngstown was begun a few years later, but that portion of the State made very slow progress until after the opening of the Ohio and Erie canal in 1832.

During the Territorial period (1787–1803), Ohio was first a part of the unorganized North-West Territory (1787–99), then a part of the organized North-West Territory (1799–1800) and later the organized North-West Territory (1800–03), Indiana Territory having been detached from it on the west in 1800. The first Territorial government was established at Marietta in July 1788, and Gen. Arthur St. Clair, the governor, arrived in that month. His administration was characterized by the final struggle with the Indians. The Revolutionary War was succeeded by a series of Indian uprisings. Two campaigns, the first under Gen. Josiah Harmar (1753–1813) in 1790, and the second under Gen. St. Clair in 1791, failed on account of bad management and ignorance of Indian methods of warfare, and in 1793 Gen. Anthony Wayne (*q.v.*) was sent out in command of a large force of regulars and volunteers. The decisive conflict, fought on Aug. 20, 1794, near the rapids of the Maumee, is called the battle of Fallen Timbers, because the Indians concealed themselves behind the trunks of trees which had been felled by a storm. Wayne's dragoons broke through the brushwood, attacked the left flank of the Indians and soon put them to flight. In the treaty of Greenville (Aug. 3, 1795) the Indians ceded their claims to the territory east and south of the Cuyahoga, the Tuscarawas, and an irregular line from Ft. Laurens (Bolivar) in Tuscarawas county to Ft. Recovery in Mercer county, practically the whole of eastern and southern Ohio. The Jay treaty was ratified in the same year, and in 1796 the British finally evacuated Detroit and the Maumee and Sandusky forts. By cessions and purchase in 1804, 1808 and 1817–18, the State secured all of the lands of the Indians except their immediate homes, and these were finally exchanged for territory west of the Mississippi. The last remnant migrated in 1841. Gen. Wayne's victory was followed by an extensive immigration of New Englanders, of Germans, Scotch-Irish and Quakers from Pennsylvania and of settlers from Virginia and Kentucky, many of whom came to escape the evils of slavery. This rapid increase of population led to the establishment of the organized Territorial government in 1799, and to the admission of the State into the Union in 1803.

The Congressional Enabling act of April 30, 1802 followed that alternative of the North-West Ordinance which provided for five States in determining the boundaries, and in consequence the Indiana and Michigan districts were detached. A rigid adherence to the boundary authorized in 1787, however, would have resulted in the loss to Ohio of 470 sq.m. of territory in the north-western part of the State, including the lake port of Toledo. After a long and bitter dispute—the Toledo War (*see* TOLEDO)—the present line, which is several miles north of the south bend of Lake Michigan, was definitely fixed in 1837, when Michigan came into the Union. (For the settlement of the eastern boundary, *see* PENNSYLVANIA.) After having been temporarily at Marietta, Cincinnati, Chillicothe and Zanesville, the capital was established at Columbus in 1816.

Since Congress did not pass any formal act of admission there has been some controversy as to when Ohio became a State. The Enabling act was passed April 30, 1802, the first State Legislature met March 1, 1803, the Territorial judges gave up their offices on April 15, 1803, and the Federal senators and representatives took their seats in Congress Oct. 17, 1803. Congress decided in 1806, in connection with the payment of salaries to Territorial officials, that March 1, 1803, was the date when State Government began. During the War of 1812 the Indians under the lead of Tecumseh were again on the side of the British. Battles were fought at Ft. Meigs (1813) and Ft. Stephenson (Fremont, 1813), and Commodore Oliver Hazard Perry's naval victory on Lake Erie in 1813 was on the Ohio side of the boundary line.

Owing to the prohibition of slavery, the vast majority of the early immigrants to Ohio came from the north, but, until the Mexican War forced the slavery question into the foreground, the Democrats usually controlled the State, because the principles of that party were more in harmony with frontier ideas of equality. The Whigs were successful in the presidential elections of 1836 and 1840, partly because of the financial panic and partly because their candidate, William Henry Harrison, was a "favourite son," and in the election of 1844, because of the unpopularity of

the Texas issue. Victory was with the Democrats in 1848 and 1852, but since the organization of the Republican Party in 1854 the State has uniformly given to the Republican presidential candidates its electoral votes, except in 1912 and 1916 when a split in the dominant party (Republican) allowed the Democrats to win. In the Civil War Ohio loyally supported the Union, furnishing 319,659 men for the army. Dissatisfaction with the President's emancipation programme resulted in the election of a Democratic Congressional delegation in 1862, but the tide turned again after Gettysburg and Vicksburg; Clement L. Vallandigham, the Democratic leader, was deported from the State by military order, and the Republicans were successful in the elections of 1863 and 1864. A detachment of the Confederate cavalry under Gen. John Morgan invaded the State in 1863, but was badly defeated in the battle of Buffington's island (July 18). In 1873 the Democrats succeeded for the first time since 1856 in electing a governor, but in the years that have since elapsed the administrations have been almost evenly divided between Democrats and Republicans. Six presidents have come from Ohio, William Henry Harrison, Rutherford B. Hayes, James A. Garfield, William McKinley, William Howard Taft and Warren G. Harding.

Distinctive advance has been made in adapting the Constitution and the system of administration to the new needs of the State. At the election in 1910, a general Constitutional Convention was approved by a large majority. Delegates were chosen in Nov. 1911, and the convention sat from January to June 1912. The delegates, of whom the majority were Democrats, represented the progressive elements of both major parties. Forty-two amendments were submitted to the voters on Sept. 3, 1912, of which 34 were ratified; among those defeated were the abolition of capital punishment, woman suffrage and a $50,000,000 bond issue for a State system of roads. The tax-reformers secured for the general assembly the power to impose inheritance, income and franchise taxes as well as taxes upon the production of coal, oil, gas and other minerals. Several of these sources of taxation have since been adopted. The League for Direct Legislation secured the initiative and referendum, and those opposed to the liquor interests succeeded, in 1918, in establishing prohibition by a constitutional amendment. As the result of an administrative reorganization act passed in 1921, the numerous departments, commissions and boards were combined into eight departments, each with a director at its head—a system of administration similar to that of the Federal Government.

Insurance.—The State has attempted to regulate the health and safety of its industrial population. The workmen's compensation act of 1911 established voluntary "compensation for industrial accidents, which compensation is to be paid out of a State insurance fund, to which both employer and employes contribute (90% and 10% respectively) in lieu of the civil action for damages." A constitutional amendment of 1912 and a permanent law of 1913 made compulsory the system of State insurance. Ohio, under the act, maintains its own State insurance fund. By 1928 the premium income to the State amounted annually to more than $13,300,000, and protection was furnished to more than 1,600,000 workmen. Employers also were required to guard the safety of employes and to arrange reasonable hours of work. A statute of 1919 created a State-wide system of municipal and general health districts and the powers of the department of health were greatly increased. A State teachers' retirement system also was instituted in 1919. In 1926 the voters of the State rejected a proposed constitutional amendment which would have abolished the State primary election system and substituted in its stead a system of nominating conventions.

Southern Ohio has suffered at various times from floods. During the great flood of 1884, the Ohio river at Cincinnati reached the highest flood stage ever recorded at that place (over 71 ft. above normal), and throughout the Ohio valley millions of dollars worth of damage was done. Another disastrous flood in 1913, affecting especially the inhabitants of the Miami, the Scioto and the Muskingum river valleys, led to a measure for the protection of the river valley from future damage of the kind. The protective system, which consists of a series of dry reservoir dams, was undertaken by two conservancy districts—the Miami and the Upper Scioto—at a cost of $34,700,000 and $306,300 respectively.

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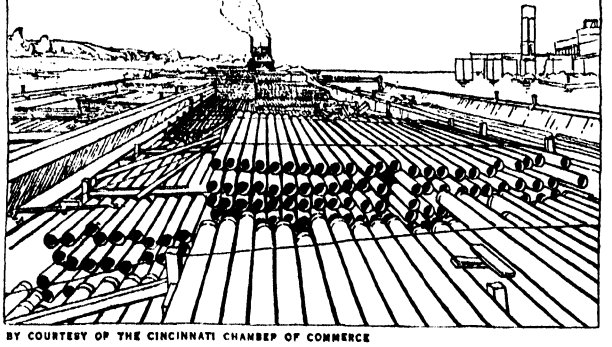
OHIO COMPANY, a name of two companies organized in the 18th century for the colonization of the Ohio valley. The first Ohio company was organized in 1749, partly to aid in securing for the English control of the valley, then in dispute between England and France, and partly as a commercial project for trade with the Indians. The company was composed of Virginians, including Thomas Lee (d. 1750) and the two brothers of George Washington, Lawrence (who succeeded to the management upon the death of Lee) and Augustine; and of Englishmen, including John Hanbury, a wealthy London merchant. In 1752 the company had a pathway blazed between the small fortified posts at Will's creek (Cumberland), Maryland, and at Redstone creek (Brownsville), Pennsylvania, which it had established in 1750; but it was finally merged in the Walpole company (an organization in which Benjamin Franklin was interested), which in 1772 had received from the British Government a grant of a large tract lying along the southern bank of the Ohio as far west as the mouth of the Scioto river. The Revolutionary War interrupted colonization and nothing was accomplished.

The second company, the Ohio company of Associates, was formed at Boston in 1786. The leaders in the movement were General Rufus Putnam, Benjamin Tupper (1738–92), Samuel Holden Parsons (1737–89) and Manasseh Cutler. Dr. Cutler was selected to negotiate with Congress, and seems to have helped to secure the incorporation in the ordinance for the government of the North-West Territory of the paragraphs which prohibited slavery and provided for public education and for the support of the ministry. On Oct. 27, 1787, Cutler and Major Winthrop Sargent (1753–1820), who had joined him in the negotiations,

signed two contracts; one was for the absolute purchase for the Ohio company, at 66⅔ cents an acre, of 1,500,000ac. of land lying along the north bank of the Ohio river, from a point near the site of the present Marietta, to a point nearly opposite the site of the present Huntington, Kentucky; the other was for an option to buy all the land between the Ohio and the Scioto rivers and the western boundary line of the Ohio company's tract, extending north of the tenth township from the Ohio, this tract being pre-empted by "Manasseh Cutler and Winthrop Sargent for themselves and others"—actually for the Scioto company (*see* GALLIPOLIS). On the same day Cutler and Sargent "for themselves and associates" transferred to William Duer, then secretary of the Treasury board, and his associates "one equal moiety of the Scioto tract of land mentioned in the second contract," it being provided that both parties were to be equally interested in the sale of the land, and were to share equally any profit or loss. Colonists were sent out by the Ohio company from New England, and Marietta, the first permanent settlement in the present state of Ohio, was founded in April, 1788.

See E. J. Benton, ed., "Side Lights on the Ohio Company of Associates from the John May Papers," Western Reserve Hist. Soc. Tracts, No. 97 (Cleveland, 1917); A. B. Hulbert, ed., *The Records of the Original Proceedings of the Ohio Company* (Marietta, O., 1917); and Herbert T. Leyland, "The Ohio Company," *Hist. and Philos. Soc. of Ohio, Quart. Pub.*, vol. xvi., no. 1 (Cincinnati, 1921).

OHIO RIVER, the principal eastern tributary of the Mississippi river, U.S.A. It is formed by the confluence of the Allegheny and Monongahela rivers at Pittsburgh (Pa.), and flows north-west nearly to the west border of Pennsylvania, south-south-west between Ohio and West Virginia, west by north between Ohio and Kentucky, and west-south-west between Indiana and Illinois on the north and Kentucky on the south. It is the largest of all the tributaries of the Mississippi in respect to the amount of water discharged (an average of about 158,000cu.ft. per sec.), is first in importance as a highway of commerce, and in length (967m.) as well as in the area of its drainage basin (approximately 210,000sq.m.) it is exceeded only by the Missouri. The slope of the river at low water ranges from 1ft. or more per mile in the upper section to about 0·75ft. per mile in the middle section and 0·29ft. per mile in the lower section, and the total fall is approximately 500ft. The greatest falls are at Louisville, where the river within a distance of 2·25m. descends 23·9ft. over an irregular mass of limestone. The ordinary width of the upper



BY COURTESY OF THE CINCINNATI CHAMBER OF COMMERCE

A SHIPMENT OF STEEL TUBES AWAITING TRANSPORTATION DOWN THE OHIO RIVER

half of the river is uniform, from 1,200 to 1,500ft. Islands are numerous and vary in size from an acre or less to 5,000ac.

Besides its parent streams, the Allegheny and the Monongahela, the Ohio has numerous large branches. On the north it receives the waters of the Muskingum, Scioto, Miami and Wabash rivers, and on the south those of the Kanawha, Big Sandy, Licking, Kentucky, Green, Cumberland and Tennessee.

The drainage basin of the Ohio, in which the annual rainfall averages about 43in., is especially in the southern part of the river, of the "quick-spilling" kind, and as the swift mountain streams in that section are filled, the Ohio rises very suddenly and not infrequently attains a height of 30 to 50ft. or more above low water level spreads out 10 to 15 times its usual width, submerges the bottom lands, and causes great damage. In March 1913, an especially destructive flood reached the highest stages on record on that part of the river between Wheeling and Cincinnati and on the tributaries entering from the north.

Robert Cavelier, Sieur de La Salle, asserted that he discovered the Ohio and descended it until his course was obstructed by a fall (thought to be the falls at Louisville); this was probably in 1670, but until the middle of the next century, when its strategic importance in the struggle of the French and the English for the possession of the interior of the continent became fully recognized, little was generally known of it. By the treaty of 1763 ending the Seven Years' War the English finally gained undisputed control of the territory along its banks. By the treaty of 1783 the entire Ohio country became a part of the United States and by the famous Ordinance of 1787 the north side was opened to settlement. Most of the settlers entered the region by the headwaters of the Ohio and carried much of their market produce down the Ohio and Mississippi to New Orleans.

DEVELOPMENT

Until the successful navigation of the river by steamboats a considerable portion of the imports was carried overland from Philadelphia or Baltimore to Pittsburgh. The first steamboat on the Ohio was the "New Orleans," which was built in 1811 by Nicholas J. Roosevelt and sailed from Pittsburgh to New Orleans in the same year, but it remained for Capt. Henry M. Shreve (1785–1854) to demonstrate with the "Washington," which he built in 1816, the success of this kind of navigation on the river. From 1820 to the Civil War the steamboat on the system of inland waterways of which the Ohio was a part was a dominant factor in the industrial life of the Middle West. Cincinnati, Louisville and Pittsburgh on its banks were extensively engaged in building these vessels. Until the Erie canal was opened in 1825 the Ohio river was the chief commercial highway between the East and the West.

The Federal Government in the year 1827 undertook to remove the snags and to increase the depth of water on the bars by the construction of contraction works, such as dikes and wing dams, and appropriations for these purposes as well as for dredging were continued until 1844 and resumed in 1866; but as the channel obtained was less than 3ft. in 1870, locks with movable dams—that is, dams that can be thrown down on the approach of a flood—were then advocated, and five years later Congress made an appropriation for constructing such a dam, the Davis island dam immediately below Pittsburgh, as an experiment. This was opened in 1885 and was a recognized success. As a result of the activity of the Ohio Valley Improvement Association, Congress authorized the secretary of war to appoint a board of engineers to report on the merits of a channel 9ft. in depth. The board reported in 1908 in favour of such a channel.

In 1910 Congress adopted the report and provision was made for a comprehensive project for canalizing the Ohio. Only slight changes have since been authorized. As it stood in 1926, the project provided for 50 locks and dams, all of the movable type, except the one immediately below Pittsburgh (Pa.), which is a fixed dam, completed in 1921. Of these dams 42 were completed and in operation, and the other eight were under construction.

The total tonnage shipped via the Ohio river in 1925 was 15,737,072 tons, of which 43·5% was sand and gravel and 41·4% was coal.

See the board of engineers' *Report of Examination of Ohio River with a view to obtaining channel depths of 6 and 9ft. respectively* (Washington, 1908); and A. B. Hulbert, *Waterways of Westward Expansion* (Cleveland, 1903) and *The Ohio River, a Course of Empire* (1906).

OHLAU, a town in the Prussian province of Silesia, 16 m. by rail S.E. of Breslau, on the left bank of the Oder. Pop. (1925) 11,369. It has a castle, became a town in 1291 and passed to Prussia in 1742. Ohlau is the centre of a tobacco-growing district.

ÖHLENSCHLÄGER, ADAM GOTTLOB (1779–1850), Danish poet, was born in Vesterbro, a suburb of Copenhagen, on

Nov. 14, 1779. His father, a Schleswiger by birth, was at that time organist, and later became keeper, of the royal palace of Frederiksberg. Through Edvard Storm, Adam received a nomination to the college called "Posterity's High School," of which Storm was the principal. Storm himself taught the class of Scandinavian mythology, and thus Öhlenschläger received his earliest bias towards the traditions of his ancestors. His studies were interrupted first by the death of his mother, and by the English attack on Copenhagen in April 1801, which, however, inspired a dramatic sketch (*April the Second 1801*).

In the summer of 1802, when Öhlenschläger had an old Scandinavian romance, as well as a volume of lyrics, in the press, the young Norse philosopher, Henrik Steffens, came back to Copenhagen after a long visit to Schelling in Germany, full of new romantic ideas. His lectures at the university, in which Goethe and Schiller were for the first time revealed to the Danish public, created a great sensation. Steffens and Öhlenschläger met, and after a conversation of sixteen hours the latter went home and wrote at a sitting his splendid poem *Guldhornene*, in a manner totally new to Danish literature. A volume of poems in the romantic style is now chiefly remembered as containing the lovely piece called *Sanct-Hansaften-Spil*. The next two years saw the production of the epic of *Thors Reise til Jotunheim*, the charming poem in hexameters called *Langelandsreisen*, and fantasy *Aladdin's Lampe* (1805).

At the age of twenty-six Öhlenschläger was universally recognized, even by the opponents of the romantic revival, as the leading poet of Denmark. He now collected his *Poetical Writings* in two volumes. He obtained a grant for foreign travel from the government, and joined Steffens at Halle in August 1805. Here he wrote the first of his great historical tragedies, *Hakon Jarl*. In the spring of 1806 he went on to Weimar, where he spent several months in daily intercourse with Goethe. The autumn of the same year he spent with Tieck in Dresden, and proceeded in December to Paris. Here he resided eighteen months, and wrote his three famous masterpieces, *Baldur hin Gode* (1808), *Palnatoke* (1809) and *Axel og Valborg* (1810). In the spring of 1809 Öhlenschläger went to Rome to visit Thorwaldsen, and in his house wrote (in German) his tragedy of *Correggio*.

He returned to Denmark in the spring of 1810 to take the chair of aesthetics at the University of Copenhagen. In 1811 he published the Oriental tale of *Ali og Gulkyndi*, and in 1812 the last of his great tragedies, *Staerkodder*. His talent culminated in the cycle of verse-romances called *Helge*, published in 1814. The tragedy of *Hagbarth og Signe*, 1815, showed a distinct falling-off in style. In 1817 he went back to Paris, and published *Hroars Saga* and the tragedy of *Fostbrödrene*. In 1818 he was again in Copenhagen, and wrote the idyll of *Den lille Hyrdedreng* and the Eddaic cycle called *Nordens Guder*. His next productions were the tragedies of *Erik og Abel* (1820) and *Vaeringerne i Miklagaard* (1826), and the epic of *Hrolf Krake* (1829).

In 1829 Öhlenschläger was publicly crowned with laurel in front of the high altar in Lund cathedral by Bishop Esaias Tegnér, as the "Scandinavian King of Song." His last volumes were *Tordenskjold* (1833), *Dronning Margrethe* (1833), *Sokrates* (1835), *Olaf den Hellige* (1836), *Knud den Store* (1838), *Dina* (1842), *Erik Glipping* (1843) and *Kiartan og Gudrun* (1847). On his seventieth birthday, Nov. 14, 1849, a public festival was arranged in his honour, and he was decorated by the king of Denmark. He died on Jan. 20, 1850, and was buried in the cemetery of Frederiksberg. Immediately after his death his *Erindringer* ("Recollections") were published in two volumes.

With the exception of Holberg, there has been no Danish writer who has exercised so wide an influence as Öhlenschläger. He awakened in his countrymen an enthusiasm for the poetry and religion of their ancestors, and his name remains to this day synonymous with Scandinavian romance. His plays, partly, no doubt, in consequence of his own early familiarity with acting, fulfilled the stage requirements of the day, and were popular beyond all expectation. The earliest are the best—Öhlenschläger's dramatic masterpiece being, without doubt his first tragedy, *Hakon Jarl*. In his poems and plays alike his style is limpid, elevated, profuse; his flight is sustained at a high pitch without visible excitement. His fluent tenderness and romantic zest have been the secrets of his extreme popularity. Although his inspiration came from Germany, he is not much like a German poet, except when he is consciously following Goethe; his analogy is much rather to be found among the English poets, his contemporaries. With all his faults he was a very great writer, and one of the principal pioneers of the romantic movement in Europe.

(E. G.; X.)

The critical edition of Öhlenschläger's works is that by J. L. Lubenberg (32 vols., 1857–62). *See* B. Andersen, *Öhlenschläger et livs poesie* (3 vols., 1899).

OHLIGS, a town in the Prussian Rhine Province, before 1891 known as Merscheid, 17 m. by rail N. of Cologne, on the railway to Elberfeld. Pop. (1925) 29,812. Its chief manufactures are cutlery, surgical instruments and hardware.

OHM, GEORG SIMON (1787–1854), German physicist, was born at Erlangen on March 16, 1787, and was educated at the university there. He became professor of mathematics in the Jesuits' college at Cologne in 1817, and in the polytechnic school of Nuremberg in 1833. In 1849 he was appointed conservator of the physical collection at Munich, and in 1852 professor of experimental physics in the High School of Munich, where he died of apoplexy on July 7, 1854. His writings were numerous, but, with one important exception, not of the first order. The exception is his pamphlet, published in Berlin in 1827, with the title *Die galvanische Kette mathematisch bearbeitet*. This work, the germs of which had appeared during the two preceding years in the journals of Schweigger and Poggendorff, has exerted a great influence on the whole development of the theory and applications of current electricity. (*See* ELECTRICITY.) The most important part of the pamphlet is summarized in what is now known as Ohm's Law. (*See* RESISTANCE, MEASUREMENT OF.) This work was so coldly received that Ohm's susceptibilities were hurt, and he resigned his post at Cologne. He eked out a precarious livelihood until appointed at Nuremberg. At this time his work began to be recognized, he was awarded the Copley medal of the Royal Society in 1841 and was made a foreign member of that society in 1842. In addition to a number of papers on mathematical subjects, Ohm wrote a memoir on interference in uniaxial crystals, and also a *Text Book of Physics* (1854).

See a memoir on Ohm by J. Lamont in *Denkschrift Münchener Akademie*.

OHMMETER (also known as a "Megger") an electrical instrument employed for measuring insulation-resistance or other high electrical resistances. The ohmmeter is described in INSTRUMENTS, ELECTRICAL: *Resistance Measuring Instruments* (*q.v.*).

OHNET, GEORGES (1848–1918), French novelist and man of letters, was born in Paris on April 3, 1848. After the war of 1870 he became editor of the *Pays* and the *Constitutionnel* in succession. In collaboration with the engineer and dramatist Louis Denayrouze (b. 1848) he produced the play *Regina Sarpi*, and in 1877 *Marthe*. He was an admirer of George Sand and bitterly opposed to the realistic modern novel. He began a series of novels, *Les batailles de la vie*. The series included *Serge Panine* (1881) which was crowned by the Academy; *Le Maître de forges* (1882), *La Grande Marnière* (1885), *Volonté* (1888), *Dernier amour* (1891). Many of his novels have been dramatized with great success, *Le Maître de forges*, produced at the Gymnase in 1883, holding the stage for a year. He published in 1908 *La route rouge*, and in 1912 *La serre de l'aigle*. His last work was *Journal d'un bourgeois de Paris pendant la guerre de 1914* (1914–18).

OIL, MINERAL: *see* PETROLEUM.

OIL, PALM: *see* PALM OIL.

OIL, SHALE: *see* SHALE OIL.

OIL-BIRD or **GUACHARO** (*Steatornis caripensis*), the sole member of a family, *Steatornithidae*. As big as a crow, its plumage exhibits blended tints of chocolate-colour and grey, barred and pencilled with dark-brown or black, and spotted in places with white. The guacharo is nocturnal, slumbering by day in deep and dark caverns. Towards evening it arouses itself and, with croaking and clattering, which has been likened to that of casta-

nets, it approaches the exit of its retreat. In Trinidad the young are esteemed a great delicacy for the table.

OIL BUNKERING: *see* BUNKERING OF SHIPS.

OIL-CAKE, a feeding-stuff of great value, prepared from the residue resulting from the crushing of various oil-seeds. For details *see* FEEDING STUFFS; COTTON INDUSTRY; LINSEED; COCONUT OIL AND CAKE.

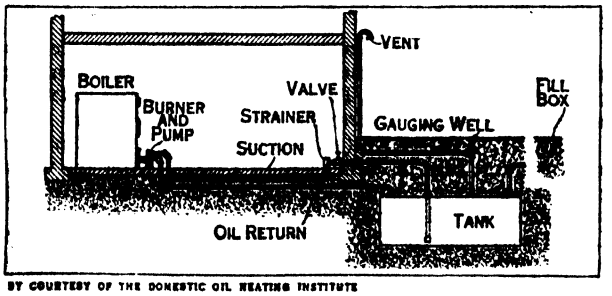
OIL CITY, a city of Venango county, Pennsylvania, U.S.A., on the Allegheny river, at the mouth of Oil creek, 75 m. N. of Pittsburgh. It is served by the Erie, the New York Central and the Pennsylvania railways. A municipal airport of 65 ac. is under construction. Pop. (1920) 21,274 (88% native white); 1928 local estimate 25,000, with 30,000 more in the immediate suburbs. The city lies 1,000 ft. above sea-level, in a rolling and wooded country. The central part is almost encircled by a deep bend of the river, and is connected with the south, west, and east sides by several bridges. Oil City is the metropolis and market of the Pennsylvania oil region; has large oil refineries and machine shops; and manufactures steel drums, boilers, pumping machinery, oil-well supplies and various other commodities. The aggregate factory output in 1925 was valued at $8,801,386. Natural gas is used for domestic and industrial purposes. The city has a commission form of government. Oil City was founded in 1860, following the drilling of the Drake well at Titusville (16 m. N.) on Aug. 27, 1859. It was incorporated as a borough in 1863, as a city in 1874. Between 1860 and 1870 there were 20 passenger and tow boats and 3,000 flatboats plying on the river, and 17,000,000 bbl. of oil were shipped to Pittsburgh. Trading in oil certificates led to the establishment of the Oil Exchange, which for many years set the price of oil for the world. On May 14 and 15, 1884, sales aggregated 29,000,000 and 27,000,000 bbl. respectively, and clearings for 1885 amounted to $1,433,738,000.

OIL-ELECTRIC LOCOMOTIVES: *see* LOCOMOTIVES.

OIL ENGINE: *see* INTERNAL COMBUSTION ENGINE.

OIL FUEL: *see* FUEL.

OIL HEATING, DOMESTIC, that branch of the heating of dwellings and other buildings in which the fuel burned is a mineral oil, such as shale oil or one of the heavier and less expensive grades of petroleum (*q.v.*, *see* also PARAFFIN OIL). Oil has been used for fuel and for heating since the time of Moses; but the mechanical development of the oil burner dates from the middle

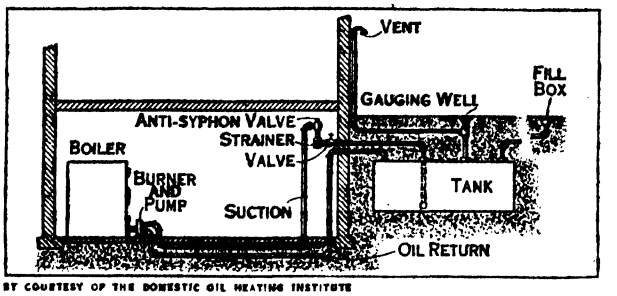


BY COURTESY OF THE DOMESTIC OIL HEATING INSTITUTE

CHARACTERISTIC UNDERGROUND TANK INSTALLED BELOW BURNER LEVEL

of the 19th century, and only since 1922, in the United States particularly, has it come into widespread use. "Oil heating" refers here only to the method of generating heat, without regard to the medium (steam, hot water or air) used to carry the heat throughout the building; "oil" refers here only to petroleum. Oil in its native state will burn, but not with maximum effect until it is atomized and mixed with air. The history of modern oil heating is the record of the search for simple and efficient methods of preparing heavy oils for complete combustion. In 1861 a mechanic named Werner, employed in one of the refineries of the Russian oil fields of the Caucasus, first suggested that what was then "refuse oil" be used as fuel; his burner, consisting of a series of griddles over which the oil trickled and burned was widely used though not patented until 1867. In 1862 two experimenters took out patents on an oil burner which solved the combustion problem by introducing the oil into the furnace in a gaseous state, the heavy oil first being heated and made to give off lighter oils. In 1863 Brydges Adams introduced into America the first spray burner, and in 1866 Ayden brought out a burner using hot air to atomize the oil and Spakorsky one using super-heated steam. Spakorsky's method was later embodied in an oil burner by Thomas Urquhart, an American at that time in the employ of a Russian railway.

Public interest was attracted by the possibilities of oil burning with a very considerable increase in the oil production of Cali-



BY COURTESY OF THE DOMESTIC OIL HEATING INSTITUTE

CHARACTERISTIC UNDERGROUND TANK INSTALLED ABOVE BURNER LEVEL, REQUIRING AN ANTI-SYPHON VALVE

fornia and Texas about 1900. Small burners, suitable for heating forges, treating furnaces, drying ovens and melting furnaces were soon produced. Larger burners were designed for boilers producing steam for power and heat. In 1902 and 1903 the U.S. naval liquid fuel board conducted tests of all available burners to determine whether vessels of the U.S. navy should be equipped for oil burning. The report, completed in 1904, was so favourable that the newer vessels were immediately designed to burn oil fuel and many of the older ones were converted.

The first attempts at domestic oil burning were crude and, in the majority of cases, consisted primarily of a pipe from a tank dropping the oil on hot, refractory material in an open pan. These were followed by natural-draught vaporizing burners, which, however, did not provide the uniform combustion necessary for economical and reliable operation. A later development was the mechanical-draught automatic burner, the foundation of the modern, domestic oil heating industry. In 1919, following the World War, oil fuel began to enter the American home on a national scale. By 1928 close to 450,000 American homes and buildings had been equipped for oil heating. The rapid rise of the oil burner lies in its convenience; an oil fire can be built or banked by the turn of a switch. Through electrical control, all the processes of furnace tending have been made automatic.

Another advantage is that oil may be conveniently stored in congested business districts. The labour required for attending oil-fired boilers is considerably less than that where coal is used, even when this is handled by modern equipment.

Types of Burners.—There are numerous varieties of oil burners, but all may be included under two distinct types: the natural draught and the mechanical draught burners. In the first type, sometimes called a gravity burner, there are no moving parts and the force of the draught depends on the size and height of the chimney, and on the differences in temperature and density between the outside air and the flue gases in the chimney. For this reason it is affected by changes in the weather, wind currents above the chimney and similar factors controlling variations in draught intensity. The natural draught burner is usually limited to heating on a small scale and requires lighter oils for efficient operation. In the second type, the air for combustion is supplied by a fan or blower. When a fan is used, the entire amount of air for combustion is usually supplied under pressure. The mechanical draught burner, since its air supply is controlled for the most part by the fan or blower, is more efficient than the natural draught burner, and maintains uniformly efficient combustion under all conditions.

Burners are also classified by the means employed to prepare the fuel for combustion. The oil may be atomized or vaporized. In the latter type, oil is prepared for combustion by first being heated. The vapour is mixed with the air just before or during

the combustion process. Burners of this type are especially flexible, with low oil capacities, and moving mechanical parts can be eliminated. In the atomizing burner, high or low pressure air or steam, mechanical pressure or rotating parts break up the fuel into small particles which are quickly vaporized by the heat of combustion. In commercial installations, where oil fuel is used in the heating of factories, office buildings, schools, theatres, apartments, etc., atomizing burners are used almost to the exclusion of other types.

The modern oil burner is automatic. A room thermostat electrically controls the burner so that the heat of the house can be kept constant within two degrees on either side of the desired temperature. A boiler or furnace control prevents overheating of the boiler and, in the case of a steam boiler, prevents abnormal pressures being developed. A burner safety control establishes a time limit within which the oil must be ignited every time the burner is started up; if the oil is not ignited the burner mechanism is shut down. When ignition is electric, it is accomplished by means of a spark from a high-tension transformer or by a hot resistance coil. The spark type of ignition is more widely used. Some burners require a gas pilot. In general there is no particular advantage of one type of ignition over another. An oil burner can be installed in practically any hot water or steam boiler, or in any warm-air heater.

The oil used in automatic oil-heating equipment varies in accordance with needs of the individual burner. It may range from light, untreated kerosene to the straw-coloured distillate, to dark brown gas or Diesel oil. The American Oil Burner Association has adopted specifications covering such grades of oil fuel, the number and names of which are given in the following table together with their old designations and approximate A.P.I. (American Petroleum Institute) gravity range.

Specification Number	A.O.B.A. Designation Name	Gravity range	Old Designation Name
1	Furnace oil—light	40–36	Distillate
2	Furnace oil—medium	36–32	Gas oil
3	Furnace oil—heavy	32–28	Light fuel oil
4	Fuel oil—light	24–28	Medium fuel oil
5	Fuel oil—medium	24–18	Heavy fuel oil
6	Fuel oil—heavy	18–12	Very heavy fuel oil

Oils number 1, 2, 3 are most generally used in automatic burners. Oil number 4 can be used in some types of automatic burners, but its application is not general. Oils 5 and 6 because they require pre-heating are used primarily in large commercial and industrial installations.

The utility of a fuel oil for domestic heating depends also upon its flash point. The flash point of any oil is the lowest temperature at which the vapours on the surface of the oil will ignite and burn momentarily on application of a spark or flame. About 20° above the flash point is the fire point of the oil. This is the temperature at which the oil will ignite and burn continuously. It is desirable that this fire point should be sufficiently low so that the oil will ignite from a cold start without hesitation. A flash point as low as 100° or 110° is allowable, and an oil with a flash point above 170° should not be used with most burners because of the difficulty of initiating ignition.

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(H. F. T.)

OIL ISLANDS: *see* CHAGOS.

OILLETS, the architectural term for the arrow slits in the walls of mediaeval fortifications, but more strictly applied to the round hole or circle with which the openings terminate; also applied to the small circles in the tracery head of the windows of the Decorated and Perpendicular periods which were sometimes varied with trefoils and quatrefoils.

OIL PAINTING, TECHNIQUE OF. As the musician must be taught, and the subtlest of harmonies are subject to material limitations, so the art of the painter must be learned, and he, more perhaps than any other artist, is bound by severe material necessities. It is not intended here to give instruction in the art of painting or to express individual preferences. The object in view is rather, taking as a basis the various methods employed by the great masters, to give an account of the technical considerations which all painters are obliged to bear in mind.

One thing to be noted in a consideration of painting is that there is a wider divergence in the techniques employed than in that of any other art. We should not find this diversity so extensive if, instead of discussing the technique of oil painting, we were analysing the technical methods of the Primitives who painted with wax, yolk of egg, or in fresco. Whatever difference there may be in the appearance of a painting by Cimabue and one by Mantegna, it will be very much less than the difference between the work of two artists painting after the invention of oil painting.

It may not be necessary to recall that all the colours used in painting, whether they are of mineral or vegetable origin, finally appear in the form of more or less soft stones which are ground to a powder in order to be used. These coloured powders require some binding vehicle in order to bring them to a sufficient consistency. The vehicle may be wax, mortar, glue, glycerine or resin. The brothers Van Eyck are generally believed to have been the first to mix their colours with oil. From the numerous controversies to which their discovery has given rise, it would seem that the principal achievement of the brothers Van Eyck was that they perfected, for the purpose of painting easel pictures, the results of the much earlier practice which had been to use oil for the painting of large surfaces, and especially for the painting of boats. The effect of oil in rendering colours durable had been observed previously; pictures painted with yolk of egg had been covered with a coating of oil which was hardened by drying in the sun and which at once protected and intensified the colours.

Once, however, the practical method of grinding colours with oil had been discovered, a vast field of technical research opened up before painters, and they were naturally tempted to explore the new possibilities which were provided. It was this possibility of variety in technical methods which, in combination with the individual genius of the great masters, enabled the art of oil painting strictly so called to rise to such great heights at the time of the Renaissance.

The Support.—Oil paint will adhere to a number of materials, and during the ages painters have experimented in painting on a number of metal and mineral grounds. Slate, marble and alabaster have been used, but comparatively rarely owing to their fragility. Copper has also been utilised, though, of course, only for works of small size. Paper deserves special mention. Far from being an inferior material as might be supposed, paper is perhaps the most suitable ground for works of a spontaneous character. It was used by Flemish painters, who glued it to wood panels or canvases by means of casein. Later, in the 18th and early 19th centuries, a large number of French painters used this process, which was of great value in setting off their brilliant execution. No other material gives such transparency to browns or so much depth to blacks.

Practical considerations have, however, led most painters to prefer two supporting materials: first, wood, and second, canvas. Up to the end of the Renaissance period wood was generally employed; but it would be an error to suppose that the change to canvas was a sudden one. There are a number of examples of wood panels upon which a fine canvas has been glued. Besides, although the use of canvas became very frequent after the Renaissance, it cannot be said to have been universal, since at all periods in the history of painting, including the present, many artists have painted on wood. In Italy the white poplar was generally used; in Flanders they used oak. To-day mahogany, which does not crack so easily as oak, is often used.

Canvas appears to be the most suitable material for pictures of a large size. There are, however, exceptions, even among painters.

who habitually used canvas for their large works. Thus Rubens' *Magi* in the Antwerp Museum, one of the largest as well as one of the most admired compositions of that master, is executed on an enormous wooden panel formed by several transverse sections. Rubens' choice of a panel in this case and in others is not a mere chance. It may be laid down as an axiom that everything counts in the execution of a picture, and the support is not the least important factor in the final appearance of the work. It is an even more important factor in its preservation. Too much stress cannot, therefore, be laid on the importance of seeing that the support of the painting is of the best quality.

The history of painting shows so many examples of fine works which have perished that we must take every possible precaution to prevent damage to those which may be painted in the future. If wood is used, it must be carefully seasoned, thoroughly dry and cut radially, as otherwise it will be affected by changes of temperature and the picture will warp or split. If canvas is chosen, it should be of hemp, or better still of pure, unbleached flax fibre, without any admixture of cotton; this will prevent its being too liable to suffer from changes of temperature. It will easily be understood that if the tissue is constantly expanding and contracting the priming or the paint itself will be likely to scale off.

Preparation of the Support.—There is, however, another important matter to consider; the wood or canvas may be treated with a priming or used without. The latter method, which is the simplest, may be dealt with first without regard to chronology; for though it was occasionally used by old masters, such as Rembrandt and Van Goyen, it is in the main a modern practice. Many present-day painters prefer to dispense with priming, and this often gives good results, especially in painting on wood. If canvas is used the method has certain disadvantages, for contact with the oil renders the canvas brittle, and it thus loses the flexibility which is one of its principal merits.

Canvas, therefore, needs to be covered with priming before it is used, and the priming is, of course, an important factor. It has been the subject of extensive research from the time when it was first used. The basis of all priming is either size or casein mixed with plaster or carbonate of lime, or else a thin coating of white lead over a coating of size. These simple elements can be combined in a great variety of ways. Experiments with different kinds of priming have been tried at all periods of the history of painting. The Primitives used plaster and carbonate of lime for tempera painting, and this practice was continued long after the invention of oil painting. It was principally in the 17th century that it became customary to use white lead, more or less strongly tinted with grey, red or brown. A transitional method, which the present writer regards as excellent, was to cover the canvas with a thin coat of carbonate of lime, and then to complete the priming with white lead. Later, painters contented themselves with sizing the canvas and then covering it with one or two thin coatings of white lead. This process has become almost universal at the present day, but some painters are tending to return to plaster priming. It should never be forgotten that the principal quality which should be possessed by the priming of canvases is flexibility. Consequently the first coating of size which is placed over the canvas in order to fill up the interstices in the fabric must not be too thick, and if subsequent coats of carbonate of lime or white lead, or both of those materials in succession, are put on, they also should be very thinly applied. If the canvas is to dry well, it is better to apply several thin coats of priming than one thick one. It is extremely important to make sure that the canvas has dried properly. This is not always done with sufficient care before a picture is begun, and yet nothing is more dangerous than to use a canvas which has not dried properly. The dark colours will inevitably crack sooner or later. Industrially prepared canvases are often prepared without paying pre-consideration to the artist's requirements and so expose the paintings to accidents of this kind. This can be proved by a very simple experiment; take a piece of wood or canvas, and cover it with a coat of white lead; then, instead of waiting several months, as would be necessary if a picture were to be painted, paint on it patches of brown, madder lake, ultramarine and emerald green. These colours will rapidly crack; the first cracks will be noticeable on the emerald green after a few days only.

Colours and Their Preparation.—Colours, in the state in which they reached the painter when he prepared them himself, and in the state in which they now reach the manufacturer, are in the form of blocks, either crystalline or powdery, but generally of the consistency of soft chalk. Their quality undoubtedly depends above all on the purity of the raw materials used. The chemist isolates the colouring matter from the crude materials which he receives. In some cases the material is earth, as in the case of ochres; the earth is in its natural state in the case of yellow and red ochre, and it can be calcined so as to obtain other colours such as burnt sienna. Other colours are obtained from elementary materials; thus different kinds of black are produced from lamp black, bone charcoal and charcoal obtained from vine stocks. Ultramarine is also a natural stone—lapis lazuli. But unlike the coloured earths, which are abundant, natural ultramarine is so rare that it is scarcely used. By means of laboratory research a fairly stable blue resembling natural ultramarine has been obtained from sodium sulphide and silicate of aluminium.

It would be desirable if painters could use only colours extracted from simple sources such as earths. A colourist can do a great deal merely with yellow ochre, red ochre and black. These materials are little subject to alteration. Even the most skilful artist, however, cannot go far without the use of white; and this is the first stumbling block. The white which is known as flake white (in French, *blanc d'argent*) is a carbonate of lead, or in other words a purified form of white lead. It turns black in the course of time. The least that can happen is that it will turn yellow. Zinc white has not this disadvantage, but it cracks, does not spread easily and dries slowly. Moreover, even if the problem of the stability of white were solved, there would remain that of other colours which are absolutely necessary to the painter, such as bright yellow, whether strontian or cadmium, red, such as vermilion or even madder lake, blue, green and brown. These colours are the product of chemical combination and are only relatively stable. Some turn black, others absorb the colours mixed with them, while others become opaque.

However, not all of the hundreds of colours at the painter's disposal are equally bad. In order to choose the lesser of two evils, the painter should only add to the tones obtained from earths the indispensable minimum of other less durable colours.

Prussian blue, which was discovered in 1710 and was used to excess in the early 19th century, is today almost abandoned. Unless it is laid on as a light glaze, or supported by a considerable admixture of white, it tends to turn black and to absorb the colours mixed with it. A green composed of Prussian blue and a yellow (especially if this is not one of the earth yellows) gradually turns blue; similarly a violet into which Prussian blue enters gradually loses its red elements. Cobalt blue has the serious defect of appearing violet by artificial light.

It is possible to make a verbal distinction and to say that Rubens and Rembrandt did not use bitumen; they used a bituminous colour, and so did all the Dutch and Flemish painters; indeed all painters of whatever school have used a transparent brown resembling bitumen and fulfilling the same function; but it was recognised that the use of this colour was subject to certain strict technical conditions. At the end of the 18th century an attempt was made to recover the exact tone of bitumen which was believed to be that used by Rembrandt; it was believed to be very durable, and most of the painters of the day made abundant use of it. The terrible consequences are well known at the present time. The worst of it is that the damage due to bitumen, which never dries, combined with varnish which dries rapidly, may not become apparent until after many years.

The industrialisation of the manufacture of colours thus gives rise to a number of problems and technical points with which modern painters are unacquainted. They ought themselves to try experiments on the power of resistance of colours by exposing them to sunlight, and to fumes containing sulphur, sulphuretted hydrogen and ammonia; and in addition it would be in their interest to simplify their palette. Experience has shown, for

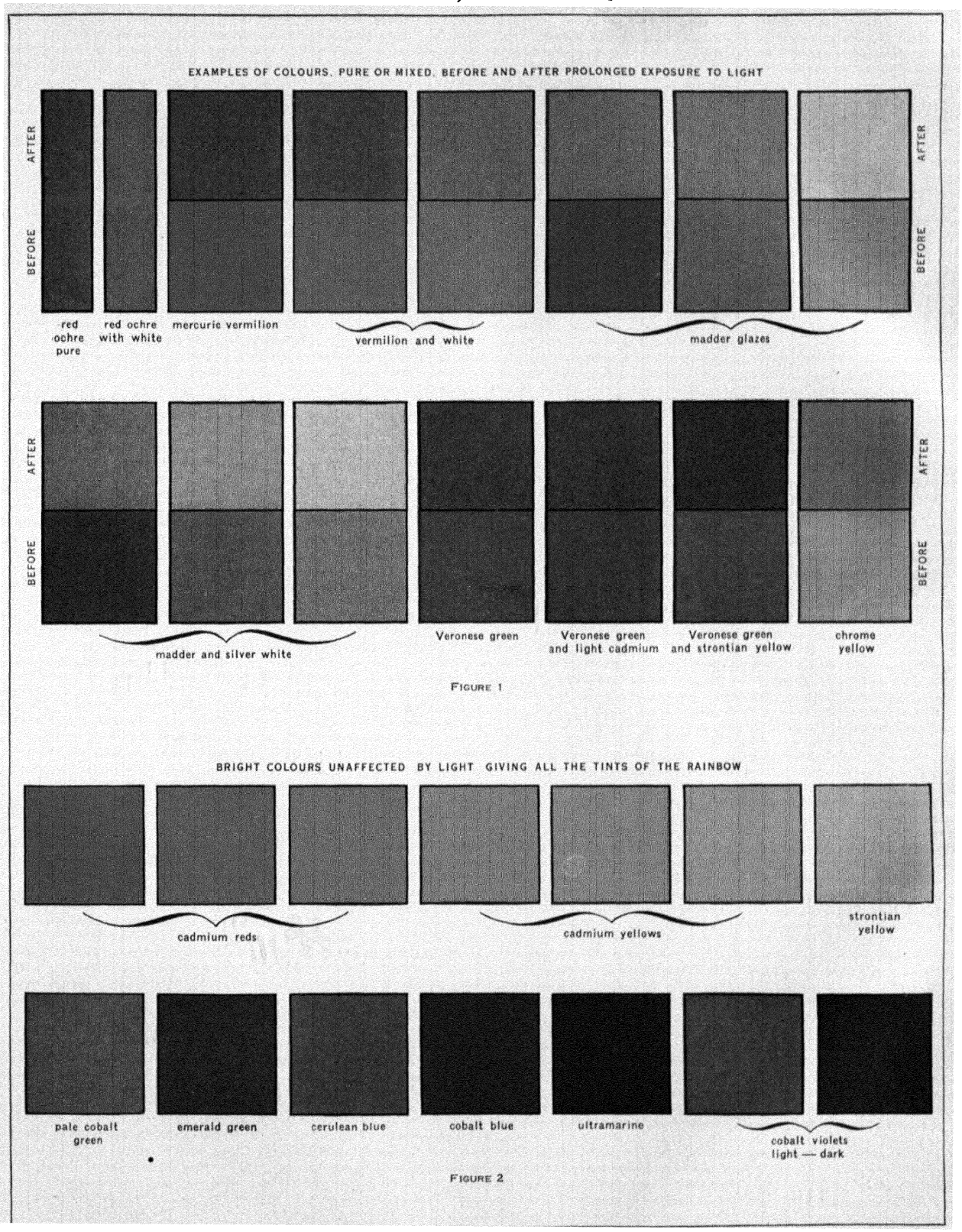


FIGURE 1

FIGURE 2

REPRODUCED BY FOUR-COLOUR PROCESS AFTER A LITHOGRAPHED PLATE IN 26 COLOURS IN "THE TECHNIQUE OF PAINTING" BY CHARLES MOREAU VAUTHIER, BY COURTESY OF HATCHETTE AND G. P. PUTNAM'S SONS. THERE HAS BEEN A SLIGHT, BUT NEGLIGIBLE, LOSS OF QUALITY IN THE COLOURS OF THE ORIGINAL BECAUSE OF THE DIFFERENT METHOD OF REPRODUCTION

CHART ILLUSTRATING THE INFLUENCE OF LIGHT ON COLOURS

1. Red ochre, a dull but permanent colour, is redder after exposure to light than the brilliant mercuric vermilion. 2. Formerly only a single colour of the rainbow, lapis lazuli (blue), was absolutely permanent. At the present day all are so except madder (red), which is not represented in this table

example, that Naples yellow becomes dull and greenish; that umber darkens and rapidly alters the colours mixed with it; that cadmiums lose their brightness in time; that ultramarine becomes opaque; that bitumen should only be used as a light glaze; and that colours which may be highly recommended must pass the test of time, and cannot be used with certainty until they have done so. It is only possible to calculate their palettes by making a close study of the old masters' pictures in a good light. It is possible to train oneself in a study of this kind by beginning with modern pictures. If the painting of a picture is closely examined, it is almost always possible to discern, in a single brush stroke, particles of the pure colours of which it is composed. If a study of several pictures by the same painter gives the same results, they may be taken as accurate.

A simple example may be found in the works of Pissarro; in all his pictures painted between 1878 and 1885 approximately, a mixture of Veronese green and ultramarine can clearly be distinguished. The use of these two colours during the period in question is thus established. This example has been selected because Pissarro obtains highly characteristic effects by this means. The remainder of his palette could easily be ascertained by continuing the analysis. Although, however, analysis may be simple in the case of the Impressionist school, it becomes more difficult as we go further back in the history of painting. The present writer frankly confesses that he cannot himself read the palette of all painters from their works. It is, however, possible to derive one general conclusion from a close study of the works of the great masters: that it is not necessarily the number of colours used which makes the colourist.

The grinding of the colours is a long and somewhat difficult business. It consists in pounding the powder, moistened with oil, until the grains are so fine as to be imperceptible. (*See* COLOUR MILLS.) This is done with a heavy muller, the under surface of which is as smooth as the slab of granite, on which the colours are ground. From time to time the grinder adds a few drops of oil. He has to continue kneading the paste until it is of the requisite fineness and consistency. It should be noted that a colour which reaches different grinders in the same state of chemical purity may not be of equal quality when it leaves their hands; the cleanliness with which the operation is carried out and the quality of the oil used affect the final result. The manufacture of colours is not a simple operation. Great practice is for example necessary to bring cobalt blue to the right consistency. Oil alone will not bind the paste sufficiently, and wax has to be added. The kind of oil used has its importance; olive oil, which was formerly much used in Italy because of its abundance, has now been given up because it dries slowly. Linseed oil on the other hand dries rapidly; copal oil is much esteemed by certain manufacturers; but poppy oil, which is light and colourless, is by far the most frequently used.

The painter should be able to use the paints in the form in which they reach him. He may use a siccative to make them dry more rapidly, but he should remember that this is an evil, even if a necessary one. He may use the colours in a thick paste, or slightly diluted, or as a thin wash; they are diluted with a quantity of oil, or turpentine, or a mixture of the two. It may be explained that the thin wash or glaze is composed of a transparent colour for choice, very much diluted, and its purpose is to heighten the value or activity of a tone which has already been laid on and has dried. Delicate effects and fine harmonies may be obtained in this way. The colours which are in practice used for this purpose are as a rule transparent yellows (Indian yellow, yellow lake, raw sienna and sometimes dark cadmium), nearly all the reds, but principally the lakes, black, nearly all the browns, and particularly bitumen. Although they have immense advantages, glazes have the defect of being liable to damage by the hand of time. They are slow in drying, and there is a risk that they may become incorporated in the varnish if the latter is applied too soon; and it must be admitted as an axiom that a picture will sooner or later have to be devarnished, and the painting itself should not be liable to injury when this happens.

A great number of prepared colours are now available; and while it is not necessary to give a list of them, it may be of use to mention a small number of specially durable colours with which a great variety of effects may be obtained. These are: flake white, golden ochre, strontian yellow, deep cadmium yellow, Venetian red, burnt sienna, cadmium red or vermilion, dark madder lake, ultramarine, cobalt blue, emerald green and ivory black or blue black.

This palette is only given as an example, since it would be arbitrary and useless to attempt to establish a uniform palette suitable to all temperaments. Some colours, too, may in themselves be injurious, and should be avoided as far as possible, but nevertheless may assist in creating the effect which is desired if they are used in the right place and with the necessary skill. For the nature of the colour itself is not the only factor; the manner in which it is used matters perhaps even more.

Brushes.—There are two kinds in general use, very different from one another; those made of sable hairs and those made of hogs' bristles. The latter are the most generally used. They consist of a metal collar which is generally flattened and keeps flat the bundle of bristles which form the brush itself. (*See* BRUSH: *in Art.*) The change from the round brushes, which were used until the 19th century, to flat brushes is due to the almost universal desire of the modern school to paint in separate touches with a full brush. The shape of the brush undoubtedly affects the nature of the stroke; but though it is difficult to describe the subtle difference made by the use of a round or a flat brush, because everything depends on the hand which uses it, it is easy to distinguish between passages executed with a sable brush and those executed with a hogs' bristle brush. The sable brush is better where precision of detail is required. The touch can be impasted and yet smooth, where bristle would not follow the exact intention of the painter with the same docility. Sable brushes are best for painting small pictures on panels, and for compositions where emphasis on detail gives the work part of its character. On the other hand it would be difficult to paint a life-size portrait or a large landscape with sable. The softness of the hairs would make it difficult to deal with a considerable quantity of paint, and the touch would be greasy and soft while a firm hogs' bristle brush would enable the painter to lay on a broad and vigorous surface.

Painters have at all times used their fingers and this use of the finger as a sort of flesh-and-blood trowel gave Courbet the idea of using the palette knife as a partial substitute for the brush. By using a flexible steel knife it is possible to obtain a vigorous touch and great variety of technique. It would of course be impossible to do any delicate drawing with the palette knife, but no instrument can be compared with it for preserving the purity of tones which often leave the palette fresh but are impaired by the time they reach the canvas. The palette knife can be wiped clean with a rag after each stroke; it represents an absolutely clean means of transferring the paint from the palette to the canvas, while only too often the brush is insufficiently cleaned and contains traces of all sorts of other colours. This does not however mean that the palette knife can take the place of the brush. The knife can only be used for certain restricted purposes, and for general use nothing can replace the brush. But everyone knows how important cleanliness is in the composition of colours, and it is only too often forgotten that the palette, the vessel which contains the vehicle, and the brushes, need careful attention because they are the last recipients of the colours, and colours cannot be beautiful unless they are skilfully used.

DEVELOPMENT OF THE ACTUAL PAINTING

We often hear it said that a picture has darkened or turned yellow. We are not here referring to the changes to which the varnish is subject, since although varnish gives the colours their maximum intensity, it does not form an integral part of the picture and will be dealt with only at the end of the article. What we now have to consider is the development of the paint which actually constitutes the picture.

Preparation of the Groundwork.—It has already been said that artists should give the utmost personal attention to the prep-

aration of their canvases. Upon the preparation of the ground-work the final aspect of the finished picture may depend. The old masters varied the priming of their panels or canvases according to the nature of the picture which they intended to paint. Rubens used a ground-work which was sometimes grey, sometimes tinted with ochre, sometimes greenish, and sometimes plain white as in the "Miraculous draught of fishes." Poussin used a grey ground-work for his "Autumn," and Boucher a pink-tinted one for his "Three Graces."

There is no doubt that the ground-work affects the painting which is superimposed on it. Let us suppose that two replicas of the same picture are painted, one on a yellow and one on a red canvas. After a few years the two pictures will be seen to differ from one another, and their general colour harmony will change, becoming nearer to that of the ground-work. A painter can thus, to a limited extent, plan in advance the future development of his picture, and should not neglect a factor which may add to its beauty later.

The desire to obtain rich colour harmonies must however always be subordinated to the numerous and complex exigencies of paint. Many pictures painted on light grounds have preserved an astonishing freshness down to the present day, while others painted on red, brown and even black grounds have suffered; indeed such paintings have generally worn badly, even if they were painted by Tintoretto, Poussin or Courbet.

The red grounds which so many painters have found attractive certainly make it easy to obtain a vibrant and transparent tone. But such a ground is of no value unless the paint itself is very lightly applied over it. And although the results may be satisfactory at first and may remain so for a number of years, the thin layer of paint which covers the coloured ground nevertheless gradually tends to disappear, and the tone of the ground begins to prevail over the others, thus putting out the colour harmony of the picture and destroying the balance of values; for, as will readily be supposed, the only parts which resist will be the high lights, which are generally painted in strong colours and which last all the better because they have probably been applied with fairly vigorous impasto in order to hide more completely the dark ground on which they were painted.

From the last observations we may at once draw a general conclusion which is of the greatest consequence to the painter: it must never be thought that the colours of a picture can be neutralized by the final layers of paint which are applied over them. A proof of this may be found in the curious phenomena connected with what are known in France as *repentirs*. These are corrections of a part of a picture which has already been painted, made before the whole picture is complete. If for example, at one of the sittings for a portrait, the artist sees that the arm or leg of his subject would produce a more characteristic effect if its position were changed, he may merely repaint the arm or leg without scraping off the original paint. Or again, accessories which prove inconvenient in the composition of a picture may be covered over with a few strokes of the brush. It often happens that after a longer or a shorter period the original detail begins to show through, and sometimes becomes quite clearly visible. This can be seen in Velasquez' portrait of Philip IV. in the Prado, in Ingres' "Jesus among the doctors" at Montauban, and in Bonington's "View of Venice" and Gros' "Portrait of the Comte Fournier-Sarlovèze" in the Louvre, to mention a few examples chosen haphazard from hundreds of others equally striking.

Development of Colours.—It is difficult to praise too highly the fertility of invention in colour harmonies and the bold experiments in technique which are due to the painters of the present generation. Only too often, however, these inventions contain an element of risk, and only too often, quite apart from the quality of the work, technical considerations are sacrificed. The creation of a picture makes great demands on the intellect, and in its execution, strict discipline must be observed; otherwise the paint in time takes its revenge.

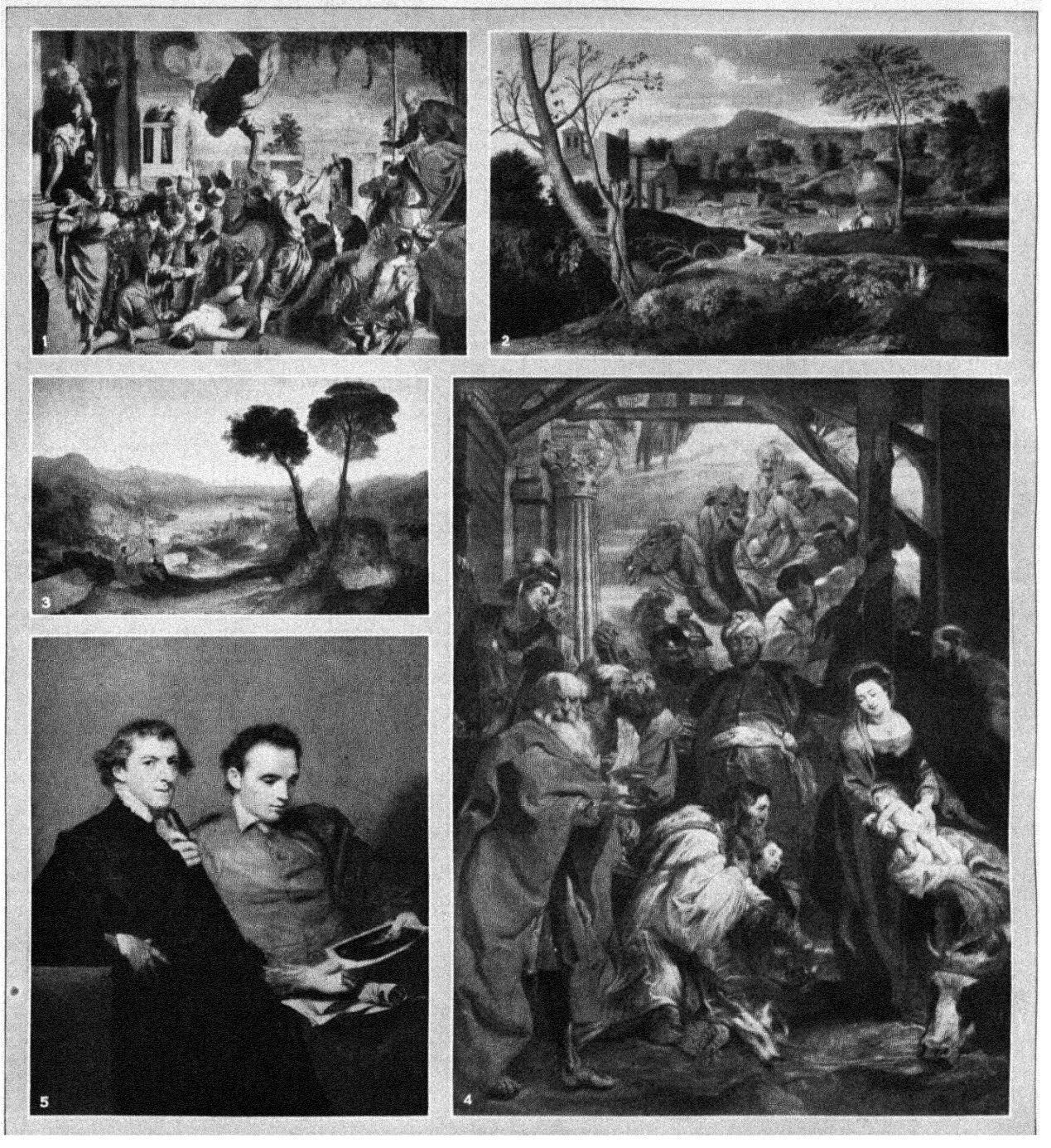
Some painters, having carefully studied portraits by Titian and important pieces of painting by Tintoretto, in which those masters obtained astonishing effects simply by the use of four durable colours, white, black, yellow ochre and red ochre, have tried to reduce their palette to that basis, adding the minimum of additional colours when necessary. Some very good work has certainly been done by this method in the last few years. At the same time there are a number of pictures painted in this way which are heavy even when freshly painted, and which soon afterwards become painfully opaque. And yet, even leaving aside the Italian Renaissance, even leaving aside Velasquez, it is easy to show what variety can be obtained with this sober palette. It is only necessary to look at what has been done by men such as Manet, Corot in some of his figure subjects, Whistler, and Cézanne in his first manner.

There is however one often tested axiom which will give us one of the keys of the enigma: When the same colour, with the same value, is applied twice in the same place, the second application becomes opaque. It is owing to skilful organisation of their work that painters are able to include other colours in their palette besides the ochres, which, incomparably valuable as they are, have their limitations. For it has been proved that the best colours, if not cleanly applied, may lose their qualities, while others, which are not usually used, may be so employed that they will stand the test of time. No more typical example could be found than that of Veronese green. Too many painters use this colour in all circumstances, for it is very attractive owing to the variety of tones which can be derived from it. Unfortunately the effects which it gives do not last, and the subtlest harmonies, the most delicate greys, turn to a muddy and leaden black. Yet Gauguin constantly uses Veronese green without ill results. It should however be noted that Gauguin only employs this dangerous colour either pure or mixed with strontian yellow. Another example is that of vermilion, which loses its freshness and intensity in a few days unless it is applied boldly and without retouching.

Colours have characteristics of their own and however gifted an artist may be, he cannot dispense with patient observation of the difficult technical side of his art. In this respect, the best example in modern times is set by the Impressionists. If we take their best period, arbitrarily selecting 1890 as the final date, we shall find that their palette does not by any means consist of the most stable colours. The cadmiums and the madders play a much greater part than the earth colours, which the Impressionists did not use very frequently; but what admirable technical knowledge was shown by these painters, who were so long criticised for their revolutionary ideas! In their pictures we may note a light and luminous outline; the spots of colour are interlaced, but yet remain distinct. The colour effects are produced rather by the juxtaposition than by the mingling of tones, and it is left to the hand of time to blend and harmonise colours whose original bloom has been respected.

III. **Technique of Execution.**—A painter cannot with impunity retouch his picture whenever he feels inclined; a fact which only too many fail to realise, much to their detriment. The coloured paste which is transferred from the palette to the canvas is a fragile and capricious substance. To paint as inspiration and fancy dictate is not to paint soundly, especially if the work undertaken is on a large scale. Pictures completed at a sitting give the best account of the painter's talent. Everyone knows that studies for pictures are nearly always more brilliant than the completed work. A good example may be provided by a comparison between the female torso by Delacroix in the Musée d'Angers and the same passage as it appears in the "Sardanapalus" in the Louvre.

What can be done with a small picture, however, becomes much more difficult when it is desired to paint on a larger scale. Some masters have, nevertheless, in certain cases been able to paint large canvases without going back over what they had once begun; examples are Tintoretto's "End of the World" in the Madonna dell'Orto at Venice, and Franz Hals' "Banquet of the officers of the corps of archers at Saint-Georges," at Haarlem. By this means they attained an extraordinary vitality of colouring, and their works defy the passage of time. Spontaneous execution of this kind is, however, necessarily limited to certain effects; it is, for example, impossible to arrive all at once at all the pro-

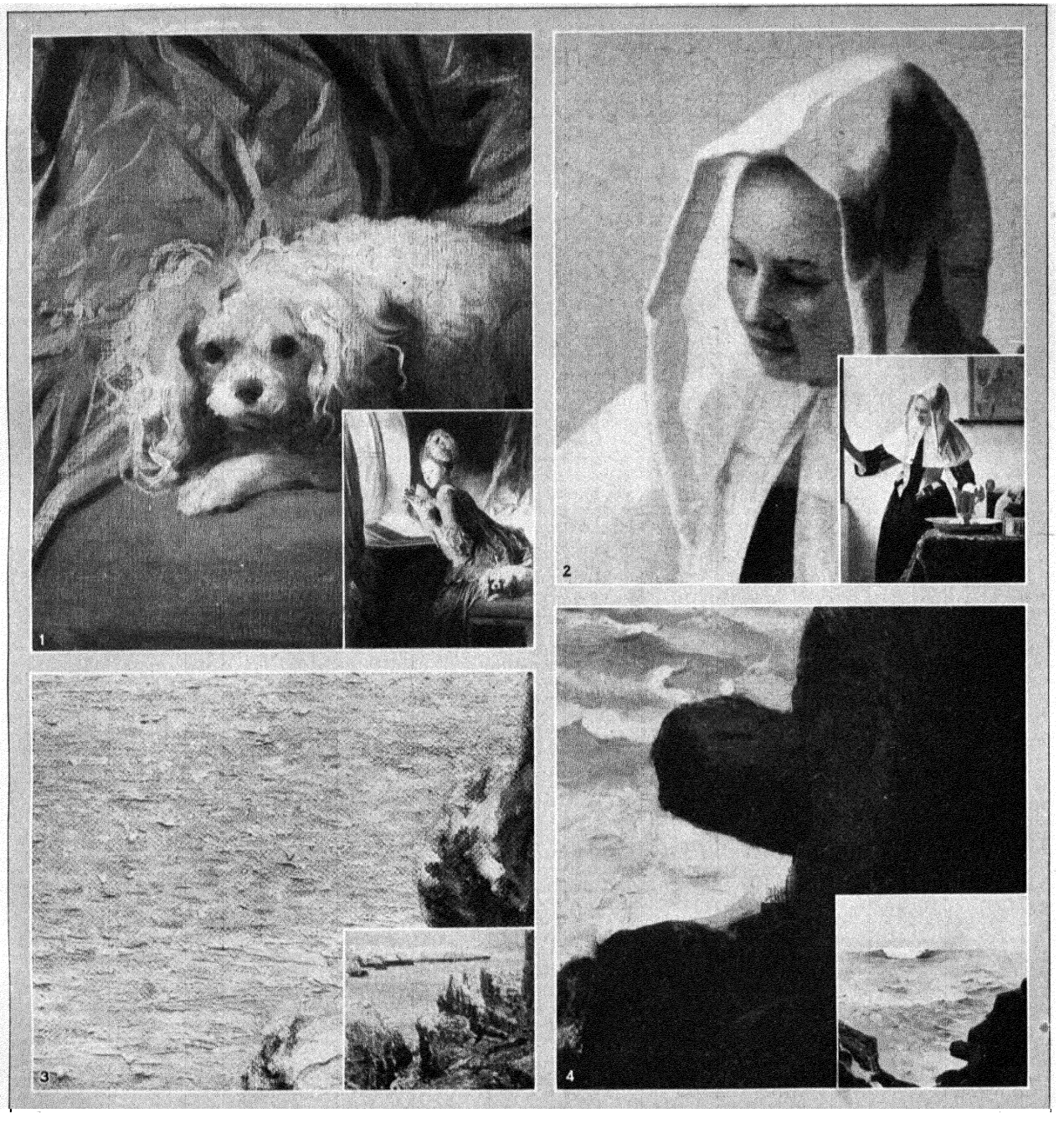


BY COURTESY OF (3, 5) THE NATIONAL GALLERY, LONDON; PHOTOGRAPHS, (1, 2) ANDERSON, (4) G. ZARRARINI

VARIETY OF TECHNIQUE IN COLOUR AND LIGHT

1. Miracle of St. Mark (1548), by Tintoretto (Jacopo Robusti, 1518–94), Venetian School (The Academy, Venice). This artist was one of the first to project vast canvases in oil. He covered gigantic surfaces with rich oil colour, where fresco (on the fresh plaster) had been previously used as a medium
2. Landscape, by Nicolas Poussin (1594–1665), French. (The Prado, Madrid). Poussin used a canvas with a brown priming. His paintings have suffered accordingly and his landscapes are badly faded
3. The Bay of Baiae, with Apollo and the Sibyl, by J. M. W. Turner (1775–1851), English. Turner was fascinated with light, and uses colour with fluidity and brilliance. He greatly influenced the Impressionists
4. Adoration of the Magi, by Peter-Paul Rubens (1577–1640), Flemish. (Musée Royale des Beaux-Arts, Antwerp). This unparalleled achievement from the technical point of view is one of the largest and most admired of the master's compositions. It is executed on a large wooden panel, made up of several sections, directly over a ground-sketch in brown. Signs of the removal by the restorer of the vermilion and the old varnish appear below, right
5. Two Gentlemen, portrait of George Huddesford and of Codrington Warwick Brampfylde, by Sir Joshua Reynolds (1723–92), English. Reynolds worked with very long brushes, being thus enabled to see the effect of his work from some distance while laying on the colour. He often blocked in his pictures in *impasto* or *grisaille*, then coloured it and carried it further with glazes. His paintings evaporated, turned yellow, cracked, and perished even during his life time

OIL PAINTING, TECHNIQUE OF



BY COURTESY OF (1) JULES S. BACHE, (2, 3, 4) THE METROPOLITAN MUSEUM OF ART, NEW YORK

VARIETY IN TECHNIQUE OF EXECUTION

1. "The letter" (*Le billet-doux*) by Jean-Honoré Fragonard (1732–1806), French. This illustrates dexterity of handling. Fragonard was one of the most brilliant sketchers ever known, equally notable for the virtuosity of his facile swift brushwork and for his pure, delicate colouring. He was a master of the sketch as a thing complete in itself
2. "Young woman with a jug" by Jan Vermeer of Delft (1632–75), Dutch. A great colourist, famous for his light effects, Vermeer achieved his smooth even handling with a round soft brush
3. "The Isle of Shoals" by Childe Hassam (1859–), American. Childe Hassam, as an Impressionist and a follower of Monet, frequently paints in the *pointilliste* method, with separate points or touches of pure colour, applied in conformity with the configuration of the surface to get the modelling. The whole scene vibrates with light
4. "Cannon Rock" by Winslow Homer (1836–1910), American. This painting of the Maine Coast series, sometimes called Homer's "Ocean Symphony," illustrates the artist's technical command of palette-knife and brush in the use of thick and thin paint



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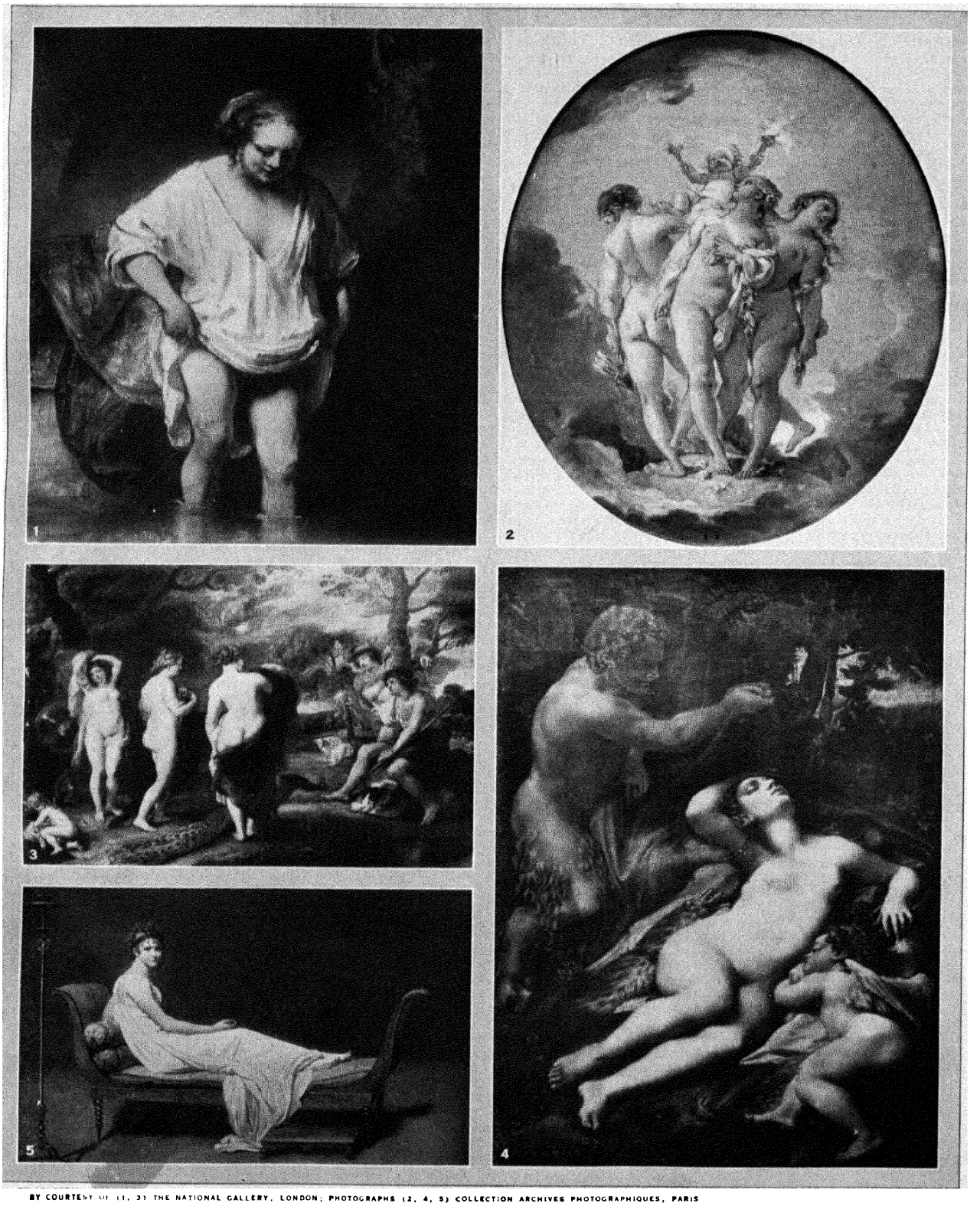
FAULTS AND DEFECTS OF PAINTINGS—ENLARGED VIEWS SHOWING DETAILS OF TECHNIQUE

1. Head of a Girl, by Jan Vermeer of Delft (1632–75), Dutch. In the Royal Picture Gallery at The Hague. The cracks are caused by painting over a smooth priming. 2. Portrait of M. Leblanc, by Jean Auguste Dominique Ingres (1780–1867), French. The cracks due to bitumen are clearly visible. 3. The Harvesters, by Pieter Bruegel the Elder (1525–69), Flemish. Underpainting showing through an overpainted correction is known as a *penimento*. Here the underpainting shows through, owing to the fact that the colours have become transparent from age. The tree trunk shows through the hat. 4. Portrait of Philip IV., by Diego Velasquez (1599–1660), Spanish. In this famous portrait the original detail is beginning to show through and is clearly visible in places. In the Prado, Madrid

OIL PAINTING, TECHNIQUE OF



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VARIETY OF TECHNIQUE IN EXECUTION AND COLOUR

1. "A Woman Bathing," by Rembrandt van Rijn (1606–1669), Dutch. Rembrandt used glazes to add to the richness and luminous depth of the picture. 2. "The Three Graces," by François Boucher (1703–1770), French. Boucher here used a pink-tinted ground-work. 3. "The Judgment of Paris," by Peter Paul Rubens (1577–1640), Flemish. Rubens used glazes freely to add to the brilliance and charm of his colour. 4. "The Sleep of Antiope," by Correggio (1494–1534), Italian. In the Louvre. The glazes and half-tones have largely disappeared because of poor restoration in the 18th century. 5. "Portrait of Mme. Récamier" (unfinished), by Jacques Louis David (1748–1825), French. In the Louvre

fundities of technique and observation which go to make up a Rembrandt; in such cases sketches must be made first.

Several methods of preparation have been and still are adopted. In order to retain as far as possible the impression of a picture executed without repainting, some masters have first sketched in their picture with a thin wash of a single colour, very much diluted. They thus mass in the lights and shadows and lay down the main lines of their subject, after which they attempt the final painting. This system was used for a great many 18th-century pictures in which the colours work in admirably with the original sketch executed in a reddish brown wash. An example is Fragonard's "Music Lesson," which has all the spontaneity of a rapid sketch.

Even before the 18th century Rubens, whose genius delighted in the overcoming of difficulties, was naturally attracted by this method. Not content with studies or simple compositions, he painted his "Kermesse" in the Louvre and his great "Adoration of the Magi" in Antwerp directly over a ground-sketch in brown. The latter work is an unparalleled *tour de force* from the technical point of view. But not all artists are Rubens, and a painter who does not possess his incomparable technical mastery cannot execute large-scale canvases by this method. There is, moreover, a danger; however vigorously the picture is painted, the colour in which the preliminary sketch is executed gradually tends to prevail in the general harmony. The result of this is indeed sometimes admirable; the "Portrait of Helène Fourment and her children" in the Louvre owes to its warm-tinted ground sketch a golden tone which is independent of the thick coat of varnish which has been applied.

Thus this attractive, but difficult and sometimes dangerous method, can only be used for limited purposes. It is more usual for painters to make use of all the materials at their disposal for sketching in their pictures; they use all the colours of their palette for the first groundwork, which matters so much to the success of the picture and still more to how it will develop in the future, and they gradually work up to the desired colour harmony. Great masters, such as Raphael, Chardin and Delacroix, have painted in this way. But they have never lost sight of the discipline which must be observed if a painting is to keep its pristine qualities. Like the sound technicians that they were, they did not forget the twofold danger which has to be avoided in the painting of a picture: overdone brushwork and muddy overlaid colour. A canvas painted without method is doomed to perish. If a sketch is painted over while it is only half dry, the paint will become muddy and dead; if solid colours, such as ochres, are applied over fragile groundwork painted with madders, or if a dark tone is put in over a light ground which is still fresh, cracking will result. What most often happens, however, is that one part of the canvas is painted over again to correct it without sufficient care; then all the dark parts become opaque black, while the lights lose their brilliance.

In order to avoid these dangers and to ensure good and solid quality in their paint, many painters work according to a system of division of labour. They use grisaille in the form of an undiluted paste for the preparation of their works, following a method first used by Italian Renaissance artists. Their pictures are sketched in with two colours, white and black or white and brown, as in a chalk and charcoal drawing. The painter can then, without any danger of working over the colour too much, work on a particular passage or modify the composition until the balance of the whole is satisfactory. The colour can then be put in on this solid foundation of grisaille; the final painting should be executed as rapidly as possible. This method has been used by Titian in his nudes and most of his portraits, El Greco and Rubens in many of their great works, Watteau in his "Gilles," Prud'hon in nearly all his pictures, and nearer to our own time Ricard and Gustave Moreau. Some painters go so far as to obtain their final harmony simply with glazes and a few touches of impasto over a monochrome ground; a typical example of this method carried to an extreme is to be found in Reynolds' "Portrait of Master Hare" in the Louvre. It will be observed that with this method the paint never becomes heavy, the colour may in some cases fade if it is put on too lightly, but no method of work does more to protect the delicate effects of a colourist or to preserve the unity of execution.

The Varnish.—The part played by varnish is twofold. In the first place it protects the picture from impurities in the air. In the second place it restores freshness to the picture when this has been lost, for as it dries, the oil which enters into the composition of the colours penetrates to the lower layers, as well as evaporates, leaving the colours dimmed. Varnish restores them to their original vigour, and it has the property of remaining transparent when it hardens. The theoretical value of varnish is thus simple and obvious. Its application is, however, often criticised. When painters leave the varnishing of their pictures to their colour dealers, and it is curious to note how many of them do, the dealer frequently puts on the varnish too thickly and irregularly. Pictures varnished in this way are painfully shiny, and as many modern painters give as much emphasis to their dark tones as to their high lights, it often happens that all the intersections of the dark strokes shine to such an extent that the picture cannot be properly seen. The first results of bad varnishing soon show themselves in the form of large stains on the picture corresponding to the irregularities in the application of the varnish.

Not only is varnishing sometimes badly done, but it is done too soon and at the wrong moment. Since varnish solidifies very quickly, it is quite obvious that it should not be applied until a painting is perfectly dry. This will prevent it from softening the paint even to the slightest extent, and thus causing it to crack by drying differently. Care should also be taken never to varnish a picture while it has dust on it; otherwise impurities will remain between the paint and the varnish and will in time spoil the picture. The coat of varnish should be extremely thin and applied firmly and regularly, since it loses its qualities and dries cloudy if it is put on thickly. Varnishing should not be done on a wet day, or moisture will be imprisoned between the varnish and the canvas. If this precaution is neglected, there will be a bluish film over the picture.

One of the most frequent stumbling-blocks for the painter is the result known as "matt" effect. The dulling of the paint, which has already been mentioned as one of the reasons for which varnish has to be used, may be produced while the picture is being painted, and will be especially marked if the first sketch is painted over before it is properly dry. The oil of the second coat may be absorbed so rapidly that the last touches which are put on appear to be of a dull grey nothing like the real colour. The "matt" effect at once disappears if any liquid is passed over the picture; but it often causes worse damage in the end, for the repeated imprisonment of moisture between the various layers of paint constituted by retouching will slowly but surely destroy the picture.

Siccatives, heavy oils and mixtures of all kinds are really responsible for much of the damage which is attributed to varnish. It is a matter of common knowledge that Delacroix was not always as strong on the technical side as he was lofty in his conceptions. It is difficult to say which did most to destroy his paintings—the curious mixtures of liquids which he used, or the disastrous qualities of the materials which entered into the composition of the colours with which he habitually painted. We can obtain some idea of the splendour which his works ought to have retained by looking at those canvases which he executed simply, such as the "Algerian Women," "The Artist's Studio" and the "Still Life" in the Moreau-Nélaton collection in Paris. And very often that delicate artist Prud'hon made excessive use of heavy oil and bitumen, which caused immense cracks to form in his pictures, as for example in his "Christ" in the Louvre.

How then, it will be asked, is it possible to correct a passage which is seen in the course of painting a picture to be unsatisfactory? And once the picture is painted, how can it be made fit for exhibition if it cannot yet be varnished without danger, and if the colours have a "matt" effect.

There are on the market a number of varnishes known as retouching varnishes, the merits or demerits of which cannot be discussed here. It may, however, be said that the lighter and more transparent the liquid to be applied over the piece which it

is desired to repaint, the less danger there is that it will impair its freshness in time to come.

When the painting is completed, the general effect can be clearly seen if it is washed over with a mixture of white of egg, water and sugar. This preparatory varnish does not affect the colours in any way, and it can be sponged off with water when the time comes, about a year later, to apply the final coat of varnish which it has by this means been possible to defer.

Some have thought that varnish can be replaced by glass, and many have followed the example of the British picture galleries by glazing oil paintings. Glass is an effective protection against damp, especially if the back of the picture is felted. This is the reason why it is used in London, where the air is very damp. At the same time glass protects the picture from the fingers of clumsy visitors to public galleries, and from smoke in private houses. But it can never be a substitute for varnish; indeed it often makes it impossible to see and appreciate a picture properly. Not only is glass no substitute for varnish, but it transforms the picture into a mirror, so that the spectator sees a reflection of himself rather than the painting.

The disadvantages of glass are not so serious in the case of pictures in which the general tone is light. The difficulty still exists, but it is lessened because white does not transform a sheet of glass placed in front of it into a mirror. Many modern painters who paint in light tones have refrained from varnishing their pictures, as it does not help very much to bring out light tones. The objection to varnish dates, naturally enough, from the Impressionist period. The Impressionists wished their colours to produce as vibrant an effect as possible, and they therefore took care not to cover the paint with a foreign substance which was liable to develop in a way which they did not like.

It was inevitable that as painters gave up the use of varnish, they should gradually come to use turpentine to dilute their colours, and at the same time to paint on absorbent canvas. Mat painting has the technical advantage of avoiding the difficulty of "bloom" which was mentioned above; a deliberate attempt is made to obtain harmonies by the use of colours which do not shine because they contain less oil, either on account of their having been mixed with turpentine or on account of the oil having been absorbed by the canvas. So many admirable works have been produced by this method that we cannot fail to rejoice at a new discovery in the technique of painting. It must, nevertheless, be asked in all impartiality how a painting from which for one reason or another varnish has been excluded will stand the effects of time. If pictures were always to be exhibited under favourable circumstances, in a dry climate, not exposed to changes of temperature, and sheltered from dust, smoke and fumes of all kinds, we could allow varnish to be an unnecessary protection. All persons who have had occasion to see a large number of paintings will, however, have met with cases, somewhat rare, it is true, of 18th century decorative panels which have never been varnished. As a general rule about one centimetre of the edge of the painting is concealed by a frame or beading. The painting has not turned yellow as it would have done if it had been too heavily varnished, but at the same time it has not kept its original brilliance; it is covered, as it were, with a veil of warm grey except under the frame, where it has been protected from the light and from the impurities in the air and has preserved its original freshness. The worst feature is that there is no way of cleaning pictures of this kind. The dust fixed on the paint by the moisture in the air has become incorporated with it; but still more, the very body of the colour has been affected. Simple tones such as light greys have remained comparatively luminous, but the reds have become purplish, the yellows have turned brown, and the browns have lost their transparency. The dirt produced by dust fixed on the picture by the moisture of the air has worked right into the grain of the canvas. Such attacks by foreign bodies would not have had so much effect on varnish, and even if owing to circumstances the varnished picture had suffered an accumulation of dirt, it would still be possible to remove the varnish and find underneath the picture as the painter conceived it.

It is most desirable to protect these mat pictures with glass, unless a coating of wax is put over them to preserve their non-shiny appearance. The merits of wax for this purpose have always been known; it is one of the best means of preserving paintings, and it isolates them from injury from without in the same way as varnish.

(*See* PAINTING; LANDSCAPE PAINTING; PORTRAIT PAINTING; STILL LIFE PAINTING; MURAL PAINTING; FLOWER PAINTING.)

(J. G. G.)

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OIL-PALM (*Elaeis*), a genus of palms closely allied botanically to the coconut palm (*Cocos*). Two species are generally recognized, both medium-sized trees native to the tropics—one of considerable range in the Old World and the other found in South America.

The African oil-palm (*E. guineensis*), the source of palm oil and of palm-kernel oil, is a widely-known tree of great economic value. It occurs throughout an extensive area in tropical West Africa, and is also found in Malay archipelago and in the Sunda islands. It has been introduced into the West Indies and South America, and is grown to a limited extent in southern Florida. It is a handsome tree with a stout, deeply and coarsely ringed stem, 20 ft. to 30 ft. high, bearing at its summit a somewhat irregular crown of immense feathery leaves, 10 ft. to 15 ft. long. The leaves, which are pinnately divided into from 50 to 60 narrowly lance-shaped, sharp-pointed leaflets, are alike in colour on both sides, and are borne on stout leaf-stalks with spiny-toothed margins. The exceedingly numerous flowers are crowded on a short spadix and develop into a huge ovate fruit cluster containing usually from 150 to 200 reddish or orange-coloured thin-skinned drupes. The ripe drupes have a red or golden pulp which surrounds from one to three black hard-shelled stones or nuts with oily kernels (seeds). Upon attaining a height of several feet this species is one of the most attractive palms, and in suitably mild climates, as in southern California, young trees are grown for purely ornamental purposes.

The South America representative of the genus, *E. melanococca*, is a similar but much smaller tree. The leaves yield a useful fibre and the fruit, like that of the Old World species, contains oil.

Palm oil, called also palm butter and palm grease, is extracted by a process of fermentation from the pulp of the oil-palm fruit. It is a fixed, butter-like, reddish-yellow fatty oil, possessing a faint violet odour, which is remarkably persistent, being conveyed to soap manufactured from it. Its chief constituents are free palmitic acid, varying from 12% in fresh oil to 55% in older oil, together with stearic acid and glycerides of palmitic and oleic acids. Its specific gravity varies from 0·920 to 0·927; its melting point is such (80·5° F to 108·5° F) that while it is usually a liquid in the Tropics, it is a semi-solid in temperate regions. Its saponification number is 202; its iodine value ranges from 65 to 72, and its Reichert number is 0·5. Palm oil is soluble in alcohol,

ether, carbon bisulphide and chloroform.

Palm oil is extensively used in the manufacture of soap and also of candles. Mixed with cottonseed oil and mineral oil it is widely utilized in the tin-plate industry for coating iron. It has long been employed as a lubricant, particularly for railway-car axles. It is also used to give colour to butter-substitutes. Palm oils that are low in fatty acids are called "soft oils"; those containing a high percentage of fatty acids are known as "hard oils." In tropical West Africa, especially in the Gold Coast, a specially prepared palm oil, called chop oil, is a staple article of food, being used in the same manner as olive oil, soy bean oil and butter are in temperate regions.

Palm-kernel oil or palm-nut oil, is extracted from the kernels of the crushed nuts either by pressure or with solvents, the yield ranging from 45% to 50%. It is a yellowish fatty oil more closely resembling coconut oil than palm oil. When fresh, palm-kernel oil is free from fatty acid, but, upon exposure to the air, quickly becomes rancid. Its principal constituents are triolein 15% to 25%; triglycerides of stearic, palmitic and myristic acids about 33%; and triglycerides of lauric, capric, caprylic and caproic acids 45% to 55%. The specific gravity of palm-kernel oil is 0·952; its melting point varies from 78·6° F to 86° F; its saponification number is 247·6, and its iodine value is 13·4–13·6. It is extensively used in the manufacture of soaps, chocolate products, pharmaceutical preparations and perfumery.

Tropical West Africa is the main source of the world's supply of palm oil. Nigeria is the leading producer, exporting in 1926 113,267 tons, valued at £3,616,159. French Guinea and the Ivory Coast are the chief exporting dependencies of French West Africa. Ashanti, Gambia, the Gold Coast, Sierra Leone, the Cameroons, Dahomey, Togo and Liberia are also exporters of palm oil.

While palm oil is prepared directly from the fruit pulp in the regions where the oil palm grows, the hard-shelled nuts are largely exported in bulk and the extraction of oil from their kernels is made elsewhere. In 1926 the exports of palm kernels from Nigeria amounted to 249,100 tons, valued at £4,440,452. In 1927 the exports of palm kernels from the Ivory Coast were valued at 32,260,165 fr. and those from French Guinea at 26,424,468 fr. The total oil-equivalent of the products of the oil palm in all countries in 1926 was estimated at about 400,000 tons. (*See* OILS, FATS and WAXES; PALM; PALM OIL.)

OIL REFINING: *see* PETROLEUM.

OILS, FATS AND WAXES. The term "oils" is loosely used as a generic term for substances having the common property of being greasy fluids, either at the ordinary temperature, or at temperatures below the boiling-point of water. Formerly, when substances were principally classified by obvious characteristics, the word included such a body as "oil of vitriol" (sulphuric acid), which has, of course, nothing in common with what is now understood under the term oils.

In its most comprehensive ordinary acceptation the word embraces at present the fluid, "fixed," or fatty oils (*e.g.*, olive oil), the soft fats which may be fluid in their country of origin (*e.g.*, coconut oil, palm oil), the hard fats (*e.g.*, tallow), the still harder vegetable and animal waxes (*e.g.*, carnaüba wax, beeswax), the odoriferous ethereal (essential) oils and the fluid and solid volatile hydrocarbons—mineral hydrocarbons—found in nature or obtained from natural products by destructive distillation (petroleum, shale oils, oils from the low-temperature distillation of coal).

The importance of fatty and mineral oils to the life and industry of a nation is a commonplace of everyday observation; the exigencies arising from the World War did but emphasize human dependence on these raw materials for food and power, and stimulated development and research in all branches of the industries connected with them. Great advances have been made in the utilisation of mineral (petroleum) oils (*q.v.*). The last two decades have seen great developments in oil-fuelled internal combustion engines and the widespread adoption of oil as a fuel for steam-raising, both in stationary boilers and for shipping, and more especially for battleships, where high power output combined with economy in fuel-storage space and stokehold labour are of primary importance. Improvements in the production of lubricating oils have been necessitated by the advances in modern machinery, which involve higher working temperatures and pressures. We may note in passing the development, especially in Germany, probably as a direct result of war-time isolation from supplies of mineral oils, of the production of oils by the distillation of lignites and by synthesis from producer gas.

The fatty oils, ever of paramount importance as food, acquired an increased significance during the War as sources of glycerine, the basis of explosives of the dynamite class. In England, strict government supervision was exercised over soap manufacture, and all industries involving the hydrolysis of fats, to ensure the maximum recovery of glycerine (about 10–14% of the weight of a fresh oil). Towards the end of the War period a process was mooted to replace the glycerol in edible fats by mannitol or a similar sugar, in order to obtain both the glycerine and a product equal in nutritive value to the original fat.

The shortage of edible oils in all countries during the War led to great advances in the technique of oil-refining; oils hitherto regarded as purely industrial became available for food as a result of improved methods of purification, and it may be said that to-day almost all fats, with the exception of those possessing marked physiological action, such as castor, curcas and chaulmoogra oils, can be utilised as food. Especially in the Central European countries, where, as a result of the blockade, the shortage of fats became acute, every effort was made to stimulate the investigation and production of synthetic fats. In some cases processes were put into actual operation; and in Germany attempts were made to supplement available resources with fat obtained from yeast under intensive cultivation. Synthetic fatty acids can be prepared by the oxidation of paraffin wax and other hydrocarbons, and glycerides have been synthesised on the large scale by heating these acids, under pressure, with glycerol, which may be obtained by the fermentation of non-crystallisable sugars. In view, however, of the enormous expansion of which the natural production of the fats is capable, it is extremely improbable that these methods will be commercially successful under normal economic conditions.

The common characteristic of all the "oils" is that they consist principally, in some cases exclusively, of compounds of carbon and hydrogen. They are all readily inflammable and are practically insoluble in water. The mineral hydrocarbons found in nature, or obtained by destructive distillation do not come within the range of this article (*see* NAPHTHA, PARAFFIN, PETROLEUM), which is restricted to the following two large groups of bodies, formed naturally within the vegetable and animal organisms, viz. (1) Fixed oils, fats and waxes, and (2) Essential, ethereal or volatile oils.

FIXED [FATTY] OILS, FATS AND WAXES

The substances to be considered under this head divide themselves naturally into two large classes, viz., fatty (fixed) oils and fats on the one hand, and waxes on the other, the distinction between the two classes being based on a most important chemical difference. The fixed oils and fats consist essentially of *glycerides*, *i.e.*, esters formed by the union of three molecules of fatty acids with one molecule of the trihydric alcohol *glycerol* (glycerine, *q.v.*).

In a class of glycerides known as the phosphatides (*q.v.*) or phospholipines one or more of the fatty acid radicles is replaced by a grouping containing nitrogen and phosphorus, as, for example, lecithin.

The waxes consist of esters formed by the combination of one molecule of fatty acid with one molecule of a monohydric alcohol, such as cetyl alcohol, cholesterol, etc. Only in the case of the wax *coccerin* are two molecules of fatty acids combined with a dihydric alcohol. It must be pointed out that this distinction does not find ready expression in common parlance; thus *Japan wax* is a glyceride and should be more correctly termed Japan tallow, whereas *sperm oil* is, chemically speaking, a liquid wax. Although these two classes of substances have a number of physical properties in common it is better, for some purposes, to consider them

under separate heads. The true chemical constitution of oils and fats was first expounded by the classical researches of Chevreul, embodied in his work, *Recherches sur les corps gras d'origine animale* (1823, reprinted 1889).

Occurrence.—The oils and fats cannot be looked upon as definite chemical individuals, but as representatives of natural species which vary, although within narrow limits, according to the climate and soil in which the plants producing them are grown, or, in the case of animal fats, according to the climate, the race, the age of the animal and especially the food as well as the idiosyncrasy of the individual animal. The oils and fats are distributed throughout the animal and vegetable kingdom, from the lowest organisms to the highest, and are found in almost all tissues and organs. The vegetable oils and fats occur almost exclusively in the seeds and fruits; the waxes appear usually as thin films covering leaves and fruits. In animals the fats are enclosed mainly in the cellular tissues of the intestines and of the back, although a certain amount of fat is present in all the organs; in the lower animals fat is also stored in the liver, muscles, etc. There are a few liquid waxes known, occurring in the blubber and head cavity of sperm whales and stored in the stomach of certain arctic and antarctic birds (*e.g.*, Australian mutton-bird [*q.v.*]); other waxes occur as insect secretions, while wool-wax is the natural grease found in sheep's wool.

Physiology of the Fats.—The most evident function of the fats in animal organisms is that of food-reserve, to supply, by subsequent oxidation, energy for the growing and working tissues. The storage of fats and oils in vegetable seeds can be similarly explained as food-reserve for the embryo; it is difficult, however, to account for the presence of oil in large quantities in the pericarp of fruits such as the olive and palm, which is probably destroyed before germination of the seed. The fats, and especially the waxes, can fulfil other valuable service by virtue of their physical properties, *e.g.*, insolubility in water, and their chemical inertness. For instance, subcutaneous fat deposits protect the organism from cold; beeswax prevents dilution of the concentrated sugar solutions of the comb by external moisture; the waxes, and in some cases the fats, secreted in the leaves of plants preserve the underlying tissues from loss or access of water. It is probable that the resistant powers of the tubercle bacillus are largely attributable to the protective effect of the wax coating in which it is encased; this waxy secretion is remarkably inert and resists the action of the usual hydrolysing measures. It is probable that the fats fulfil still other, though more recondite, essential functions, quite distinct from their office as fuel supply for the cells.

It is only within the last few years that the importance of the animal fats as sources of the fat-soluble vitamins has been recognised: the discovery that vitamins (*q.v.*) may be produced in some non-active vegetable oils by the action of light is among one of the most recent advances of biochemistry. These bodies, of vital physiological importance as accessory growth factors, appear in minute proportions in the unsaponifiable (non-glyceridic) fraction of natural oils probably as a result of their physical solubility in these media; nevertheless the recognition of the part played by these substances attaches a new significance to the rôle played by the fats in animal metabolism.

Synthesis and Oxidation of Fats in Living Organisms.—The fat of the flesh-eating animals appears to be mainly derived from the fats consumed in the food; it has been demonstrated, however, by the classical researches of Lawes and Gilbert, that animal fats can be derived from carbohydrate food, while it is probable, although the proof is not so clear, that carbohydrates are the source of the fats in herbivorous animals and plants. In the case of vegetable seeds and fruits the formation of fats occurs late in the ripening process; in the unripe condition carbohydrates (sugars, starches, etc.) are to be found in the fruits and sap, but no fatty acids (or oils) and it is likely that the former are broken up and converted into fatty acids and subsequently into glycerides during the maturing process. In the case of almonds it has been observed that carbohydrates disappear as fat is formed.

It is a noteworthy fact that, almost without exception, only acids with an even number of carbon atoms in the molecule occur in the natural fats. The preponderance of C_{18} acids suggests the hypothesis that the fats are derived from the C_{18} nucleus of the polysaccharides, or, perhaps, from three molecules of glucose. Secondary oxidations and condensations are necessitated to explain the formation of C_{16} and the higher acids C_{20}, C_{22} and C_{24}. To account for the formation of milk fats and fats of the coconut class, which are distinguished by the presence of the lower fatty acids, a second type of synthesis has been postulated, involving a building-up process of the acids, one from another, and originating from simple sugars instead of the more complex polysaccharides. Yet other theories have been propounded to account for the formation of the unsaturated link in the middle of the oleic acid chain. It is possible that fats can be formed from protein material.

The utilisation of the stored fat by the plant embryo has been but little studied; it seems that the fat is hydrolysed by lipolytic (fat-splitting) enzymes and broken down, possibly into simpler fatty acids, with the ultimate production of carbohydrates (*cf.* conversion of fat into sugars in animals under abnormal conditions of glucosuria).

In the animal body the fats of the food are emulsified and hydrolysed by enzymes in the intestine; the glycerol and fatty acids are absorbed through the intestinal epithelium, recombined to form glycerides characteristic of the animal in question and transported *via* the blood and chyle to the connective tissues for storage. It may be noted that the fat of an individual animal can vary according to the fatty food supplied; for instance, the milk-fat of cows fed on a diet rich in coconut-oil simulates the latter in its properties; the fat of the Eskimo possesses an abnormally high iodine value, and resembles blubber oil.

The way in which the fat reserves are circulated to the organs in which combustion of the fat with the liberation of energy occurs, is scarcely understood. It is established that when mobilisation of reserve fat takes place the stream is primarily directed to the liver, where the fatty acids are desaturated, *i.e.*, unsaturated linkages are introduced into the fatty acid molecules. It is uncertain whether unsaturated acids so produced are distributed to the working cells as glycerides; it is possible that compounds of the fatty acids with nitrogen and phosphorus (the phospholipines, which are found in the liver and other organs) must be built up by the liver prior to transfer by the blood to the various organs. The unsaturated links introduced into the fatty acids by the liver appear to provide weak points for attack by the working cells in the process of combustion to the ultimate products of carbon dioxide and water.

FATTY OILS AND FATS

The fixed oils and fats form a well-defined and homogeneous group of substances passing through all gradations of consistency, from oils which are fluid even below the freezing point of water, up to the hardest fats which melt at about 50° C. Therefore, no sharp distinction can be made between fatty oils and fats. Nevertheless it is convenient to apply the term "oil" to those glycerides which are fluid below 20° C, and the word "fat" to those which are solid above this temperature. As a general inclusive term the expression "fat" is preferable, since this avoids confusion with mineral and essential oils.

Chemical Composition.—No oil or fat is found in nature consisting of a single chemical individual. Following on Chevreul's work, the fats were considered to consist in the main of mixtures of "simple triglycerides," this is, of *glycerides* in which each molecule of *glycerol* is combined with three molecules of the same acid, *e.g.*, tristearin, $C_3H_5(O{\cdot}CO{\cdot}C_{17}H_{35})_3$, the glyceryl ester of stearic acid, $C_{17}H_{35}COOH$; triolein, $C_3H_5(O{\cdot}CO{\cdot}C_{17}H_{33})_3$. Recently, however, it has been shown that "mixed glycerides," *i.e.*, compounds wherein one molecule of glycerol is united with two or three different fatty acid radicles, preponderate, *e.g.*, dipalmito-stearin, $C_3H_5(O{\cdot}CO{\cdot}C_{15}H_{31})_2(O{\cdot}CO{\cdot}C_{17}H_{35})$; palmito-oleo-stearin, $C_3H_5(O{\cdot}CO{\cdot}C_{15}H_{31})\ (O{\cdot}CO{\cdot}C_{17}H_{33})\ (O{\cdot}CO{\cdot}C_{17}H_{35})$. The natural fats, therefore, may differ, firstly in the fatty acids which they contain, and, secondly, by the different arrangement of the acids in simple and mixed glycerides. Fatty diglycerides only

occur occasionally as products of partial hydrolysis of the oil by ferment action.

Fatty Acids.—The most important and widespread of the fatty acids are *palmitic*, $C_{15}H_{31}COOH$ and *stearic*, $C_{17}H_{35}COOH$, acids (of the saturated series), and the unsaturated *oleic* acid, $C_{17}H_{33}COOH$.

The fatty acids are classified into related (homologous) series according to their degree of unsaturation, *i.e.*, the number of unsaturated or ethenoid bonds $>C=C<$, in the molecule of the acid. This classification is amplified in the list of examples which here follows.

Straight chain fatty acids.—The acids of the saturated (*acetic*, or *stearic*) series, general formula $C_nH_{2n+1}COOH$, include among the lower members butyric acid, C_3H_7COOH, characteristic of butter fat (*q.v.*), caproic, $C_5H_{11}COOH$, caprylic, $C_7H_{15}COOH$, capric, $C_9H_{19}COOH$, lauric, $C_{11}H_{23}COOH$, and myristic acids, present in butter and fats of the coconut class; stearic and palmitic acids are higher in the series. Acids of the oleic series, $C_nH_{2n-1}COOH$, (one pair of doubly-linked carbon atoms), of which oleic acid $C_{17}H_{33}COOH$, present in nearly all oils and fats, and erucic acid $C_{21}H_{41}COOH$, characteristic of rape and fish oils, are the most important. Acids of the linoleic series, $C_nH_{2n-3}COOH$ (two ethenoid bonds), include linoleic acid, $C_{17}H_{31}COOH$, present to a large extent in maize and cottonseed oils. The linolenic series acids, $C_nH_{2n-5}COOH$ (three double bonds) of which linolenic acid, $C_{17}H_{29}COOH$, the characteristic acid of linseed oil is very important, as the high degree of unsaturation of this acid is responsible for the "drying" power or oxidisability upon which the commer-

TABLE I.

Oil	Principal sources of raw material	Yield %	Iodine value	Principal applications
Vegetable Oils				
Drying oils				
Linseed	Argentina, India, N. America, Russia	38–40	175–205	Paint, varnish, linoleum, soft soap.
Tung	China, Japan	40–41	150–165	,, ,,
Hempseed	W. Europe, N. America, India, Japan	30–35	148	,, ,, soft soap, rubber substitute.
Poppyseed	Levant, India	41–50	123–143	Salad oil, artists' oil, soft soap.
Semi-drying oils				
Soya bean	China, Japan	13–17	122	Edible, burning.
Maize; corn	U.S.A., Argentina	6–10	113–125	,, soap.
Cottonseed	,, India, Egypt	30–32	116	Food, soap, steel-plate industry.
Sesame	India, etc., Egypt, Levant	24–26	108–110	,, ,,
Rape (Colza)	E. India, Europe	33–43	94–102	Food, lubricant, burning, wool oils, steel-plate industry.
Non-drying oils				
Almond	S. Europe, N. Africa	45–55	93–100	Perfumery, pharmacy.
Arachis (ground-nut)	India, W. Africa, China, U.S.A.	43–45	83–100	Edible, soap.
Olive	Mediterranean countries	40–60	79–88	,, ,, soap, perfumery, lubricating, pharmacy.
Castor	E. India, Mediterranean, C. America	46–53	83–86	Medicine, soap, lubricant, Turkey-red oil.
Animal Oils				
Marine Animal Oils				
Fish oils:				
Menhaden	Atlantic coast of N. America	..	140–173	Leather currying, steel-plate industry, linoleum.
Herring	N. Sea, Japan	..	124–142	Leather currying.
Liver oils:				
Cod liver	N. Sea, E. coast N. America	..	167	Medicine, leather currying.
Shark liver	Coasts of N. America	..	115	Leather currying.
Blubber oils:				
Seal	Arctic and Antarctic seas	..	127–147	Burning, leather currying.
Whale	,, ,, ,, ,,	..	121–136	,, soap, fibre dressing, margarine (after hardening), leather currying, screw oils, greases.
Dolphin, jaw and body oils		..	33, 99–126	Lubricating oil for delicate machinery.
Porpoise ,, ,, ,, ,,		..	36, 119	
Terrestrial Animal Oils				
Neat's-foot	U.S.A., S. America, Europe	..	67–73	Lubricating, high-grade leather-dressing.
Vegetable Fats				
Mahua (Illipé) butter	India, Malaya	50–55	53–67	Food, soap, candles, inferior chocolate fat.
Shea butter	W. Africa, Sudan	49–52	56	Food, soap, candles.
Palm oil	W. Africa	65–72	53	Candles, soap, tin-plate industry.
Cacao (cocoa) butter	W. Indies	32–41	32–41	Chocolate, pharmacy, perfumery.
Palm-kernel oil	W. Africa	45–50	13–14	Food, soap.
Coconut oil	E. Indies, Ceylon, Oceania, S. American coasts	20–25	8–10	,, ,, , candles.
Japan wax	China, India, Japan	25	4–10	Polishes.
Animal Fats				
Non-drying fats				
Lard	U.S.A., Central Europe	..	50–70	Food, soap, pharmacy, perfumery.
Bone	,, India, Europe	..	46–56	Soap, candles.
Tallow, beef	Argentina, U.S.A.	..	38–46	Food, soap, candles.
,, mutton	Australasia	..	35–46	,, ,, ,,
Butter	N.W. Europe, Australasia, Canada	..	26–38	Food.

cial application of the oil in the paint industry depends. Still more unsaturated acids occur, such as clupanodonic acid, $C_{22}H_{33}COOH$ (four ethenoid bonds), typical of fish, liver and blubber oils. The oxidation products of these oils, however, do not form such tenacious films as linseed oil, to which they are much inferior as paint oils. The hydroxylated acids of the ricinoleic series, $C_nH_{2n-2}(OH)COOH$, are typified by ricinoleic acid, $C_{17}H_{32}(OH)COOH$, the occurrence of which is responsible for the solubility of castor oil in alcohol.

The occurrence of *cyclic* (closed chain) acids is confined to oils of the chaulmoograc and hydnocarpus family. Acids with more than twenty-two carbon atoms in the molecule are rare among the fats, but are of fairly frequent occurrence among the waxes.

Unsaponifiable Matter.—Since the methods of preparing the vegetable and animal fats are comparatively crude, they usually contain certain impurities of one kind or another, such as colouring and mucilaginous matter, remnants of animal and vegetable tissues, etc. For the most part these foreign substances can be removed by processes of refining, but even after this purification the fats still retain small quantities of foreign bodies, such as traces of colouring matter, albumenoid and (or) resinous substances, and other non-glyceridic compounds; these substances can only be isolated after saponification of the fat, and are comprised in the term "unsaponifiable matter." Included among the "unsaponifiable matter" are the *sterols* (cyclic alcohols) —*phytosterol*, $C_{27}H_{46}O$, *sitosterol*, $C_{27}H_{46}O$, *stigmasterol*, $C_{30}H_{48}O$, *ergosterol*, $C_{27}H_{42}O$, and the animal sterols—*cholesterol*, $C_{27}H_{46}O$, *coprosterol*, $C_{27}H_{48}O$, etc. Phytosterol (*i.e.*, "plant-sterol) occurs in all oils and fats of vegetable origin; cholesterol is characteristic of all oils and fats of animal origin. This important difference affords a means of distinguishing by chemical methods vegetable oils and fats from animal fats. It is in the "unsaponifiable" fraction of oils that the bodies known as the fat-soluble vitamins (*q.v.*) have been located; these appear to be substances related to the sterols; for example, it has recently been clearly demonstrated that vitamin D can be produced from inactive ergosterol by irradiation with ultra-violet light.

The amount of unsaponifiable matter in an oil or fat does not, as a rule, exceed 2%, but in the case of some shark-liver oils the proportion is abnormally high, as large quantities (up to 85%) of highly unsaturated hydrocarbons, such as spinacene and squalene ($C_{30}H_{50}$?) are present; the relationship of these bodies to the glycerides normally occurring in oils, including fish-body oils, is still a matter for research.

Classification.—Following subdivision into animal and vegetable oils and fats, a second guiding principle to classification is afforded by a consideration of the amount of iodine the various fats are capable of absorbing. This is a measure of the unsaturated acids present, since iodine is absorbed (under suitable conditions) at the ethenoid linkages of the molecule of fatty acid.

About 80 of the natural fats are commonly utilised to a greater or less extent; the annual world consumption of each of about 20 of these approaches or exceeds 100,000 tons, and in the case of some half dozen is in the neighbourhood of 1,000,000 tons. They are classified as follows:—

Solid Vegetable Fats.—These are found mainly in the kernels and seeds of tropical fruits. They melt at from 20–35° C, and contain in general but little combined oleic acid, the bulk of the component fatty acids being lauric, myristic and palmitic. Fruits of many of the palm family, notably coconut oil and palm kernel oil, contain very large amounts of combined lauric acid. Palm oil contains chiefly palmitic and oleic glycerides. All these fats, when suitably refined, are used for edible purposes, and many are used in the manufacture of the higher grades of toilet and other soaps.

Solid Animal Fats.—A most important group of animal fats is that of milk fats, which are used universally as *butter*. All milk fats are characterized by the presence of definite, if relatively small, quantities of fatty acids which are known respectively as butyric, caproic and caprylic acids.

Physical Properties.—The specific gravities of oils and fats ranges from 0·913 (rape oil) to 0·975 (Japan wax, myrtle wax); for the bulk of the fats the value is between 0·915 and 0·945. Some oils, notably those of the castor oil and chaulmoogra groups, rotate the plane of polarisation of light.

The oils and fats are practically insoluble in water; with the exception of oils of the castor oil group they are insoluble in cold, and only sparingly soluble in boiling, alcohol. They are completely soluble in ether, carbon disulphide, chloroform, carbon tetrachloride, petroleum ether and benzene. Oils and fats have no distinct melting or solidifying point; this is not solely due to the fact that they are mixtures of several glycerides, for even pure glycerides exhibit the phenomenon of a "double melting-point." The freezing points of the oils range from a few degrees above zero down to −28° C (linseed oil). At low temperatures (*e.g.*, at 12° C in the case of cottonseed oil), solid portions, usually termed "stearine" separate out from many oils. These solid portions can be filtered off; the filtrates constitute the commercial "demarginerated oils" or "winter oils" which will remain limpid at low temperatures.

Oils and fats can be heated to a temperature of 200° to 250° C without undergoing any material change, provided prolonged contact with air is avoided. On being heated above 250° up to 300° C some oils, *e.g.*, linseed oil, safflower oil, tung oil (Chinese or Japanese wood oil, *q.v.*) and even castor oil, undergo a change, probably due to polymerisation, resulting in the formation of semi-solid or solid products. Above 300° C fats are decomposed; this is evidenced by the evolution of acrolein (a decomposition product of glycerin), which possesses the pungent odour of burning fat. Hydrocarbons are formed at the same time (*see* PETROLEUM).

On exposure to the air oils and fats gradually undergo certain changes. The *drying* oils absorb oxygen ("dry") somewhat rapidly, thin layers forming a skin or film. Extensive use of this property is made in the paint and varnish trades. The *semi-drying* oils absorb oxygen more slowly than the drying oils and are, therefore, useless as paint oils; still, in course of time, sufficient oxygen is absorbed to produce distinct thickening. The oxidation of the semi-drying oils is accelerated by spreading such oils over a large surface, notably over woollen or cotton fibres, when oxygen absorption may proceed so rapidly that spontaneous inflammation ensues. Many fires in cotton and woollen mills have been caused in this way. The *non-drying* oils, of which olive oil is typical, do not become oxidised readily on exposure to the air, although gradually changes take place, including slow hydrolysis (splitting to fatty acids and glycerol) and subsequent oxidation; the oils thicken slightly and acquire the peculiar disagreeable smell and acrid taste defined by the term "rancidity." The chemical reactions involved in the development of rancidity have not yet been fully explained. If the action of the air and moisture is allowed free play, the hydrolysis of the oils and fats may become so complete that only the insoluble fatty acids remain, the glycerol being washed away. This is exemplified by *adipocere* (corpse fat) and also by Irish bog butter, which consists chiefly of free fatty acids.

The property of the fats of being readily hydrolysed is most important, and extensive use of it is made in the arts (soap-making, candle manufacture, etc., and recovery of their by-products). If treated with water alone under high pressure (corresponding to a temperature of about 220° C), or in the presence of water with caustic alkalies, alkaline earths, or basic metallic oxides (which act as catalysers), at lower pressures, they are converted in the first instance into free fatty acids and glycerol, *e.g.*: If bases sufficient in amount to combine with the fatty acids be present, the corresponding salts of these acids are formed, such as the sodium salts of fatty acids (hard soap), or potassium salts (soft soaps), soaps of the alkaline earths (lime soap) or of the metallic oxides (zinc soap), etc. For detailed descriptions of the methods employed in commercial hydrolysis, *see* CANDLES, SOAP.

Extraction.—Since the oils and fats have always served the human race as one of the most important articles of food the oil and fat industry may well be considered to be as old as the human race itself. The methods of preparing oils and fats range

themselves under three heads: (1) Extraction by "rendering," *i.e.*, boiling out with water; (2) extraction by expression, and (3) extraction by means of solvents.

Rendering.—The crudest method of rendering oil from seeds, still practised in Central Africa, in Indo-China and on some of the South Sea Islands, consists in heaping up oleaginous fruits and exposing them to the heat of the sun, when the exuding oil runs off and is collected. In a somewhat improved form this process of rendering is practised in the preparation of palm oil (*q.v.*) and the rendering of the best (Cochin) coconut oil by boiling the fresh kernels with water. Naturally these processes can only be applied to those seeds which contain large quantities of fatty matter, such as coconuts and olives. The rendering process is, however, applied on a very large scale to the production of animal fats, such as tallow (*q.v.*), lard, bone fat and whale oil (*q.v.*). The method consists essentially in cutting up the fatty matter into small fragments, which are transferred to vessels containing water, wherein the comminuted mass is heated by steam, either under atmospheric pressure in open vats or under higher pressure in digesters. The fat gradually exudes and collects on top of the water, whilst the membranous matter, "greaves," falls to the bottom. The fat is drawn off the aqueous (gluey) layer and strained through sieves or filters. The greaves are placed in hair or woollen bags and submitted to hydraulic pressure, by which a further portion of fat is obtained (cf. *Pressing*). In the case of animal fats intended for edible purposes, such as lard, suet for margarine, etc., the greatest cleanliness must, of course, be observed, and the temperature kept as low as possible in order to obtain a perfectly sweet and pure material. To obtain a harder product, fats, such as tallow, are frequently subjected to pressing to squeeze out the more liquid portions, which are sold as oleo oil, lard oil, etc.

Pressing.—The boiling out process cannot be applied to small seeds, such as linseed, rapeseed, etc. Whilst, perhaps, the most primitive method of expression was to crush the seed in mortars until the oil should exude, in the East, where vegetable oils form an important article of food and serve also for other domestic purposes, various ingenious applications of lever and of wedge presses have been used from the remotest times. A detailed description is given by Pliny of the screw presses used by the Romans for the production of olive oil. At an early stage in history the Chinese employed the same series of operations which are followed in the most advanced mills of modern times, viz., bruising and reducing the seeds to meal under edge-stones, heating the meal in open pans and pressing out the oil in a wedge press. This primitive process is still carried out in Manchuria, in the production of soya bean cake and oil, one of the staple industries of that country. The Dutch or stamper press, invented in Holland in the 17th century, was almost exclusively employed in Europe for pressing oil-seeds until the early years of the 19th century; it yielded place to the hydraulic press which has practically superseded all other appliances for expression. The sequence of operations in treating oil-seeds, oil-nuts, etc., is as follows: As an important preliminary operation the seeds, etc., are freed from dust, sand, and other impurities by sifting; in the case of seeds amongst which are found pieces of iron (hammer heads among palm-kernels, etc.), the seeds are passed over magnetic separators. The seeds and nuts are then decorticated (where requisite), the shells removed and the kernels ("meats") converted into a meal by grinding between finely grooved rollers. The comminuted mass, forming a more or less coarse meal, is either expressed in this state, or subjected to preliminary heating according to the quality of product required. For the preparation of *edible* oils, the meal is packed in bags and expressed in hydraulic presses in the cold, under a pressure of 300 atmospheres or more. The cakes remain under pressure for about seven minutes. Oil expressed in the cold dissolves the least amount of colouring matter, etc., and hence has suffered least in quality; oils so obtained are known in commerce as "cold-drawn oils," "cold pressed oils," "salad oils," "virgin oils."

By pressing in the cold only part of the oil is recovered. A further quantity is obtained by pressing the meal at a somewhat elevated temperature, either after the cold-drawn oil has been taken off, or in the case of oleaginous seeds of low value, *e.g.*, cottonseed, coconut, where it is of importance to extract as much oil as possible in one operation, immediately after the meal has left the mill. The process, which is general in application to all oil-seeds is described in some detail, with illustrations of typical hydraulic presses, in the article COCONUT OIL AND COPRA. Oil obtained from heated meal is usually more highly coloured and harsher to the taste than cold-drawn oil, more of the extractive substances being dissolved and intermixed with the oil. Such oils are hardly suitable for edible purposes and are chiefly used in manufacturing processes. According to the care exercised by the manufacturer and the range of temperature to which the seed is heated, various grades of oil are obtained. The residual meal is used as cattle-food, or if from poisonous seeds such as castor beans, as manure.

Extraction by Solvents.—The cakes obtained in the foregoing process still retain considerable proportions of oil, usually about 10%. If it be desired to obtain larger quantities than are yielded by the methods described above, the extraction of the seeds must be performed by the use of volatile solvents. Extraction by carbon disulphide was first introduced in 1843 by Jesse Fisher of Birmingham. For several years the process made little advance, for the colour of the resulting oils was dark and the taste sharp. The oil retained traces of sulphur, causing a disagreeable smell in soaps made from it, and the blackening of substances with which it was used. The meal was so tainted with carbon disulphide that it was absolutely out of the question to use it as cattle-food. With improvement in the manufacture of carbon disulphide these drawbacks have been surmounted to a large extent, and the practice of extraction with this solvent has especially gained extension for waste olive marc in France, Italy and Spain. Modern methods largely use petroleum ether (shale naphtha is more usual for the oil extraction of bone-fat); benzene and the non-inflammable hydrocarbons such as trichlorethylene, have been used, but have not proved so satisfactory, and in the latter case the risk of physiological action on the workmen, has militated against their wider utilisation. The methods of operation have been improved so that losses of solvent do not amount to more than 1%. Good quality oils can be obtained, and the processes are able to compete with expression, the choice of method resting mainly on considerations of the particular seed to be treated and the type of meal desired.

The apparatus employed on the large scale depends on the temperature at which the extraction is to be carried out. In the main two types of plant are differentiated, viz., for extraction in the cold, and for hot extraction. The seed is prepared as for pressing, but the grinding is coarser. In cold extraction the meal is placed in a series of closed vessels, and the solvent allowed to percolate by displacement (upward, in a recent process) on the "counter-current" system. The solution of extracted fat is then transferred to a steam-heated still, where the solvent is driven off and recovered by condensation to be used again. The last remnants of volatile solvent in the oil are driven off by a current of steam blown through the oil in the warm state. The hot-extraction process is carried out in apparatus, the principle of which is exemplified in the well-known Soxhlet extractor. The comminuted seed, spread on trays, is placed inside a vessel containing the solvent and fitted with a reflux condenser. On heating the solvent by means of a steam-coil or jacket the vapours rise through and around the meal, passing into the condenser, whence the solvent drops back as liquid on to the hot meal, percolating through it, and reaches the bottom of the vessel as a more or less saturated solution of oil in the solvent. The solvent is again evaporated, leaving the oil behind, the process proceeding continuously until the extraction is deemed finished. The oil solution is run into a still and the oil freed from solvent as already described. The solvent remaining in the meal is removed by a similar steaming process. It is true that on the European continent extracted meal, especially rape meal from good Indian seed and palm kernel meal, is somewhat largely used as cattle-food in admixture with press-cake; in England extracted meal is not

so employed, but finds its proper use in manuring the land.

Refining and Bleaching.—The oils and fats prepared from fresh ("sweet") material by any of the methods detailed above are practically neutral. Carefully rendered or cold-drawn oils are, as a rule, sufficiently pure to be delivered to the consumer, after a preliminary settling has allowed any mucilaginous matter, animal or vegetable fibres, etc., to separate. The clarification process may be shortened by filtering the oils, or otherwise brightening them, *e.g.*, by blowing with air. In many cases these methods still suffice for the production of commercial fats. Oils intended for use as salad oils, or as lubricants, which deposit "stearine" in the cold are "demargerinated" (*see* p. 749).

In special cases, such as the preparation of edible oils and fats, a further improvement in colour and greater purity is obtained by filtering the oils over absorbent materials such as charcoal, fuller's earth, etc. As in the case of coconut and palm-kernel oils, a preliminary purification in a current of steam may be employed. For refining oils and fats intended for edible purposes, only the foregoing methods, which may be summarized by the name of physical methods, can be used; the only chemicals permissible are alkalies or alkaline earths to remove free fatty acids. The practice of refining by caustic soda has gained considerable extension; the fatty acids are neutralised by caustic soda and removed in the form of soaps by washing, but technically, the process is complicated by the formation of emulsions. Treatment with other chemicals renders the fats unfit for consumption. Hence, all bleaching and refining processes involving other means than those enumerated can only be used for technical oils and fats. There is no universal method of oil refining applicable to any and every oil and fat. Not only must each kind of fat be considered as a special problem, but frequently even varieties of one and the same fat are apt to cause the same difficulties as would a new individual. In many cases purification by sulphuric acid is still usefully applied. The oil is treated with a small proportion of concentrated sulphuric acid; this acts on the suspended impurities, carbonising them to some extent, and causes them to coagulate in the form of a flocculent mass, which settles out carrying with it mechanically other impurities that have not been acted upon. This method is chiefly used in the refining of linseed and rape oils. After treatment with sulphuric acid or caustic soda the oils must be thoroughly washed; the water is allowed to settle out and the oils finally filtered.

A large variety of reagents are in use for bleaching technical oils intended for soaps, lubricants, paints, etc. In general, besides treatment with absorbent media, or exposure to air and light (olive oil), bleaching methods involve the use of oxidising agents such as sodium dichromate and acid, permanganate, hypochlorites, metallic per-salts, peroxides, etc.

Fat-hardening.—There is great demand in the arts for hard fats, and a great development of the fats and oils industry took place in the early years of the present century as a result of the invention of a successful method for converting the liquid unsaturated fatty acids and glycerides into the corresponding solid saturated bodies. The change ("hardening," "hydrogenation") which consists in the addition of hydrogen to the unsaturated bonds, *e.g.*,

$$\underset{\text{oleic acid}}{CH_3(CH_2)_7HC = CH(CH_2)_7COOH} + H_2 = \underset{\text{stearic acid}}{CH_3(CH_2)_7CH_2CH_2(CH_2)_7COOH}$$
(+ hydrogen)

proved to be difficult of practical realisation. Many attempts had been made; stearolactone had been prepared by the action of concentrated sulphuric acid on oleic acid, and palmitic acid by treatment with potash, while the conversion into stearic acid itself had been effected by heating oleic acid under pressure with small quantities of iodine, or by subjecting it to the action of hydrogen under the influence of the silent electric discharge. None of these processes, however, proved economically successful on the commercial scale. The problem was solved by the application of the general reaction discovered by Sabatier and Senderens, namely, that hydrogen could be assimilated by unsaturated compounds in the presence of a metallic catalyst. The principle was found to be readily applicable, not only to fatty acids, but also to the glycerides. The metal in general use is nickel; platinum and palladium are active catalysts, and by their use the reaction can be effected at much lower temperatures, but their high cost and susceptibility to poisoning by traces of impurities preclude their commercial use.

The usual process consists in passing hydrogen through the oil, which is intimately mixed with the catalyst; this consists of finely divided metallic nickel, which, as a rule, has been deposited on an inert support, such as kieselguhr or fuller's earth. The reaction is conducted at temperatures between 140° and 200° C, according to conditions. After hydrogenation the oil has to be filtered to free it from powdered catalyst; the nickel from the latter is recovered. A recent innovation, designed to allow of continuous working, and to obviate the tedious processes of filtration and recovery of the nickel from the oil-saturated residue, employs fine nickel turnings. The turnings are placed in perforated cages in the reaction vessel. The pre-heated oil and the hydrogen flow over them on the counter-current system. The oil delivered is free from nickel and does not require filtration; when the activity of the catalyst becomes reduced, as a result of gradual poisoning, it is easily regenerated by electrolytic oxidation and subsequent reduction. The mechanism of oil-hydrogenation, and the way in which the nickel assists the reduction, has not been fully explained; it appears that the reduction takes place in stages, the most unsaturated acids being first attacked. As the hardening process is always accompanied by a certain amount of deodorisation, more especially in the case of whale and fish oils, it has rendered possible the utilisation of these oils for the manufacture of hard soap, and has led to the substitution of cheaper vegetable oils, hydrogenated to the required consistency, for the more expensive tallow and lard.

The detection of hardened fats in a mixture is a difficult, if not an insoluble, problem. Indications may be furnished by the detection of fatty acids of high molecular weight, *e.g.*, behenic acid from hardened rape or marine animal oils, or of considerable proportions of iso-oleic acid, which is a transition product in the conversion of oleic into stearic acid.

Applications.—It is almost impossible to enumerate the many applications of the fats: in the table above the principal uses of some typical oils and fats are given. Almost all the best quality fats, including hardened whale oil, etc., can be used for edible purposes (margarine, cooking fats, salad oils, etc.), and some constitute a staple article of diet for native races, for instance, palm oil in W. Africa, soya bean oil in Manchuria.

In the arts the fats are used for soap-making (*q.v.*), candle stearine manufacture (*q.v.*) and leather-dressing; the latter industry provides an outlet for fish-oils and other low grade fats. Linseed oil, tung oil, and to a less extent other drying oils, are employed as the basis of paints, varnishes and for linoleum. Many of the non-drying oils (*e.g.*, neat's foot oil, sperm oil, etc.), are employed as lubricants, either alone or compounded with mineral oils (rape, castor oil), while lubricating greases are made from metallic soaps. Rape oil (colza) and other oils are still used as burning oils in remoter districts. Castor, and "tournant" olive oils provide the turkey-red oils used in dyeing textiles (*see* also GLYCERINE).

In medicine.—Some of the oils possess peculiar properties for which they are valued medicinally. Castor (*q.v.*) and curcas oils have a strong purgative action, while chaulmoogra oil, and others of the same group, have recently attracted attention as specifics for leprosy. Lard, olive, almond and other oils find application in pharmacy as vehicles for various medicatments (*see* also COD LIVER OIL).

Commerce.—In the table the principal countries of origin of the sources (seeds, etc.) of the fats are given. In a great many cases the oils are not extracted in their country of origin; the raw materials are shipped to European countries and America; thus Marseilles becomes the centre of the coconut oil trade, Liverpool and Hull centres of oil-seed expression, etc. Recent

development of industry in tropical countries, together with the war-time need for economy in freightage, has led, however, to increased production of oils and fats in the native countries; thus we find exports of copra from the Philippines decreasing, while the exports of oil increase. Statistics for the production of fats are very scanty; estimations based on available import and export returns take no account of the consumption in the countries of origin, which may be considerable, *e.g.*, coco-nut oil in the Philippines, palm oil in W. Africa. For the available data, the reader is referred to the trade returns (U.K., U.S.A., etc.) and to the publications of the International Institute of Agriculture, Rome—*Oleaginous Products and Vegetable Oils* and the *Year Book of Agricultural Statistics*.

Production.—The production of oils is liable to considerable fluctuation, but the following estimates may be taken as representative. On the whole the production and consumption of oils and fats has steadily augmented since the War, the increase being especially marked in the case of soya-bean, coco-nut, palm-kernel and groundnut (peanut) oils.

Production of Oil-seeds, Nuts, etc. (reduced to Oil-equivalent), and Oils

Oil	1924*	1926†	Estimate for 1928†
	1,000 quintals	Tons	Tons
Cottonseed	19,260	931,963	1,246,800
Copra	13,000	733,431	902,500
Groundnut (peanut)	12,366	527,441	835,000
Linseed	10,000	694,292	885,000
Olive	7,653	626,000	650,000
Rapeseed	4,652	73,786	297,500
Soya	4,000	398,961	380,900
Sesamum	2,020	..	153,000
Sunflower	..	136,730	375,000
Palm and palmkernel	..	408,891	422,000
Other vegetable oils	..	..	251,200
Lard	..	..	645,000
Tallow	..	..	99,000
Total	..	..	7,142,900
	Barrels	Barrels	1927, barrels
Whale oil production	641,583	1,166,857	1,220,415

*From "*Oleaginous Products and Vegetable Oils.*"
†From "*Review of the Oilseed and Oil Markets for 1927*," issued by Frank Fehr & Co.

WAXES

The *waxes* consist chiefly of the fatty acid esters of the higher monohydric alcohols, with which are frequently associated free alcohols as also free fatty acids. Important among the acids found are palmitic acid, occurring in beeswax and spermaceti (*q.v.*), cerotic acid, $C_{25}H_{51}COOH$, in beeswax, wool-wax and other waxes, and melissic acid, $C_{29}H_{59}COOH$, of beeswax.

The hydroxylated lanopalmic, $C_{15}H_{30}(OH)COOH$, and lanoceric, $C_{29}H_{57}(OH)_2COOH$, acids also occur in wool-wax. The alcohols cetyl alcohol, $C_{16}H_{33}(OH)$ ("ethal" of the older writers) of spermaceti, and myricyl (melissyl) alcohol, $C_{30}H_{61}(OH)$, of beeswax and carnaüba wax are the most important, while the cyclic sterols, cholesterol and isocholesterol, occur in considerable amounts in wool-wax.

Spermaceti consists practically of cetyl palmitate, Chinese wax of ceryl palmitate. The other waxes, especially wool-wax, are of more complex composition.

The waxes can be simply classified, similarly to the fats, as follows:—

I. Liquid waxes
II. Solid waxes
  A. Vegetable waxes
  B. Animal waxes.

The table enumerates the most important waxes (*see* also separate articles, SPERMACETI, etc.).

The occurrence and physiological importance of the waxes have been discussed above. In their physical properties the natural waxes resemble the fats. They behave similarly towards solvents, and in the liquid condition leave a grease-spot on paper.

Wax	Occurrence	Iodine value	Principal use
Liquid waxes			
Sperm oil	Atlantic, Pacific	81–90	Lubricant
Arctic sperm oil	Arctic	67–82	„
Solid waxes			
Vegetable waxes:			
Carnaüba wax	Brazil	13	Polishes, phonograph mass
Sugar cane wax	..	60	Polishes
Montan wax (distilled from peat)	Germany, Ireland, etc.	12–16	„ phonograph mass
Animal waxes:			
Wool-wax	As mutton-tallow	30–35 (Wijs)	Ointment ("lanolin")
Beeswax	General	8	Candles, polishes
Spermaceti	As sperm oil	0–4	Candles, surgery
Insect wax, Chinese wax	China	0–1·4	Candles, polishes, sizes

An important property is that of easily forming emulsions with water, of which large quantities can readily be incorporated (lanolin [*q.v.*]).

Only a few vegetable waxes are found in sufficiently large quantities to be of commercial importance; so far carnaüba and sugar-cane waxes are practically the only plant waxes of importance in the world's markets. The most important animal wax is beeswax (*q.v.*), collected in almost all parts of the world. An exceptional position is occupied by wool-wax, the main constituent of the natural wool fat that covers the hair of sheep, which is obtained as a by-product in scouring raw wool. Wool-fat is purified on a large scale and brought into commerce, under the name *lanolin*, as an ointment, which is valued for its property of easy assimilation by the skin.

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OIRAT AUTONOMOUS AREA, an administrative division of the Russian S.F.S.R., created in 1922, within the Siberian area, bounded by Kazakstan on the south-west and Mongolia, with the Mongolian Tannu-Tubinsk republic on the south and east, and by the Siberian area on the north. Area 91,200 sq.km. Pop. (1926) about 100,000. It lies between 49° 5′ and 52° 4′ N. and 84° and 89° 55′ E., and is entirely rural, the administrative centre Ulala, on the Katun river, having 5,726 inhabitants in 1926. The area is mountainous, lying in the Altai region of West Siberia, which forms part of the Alpine highlands bordering the Mongolian plateau. Within it lies Mount Byelukha, whose summits rise to 14,890 feet and 14,560 feet respectively, and on which several glaciers exist. Numerous spurs strike from the Sailughem mountains towards the Siberian plain in all directions, amongst which are the Chuya Alps, average altitude 9,000 feet, with peaks rising to 12,000 feet, and at least 10 glaciers on the northern slope, and the snow clad Katun Alps (10,000 feet). The Katun river rises in a glacier in a wild gorge on the south-west slope of Byelukha and, after making a wide curve, pierces the Katun range and flows to the north. The upper course of the Biya, which with the Katun later forms the Ob, lies in the Oirat area. The Biya flows from the beautiful alpine Lake Teletskoye, to the south of which are the high Bashkaus, Chulyshman and Chulcha valleys all draining into the lake. The Kok-su and the Argut are the chief among the numerous tributaries of the Katun.

The climate is severe, average winter temperature −13° to −16° C, summer 16° to 18° C. The maximum rainfall is in the

Chernevoi district of the north-east, on the right bank of the Katun river, thickly forested with Siberian cedar and fir. In the north-west the conifers are mixed with birch, poplar and aspen. The Chuya, Kurai and Chulyshman Alps lie above the tree limit and have much tundra. The soils are mainly bog, meadow, rubble and forest clays; their poor character, the short vegetation period and the drought of the region under the influence of winds from Mongolia make cultivation difficult. Wheat and oats, with a little barley, rye, millet, flax, hemp, buckwheat and potato are grown, but only 10% of the area is under cultivation. Primitive irrigation channels had rendered crop production possible in the Uimonsk district in the bend of the Katun river, but during the civil war following the 1917 revolution, the irrigation canals were ruined and have not yet been restored. Grain has to be imported, but the absence of railway or steamer transport makes its cost heavy and many peasants cannot purchase it, especially as war conditions heavily depleted flocks and herds, horses and mules being still far below pre-war level. This is a disaster as many of the natives depended on transport in connection with the trade between Kobdo in Mongolia and Biisk in Siberia for supplementary income.

Forest fires and reckless exploitation for army purposes diminished the timber in accessible places and also reduced the number of fur-bearing animals, already diminishing in pre-war times through intensive hunting. Squirrel, bear, fox, ermine and sable are the chief fur-bearing animals of the region. The collection of cedar nuts for the oil pressing factories of Siberia, formerly an important occupation, was also affected by the causes given above. Timber, in any case, is difficult to exploit in the absence of transport facilities in a wild and rocky country. The chief occupation of the people is stock-raising, horses, working and dairy cattle, sheep, goats and pigs being bred. War conditions, followed by a period when troops of bandits infested the region, not only destroyed many of the best breeds, but caused the herdsmen to cross into Mongolia, with their remaining cattle and flocks. Epizootic diseases are prevalent, possibly because of their spread along the road from Mongolia. Milk and meat, with fermented mare's milk (kumiss) form the staple diet of the people. Raw leather with butter from the farms of the Russian settlers, are exported to a small extent. Meat and wool are used locally, for peasant industries have to supply local needs of homespun, felt, wooden and leather articles and flour and cheese. There is no factory industry. Beekeeping is profitable among the Russian settlers, and is increasing. The maral deer, from whose horns a substance called *panty*, used as a medicine in China, is obtained, is kept by the natives.

Of the population about 50% are Russians, partly descendants of the Old Believers who took refuge here from religious persecution from 1761 onwards. Colonization began in the 19th century, the settlers being mainly peasants from the crown lands, but no attempt was made to organize Russian colonization until 1874–1879. The colonists have occupied the areas suitable for cultivation, especially the Uimonsk region. Disputes between the Russian tillers of the soil and the nomad herdsmen of the hills were frequent and sharp before the creation of the autonomous area. The etymology of the word Oirat or Uirad is uncertain. Remusat and Pallas considered the term Durben Uirad, by which name Chinese writers speak of the Kalmucks, to mean The Four Allies, referring to the confederacy of four Kalmuck tribes which existed in the middle ages. Schmidt states that the Volga Kalmucks call themselves Uirad or Mongol Uirad, and the term Uirad Buriat also occurs in the records. Howorth after at first inclining to the view of Pallas and Remusat and considering that the term had no racial significance, later decided that Uirad was an indigenous term among the Kalmucks. Marco Polo says that Jenghiz Khan allowed the Horiads, out of gratitude for a victory they had won for him, to share the milk of his private herd of white mares, and Yule identifies the Horiads with the Uirads. According to Vambéry the term means grey mare.

The Uirads are recorded as living in the region of the "eight rivers," *i.e.*, the sources of the Kem or Upper Yenisei, at the accession of Jenghiz Khan. Apparently they were Mongols with a Turkish admixture. They submitted to Jenghiz Khan without any struggle and their chieftain Kara Kiragho was one of the nine famous generals or *orloks* who commanded divisions of Jenghiz Khan's army. A long struggle afterwards ensued between the Uirads and the Mongols, and in the 15th century the greater part of the western Mongols were under Uirad overlordship. Towards the end of the 16th century the Uirad power decayed and the Mongols recovered their supremacy. The Dzungarians later overran the Uirad territory, but were themselves conquered by the Chinese in the 18th century, when many took refuge with the Kirghiz in Russian territory. The non-Russian population of the Oirat autonomous area is thus composed of the descendants of these various Turkish, Kalmuck and Mongol tribes and includes also some Kirghiz shepherds. These Altai hill tribes are all nomad herdsmen, supplementing their income by hunting and by undertaking transport along the road from Kobdo to Biisk which passes through the Oirat area. It should be noted that the Telengets of the district north of Kusnetsk, lying outside the Oirat area, call themselves Oirat and that their language and poetry is similar to that of the Altaians, Howorth suggests that they may have been closely allied. Another division of the Uirads in 1296 deserted the Khan of Persia and went to Damascus. Among Altai mountain peoples are the Mountain or Black Forest Tatars, living in the cedar forest region between the Katun and Lake Teletskoye and supplementing their semi-nomad herding by collecting cedar nuts and roots and hoeing the soil in a primitive way for wheat and barley cultivation. The Kumandins, live on both banks of the Biya from the mouth of the Lebed downwards, and are taking to settled agriculture. Another Tatar group lives along the Lebed shores and is mainly occupied in hunting.

See Henry Howorth, *The History of the Mongols* (1876), and in Russian *Atlas of the U.S.S.R.* (1928).

OISE, a department of northern France, three-fourths of which belonged to Ile-de-France and the rest to Picardy, bounded north by Somme, east by Aisne, south by Seine-et-Marne and Seine-et-Oise, and west by Eure and Seine-Inférieure. Pop. (1926) 405,971; area 2,272 sq.m. As its name implies, the department includes a good deal of the lower basin of the Oise and its tributaries, forming a broad basin dissected from the outlying zone of the Eocene deposits. To the south-east of the Oise the Eocene forms a plateau with a considerable amount of forest, especially towards the north. To the north-west of the Oise the Eocene is capped along various south-east–north-west ridges by Pliocene, forming the hills of the Pays de Bray (770 ft.). The valley of the Oise itself is a sunny region, with less than 24 in. of rain per annum, and a range of seasonal averages of temperature from about 38° to 64° F.

Clay for bricks and earthenware, sand and building-stone are among the mineral products of Oise, and peat is also worked. Pierrefonds, Gouvieux, Chantilly and Fontaine Bonneleau have mineral springs. Wheat, oats and other cereals, potatoes and sugar beet are the chief agricultural crops. Cattle are reared especially in the western districts, where dairying is actively carried on. Bee-keeping is general. Racing stables are numerous in the neighbourhood of Chantilly and Compiègne. The chief industries of the department are manufactures of sugar and alcohol from beetroot. The manufacture of furniture, brushes (Beauvais) and other wooden goods and of toys, fancy-ware, buttons, fans and other articles in wood, ivory, bone or mother-of-pearl are important. There are also woollen and cotton mills, and manufactories of woollen fabrics, blankets, carpets (Beauvais), hosiery and lace (Chantilly and its vicinity). Creil and the neighbouring Montataire form an important metallurgical centre. Oise is served by the Northern railway, on which Creil is an important junction, and the Oise and its lateral canal and the Aisne afford about 70 m. of navigable waterway.

There are three arrondissements—Beauvais, Compiègne and Senlis—with 35 cantons and 701 communes. The department forms the diocese of Beauvais (province of Reims) and part of the region of the II. army corps and of the *académie* (educational division) of Paris. Its court of appeal is at Amiens.

OISE, a river of northern France, 187 m. long, flowing south-

west from the Belgian frontier to join the Seine 39 miles below Paris. It drains the north-eastern part of the Paris basin. Rising in Belgium, 5 m. S.E. of Chimay at a height of 980 ft., the river enters France after a course of little more than 9 m. It divides below Guise into several arms and is joined by the Serre (left), near La Fère. Thence as far as the Ailette (left), it flows through well-wooded country to Compiègne, above which it receives the Aisne (left). Skirting the forests of Compiègne, Halatte and Chantilly (all left), and receiving near Creil the Thérain and the Brèche (both right), the river flows past Pontoise to reach the Seine. Its channel is canalized (depth 6 ft. 6 in.) from Janville to its mouth. Above Janville a lateral canal continued by the Sambre-Oise canal accompanies the river to Landrecies. It is connected by canal with the canal system of Flanders and with the Somme and the Eastern canal systems. (*See* SEINE.)

OISIN (pronounced *Usheen*), reputed to be the son of Finn mac Cumhaill (*q.v.*), a heroic warrior and bard. He figures to but a small extent in the earlier literature of the Finn cycle, being eclipsed by his father and by his son Oscar. But in the later "Ossianic" literature he is prominent as the narrator of the events through which he claims to have lived. According to the legend, he remained alive after the Battle of Gabhra (Garristown, Co. Dublin) in which Cairbre Liffechair, son of Cormac mac Airt, destroyed Finn and his followers (A.D. 283), and survived long enough to meet St. Patrick (who arrived in Ireland in A.D. 432) and to tell him the ancient traditions of his youth. This prolonged existence was accounted for by his having been carried off by a fairy maiden to the Happy Otherworld; a tale not found in any ancient manuscript, but preserved orally, and successfully versified by the 18th-century Irish poet Michael Comyn. In a very valuable prose tract, *Agallamh na Senórach* ("The Colloquy of the Elders"), Patrick is described as making a circuit of Ireland, with Oisin and his old companion in arms, Caeilte, as *ciceroni*. The same formula was afterwards adopted in verse, but with the difference that whereas in the prose narrative the pagan warriors and the saint treat each other with courtesy, in the verses they argue with a petulance often descending to ribaldry on both sides. The poet's name, in the form "Ossian," was popularized by James Macpherson; but his version of the tales and poems is so much manipulated as to be practically a new work.

Agallamh na Senórach is published with a translation in O'Grady's *Silva Gadelica* (1890). For the chief Ossianic poems *see* the publications of the Ossianic Society (1856, 1858); also Eoin MacNeill, *Duanaire Finn* (Irish Texts Society, 1908). *See* also L. C. Stern, *Die Ossianischen Heldenlieder* (English Translation in *Transactions of the Gaelic Society of Inverness*, xxii., p. 257). (R. A. S. M.)

OJIBWA. The Ojibwa or Chippewa form a large, loosely knit group of Algonkin Indians, said to have held originally the northern shores of lakes Huron and Superior, but extending in the historic period also westward across northern Minnesota and into Manitoba as far as Turtle mountain. Their expansion was largely at the expense of the Dakota, whom they bested with firearms obtained from the French. They were friendly to the French, and later to the British against the Americans, but have never been aggressive in warfare, at least not unitedly so, although esteemed brave. They were a timber people, farming only in part, and subsisting largely on game and wild rice. They are a large and widely spread group, numbering 30,000 or more, about equally divided between Canadian and American soil. (A. L. K.)



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

MALE OKAPI (OCAPIA JOHNSTONI), FOUND MOSTLY IN THE CONGO DISTRICTS

OKAPI (ō-kah'pĭ), large animal allied to giraffes, inhabiting the Semliki forest between Lakes Albert and Albert Edward in Central Africa. First obtained by Sir H. H. Johnston, in 1900, the okapi (*Ocapia johnstoni*) has shorter legs and neck than the giraffe, standing 5ft. at the shoulder. In colour it is purplish, with the sides of the face puce and the limbs barred with black and white. The horns, only present in the males, are capped with a small polished tip which alone penetrates the covering skin. The skull is intermediate between that of the giraffe and that of the extinct *Samotherium* of the Lower Pliocene of Europe. The okapi dwells in the densest parts of the primeval forest, feeding on leaves of trees, shrubs and epiphytes. Its colouring renders it practically invisible at a short distance. It belongs to the family *Giraffidae* (*see* PECORA).

See for further details Ray Lankester, *Trans. Zool. Soc. of London* (xvi., 6, 1902).

OKEGHEM, JOANNES (also OCKEGHEM, OCKENHEIM, OKERGAN, JEAN DE) (early 15th cent.–c. 1495), was born early in the 15th century at Termonde, East Flanders. He was a chorister at Antwerp in 1443 and is generally supposed to have been a pupil of Binchois. The latter part of his life was spent at Tours, where he held the coveted post of treasurer to St. Martin's church under Louis XI. He stands out in the early history of music as one of the greatest of teachers and is by common consent regarded as the founder of the second Netherlands school of contrapuntists, covering the latter half of the 15th century. Josquin des Près and De la Rue were but two among the many famous pupils who carried his teaching into all countries. His skill and ingenuity in counterpoint were considered extraordinary even in that age of elaboration. He wrote, among others, a transposing mass, the *Missa cujusvis toni*, which could be sung in any of the church modes, and a complicated motet for 36 voices. In fugue he introduced the *stretto*, a now familiar device by which the answer follows the subject at a closer interval than in the original statement, and in addition to the usual form of canon in unison he added the canon at the fourth below. Much of his work was destroyed in the wars, or lost, and he lived too early to see his works in print. The masses and motets were not published till after his death. Two masses (Trent codices) have been published by the *Gesellschaft sur Herausgabe von Denkmälern der Tonkunst in Osterreich* (Vienna) and 4 Chansons are in A. W. Ambros, *Geschichte der Musik* (5 vols., Leipzig, 1862–82. The 5th vol. containing examples of music, has not been re-issued).

See also A. de Marsy, *Un musicien flamand: Jean de Ockeghem* (1895); Dragan Plauenocz, *J. Ockeghem als Motett- und Chansons-Komponist* (Vienna, 1925).

OKEN, LORENZ (1779–1851), German naturalist, whose real name was Ockenfuss, was born at Bohlsbach, Baden, on Aug. 1, 1779. He studied at Würzburg and Göttingen, where he became *Privatdozent*. In 1870 he was appointed professor extraordinarius of medical sciences at Jena. His inaugural discourse on the signification of the bones of the skull, based upon a discovery he had made in the previous year, was delivered in the presence of Goethe, as privy-councillor and rector of the university, and was published in the same year, with the title, *Ueber die Bedeutung der Schädelknochen*. In 1816 he began to publish at Weimar the periodical *Isis, eine encyclopädische Zeitschrift, vorzüglich für Naturgeschichte, vergleichende Anatomie und Physiologie*. Comments on the politics of other German States led to a remonstrance from the court of Weimar, which demanded either the suppression of the *Isis* or resignation. Oken resigned, and continued to publish the *Isis* at Rudolstadt until 1848.

In 1821 Oken promulgated the idea of annual general meetings of German naturalists and medical practitioners, the first meeting being held in Leipzig in 1822. The British Association for the Advancement of Science was first organized after the Okenian model.

In 1828 Oken resumed his duties as privat-docent in the newly-established University of Munich, and soon afterwards was appointed professor in the same university. In 1832, on the proposal by the Bavarian Government to transfer him to a professorship in a provincial university of the State, he resigned his appointments and left the kingdom. He was appointed in 1833 to the professorship of natural history in the then recently-established University of Zurich, where he resided until his death, on Aug. 11, 1851.

All Oken's writings are eminently deductive illustrations of a foregone and assumed principle, which, with other philosophers

of the transcendental school, he deemed equal to the explanation of all the mysteries of nature. According to him, the head was a repetition of the trunk—a kind of second trunk, with its limbs and other appendages; this sum of his observations and comparisons—few of which he ever gave in detail—ought always to be borne in mind in comparing the share taken by Oken in homological anatomy with the progress made by other cultivators of that philosophical branch of the science. Oken's axiom that "all the parts of higher animals are made up of an aggregate of infusoria or animated globular nomads" is of the same order as his proposition that the head is a repetition of the trunk. This latter proposition was claimed to have been discovered by Goethe. He stated this in his *Morphologie* in 1820. A controversy followed; Oken replied with an able statement in *Isis* (Part 7, 1847).

The following is a list of Oken's principal works: *Grundriss der Naturphilosophie, der Theorie der Sinne; und der darauf gegründeten Classification der Thiere* (1802); *Die Zeugung* (1805); *Abriss der Biologie* (1805); *Beiträge zur vergleichenden-Zoologie, Anatomie und Physiologie* (along with Kieser, 1806–07); *Ueber die Bedeutung der Schädelknochen* (1807); *Ueber das Universum als Fortsetzung des Sinnensystems* (1808); *Erste Ideen zur Theorie des Lichts, der Finsterniss, der Farben und der Wärme* (1808); *Grundzeichnung des natürlichen Systems der Erze* (1809); *Ueber den Werth der Naturgeschichte* (1809) *Lehrbuch der Naturphilosophie* (1809–11; 2nd ed., 1831; 3rd ed., 1843; Eng. trans., *Elements of Physiophilosophy*, 1847); *Lehrbuch der Naturgeschichte* (1813, 1815, 1825); *Handbuch der Naturgeschichte zum Gebrauch bei Vorlesungen* (1816–20); *Naturgeschichte für Schulen* (1821); *Esquisse d'un Système d'Anatomie, de Physiologie, et d'Histoire Naturelle* (1812); *Allgemeine Naturgeschichte* (1833–42, 14 vols.).

See also A. Ecker, *L. Oken* (1880); C. Güttler, *L. Oken und sein Verhälbais zur Modernen Entwicklungslehre* (1884).

OKHOTSK, SEA OF, a part of the western Pacific Ocean, lying between the peninsula of Kamchatka, the Kurile Islands, the Japanese island of Yezo, the island of Sakhalin, and the Amur province of East Siberia. The Sakhalin Gulf and Gulf of Tartary connect it with the Japanese Sea on the west of the island of Sakhalin, and on the south of this island is the La Pérouse Strait.

OKI, a group of islands belonging to Japan, lying due north of the province of Izumo, at the intersection of 36° N. and 133° E. The group consists of one large island called Dogo, and three smaller isles—Chiburi-shima, Nishi-no-shima, and Naka-no-shima—which are collectively known as Dozen. These four islands have a coast-line of 182 m., an area of 130 sq.m., and a population of 63,000. The island of Dogo has two high peaks, Daimanji-mine (2,185 ft.) and Omine-yama (2,128 ft.). The chief town is Saigo in Dogo, distant about 40 m. from the port of Sakai in Izumo. The name Oki-no-shima signifies "islands in the offing," and the place is celebrated in Japanese history not only because the possession of the islands was much disputed in feudal days, but also because an ex-emperor and an emperor were banished thither by the Hojo regents in the 13th century.

OKLAHOMA is a west south central State of the United States of America, lying between 33° 35′ and 37° N. lat. and 94° 29′ and 103° W. long. It is bounded north by Colorado and Kansas; east by Missouri and Arkansas; south by Texas, from which it is separated in part by the Red river; and west by Texas and New Mexico. It has a total area of 70,057 sq.m., of which 643 sq.m. are water-surface. Although the extreme western limit of the State is the 103rd meridian, the only portion W. of the 100th meridian is a strip of land about 35 m. wide in the present Beaver, Texas and Cimarron counties, and formerly designated as "No Man's Land." Oklahoma is called the "Sooner State" because those who entered on April 22, 1889, with the rush, found much of the best land taken up by those who had evaded the guards and entered the territory in advance of the official opening. These persons who evaded the regulations and thus secured the best land were known as "Sooners."

Physical Features.—The topographical features of the State exhibit considerable diversity, ranging from wide treeless plains in the west to rugged and heavily-wooded mountains in the east. Elevations above the sea range from 4,800 ft. (Black Mesa) in the extreme north-west to 300 ft. in McCurtain county in the south-east. The State has a mean elevation of 1,300 ft., with 34,930 sq.m. below 1,000 ft.; 25,400 sq.m. between 1,000 and 2,000 ft.; 6,500 sq.m. between 2,000 and 3,000 ft.; and 3,600 sq.m. between 3,000 and 5,000 feet.

The western portion of the Ozark mountains enters Oklahoma near the centre of the eastern boundary, and extends west-south-west half way across the State in a chain of hills gradually decreasing in height. In the south central part of the State is an elevated table-land known as the Arbuckle mountains. In its western portion this table-land attains an elevation of about 1,350 ft. above the sea and lies about 400 ft. above the bordering plains. At its eastern termination, where it merges with the plains, it has an elevation of about 750 feet. Sixty miles north-west of this plateau lie the Wichita mountains, a straggling range of rugged peaks rising about 1,500 ft. above the plain, but on account of their steep and rugged slopes they are difficult to ascend. A third group of hills, the Chautauqua mountains, lie in the west in Blaine and Canadian counties, their main axis being almost parallel with the North Fork. The north-western part of Oklahoma is a lofty table-land forming part of the Great Plains region east of the Rocky mountains.

The prairies north of the Arkansas and west of the Neosho rivers are deeply carved by small streams, and in the western portion of this area, where the formation consists of alternating shales and sandstones, the easily eroded rocks have been carved into canyons, buttes and mesas. South of the Arkansas river these ledges of sandstone continue as far as Okmulgee, but the evidences of erosion are less noticeable. East of the Neosho river the prairies merge into a hilly woodland. In the north-west four salt plains form a striking physical feature. Of these, the most noted is the Big Salt plain of the Cimarron river, in Woodward county, which varies in width from ½ m. to 2 m. and extends along the river for 8 miles. The plain is almost perfectly level.

Following the slope of the land, the important streams flow from north-west to south-east. The Arkansas river enters the State from the north near the 97th meridian, and after following a general south-easterly course, leaves it near the centre of the eastern boundary. Its tributaries from the north and east—the Verdigris, Grand or Neosho and Illinois—are small and unimportant; but from the south and west it receives the waters of much larger streams—the Salt Fork, Cimarron and the Canadian, with its numerous tributaries. The extreme southern portion of the State is drained by the Red river, which forms the greater part of the southern boundary, and by its tributaries, the North Fork, the Washita and the Kiamichi.

Climate and Soils.—The climate of the State is of a continental type, with light rainfall. The western and central portions of the State are in general cooler and drier than the east. Thus, at Beaver, in the extreme north-west, the mean annual temperature is 57° F and the mean annual rainfall 18·9 in.; while at Lehigh, in the south-east these figures are respectively 62° and 35·1 inches. At Oklahoma City, in the centre of the State, the mean annual temperature is 59·4°; the mean for the summer (June, July and August) is 78·8°, with an extreme recorded of 108°; the mean for the winter (December, January and February) is 38·4°, with an extreme recorded of −17°. At Mangum, in the south-west, the mean annual temperature is 61°; the mean for the summer is 81° and for the winter 41°, while the highest and lowest temperatures ever recorded are respectively 114° and −17°. The mean annual precipitation for the State is 31·7 in.; the variation between the east and the west being about 12 inches.

The prevailing type of soil is a deep dark red loam, sometimes (especially in the east central part of the State) made up of a decomposed sandstone, or (in the north-central part) of shales and decomposed limestone. Not infrequently there are a belt of red sandy loam on uplands north of a river, a rich deposit of black alluvium on valley bottom lands, a belt of red clay loam on uplands south of a river, and a deposit of wind-blown loess

on the water parting.

Population.—The population of the territory now embraced within the State of Oklahoma increased from 258,657 in 1890, when the first census was taken, to 790,391 in 1900, or 205·6%; to 1,657,155 in 1910, or 109·7%; and to 2,028,283 in 1920, or 22·4%. The population on July 1, 1928, was 2,426,000, according to the U.S. census estimate. Of the total population in 1920, 1,821,194 were whites, 149,408 negroes, 57,337 Indians and 344 Mongolians. In the decade 1910–20 the Indian population decreased 16,948, or 22·8%. The only Indians who are natives of this region are a few members of the Kiowa, Comanche and Apache tribes. The others are the remnants of a number of tribes collected here from various parts of the country: Cherokees, Cheyennes, Chickasaws, Choctaws, Foxes, Iowas, Kaws, Kickapoos, Miamis, Osages, Otoes, Ottawas, Pawnees and others. The foreign-born population (40,432) in 1920 constituted 2·2% of the total. Chief among the foreign-born were: Germans, 7,028; Mexicans, 6,884; Russians, 5,005; English, 2,687; Canadians, 2,489; and Italians, 2,122.

The density of population per square mile increased from 2 in 1890 to 29·2 in 1920. The distribution of population then was 1,488,803, rural; 539,480 or 26·6%, urban. The principal cities in 1928 were Oklahoma City (the capital), Tulsa, Muskogee, Okmulgee, Bartlesville, Enid, Ardmore, Shawnee, Ponca, McAlester, Chickasha and Sapulpa.

Government.—The Constitution now in operation was adopted in Sept. 1907, and is that with which the State was admitted into the Union in November of the same year. Amendments may be submitted through a majority of the members elected to both houses of the legislature or through a petition signed by 15% of the electorate, and a proposed amendment becomes a part of the Constitution if the majority of the votes cast at a popular election are in favour of it. The right of suffrage is conferred on all citizens of the United States, 21 years of age or over, who have resided in the State for one year, in the county six months, and in the precinct for the 30 days preceding the election. General elections are held in even-numbered years; party candidates for State, district, county and municipal offices, and U.S. senators and congressmen are chosen at primary elections.

The executive authority of the State is divided among 13 elected officials, including the governor, lieutenant governor, secretary of State, treasurer, auditor, attorney-general, superintendent of public instruction, examiner and inspector, commissioner of labour, commissioner of insurance, chief mine inspector, commissioner of charities and corrections and president of the State board of agriculture. They are elected for a term of four years, and the governor, secretary of State, auditor and treasurer are ineligible for the next succeeding term. Other elected State officials are the three members of the corporation commission (one elected every two years for a six-year term), the clerk of the supreme court and four assistant mine inspectors. Administrative work is also done by more than 60 other officers, commissions, departments and boards. The governor is a member of some important administrative boards, but the number of officers whom he appoints is rather limited and for most of his appointments the confirmation of the senate is required. His right of veto extends to items in appropriation bills, and to pass a bill over his veto a vote of two-thirds of the members elected to each house is required.

The legislative authority is vested in a senate of 44 members and a house of representatives (108 members in 1928), limited to 109 members. Half of the senators and all the representatives are elected every two years, senators by districts and representatives by counties. Sessions are held biennially in odd-numbered years and begin the first Tuesday after the first Monday in January. Oklahoma has put into its Constitution many things which in the older States were left to legislation.

For the administration of justice there have been established a supreme court, composed of nine justices elected for a term of six years; a supreme court commission of nine members appointed by the governor and confirmed by seven members of the supreme court; a criminal court of appeals composed of three justices elected one each two years, for a term of six years; 31 district courts, each with one or more justices elected for a term of four years; superior courts in certain of the more populous counties, with a judge elected for a term of four years; a county court in each county, with one judge elected for a term of two years; justice of the peace courts held by justices elected for a term of two years; and municipal courts in the cities. The supreme court has appellate jurisdiction in all civil cases, but its original jurisdiction is restricted to a general control of the lower courts. The supreme court commission was created by the legislature in 1927 to assist the supreme court in the adjudication of civil cases appealed from trial courts. The criminal court of appeals has jurisdiction in all criminal cases appealed from the district and county courts. The district courts have exclusive jurisdiction in civil actions for sums exceeding $1,000, concurrent jurisdiction with the county courts in civil actions for sums greater than $500, and original or appellate in criminal cases. The superior courts were created to relieve the district courts and have a similar jurisdiction. The county courts have, besides the concurrent jurisdiction above stated, original jurisdiction in all probate matters, original jurisdiction in civil actions for sums greater than $200 and not exceeding $500, concurrent jurisdiction with the justices of the peace in misdemeanour cases, and appellate jurisdiction in all cases brought from a justice of the peace or a police court.

Local Government.—The general management of county affairs is entrusted to three commissioners elected by districts. The other county officers are a sheriff, attorney, judge, clerk, court clerk, treasurer, assessor, surveyor, superintendent of public instruction and public weigher. They are chosen for a term of two years at the general elections in November. Since 1919, only 21 counties have township government. The municipalities of Oklahoma may be classified as incorporated towns and as cities (over 2,000 inhabitants).

Finances.—The revenues for State and for local purposes are derived almost wholly from separate sources. The greater part of the State's revenue is derived from a gross production tax on minerals, motor vehicle licences, a gasolene tax, insurance fees, an inheritance tax, an income tax and miscellaneous departmental collections. Revenue for local purposes is obtained chiefly from tax levies on personal and real property. The valuation and assessment of personal and real property and of public service corporations for 1926 was $1,697,364,263. This, however, did not include mineral property which is taxed on gross production only. The only State levies on property in 1927 were the constitutional taxes of ¼ mill on a dollar for common schools and a similar levy for State highway construction. The highway money was returned to the county of source and the school revenue was disbursed on a *per caput* basis. The total revenue receipts for the year ending June 30, 1927, were $26,334,527; the disbursements $23,820,322; and the balance $6,059,141. The total bonded indebtedness of the State on the above date was $1,543,900.

A feature of the banking system is a fund for the guaranty of deposits in banks operating under State charters. The bank guarantee law was held to be valid by the U.S. Supreme Court in 1908 after the U.S. attorney-general had decided that it was illegal. There were 738 banking institutions operating within the State on June 30, 1926. Their combined resources were $515,017,000; and their total deposits were $402,606,000. Of the total number of banks, 370 were national and 368 State banks

Education.—Oklahoma has an excellent system of public education, and especially is this true for specialized and advanced instruction. The public school system is administered by a State superintendent of public instruction, a State board of education, county superintendents and district boards. The State board, which is composed of the State superintendent and seven appointed members, has administrative control over the six teachers' colleges, the school for the blind and the school for the deaf. It also apportions the various State school-aid funds. The scholastic enumeration in 1925 showed 712,321 children of school age. Of this number 654,742 were enrolled in the public schools and 456,772 were in average daily attendance. The average number of days

attended per enrolled pupil was 115; nearly 63% of the pupils were, however, enrolled in schools which were open 160 days or more. The number of standard four-year high schools was 508; and the number of consolidated rural schools was 389. The total expenditure for schools in 1925 was $30,187,234. Of the total revenue receipts ($31,135,715), the State contributed $2,870,799; the Federal Government $297,757; county sources $3,893,098; local sources $23,578,465; and benevolent sources $28,090.

The higher educational institutions supported by the State are the University of Oklahoma at Norman; the Agricultural and Mechanical college, a land-grant college with experiment stations, at Stillwater; the Oklahoma College for Women, teaching especially domestic science and the fine arts, at Chickasha; Eastern Oklahoma college (School of Mines) at Wilburton; six teachers' colleges at Durant, Edmond, Ada, Weatherford, Alva and Tahlequah; and the Coloured Agricultural and Normal university at Langston. Among the institutions of higher learning neither maintained nor controlled by the State, are Phillips university at Enid; Oklahoma City university at Oklahoma City; the Catholic College of Oklahoma for Women at Guthrie; the University of Tulsa at Tulsa; and Oklahoma Baptist university at Shawnee.

Charities and Corrections.—Under the Constitution the supervision and inspection of charities and institutions of correction are in the hands of a State commissioner of charities and corrections, elected by the people.

The State-maintained institutions in 1927 were hospitals for the insane at Norman, Vinita and Supply; the University hospital at Oklahoma City; tubercular sanatoriums at Clinton and Talihina; a Confederate soldiers' home at Ardmore and a similar institution for Union soldiers at Oklahoma City; orphanages for white children at Pryor and Helena; an institute for the feebleminded at Enid; and a home for deaf, blind and orphan coloured children at Taft. The State penal institutions consisted of four training schools, for negro girls at Taft, for negro boys at Boley, for white girls at Tecumseh and for white boys at Pauls Valley; the Oklahoma State reformatory at Granite; and the State penitentiary at McAlester.

Agriculture and Stock-raising.—Prior to the first opening to settlement by white men in April 1889, the territory now comprising Oklahoma was a cattle country, and since then, although the opening was piecemeal, the agricultural development has been remarkably rapid. By 1900, 51·1% of the total land surface was included in farms; and by 1920 the farm area was 31,951,934 ac., or approximately 72% of the total. The farm acreage in 1925 had decreased to 30,868,965 ac., or 69·5% of the total land area. The average size per farm then was 156·5 acres. The total number of farmers in 1925 was 197,218 as compared with 191,988 in 1920, and 190,191 in 1910. Of the total number of farm operators (197,218) in 1925, 177,170 were whites and 20,048 coloured. In 1925, 81,226 farms were worked by owners or part owners, 494 by managers, and 115,498 by tenants. The percentage of tenancy then was 58·6 as compared with 54·8 in 1910. The total population residing on farms in 1925 was 925,690, or about 40·3% of the State's total. The value of all farm property in 1920 was $1,660,423,544; by 1925 it had decreased to $1,210,134,914. The average value per farm then was $6,136. The total value of all crops in 1919 was $550,084,742; but, chiefly because of the decline in prices, the total value in 1926 was $308,500,000.

In the production of broom corn in 1926, Oklahoma ranked first among the States; in cotton and grain sorghums, second only to Texas; and in wheat third, the State's product being exceeded by Kansas and North Dakota. The 4,912,000 ac. planted in cotton in 1926 had a yield of 1,950,000 bales of lint and 866,000 tons of seed, with a combined value of $107,911,000. Wheat was the crop second in importance in both acreage (4,214,000) and value ($87,019,000). Other important cereal crops were Indian corn, 61,176,000 bu.; oats, 38,304,000 bu.; grain sorghums, 24,318,000 bu.; barley, 4,752,000 bu.; and rye 558,000 bushels. The hay crop of 1,258,000 tons, valued at $13,672,000 was harvested from 551,000 ac. of cultivated hay and 509,000 ac. of wild hay. The potato crop consisted of 2,838,000 bu. of white potatoes valued at $4,825,000, and 2,520,000 bu. of sweet potatoes valued at $2,520,000.

The live stock and poultry products of Oklahoma, in 1926, according to the State board of agriculture, had a value of $145,002,000. Of this total $47,046,000 represented the value of the live stock slaughtered and sold for slaughter, and $35,956,000 the poultry and eggs produced. In the production of turkeys, Oklahoma is outdone by Texas only. The live stock in the State on Jan. 1, 1927, consisted of 1,723,000 cattle, of which 581,000 were kept for dairy purposes; 777,000 swine; 84,000 sheep; 565,000 horses; and 365,000 mules. The estimated value was $105,679,000.

Minerals, Lumber and Timber Products.—Oklahoma, which ranks 17th in size among the States, ranked second in the value of mineral products for 1925. The State then produced 10·07% of the total mineral wealth of the U.S. as compared with 17·40% produced by Pennsylvania. The principal mineral products in the order of value were petroleum, zinc, natural-gas gasolene, natural gas, lead, coal and gypsum. Ranked by value of output, Oklahoma was first among the States in the production of petroleum, natural-gas gasolene, natural gas and zinc; second in chats; and fourth in lead, native asphalt and diatomaceous earth and tripoli. The mineral production of the State in 1925 had a value of $501,767,118. The petroleum and natural gas producing regions of Oklahoma extend over about 43 counties in the north-central and southwestern parts of the State. In 1925 the greater number of Oklahoma's 250 oil and gas fields were still producing. Tulsa, the oil capital of America, is situated in about the centre of the north-central producing area. The petroleum production in 1925 was 176,768,000 bbl. valued at $348,230,000; in 1926 it was 179,272,000 bbl., valued at $410,000,000. The 1927 production was estimated at 278,000,000 barrels. The 390,861,000 gal. of natural-gas gasolene produced in 1925 had a value of $40,973,000; and the 249,285,000,000 cu.ft. of natural gas was valued at $36,121,000. The industry second in importance, ranked by value of product, was the mining of zinc ore in Ottawa county. The 1925 production was 283,371 tons, valued at $43,072,392. The same region produced 79,946 tons of lead, valued at $13,910,604. The bituminous-coal mining industry was sixth in importance in the State in 1925 on the basis of value of products. The Oklahoma coal-fields lie in the eastern part of the State and extend over a very wide territory from which 11 counties reported production in 1925. The principal mining centres are McAlester, Henryetta, Wilburton, Hartshorne, Coalgate and Phillips.

The merchantable timber is mostly in the eastern part of the State, and consists largely of yellow pine, oak, red gum, elm, cottonwood and other hard woods. In 1925, according to the census of manufactures, there were 72 active saw-mills within the State, and the cut for the year was 157,580,000 board feet. Of this total 152,120,000 bd.ft. were soft woods, chiefly pine, and 5,460,000 bd.ft. were hard woods. Oak (3,287,000 bd.ft.) and red gum (1,023,000 bd. ft.) were chief among the hard woods. The lumber industry in 1925 gave employment to 1,879 persons and had a product valued at $4,812,763.

Manufactures and Transport.—Oklahoma ranks high among the States of the Union in the production of raw materials; *i.e.*, products of farms, forests and mines, which had in 1925 a value of approximately $1,000,000,000; the total factory output was valued at $405,295,440. The table shows the chief industries, the number of wage-earners employed and the value of their product in 1925:—

Industry	Number of establishments	Number of wage-earners	Value of product
			$
State total	1,282	26,333	403,295,440
Petroleum refining	50	4,590	182,007,288
Flour and grain-mills	68	537	25,880,940
Cotton-seed oil, meal and cake	45	1,164	24,083,436
Smelting and refining zinc	7	1,924	21,047,969
Newspapers and periodicals	197	1,333	11,101,499
Bakery products	140	1,196	9,169,435
Foundry and machine-shops	63	1,255	9,006,214
Butter, cheese and condensed milk	31	191	6,772,948

The chief industrial centres of the State in 1925 were Oklahoma City, Tulsa and Muskogee.

The first railway in Oklahoma was that of the Missouri, Kansas and Texas, which completed a line across the territory to Denison, Texas, in 1872. The railway mileage, however, increased slowly until the territory was opened to white settlement (1889), and then, in a period of decades, increased by more than 4,600 miles. By 1925 the steam railway mileage had increased to 6,621, and had touched every county in the State except Cimarron. The principal lines crossing the State from north to south are the Missouri, Kansas and Texas, the St. Louis and San Francisco, the Atchison, Topeka and Santa Fe, two lines of the Chicago, Rock Island and Pacific, and the Kansas City, Mexico and Orient. The Chicago, Rock Island and Pacific also crosses the middle of the State from east to west. The 13 street and inter-urban electric railway companies operating in the State in 1925 had 371 m. of main track. Oklahoma has over 130,000 m. of public roads. Of this total 5,589 m. are included in the State-maintained highway system. By Jan. 1, 1927, 1,584·5 m. of the State highways had been surfaced.

History.—With the exception of the narrow strip north of the most northern section of Texas the territory comprising the present State of Oklahoma was set apart by Congress in 1834, under the name of Indian Territory, for the possession of the five southern tribes (Cherokees, Creeks, Seminoles, Choctaws and Chickasaws) and the Quapaw Agency. Early in 1809 some Cherokees in the south-eastern States made known to President Jefferson their desire to remove to hunting grounds west of the Mississippi, and at first they were allowed to occupy lands in what is now Arkansas, but by a new arrangement first entered into in 1828 they received instead, in 1838, a patent for a wide strip extending along the entire northern border of Indian Territory with the exception of the small section in the north-eastern corner which was reserved to the Quapaw Agency. By treaties negotiated in 1820, 1825, 1830 and 1842, the Choctaws received for themselves and the Chickasaws a patent for all that portion of the Territory which lies south of the Canadian and Arkansas rivers, and by treaties negotiated in 1824, 1833 and 1851 the Creeks received for themselves and the Seminoles a patent for the remaining or middle portion. Many of the Indians of these tribes brought slaves with them from the Southern States and during the Civil War they supported the Confederacy, but when that war was over the Federal Government demanded not only the liberation of the slaves but new treaties, partly on the ground that the tribal lands must be divided with the freedmen. By these treaties, negotiated in 1866, the Cherokees gave the United States permission to settle other Indians on what was approximately the western half of their domain; the Seminoles, to whom the Creeks in 1855 had granted as their portion the strip between the Canadian river and its North Fork, ceded all of theirs, and the Creeks, Choctaws and Chickasaws ceded the western half of theirs back to the United States for occupancy by freedmen or other Indians. In the eastern portion of the lands thus placed at its disposal by the Cherokees and the Creeks, the Federal Government within the next 17 years made a number of small grants as follows: to the Seminoles in 1866, to the Sacs and Foxes in 1867, to the Osages, Kansas, Pottawatomies, Absentee Shawnees and Wichitas in 1871–72, to the Pawnees in 1876, to the Poncas and Nez Percés in 1878, to the Otoes and Missouris in 1881, and to the Iowas and Kickapoos in 1883; in the south-western quarter of the Territory, also, the Kiowas, Comanches and Apaches were located in 1867 and the Cheyennes and Arapahoes in 1869. There still remained unassigned the greater part of the Cherokee Outlet besides a tract embracing 1,887,800 ac. of choice land in the centre of the Territory, and the agitation for the opening of this to settlement by white people increased until in 1889 a complete title to the central tract was purchased from the Creeks and Seminoles. Soon after the purchase President Benjamin Harrison issued a proclamation announcing that this land would be opened to homestead settlement at 12 o'clock noon, on April 22, 1889. At that hour, no less than 20,000 people were on the border, and when the signal was given there ensued a remarkably spectacular race for homes. In the next year that portion of Indian Territory which lay south of the Cherokee Outlet, and west of the lands occupied by the five tribes, together with the narrow strip north of Texas which had been denied to that State in 1850, was organized as the Territory of Oklahoma.

In the meantime negotiations were begun for acquiring a clear title to the unoccupied portion of the Cherokee Outlet for individual allotments to the members of the several small tribes who had received tribal allotments since 1866, and for the purchase of what remained after such individual allotments had been made. As these negotiations were successful most of the land between the tract first opened and that of the Creeks was opened to settlement in 1891, a large tract to the west of the centre was opened in 1892, a tract south of the Canadian river and west of the Chickasaws was opened in 1901, and by 1904 the entire Territory had been opened to settlement with the exception of a tract in the north-east which was occupied by the Osages, Kaws, Poncas and Otoes. By the treaties with the five southern tribes they were to be permitted to make their own laws so long as they preserved their tribal relations, but since the Civil War many whites had mingled with these Indians, gained control for their own selfish ends of such government as there was, and made the country a refuge for fugitives from justice. Consequently, in 1893, Congress appointed the Dawes Commission to induce the tribes to consent to individual allotments as well as to a government administered from Washington, and in 1898 the Curtis Act was passed for making such allotments and for the establishment of a Territorial Government. When the allotments were nearly all made Congress in 1906 authorized Oklahoma and Indian Territories to qualify for admission to the Union as one State. As both Territories approved, a constitutional convention (composed of 100 Democrats and 12 Republicans) met at Guthrie on Nov. 20, 1906. The Constitution framed by this body was approved by the electorate on Sept. 17, 1907, and the State was admitted to the Union on Nov. 16.

In politics Oklahoma has been consistently Democratic, but with a strong Republican minority. In the election of 1920 the Republican Party gained control of the house of representatives, while the senate, with half of its members holding over, remained Democratic. The Republicans were also successful in electing their candidate to the U.S. Senate. Governor Walton's excessive use of martial law in 1923 in suppressing alleged activities of the Ku Klux Klan—a national secret organization which had obtained a large membership in the State—brought about a movement for his impeachment. He was found guilty and removed from office after having served only a few months of the four-year term. Governor Johnston was similarly impeached in Jan., 1929.

The phenomenal progress made by Oklahoma during its few years of statehood is reflected in its excellent system of public education, in the care given to the poorer classes and in the improved State highways. Much of this progress has been made possible by the yield of the State's fertile soil, but in a larger measure by its rich mineral resources.

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(R. GIT.)

OKLAHOMA CITY, capital and largest city of Oklahoma, U.S.A., and county seat of Oklahoma county; on the North Cana-

dian river, near the centre of the State. It is on Federal highways 66, 266, and 77, and the airway from Chicago to the Gulf; and is served by the Fort Smith and Western, the Frisco, the Missouri-Kansas-Texas, the Oklahoma, the Oklahoma City-Ada-Atoka, the Rock Island, the Santa Fe, and two belt railways. Pop. (1925) 139,947, estimated locally at 163,000 in 1928. It is one of the newest of the large cities. Only one in four of the population in 1920 had been born in the State, and the frontier characteristic of a predominance of males (104 to 100 females) still prevailed. Home-building was still going on in 1928 at the rate of one completed, on the average, every two hours of each working day. The site covers 19 sq.m. about 1,200 ft. above sea-level. The State Capitol (completed in 1917 at a cost of $4,500,000) is an impressive colonnaded structure of white limestone, in 100 ac. of gardens and parkland. The large, modern public and business buildings are beautified with borders of turf and shrubbery. The residential streets are tree-lined and most of the houses set in spacious lawns and gardens. The city's parks and playgrounds cover 2,300 acres. Its water is supplied from Lake Overholser (10 m. N.W.), a reservoir of 1,700 ac. with two or three years' supply, built (1917–24) at a cost of $6,000,000, and planned as the centre of a great park. At the south-east corner of the city are the State Fair Grounds of 160 acres. The city operates under a city-manager form of government, adopted in 1927. It is the seat of Oklahoma City University (Methodist Episcopal; established at Guthrie in 1911, superseding Epworth University) and of the medical school and hospital of the University of Oklahoma, which has its main seat at Norman (*q.v.*), 18 m. south. Equally accessible is the Central State Teachers' College at Edmond, 15 m. north. The city's public-school system represents an investment of $9,000,000.

Oklahoma City is the commercial and financial metropolis of the State, the seat of a branch of the Federal Reserve bank, the home of insurance offices writing 75% of the policies in the State, and of wholesale houses distributing 75% of all the goods, 95% of the automobiles, trucks, and tractors, and 100% of the farm machinery and farm implements used throughout the State. It gins and markets a large part of the state's cotton crop ($\frac{1}{13}$ of the total grown in the country), and makes large quantities of cotton-seed oil, meal, and cake; is an important market for horses (notably registered Percherons) and mules, and is the home of the South-West American Livestock Show; and has stockyards (at Packingtown, just outside the city limits) with a capacity of 31,000 head daily, and packing-plants with an annual output valued at over $70,000,000. The nearest producing oilfield is 35 m. from the city, but many large operating companies have their headquarters here, and there are many supply houses doing a large business. The manufacturing industries had an output in 1927 valued at $125,368,000. Building permits in 1927 represented values totalling $16,238,714. Bank debits in 1927 aggregated $1,251,251,000.

The site of Oklahoma City was opened to settlement on April 22, 1889. By night it had a population of 10,000 under tents. The city was chartered in 1890 and became the capital of the State in 1910. In less than 40 years from its birthday it had 51 public-school buildings, 117 churches, 245 m. of paved streets, 253 m. of water mains, over 35,000 telephones, 529 manufacturing plants, an assessed valuation (for 1928) of $121,975,196; post-office receipts amounting in a year (1927) to $1,616,346, and bank deposits (January 1, 1928) aggregating $88,067,134.

OKMULGEE, a city of eastern Oklahoma, U.S.A., on Federal highway 75 and the Frisco and Okmulgee Northern railways; the county seat of Okmulgee county. Pop. (1920) 17,430 (78% native white and 19% negroes); 1928 local estimate 30,000. It is the centre of one of the greatest oil-producing regions of the world. Within an area of 2,123 sq.m. are some 6,000 producing wells, which supply 16% of the total output of the United States. The city has refineries using 20,000 bbl. of crude oil daily, plants making 200,000 gal. of gasolene daily from natural gas, window-glass plants employing 1,000 men and numerous other manufacturing industries. In a square in the heart of the city stands the Council house which was the capital of the Creek nation for half a century. Okmulgee was settled about 1900. In 1910 it was still a little cattle town of 4,176 inhabitants. In the next decade the population increased more than fourfold and the town developed into a modern city. It was incorporated in 1912 under a commission-manager form of government.

OKU, YASUKATA, Marshal, Count (1846–), Japanese general, was born in Fukuoka-ken. He commanded the II. army in the Russo-Japanese War. In 1906–1912 he was chief of the general staff, and was made count in 1907 and marshal in 1911.

OKUBO TOSHIMITSU (1830–1878), Japanese statesman, a samurai of Satsuma, was one of the five great nobles who led the revolution in 1868 against the shogunate. He became one of the mikado's principal ministers, and in the Satsuma troubles which followed he was the chief opponent of Saigo Takamori. But the suppression of the Satsuma rebellion brought upon him the personal revenge of Saigo's sympathizers, and in the spring of 1878 he was assassinated by six clansmen. Okubo was one of the leading men of his day, and in 1872 was one of the Japanese mission which was sent round the world to get ideas for organizing the new régime.

OKUMA (SHIGENOBU), Marquis (1838–1922), Japanese statesman, was born in the province of Hizen in 1838. His father was an officer in the artillery. He was able to acquire in his youth a knowledge of English and Dutch, and by the help of missionaries he obtained books in those languages on scientific and political subjects. These works effected a complete revolution in his mind. He had been designed by his parents for the military profession, but he was determined to devote his energies to the abolition of the existing feudal system and to the establishment of a constitutional government. Though he took no active part in the revolution of 1868, the weight of his opinions was felt in the struggle. Already he was recognized as a coming man and no sooner was the government reorganized, with the mikado as the sole wielder of power, than he was appointed chief assistant in the department of foreign affairs. In 1869 he succeeded to the post of secretary of the joint departments of the interior and of finance, and for the next fourteen years he devoted himself to politics. In 1870 he was made a councillor of state, and a few months later became president of the commission which represented the Japanese government at the Vienna Exhibition. In 1872 he was again minister of finance, and was president of the commission appointed to supervise the Formosa campaign of 1874. The Japanese nation had supported him up to a certain point, but opinion now turned against him. When Okuma resigned office in the early 'eighties he established the Semmon Gakko, or school for special studies, and subsequently other schools.

In 1896–97 he was a member of the Matsukata cabinet. An attempted assassination by bomb necessitated the amputation of one of his legs. On Ito's retirement in 1898 he took office as premier and minister of foreign affairs. He resigned after a few months and retired into private life, cultivating his beautiful garden at Waseda near Tokyo. He emerged from his retirement in 1914 to become prime minister, in which capacity he guided the country through the opening months of the World War. In 1916, Count Okuma retired from office owing to his failing health. In the same year he was raised to a marquessate. He died at Tokyo on Jan. 10, 1922.

OLAF or **ANLAF** (d. 981), king of the Danish kingdoms of Northumbria and of Dublin, was a son of Sitric, king of Deira, and was related to the English king Aethelstan. He was of Norse descent, and he married a daughter of Constantine II., king of the Scots. When Sitric died about 927 Aethelstan annexed Deira, and Olaf took refuge in Scotland and in Ireland until 937, when he was one of the leaders of the formidable league of princes which was destroyed by Aethelstan at the famous battle of Brunanburh. Again he sought a home among his kinsfolk in Ireland, but just after Aethelstan's death in 940 he or Olaf Godfreyson was recalled to England by the Northumbrians. Both crossed over, and in 941 the new English king, Edmund, gave up Deira to the former. The peace between the English and the Danes did not, however, last long. Wulfstan, archbishop of York, sided with Olaf; but in 944 this king was driven from Northumbria by

Edmund, and crossing to Ireland he ruled over the Danish kingdom of Dublin. From 949 to 952 he was again king of Northumbria, until he was expelled once more, and he passed the remainder of his active life in warfare in Ireland. But in 980 his dominion was shattered by the defeat of the Danes at the battle of Tara. He went to Iona, where he died probably in 981, although one account says he was in Dublin in 994. This, however, is unlikely. In the sagas he is known as Olaf the Red.

This Olaf must not be confused with his kinsman and ally, OLAF (d. 941), also king of Northumbria and of Dublin, who was a son of Godfrey, king of Dublin. The latter Olaf became king of Dublin in 934; but he was in England in 937, as he took part in the fight at Brunanburh. After this event he returned to Ireland, but he appears to have acted for a very short time as joint king of Northumbria with Olaf Sitricsson. It is possible that he was the "Olaf of Ireland" who was called by the Northumbrians after Aethelstan's death, but both the Olafs appear to have accepted the invitation. He was killed in 941 at Tyningham near Dunbar.

See W. F. Skene, *Celtic Scotland* (1876); J. R. Green, *The Conquest of England* (1899).

OLAF I. TRYGGVESSÖN (969–1000), king of Norway, was born in 969, and began his career in exile. It is even said that he was bought as a slave in Estonia. After a boyhood spent in Novgorod under the protection of King Valdemar, Olaf fought for the emperor Otto III. under the Wendish king Burislav, whose daughter he had married. On her death he raided the coasts of France and the British Isles, until he was converted to Christianity by a hermit in the Scilly Islands, and his marauding expeditions ceased since he would not harry those of his new faith. He married Gyda, sister of Olaf Kvaran, king of Dublin, and administered her property in England and Ireland for some time before he sailed for Norway, then restive under its ruler Earl Haakon. He was unanimously accepted as king of Norway (995), and began the conversion of the country to Christianity. Possibly Olaf's ambition was to rule a united, as well as a Christian, Scandinavia. He made overtures of marriage to Sigrid, queen of Sweden, and increased his fleet, but she clung to her heathen faith. He made an enemy of her, and involved himself in a quarrel with King Sveyn of Denmark by marrying his sister Thyre, who had fled from her heathen husband Burislav in defiance of her brother's authority. Both his Wendish and his Irish wife had brought Olaf wealth and good fortune, but Thyre brought him ill luck; in an expedition (1000) to wrest her lands from Burislav he was waylaid off the island Svöld, near Rügen, by the combined Swedish and Danish fleets, together with the ships of Earl Haakon's sons.

The battle ended in the annihilation of the Norwegians. Olaf fought to the last on his great vessel, the "Long Snake," the mightiest ship in the North, and finally leapt overboard and was no more seen. Full of energy and daring, skilled in the use of every kind of weapon, genial and open-handed to his friends, implacable to his enemies, Olaf's personality was the ideal of the heathendom which he repudiated and oppressed. After his death he remained the hero of his people, who looked for his return. "But however that may be," says the story, "Olaf Tryggvessön never came back to his kingdom in Norway."

OLAF (II.) HARALDSSÖN (995–1030), king of Norway from 1016–1029, called during his lifetime "the Fat," and afterwards known as St. Olaf, was born in 995, the year in which Olaf Tryggvessön came to Norway. After some years' absence in England, fighting the Danes, he returned to Norway in 1015 and declared himself king, obtaining the support of the five petty kings of the Uplands. In 1016 he defeated Earl Sveyn, hitherto the virtual ruler of Norway, at the battle of Nesje, and within a few years had won more power than had been enjoyed by any of his predecessors. He had annihilated the petty kings of the South, had crushed the aristocracy, enforced the acceptance of Christianity throughout the kingdom, asserted his suzerainty in the Orkney Islands, had humbled the king of Sweden and married his daughter in his despite, and had conducted a successful raid on Denmark. But in 1029 the Norwegian nobles, seething with discontent, rallied round the invading Knut the Great, and Olaf fled to Russia. On his return a year later he fell at the battle of Stiklestad, where his own subjects were arrayed against him. After his death his cunning and cruelty which marred his character were forgotten, and his services to his church and country remembered. Miracles were worked at his tomb, and in 1164 he was canonized and was declared the patron saint of Norway, whence his fame spread throughout Scandinavia and even to England, where churches are dedicated to him. The Norwegian order of knighthood of St. Olaf was founded in 1847 by Oscar I., king of Sweden and Norway, in memory of this king.

ÖLAND, an island in the Baltic sea, next to Gotland the largest belonging to Sweden, stretching for 85 m. along the east coast of the southern extremity of that country, from which it is separated by Kalmar Sound which is from 5 to 15 m. broad. The greatest breadth of the island is 10 m., and its area 519 sq.m. The centre of the island is more densely populated than either end. The only large town is Borgholm with about 10,000 inhabitants (1928). For administrative purposes the island is included in the Kalmar *län*. From the raid of Ragnar Lodbrok's sons in 775 Öland is frequently mentioned in Scandinavian history, and especially as a battleground in the wars between Denmark and the northern kingdoms. In the middle ages it formed a separate legislative and administrative unity. A number of monuments of unknown age exists, including stones (*stensättningar*) arranged in groups to represent ships. Borgholm has one of the finest castle ruins in Sweden. The town was founded in 1817, but the castle, dating at least from the 13th century, was one of the strongest fortresses, and afterwards one of the most stately palaces in the country. The inhabitants were formerly styled Öningar, and show considerable diversity of origin in the matter of speech, local customs and physical appearance.

The island consists for the most part of Silurian limestone, and thus forms a striking contrast to the mainland with its granite and gneiss. Down the west side runs a limestone ridge, rising usually in terraces, but at times in steep cliffs, to a height of 200 ft.; and along the east side there is a parallel ridge of sand, resting on limestone, never exceeding 90 feet. These ridges, known as the Western and Eastern Landborgar, are connected towards the north and the south by belts of sand and heath; and the hollow between them is occupied by a desolate and almost barren tract: the southern portion, or Alfvar (forming fully half of the southern part of the island), presents a surface of bare red limestone characteristically weathered. The northern portion is covered with hazel bushes. Outside the ridges, however, Öland is well wooded, while the narrow strip of alluvial coast-land is good agricultural country. There are a few small streams in the island and one lake, Hornsjö, about 3 m. long.

OLAUS MAGNUS or MAGNI (1490–1558) (Magnus, *i.e.*, *Stora*, great, being the family name, and not a personal epithet), Swedish ecclesiastic and author, followed his brother, Johannes Magnus, archbishop of Uppsala, to Rome in 1527. Most of his life, after his brother's death, seems to have been spent in the monastery of St. Brigitta in Rome, where he subsisted on a pension assigned him by the pope. He wrote the famous *Historia de Gentibus Septentrionalibus* (Rome, 1555), a work which long remained for the rest of Europe the chief authority on Swedish matters and is still a repertory of much curious information.

The *Historia* was translated into Italian (Venice, 1565), German (Strassburg, 1567), English (London, 1658) and Dutch (Amsterdam, 1665); abridgments of the work appeared also at Antwerp (1558 and 1562), Paris (a French abridged version, 1561), Amsterdam (1586), Frankfort (1618) and Leiden (1652). Olaus also wrote a *Tabula terrarum septentrionalium* . . . (Venice, 1539).

OLBERS, HEINRICH WILHELM MATTHIAS (1758–1840), German astronomer, was born on Oct. 11, 1758, at Arbergen, a village near Bremen, where his father was minister. He studied medicine at Göttingen, 1777–80, attending at the same time Kaestner's mathematical course. In 1779 he devised a new method of calculating cometary orbits. The treatise containing this important invention was made public by Baron von Zach under the title *Ueber die leichteste und bequemste Methode die Bahn eines Cometen zu berechnen* (Weimar, 1797). A table of 87

calculated orbits was appended, enlarged by Encke in the second edition (1847) to 178, and by Galle in the third (1864) to 242. In 1781, Olbers settled as a physician in Bremen, where he practised till his retirement on Jan. 1, 1823. The greater part of each night was meantime devoted to astronomy, the upper portion of his house being fitted up as an observatory. He paid special attention to comets, and that of 1815 (period 74 years) bears his name in commemoration of its detection by him. He also took a leading part in the discovery of the minor planets, rediscovering Ceres on Jan. 1, 1802, and discovering Pallas on March 28 following. His hypothesis of their origin by the disruption of a primitive large planet (*Monatliche Correspondenz*, vi. 88), seemed to gain confirmation by the finding of Juno by Harding, and of Vesta by himself, in regions indicated by the hypothesis. Olbers was deputed by his fellow-citizens to assist at the baptism of the king of Rome on June 9, 1811, and he was a member of the *corps législatif* in Paris (1812–13). He died on March 2, 1840. He was twice married, and one son survived him.

See *Biographische Skizzen verstorbener Bremischer Aerzte*, by Dr. G. Barkhausen (Bremen, 1844); *Allgemeine geographische Ephemeriden*, iv. 283 (1799); *Abstracts Phil. Trans.* iv. 268 (1843); *Astronomische Nachrichten*, xxii. 265 (Bessel), also appended to A. Erman's *Briefwechsel zwischen Olbers und Bessel* (2 vols., Leipzig, 1852); *Allgemeine deutsche Biographie* (S. Günther). The first two volumes of Dr. C. Schilling's exhaustive work, *Wilhelm Olbers, sein Leben und seine Werke*, appeared at Berlin in 1894 and 1900, a third and later volume including his personal correspondence and biography. A list of Olbers's contributions to scientific periodicals is given at p. xxxv. of the 3rd ed. of his *Leichteste Methode*, and his unique collection of works relating to comets now forms part of the Pulkowa library.

OLD AGE PENSIONS. The royal commission on the Aged Poor was appointed in 1893 "to consider whether any alterations in the system of poor law relief are desirable, in the case of persons whose destitution is occasioned by incapacity for work resulting from old age, or whether assistance could otherwise be afforded in these cases." The commission considered three main schemes for the provision of old age pensions, viz., pensions paid from imperial taxation, compulsory insurance and the system of state-aided voluntary insurance supported by Joseph Chamberlain. The commission, which reported in 1895, was unable to recommend the adoption of any of these proposals. Several committees were afterward set up to consider the question but little progress was made.

Such was the position when H. H. Asquith (afterwards Lord Oxford) in his budget speech of 1907 pledged the Liberal Government to deal with the question in the following session, fulfilling that pledge in the Old Age Pensions Act of 1908.

The Act of 1908.—Under that act, which was admittedly of an experimental and tentative character, the statutory conditions for the receipt of an old age pension were (*a*) the person must have attained the age of 70: (*b*) he must have been a British subject for the last 20 years and have had his residence during that period in the United Kingdom and (*c*) his yearly means must not exceed £31.10. The following persons were disqualified even if the statutory conditions were fulfilled: (1) persons who were in receipt of Poor Law relief (other than medical or surgical relief); (2) persons who have been convicted of any offence and ordered to be imprisoned without the option of a fine—while in prison and for a further period of 10 years; (3) persons convicted in certain cases under the Inebriates Act, 1898: (4) persons detained in any asylum within the meaning of the Lunacy Act, or maintained in any place as pauper or criminal lunatics: (5) persons who had habitually failed to work according to their ability, opportunity and need for their maintenance and the maintenance of their dependants. The maximum rate of pension was 5/– a week and was payable when the yearly means did not exceed £21. The rate fell by 1/– a week for every £2.12.6. by which the means exceeded £21, the minimum rate of 1/– a week being payable when the means exceeded £28.17.6. but did not exceed £31.10.0. When the claimant was one of a married couple living together in the same house, his means were to be taken as not less than half the total means of the couple.

The abnormal conditions existing during the Great War led to certain administrative modifications in the scheme; an additional allowance of 2/6d. a week was made to every pensioner and pensions were not subject to adjustment on account of an increase of means arising from (1) separation allowances and allotments, (2) allowances from voluntary sources not exceeding 5/– a week and (3) earnings so long as the total means did not exceed 30/– a week. These emergency arrangements were terminable as soon as legislation could be obtained amending the statutory scheme, and in 1919 a departmental committee, with Sir W. Ryland Adkins, M.P., as chairman, was appointed "to consider and report what alterations, if any, as regards rates of pension or qualification should be made in the existing statutory scheme of old age pensions."

While the committee decided not to recommend any modification of the age at which a pension should become payable, this section of their report is of interest because it involved consideration of the relationship between the old age pensions scheme and the national health insurance scheme which was instituted in 1912. (*See* NATIONAL INSURANCE: *Health*.) The committee expressed the opinion that on financial and other grounds it was desirable to deal with the problem of lowering the pensionable age by an adaptation of the contributory system of insurance, and in this respect foreshadowed the scheme which was ultimately embodied in the Contributory Pensions Act, 1925. The committee unanimously recommended that the receipt of outdoor relief should not be a disqualification for the receipt of a pension and that the maximum rate of pension should be increased to 10/– a week, so that the pre-war purchasing power of the pension should be restored.

The Act of 1919.—The Old Age Pension Act, 1919, was passed to give effect to such of the recommendations of the committee as were adopted by the Government. The abolition of the means test did not find a place in the act. Apart from the important modifications made by the act of 1924 (*see* below) the conditions attaching to old age pensions at 70, where title does not arise by virtue of the Contributory Pensions Act, 1925, have remained unchanged up to 1928. These conditions are that the applicant has (1) reached the age of 70; (2) been a British subject for the last 10 years; (3) been resident in the United Kingdom for a period, in the case of natural-born British subjects, of at least 12 years since attaining the age of 50 and, in the case of naturalised British subjects, of 20 years in the aggregate; (4) the yearly means

	£.	s.	d.			
Must not exceed	26	5	0	for a	10–	pension
" " "	31	10	0	"	8–	"
" " "	36	15	0	"	6–	"
" " "	42	0	0	"	4–	"
" " "	47	5	0	"	2–	"
" " "	49	17	6	"	1–	"

In calculating the means from investments, etc., the first £25 of the value of the investments, etc., is allowed free, the means from the next £375 are calculated at 5%, and from the balance (if any) at 10%.

A person is disqualified for receiving a pension (*a*) while he is an inmate of a poor law institution, unless he has become an inmate for the purpose of obtaining medical or surgical treatment, when there is no disqualification up to a maximum period of three months from date of admission so long as treatment continues; (*b*) while he is serving a sentence of imprisonment without the option of a fine or of penal servitude; (*c*) while he is detained in an asylum within the meaning of the Lunacy Acts or is being maintained in any place as a pauper or criminal lunatic.

The Act of 1924.—A short act passed by the Labour Government in 1924 made an important modification in the means test and was directed to meet certain of the criticisms which had led the Ryland Adkins committee to recommend universal old age pensions. This act provided that from the means of a claimant as calculated under the earlier acts a deduction should be made up to a maximum of £39 of such part as was not derived from earnings. As a result of this act a claimant's means may amount to £65.5.0. without his suffering any reduction of pension provided his earnings do not exceed £26.5.0. while the minimum pension of 1/– a week may be drawn by a person whose means do not

exceed £88.17.6. if not more than £49.17.6. comes from earnings.

The Blind Persons Act, 1920, provided pensions at the age of 50 for persons who are so blind as to be unable to perform any work for which eyesight is essential on the same terms and conditions, apart from age, as are applicable to old age pensions.

Administration.—Claims for old age pensions under the Acts of 1908 to 1924 are decided by local pensions committees appointed for every county and for every borough and urban district. Every claim is investigated by the pension officer, an official of the Customs and Excise department who recommends to the local committee that the claim be admitted or rejected. An aggrieved claimant has a right of appeal to the minister of health.

The pension is paid weekly at the post office selected by the pensioner.

Statistics.—On March 31, 1911, the number of pensioners was 705,678. Three years later this number had grown to 781,929. During the war years the number of pensioners declined slightly as a consequence of the scarcity of civilian labour and the high rates of wages current, but by March 31, 1920, there were 785,833 pensioners. From this year onwards the number increased with regularity, and by March 31, 1924, it had grown to 916,771. As a consequence of the Act of 1924 the increases in the following years were abnormal and by March 31, 1926, the number of pensioners had become 1,071,093. On March 31, 1928, the number of pensions under the Acts of 1908–1924 had fallen to 995,978 (of which 972,621 were at the rate of 10/– a week). The reasons for this decline were the new qualifications embodied in the act of 1925.

The insistent demand for the lowering of the pensionable age, the rapidly mounting cost of old age pensions, and the agitation for the removal of the means test combined to direct attention to the principle of contributory insurance and as a result the Conservative Government in the Widows', Orphans', and Old Age Contributory Pensions Act, 1925 (*see* NATIONAL INSURANCE: *Widows' and Orphans' Pensions*), adopted that method.

Widows', Orphans' and Old Age Contributory Pensions Act, 1925.—The persons within the scope of the old age pensions scheme embodied in the act are those who are insured, whether as employed or as voluntary contributors under the national health insurance scheme. (*See* NATIONAL INSURANCE: *Health.*) In addition a certain number of persons whose employment is excepted from health insurance are compulsorily insured for old age pensions, although the majority of persons in "excepted employment" are excepted from insurance for old age pensions. Persons who cease to be compulsorily insurable have the option of continuing to be insured as voluntary contributors provided certain conditions are satisfied.

The normal rate of contribution under the act—9d. for a man and 4½d. for a woman—includes the contribution for widows' and orphans' pensions. Every person who is insured for old age pensions is insurable for widows' and orphans' pensions but certain persons are insured for the latter purposes only and pay a reduced contribution, man 7d. woman 3½d., so that 2d. in the case of a man and 1d. in the case of a woman is the share of the combined contribution which is attributable to old age pensions between the ages of 65 and 70. (The contribution arrangements under the act of 1925 are explained in greater detail in the article NATIONAL INSURANCE: *Widows' and Orphans' Pensions.*)

The act provides old age pensions at the uniform rate of 10/– a week, to insured men and insured women while between the ages of 65 and 70, and to the wives between these ages of insured men who are themselves entitled to pensions. An insured person claiming a pension must show (*a*) that he has been continuously insured for 5 years at the date when he attained the age of 65; (*b*) that 104 contributions have been paid; (*c*) that over the last three "contribution years"—running from July to June—preceding his 65th birthday an average of 39 contributions a year was paid (for this purpose weeks of incapacity and weeks of genuine unemployment are counted as weeks for which contributions were paid; (*d*) that he has been resident in Great Britain for the two years immediately preceding his 65th birthday and that his last employment (excluding temporary employment) was in Great Britain. Special provision is made for a person who on attaining the age of 65 has not been continuously insured for five years. He becomes entitled to a pension at the expiration of five years from the date of his entry into insurance if he is then under the age of 70, provided the other conditions, which are applied with reference to the date on which he completes five years of insurance and not to his 65th birthday, are satisfied. Although contributions cease to be paid by him when he attains 65, the employer's contribution continues to be payable so long as he is employed and these contributions will count for the purposes of conditions (*b*) and (*c*) above.

The provisions of the act relating to the payment of old age pensions to persons between the ages of 65 and 70 took effect from Jan. 2, 1928, two years after the date when the Act came into operation. The initial group of pensioners consisted of persons who on Jan. 2, 1928, were over the age of 65 and under the age of 70 with certain modifications of the statutory conditions.

The disqualifications for the receipt of a pension are the same as those under the acts of 1908 to 1924. (*See* p. 760 under act of 1919).

Unrestricted Old Age Pensions at 70.—A person who is entitled under the Act of 1925 to an old age pension while between the ages of 65 and 70 becomes, on attaining 70, entitled by virtue of the act to an old age pension at the rate of 10/– a week without regard to his means. The act also provides an unrestricted old age pension at 70 for a woman who has been receiving a widow's pension.

For insured persons who attained the age of 70 before Jan. 2, 1928, the date when old age pensions to persons between the ages of 65 and 70 began to be payable, the act also granted unrestricted old age pensions at 70. The wife or widow of an insured person entitled to one of these pensions was herself entitled to an unrestricted old age pension on attaining 70. To secure the benefit of this provision, which took effect from July 2, 1926, it had to be shown that the claimant had been insured under the National Health Insurance Act on April 29, 1925, the date of the introduction of the Pensions bill, and remained insured until he attained 70. As a person who was insured on attaining 70, at which age contributions ceased to be payable under the National Health Insurance Act, remained an insured person for life, all persons who attained 70 before April 29, 1925, and were insured on reaching that age possessed the necessary insurance qualification and became entitled to unrestricted old age pensions as from July 2, 1926. Thus one important effect of the act of 1925, in the case of persons within its scope, including the wives and widows of insured men, is to remove the means test imposed by the acts of 1908 to 1924 as regards old age pensions at 70. In the last week of March, 1928, 287,531 persons who had established their title on an insurance basis were in receipt of pensions.

Administration.—In England and Wales the old age pension scheme embodied in the act of 1925 is administered by the minister of health and in Scotland by the Scottish Board of Health. Claim forms are obtainable at all post offices and claims may be made within four months before attaining pensionable age. Unsuccessful applicants have a right of appeal to an independent body of referees. By the end of March, 1928, 524,828 pensions had been awarded to persons between the ages of 65 and 70.

Reciprocal arrangements have been made between Great Britain and Northern Ireland under which qualifications acquired in one country are of equal value in the other on change of residence.

Decennial Increases of Contributions.—The contribution payable under the Act of 1925—9d. for a man and 4½d. for a woman—is based on the amount actuarially required to provide widows' and orphans' pensions and old age pensions between the ages of 65 and 70 in the case of a person entering insurance at the age of 16, the excess cost arising in the case of persons entering at higher ages being borne by the exchequer. The cost of unrestricted old age pensions at 70 to which insured persons become entitled by virtue of the act remains an exchequer charge, but the act contains a provision under which, ultimately, the persons entering into insurance at the age of 16 will, with their employers, pay a contribution of equal value with the benefits provided for them, including the pension at 70. Provision is made

for three decennial increases of contributions. In Jan. 1936, the contribution is to be increased by 2d. a week for a man and 1d. a week for a woman, and similar increases are to be made at the beginning of 1946 and 1956, so that from the latter year the contribution will be 1s. 3d. for a man and 7½d. for a woman.

British Dominions.—In the Irish Free State the non-contributory scheme identical with that of Great Britain which was in existence before the severance was continued but certain modifications were made in 1924 in the rates of pension and in the amount of means entitling to pension. The maximum rate of pension was fixed at 9/– a week and is payable where the yearly means of the pensioner do not exceed £18.5.

As regards the oversea Dominions New Zealand was in advance of the mother country in establishing a scheme of non-contributory old age pensions, her scheme having been inaugurated in 1898. A non-contributory scheme operates also in Australia. In Australia the pensionable age is 65, in New Zealand 65 for men and 60 for women. The maximum rate of pension is £1 a week in Australia and 17/6 a week in New Zealand. In both cases a means test is applied, while in Australia the scheme is combined with a scheme of invalidity pensions. In 1927 the Dominion parliament of Canada passed an Act which provided for the payment by the Dominion Government of one-half of the cost of old age pensions in any province which adopted a scheme in accordance with the provisions of the act. The pensionable age is 70. British Columbia was the first province to establish a scheme and pensions have been paid in that province since Sept. 1927. Saskatchewan and Manitoba have also set up schemes in accordance with the Act. An announcement has been made by the Government of South Africa that it proposes to set up a non-contributory scheme of old age pensions on Jan. 1, 1929, with 65 as the pensionable age.

European Countries.—Non-contributory schemes are in force in Denmark, France and Norway. In Denmark the pensionable age is 65 and in France and Norway 70. Contributory schemes are, however, more prevalent. Germany led the way by establishing a contributory scheme in 1889 under which workman and employer paid the premium, the State adding a subvention. Her example was generally followed by those countries which established schemes after the World War. Separate schemes of old age pensions exist in Belgium and Spain but in the majority of countries the old age pension scheme is combined with a scheme of invalidity pensions. (*See* NATIONAL INSURANCE: *Invalidity*.) Combined schemes are in operation in Bulgaria, Czechoslovakia, France (which, as stated above, has also a non-contributory scheme), Germany, Holland, Greece, Italy, Luxemburg, Poland, Portugal, Rumania, Serb-Croat-Slovene kingdom, Sweden and in the Canton of Glarus in Switzerland.

The age of 65 has been adopted by many countries as the age at which the old age pension becomes payable but in Bulgaria, France and Poland the pensionable age is 60, in Sweden 67, and in Holland and the Serb-Croat-Slovene kingdom 70.

America.—Of the South American countries, Chile has a contributory scheme of old age pensions combined with invalidity pensions. Old age pension is payable at the age of 65. Uruguay has a non-contributory scheme combining old age and invalidity pensions, the old age pension being payable at 60. (*See* PENSIONS IN THE UNITED STATES.)

BIBLIOGRAPHY.—The *Report* of the Departmental Committee on Old Age Pensions (Cmd. 410, H.M. Stationery Office) reviews the position from the commencement of the Act of 1908 and considers various suggestions for amendment. The *Report* of the Government Actuary on the Financial Provisions of the Contributory Pensions Bill, 1925 (Cmd. 2,406, H.M. Stationery Office) contains a detailed explanation of the financial basis and an appendix on the statistical basis of the estimate. *General Problems of Social Insurance* (International Labour Office of League of Nations) reviews the position and principles of social insurance. (J. M. H.)

OLDBURY, an urban district of Worcestershire, England, 5 m. W. of Birmingham served by L.M.S. and by the Birmingham canal. Pop. (1921) 16,609. Coal, iron and limestone abound in the neighbourhood, and the town possesses alkali and chemical works, railway-carriage works, iron and steel works and brick and tile kilns. The urban district includes Langley and Warley.

OLDCASTLE, SIR JOHN (d. 1417), English Lollard leader, son of Sir Richard Oldcastle of Almeley, Herefordshire, served in the expedition to Scotland in 1400. Next year he was in charge of Builth castle in Brecon, and serving all through the Welsh campaigns won the friendship and esteem of Henry, the prince of Wales. Oldcastle represented Herefordshire in the parliament of 1404. Four years later he married Joan, the heiress of Cobham, and was thereon summoned to parliament as Lord Cobham in her right. Oldcastle held a high command in the expedition which the young Henry sent to France in 1411. Oldcastle had adopted Lollard opinions before 1410, when the churches on his wife's estates in Kent were laid under interdict for unlicensed preaching. In the convocation which met in March 1413, shortly before the death of Henry IV., Oldcastle was at once accused of heresy. But his friendship with the new king prevented any decisive action till evidence was found in a book belonging to Oldcastle, which was discovered in a shop in Paternoster row. He was convicted as a heretic Sept. 25. Henry granted a respite of 40 days in the hope of saving his old friend.

Before that time had expired Oldcastle escaped from the Tower by the help of one William Fisher, a parchment-maker of Smithfield (Riley, *Memorials of London*, 1868). He now put himself at the head of a widespread Lollard conspiracy. The design is said to have included the seizure of the king and his brothers during a Twelfth-night mumming at Eltham. Henry, forewarned, removed to London, and when the Lollards assembled in force in St. Giles's Fields on Jan. 10, they were easily dispersed. Oldcastle himself escaped into Herefordshire, and for nearly four years avoided capture. He took part in several conspiracies. In November 1417 he was captured by the Lord Charlton of Powis. On Dec. 14, he was formally condemned, on the record of his previous conviction, was hanged that same day in St. Giles's Fields, and burnt "gallows and all." Oldcastle died a martyr. At the same time his execution can be justified on political grounds. His opinions and early friendship with Henry V. created a traditional scandal which long continued. In the old play *The Famous Victories of Henry V.*, written before 1588, Oldcastle figures as the prince's boon companion. When Shakespeare adapted that play in *Henry IV.*, Oldcastle still appeared; but when the play was printed in 1598 Falstaff's name was substituted, in deference, as it is said, to the then Lord Cobham. Though the fat knight still remains "my old lad of the Castle," the stage character has nothing to do with the Lollard leader.

BIBLIOGRAPHY.—The record of Oldcastle's trial is printed in *Fasciculi Zizaniorum* (Rolls series) and in Wilkins's *Concilia*, iii. 351–357. The chief contemporary notices of his later career are given in *Gesta Henrici Quinti* (Eng. Hist. Soc.) and in Walsingham's *Historia Anglicana*. There have been many lives of Oldcastle, mainly based on *The Actes and Monuments* of John Foxe, who in his turn followed the *Briefe Chronycle* of John Bale, first published in 1544. For notes on Oldcastle's early career, consult J. H. Wylie, *History of England under Henry IV.* For literary history *see* the Introductions to Richard James's *Iter Lancastrense* (Chetham Soc., 1845) and to Grosart's edition of the *Poems of Richard James* (1880). *See* also W. Barske, *Oldcastle-Falstaff in der englischen Literatur bis zu Shakespeare* (Palaestra, I. Berlin, 1905); and W. T. Waugh in the *English Historical Review*, vol. xx.

OLD CATHOLICS, the designation assumed by those members of the Roman Catholic Church who refused to accept the decrees of the Vatican Council of 1870 defining the dogma of papal infallibility (*see* VATICAN COUNCIL and INFALLIBILITY) and ultimately set up a separate ecclesiastical organization on the Episcopal model. The Old Catholic movement, at the outset at least, differed fundamentally from the Protestant Reformation of the 16th century in that it aimed not at any drastic changes in doctrine but at the restoration of the ancient Catholic system, founded on the diocesan episcopate, which under the influence of the ultramontane movement of the 19th century had been finally displaced by the rigidly centralized system of the papal monarchy. In this respect it represented a tendency of old standing within the Church and one which, in the 18th century, had all but gained the upper hand (*see* FEBRONIANISM and GALLICANISM).

The proceedings of the Vatican council and their outcome

had at first threatened to lead to a serious schism in the Church. The minority against the decrees included many of the most distinguished prelates and theologians of the Roman communion, but in the end all the recalcitrant bishops gave in their adhesion to the decrees.

Initial Steps.—The universities, being less directly under the control of the Church, were prepared to show a bolder front. Dr. J. F. von Schulte, professor at Prague, was one of the first to publish a formal protest. A meeting of Catholic professors and distinguished scholars convened at Nuremberg (August 1870) recorded a like dissent, and resolved on the adoption of measures for bringing about the assembling of a really free council north of the Alps. The *Appel aux Evêques Catholiques* of M. Hyacinthe Loyson (better known as "Père Hyacinthe") appealed to the Catholic bishops throughout the world to put an end to the schism by declaring whether the recent decrees were or were not binding on the faith of the Church. This appeal, on its appearance in *La Liberta* early in 1871, was suppressed by the order of the king of Italy. On the 28th of March Döllinger, in a letter of some length, set forth the reasons which compelled him also to withhold his submission alike as "a Christian, a theologian, an historical student and a citizen." The publication of this letter was shortly followed by a sentence of excommunication pronounced against Döllinger and Professor Johannes Friedrich and read to the different congregations from the pulpits of Munich. The professors of the university, on the other hand, had shortly before evinced their resolution of affording Döllinger all the moral support in their power by an address (April 3, 1871) in which they denounced the Vatican decrees with unsparing severity. (Friedberg, *Aktenstücke z. ersten vaticanischen Concil*, p. 187.) In the following September the demand for another and a free council was responded to by the assembling of a congress at Munich. It was composed of nearly 500 delegates, convened from almost all parts of the world; but the Teutonic element was now as manifestly predominant as the Latin element had been at Rome. The proceedings were presided over by Professor von Schulte, and lasted three days. Among those who took a prominent part in the deliberations were Döllinger, Reinkens, Maassen (professor of canon law at Vienna), Friedrich and Huber. The arrangements finally agreed upon were mainly provisional; but one of the resolutions plainly declared that it was desirable if possible to effect a reünion with the Oriental Greek and Russian Churches, and also to arrive at an "understanding" with the Protestant Episcopal communions. Döllinger, in delivering his inaugural address as rector of the university of Munich, expressed his conviction that theology had received a fresh impulse and that the religious history of Europe was entering upon a new phase.

Other circumstances contributed to invest Old Catholicism with additional importance. It was evident that the relations between the Roman Curia and the Prussian government were becoming extremely strained. In February, 1872, appeared the first measures of the Falk ministry, having for their object the control of the influence of the clergy in the schools, and in May the pope refused to accept Cardinal Hohenlohe, who during the council had opposed the definition of the dogma, as Prussian minister at the Vatican. Congregations of Old Catholics were formed at numerous towns and villages in Bavaria, Baden, Prussia, German Switzerland, and even in Austria. At Warnsdorf in Bohemia a congregation was collected which still represents one of the most important centres of the movement. In September the second congress was held at Cologne. It was attended by some 500 delegates or visitors from all parts of Europe, and the English Church was represented by the bishops of Ely and Lincoln and other distinguished members.

Organization.—The movement thus entered a new phase, the congress occupying itself mainly with the formation of a more definite organization and with the question of reunion with other Churches. The immediate effect was a fateful divergence of opinion; for many who sympathized with the opposition to the extreme papal claims shrank from the creation of a fresh schism. Prince Chlodwig Hohenlohe, who as prime minister of Bavaria had attempted to unite the governments against the definition of the dogma, refused to have anything to do with proceedings which could end only in the creation of a fresh sect, and would make the prospect of the reform of the Church from within hopeless; more important still, Döllinger refused to take part in setting up a separate organization, and though he afterwards so far modified his opinion as to help the Old Catholic community with sympathy and advice, he never formally joined it.

Meanwhile, the progress of the quarrel between the Prussian government and the Curia had been highly favourable to the movement. In May, 1873, the celebrated Falk laws were enacted, whereby the articles 15 and 18 of the Prussian constitution were modified, so as to legalize a systematic state supervision over the education of the clergy of all denominations, and also over the appointment and dismissal of all ministers of religion. The measure, which was a direct response to the Vatican decrees, inspired the Old Catholics with a not unreasonable expectation that the moral support of the government would henceforth be enlisted on their side. On the 11th of August Professor J. H. Reinkens of Breslau, having been duly elected bishop of the new community, was consecrated at Rotterdam by Bishop Heykamp of Deventer, the archbishop of Utrecht, who was to have performed the ceremony, having died a few days before. In the meantime the extension of the movement in Switzerland had been proceeding rapidly, and it was resolved to hold the third congress at Constance. The proceedings occupied three days (12th to 14th September), the subjects discussed being chiefly the institution of a synod as the legislative and executive organ of the Church, and schemes of reunion with the Greek, the African and the Protestant communions.

The First Synod.—The following year (1874) was marked by the assembling of the first synod and a conference at Bonn, and of a congress at Freiburg-im-Breisgau. At the congress Bishop Reinkens spoke in hopeful terms of the results of his observations during a recent missionary tour throughout Germany. The conference, held on the 14th, 15th and 16th of September, had for its special object the discussion of the early confessions as a basis of agreement, though not necessarily of fusion, between the different communions above-named. The meetings, which were presided over by Döllinger, successively took into consideration the *Filioque* clause in the Nicene creed, the sacraments, the canon of Scripture, the episcopal succession in the English Church, the confessional, indulgences, prayers for the dead, and the eucharist (*see* DÖLLINGER). The synod (May 27–29) was the first of a series in which the doctrine and discipline of the new Church were gradually formulated. The tendency was, naturally, to move further and further away from the Roman model; and though the synod expressly renounced any claim to formulate dogma, or any intention of destroying the unity of the faith, the "Catholic Catechism" adopted by it in 1874 contained several articles fundamentally at variance with the teaching of Rome. At the first synod, too, it was decided to make confession and fasting optional, while later synods pronounced in favour of using the vernacular in public worship, allowing the marriage of priests, and permitting them to administer the communion in both kinds to members of the Anglican Church attending their services.

The new alliance between Bismarck and Pope Leo XIII. against revolutionary Socialism, deprived the Old Catholics of the special favour which had been shown them by the Prussian government; they continued, however, to enjoy the legal status of Catholics, and their communities retained the rights and the property secured to them by the law of the 4th of July 1875. In Bavaria, on the other hand, they were in March, 1890, after the death of Döllinger, definitely reduced to the status of a private religious sect, with very narrow rights. When Bishop Reinkens died in January, 1896, his successor Theodor Weber, professor of theology at Breslau, elected bishop on the 4th of March, was recognized only by the governments of Prussia,

Baden and Hesse.

BIBLIOGRAPHY.—An outline of the whole movement up to the year 1875 will be found in *The New Reformation*, by "Theodorus" (J. Bass Mullinger); and an excellent résumé of the main facts in the history of the movement in each European country, as connected with other developments of liberal thought, and with political history, is given in the second volume of Dr. F. Nippold's *Handbuch der neuesten Kirchengeschichte*, vol. ii. (1883). *See* also A. M. E. Scarth, *The Story of the Old Catholic and Kindred Movements* (London, 1883); Bühler, *Der Altkatholicismus* (Leiden, 1880); J. F. von Schulte, *Der Altkatholicismus* (Giessen, 1887); and article in Herzog-Hauck's *Realencyk. für prot. Theol. und Kirche*, i. 415. For details the following sources may be consulted: (*a*) For the proceedings of the successive congresses: the *Stenographische Berichte*, published at Munich, Cologne, Constance, etc.; those of the congress of Constance were summarized in an English form, with other elucidatory matter, by Professor John Mayor; (*b*) the series of the *Catholique national* (Berne, 1898–1908) and the series of the *Revue Internationale de théologie* (Berne, 1893–1910).

OLDENBARNEVELDT, JOHAN VAN (1547–1619), Dutch statesman, was born at Amersfoort on Sept. 14, 1547. After studying law at Louvain, Bourges and Heidelberg, and travelling in France and Italy, Oldenbarneveldt settled down to practise in the law courts at The Hague. In religion a moderate Calvinist, he became a zealous adherent of William the Silent. He served as a volunteer for the relief of Haarlem (1573) and again at Leiden (1574). In 1576 he became pensionary of Rotterdam. He was active in promoting the Union of Utrecht (1579) and the acceptance of the countship of Holland and Zeeland by William (1584). On the assassination of William it was at the proposal of Oldenbarneveldt that the youthful Maurice of Nassau was at once elected stadtholder, captain-general and admiral of Holland. During the governorship of Leicester he was the leader of the strenuous opposition offered by the States of Holland to the centralizing policy of the governor.

In 1586 he was appointed, in succession to Paul Buys, to the post of Land's Advocate of Holland. Nominally the servant of the States of Holland he made himself politically the personification of the province which bore more than half the entire charge of the union, and as its mouthpiece in the states-general he practically dominated that assembly.

During the two critical years which followed the withdrawal of Leicester, he prevented the disintegration of the United Provinces, which might otherwise have fallen an easy conquest to the army of Alexander of Parma. Fortunately for the Netherlands the attention of Philip of Spain was at that time riveted upon his contemplated invasion of England, and Oldenbarneveldt had time to gather into his own hands the control of administrative affairs. He was wholeheartedly supported by Maurice of Nassau, who, after 1589, held the Stadholderate of five provinces, and was likewise captain-general and admiral of the union. The first rift between them came in 1600, when Maurice was forced against his will by the states-general, under the advocate's influence, to undertake an expedition into Flanders, which was only saved from disaster by desperate efforts which ended in victory at Nieuwport. In 1598 Oldenbarneveldt took part in special embassies to Henry IV. and Elizabeth, and again in 1605 in a special mission sent to congratulate James I. on his accession.

The opening of negotiations by Albert and Isabel in 1606 for a peace or long truce led to a great division of opinion in the Netherlands. The archdukes having consented to treat with the United Provinces "as free provinces and states over which they had no pretensions." Oldenbarneveldt, who had with him the States of Holland and the majority of burgher regents throughout the country, was for peace, provided that liberty of trading was conceded. Maurice and his cousin William Louis, stadtholder of Frisia, with the military and naval leaders and the Calvinist clergy, were opposed to it, on the ground that the Spanish king was merely seeking an interval of repose in which to recuperate his strength for a renewed attack on the independence of the Netherlands. For some three years the negotiations went on, but at last after endless parleying, on April 9, 1609, a truce for twelve years was concluded. All that the Dutch asked was directly or indirectly granted, and Maurice gave a reluctant assent to the favourable conditions obtained by Oldenbarneveldt.

Religious Differences and the Sequel.—The now "free and independent State" was rent by internal differences between the Remonstrants (Arminians) and Contra-Remonstrants (Gomarists); the States of Holland under the influence of Oldenbarneveldt supported the former, and refused to sanction the summoning of a purely church synod (1613). They likewise (1614) forbade the preachers in the Province of Holland to treat of disputed subjects from their pulpits. Obedience was difficult to enforce without military help, riots broke out in certain towns, and when Maurice was appealed to, as captain-general, he declined to act. He did more, though in no sense a theologian; he declared himself on the side of the Contra-Remonstrants, and established a preacher of that persuasion in a church at The Hague (1617).

The advocate now took a bold step. He proposed that the States of Holland should, on their own authority, as a sovereign province, raise a local force of 4,000 men (*waardgelders*) to keep the peace. The states-general meanwhile by a bare majority (4 provinces to 3) agreed to the summoning of a national church synod. The States of Holland, also by a narrow majority, refused their assent to this, and passed (Aug. 4, 1617) a strong resolution (*Scherpe Resolutie*) by which all magistrates, officials and soldiers in the pay of the province were required to take an oath of obedience to the states on pain of dismissal, and were to be held accountable not to the ordinary tribunals, but to the States of Holland. It was a declaration of sovereign independence on the part of Holland, and the states-general took up the challenge and determined on decisive action. A commission was appointed with Maurice at its head to compel the disbanding of the *waardgelders*. On July 31, 1618 the stadtholder appeared at Utrecht, which had thrown in its lot with Holland, at the head of a body of troops, and at his command the local levies at once laid down their arms. His progress through the towns of Holland met with no opposition. The states party was crushed without a blow being struck. On Aug. 23, by order of the states-general, the advocate and his chief supporters, de Groot and Hoogerbeets, were arrested.

Oldenbarneveldt was with his friends kept in the strictest confinement until November, and then brought for examination before a commission appointed by the states-general. He appeared more than 60 times before the commissioners, and was, most unjustly, allowed neither to consult papers not to put his defence in writing. On Feb. 20, 1619 he was arraigned before a special court of twenty-four members, only half of whom were Hollanders, and nearly all of them his personal enemies. It was in no sense a legal court, nor had it any jurisdiction over the prisoner, but the protest of the advocate, who claimed his right to be tried by the sovereign province of Holland, whose servant he was, was disregarded. He was allowed no advocates, nor the use of documents, pen or paper. It was in fact not a trial at all, and the packed bench of judges on Sunday, May 12, pronounced sentence of death. On the following day the old statesman, at the age of seventy-one, was beheaded in the Binnenhof at The Hague.

Not a shred of evidence has ever been produced to throw suspicion upon the patriot statesman's conduct. All his private papers fell into the hands of his foes, but not even the bitterest and ablest of his personal enemies, Francis Aarssens (*q.v.*), could extract from them anything to show that Oldenbarneveldt at any time betrayed his country's interests. His high-handed course of action in defence of what he conceived to be the sovereign rights of his own province of Holland to decide upon religious questions within its borders may be challenged on the ground of inexpediency, but not of illegality. The harshness of the treatment meted out by Maurice to his father's old friend, the faithful counsellor and protector of his own early years, leaves a stain upon the stadtholder's memory. That the prince should have felt compelled in the last resort to take up arms for the Union against the attempt of the province of Holland to defy the authority of the Generality may be justified by the plea *reipublicae salus suprema lex*. To eject the advocate from power was one thing, to execute him as a traitor quite another. The condemnation of Oldenbarneveldt was carried out with Maurice's consent and approval, and he cannot be acquitted of a prominent share in what posterity has pronounced to be a judicial murder.

Oldenbarneveldt was married in 1575 to Maria van Utrecht.

He left two sons, the lords of Groeneveld and Stoutenburg, and two daughters. A conspiracy against the life of Maurice, in which the sons of Oldenbarneveldt took part, was discovered in 1623. Stoutenburg, who was the chief accomplice, made his escape and entered the service of Spain; Groeneveld was executed.

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OLDENBURG, a republic of Germany, with an area of 2,479 sq.m. It consists of three widely separated provinces—(1) Oldenburg, (2) Lübeck, and (3) Birkenfeld. It has one vote in the German Reichsrat.

Oldenburg proper is bounded on the north by the North sea and on the other three sides by Hanover, with the exception of a small strip on the east, where it is conterminous with the territory of the free city of Bremen. It forms part of the north-western German plain lying between the Weser and the Ems. The climate is temperate and humid; the mean temperature of the coldest month at the town of Oldenburg is 26° F, of the warmest 66°. Storms are numerous and fogs and ague are prevalent in the marsh lands. The chief rivers are the Hunte, flowing into the Weser, and the Hase and Leda flowing into the Ems. The Weser itself forms the eastern boundary for 42 m., and internal navigation is facilitated by a canal connecting the Hunte and the Leda. On the north there are several small coast streams conducted through the dikes by sluices. Large tracts of moorland, however, are useful only as producing peat for fuel, or as affording pasture to the flocks of small coarse-woolled Oldenburg sheep. The rich soil of the marsh lands produces good crops of wheat, oats, rye, hemp and rape, but is especially adapted for grazing. The mineral wealth of Oldenburg is very small. Woollen and cotton fabrics, stockings, jute and cigars are made at Varel, Delmenhorst and Lohne; cork-cutting is extensively practised in some districts, and there are a few iron-foundries. Trade is relatively of more importance, chiefly owing to the proximity of Bremen.

Lübeck.—The former principality of Lübeck has an area of 209 sq.m. and shares in the general physical characteristics of east Holstein, within which it lies. On the east it extends to Lübeck bay of the Baltic sea, and on the south-east it is bounded by the Trave. It is dotted with small lakes. Agriculture is practised here even more extensively than in Oldenburg proper, about 75% of the area being cultivated. The population in 1925 was 47,494. The city of Lübeck (*q.v.*) is entirely apart.

Birkenfeld.—The former principality of Birkenfeld, 312 sq.m. in extent, lies in the midst of the Prussian province of the Rhine, about 30 m. W. of the Rhine at Worms and 150 m. S. of the duchy of Oldenburg. The population in 1925 was 55,649. (*See* BIRKENFELD.)

General Features.—The total population of the republic of Oldenburg in 1925 was 545,172. The bulk of the inhabitants are of Saxon stock, but to the north and west of the republic there are numerous descendants of the ancient Frisians. Low German (*Platt-deutsch*) is universally spoken, except in one limited district, where a Frisian dialect has maintained itself.

Oldenburg is mainly a Protestant country, but Roman Catholicism preponderates in the south-western provinces, which formerly belonged to the bishopric of Münster, and Oldenburg Roman Catholics are under the sway of the bishops of Münster.

The constitution of 1919 provides for a single representative chamber (*Landtag*), elected by universal suffrage and exercising rights of legislation and taxation. The chamber which consists of 48 members, is elected every three years.

History.—The descendants of Elimar (d. 1108), the first historical count of Oldenburg, attained the dignity of princes of the empire when the emperor Frederick I. dismembered the Saxon territory in 1180. The free city of Bremen and the bishop of Münster were frequently at war with the counts of Oldenburg.

Count Christian, who in 1448 was chosen king of Denmark as Christian I., became king of Norway in 1450, and in 1457 king of Sweden. In 1460 he inherited the duchy of Schleswig and the county of Holstein, an event of high importance for the future history of Oldenburg. In 1454 he handed over Oldenburg to his brother Gerhard (*c.* 1430–99). Count Anton Günther (1583–1667), who succeeded in 1603, proved himself the wisest prince who had yet ruled Oldenburg. By his prudent neutrality during the Thirty Years' War he secured for his dominions an immunity from the terrible devastations to which nearly all the other states of Germany were exposed. He also obtained from the emperor the right to levy tolls on vessels passing along the Weser, a lucrative grant which soon formed a material addition to his resources. From 1702 to 1773 the county was ruled by the kings of Denmark, this period being on the whole one of peaceful development. In the latter year Frederick Augustus, bishop of Lübeck, a kinsman of the Emperor Paul of Russia, became count, and in 1777 the county was raised to the rank of a duchy. In 1815 the title of grand duke was allowed to the reigning duke, in consideration of his services to the allies, but was not taken up till 1829. In 1871 Oldenburg became a state of the new German empire and in 1918 the Grand Ducal family was expelled by the German revolution.

For the history of Oldenburg *see* Runde, *Oldenburgische Chronik* (Oldenburg, 1863); E. Pleitner, *Oldenburg im 19 Jahrhundert* (Oldenburg, 1899–1900); and *Oldenburgisches Quellenbuch* (Oldenburg, 1903). *See* also the *Jahrbuch für die Geschichte des Herzogtums Oldenburg* (1892 *seq.*).

OLDENBURG, a town of Germany, and capital of the republic of Oldenburg, situated 27 m. by rail W. of Bremen, on the navigable Hunte and the Hunte-Ems canal. Pop. (1925), including the suburbs, 33,345. According to popular tradition Oldenburg was founded by Walbert, grandson of the Saxon hero, Widukind, and was named after his wife Altburga, but the first historical mention of it occurs in a document of 1108. It was fortified in 1155, and received a municipal charter in 1345. The Evangelical Lambertikirche, though dating from the 13th century, was transformed in 1874–86. The former palaces of the grand-duke and the old town-hall are Renaissance buildings of the 17th and 18th centuries. The picture gallery includes works by Veronese, Velasquez, Murillo and Rubens.

OLDESLOE: *see* BAD OLDESLOE.

OLDFIELD, ANNE (1683–1730), English actress, was born in London, the daughter of a soldier. She was apprenticed to a sempstress, but, fortunately, she attracted George Farquhar's attention by reciting some lines from a play in his hearing. She was engaged at Drury Lane in 1692, and ten years later she was generally acknowledged as the best actress of her time. Mrs. Oldfield's beauty and generosity found innumerable eulogists, as well as sneering detractors. Alexander Pope, in his *Sober Advice from Horace,* wrote of her—

> "Engaging Oldfield, who, with grace and ease,
> Could join the arts to ruin and to please."

She died at 47 on Oct. 23, 1730, and was buried in Westminster Abbey.

OLD FORGE, an anthracite-mining borough of Lackawanna county, Pennsylvania, U.S.A., on the Lackawanna river, 6 m. S.W. of Scranton; served by the Erie and the Lackawanna railways. Pop. (1920) 12,237 (33% foreign-born white). Old Forge was settled in 1830 and incorporated as a borough in 1899.

OLDHAM, JOHN (1653–1683), English satirist, son of a Presbyterian minister, was born at Shipton Moyne, near Tetbury, Gloucestershire, on Aug. 9, 1653. He graduated from St. Edmund Hall, Oxford, in 1674, and was for three years an usher in Whitgift's School, at Croydon. In 1681 he became tutor to the grandsons of Sir Edward Thurland, near Reigate. *Garnet's Ghost* was published as a broadside in 1679, but the other *Satires on the Jesuits,* although written at the same time, were not printed until 1681. His undoubted services to the Country Party brought no reward from its leaders. Eventually he became chaplain to William Pierrepont, earl of Kingston. He died at Holme-Pierrepoint, near Nottingham, on Dec. 9, 1683.

Oldham took Juvenal for his model, and in breadth of treat-

ment and power of invective surpassed his English predecessors. Thomas Garnet, who suffered for supposed implication in the Gunpowder Plot, rose from the dead to encourage the Jesuits in the first satire, and in the third Ignatius Loyola is represented as dictating his wishes to his disciples from his death-bed. Oldham's verse is rugged, and his rhymes often defective, but he met with a generous appreciation from Dryden.

The best edition of his works is *The Compositions in Prose and Verse of Mr. John Oldham . . .* (1770), with memoir and explanatory notes by Edward Thompson; *see* also *Poems*, ed. w. memoir by R. Bell (1891).

OLDHAM, THOMAS (1816–1878), British geologist, was born in Dublin on May 4, 1816. He studied at Dublin and Edinburgh, and in 1839 became chief assistant in the geological department of the Ordnance Survey, where he helped to prepare the *Report on the Geology of Londonderry* (1843). Appointed professor of geology in Dublin university in 1845, he became director of the geological survey of Ireland in 1846, and two years later, F.R.S. The fossil named *Oldhamia* was discovered by him in the Cambrian rocks of Bray Head in 1849. In 1850 he was put in charge of the geological survey of India, which led him to publish, in 1864, a report on the coal resources of India. He retired in 1876, and died at Rugby on July 17, 1878.

OLDHAM, municipal, county, and parliamentary borough, Lancashire, England, 7 m. N.E. of Manchester, on the L.M.S. and L.N.E. railways and the Oldham canal. Pop. (1921) 144,983. The principal railway station is called Mumps, but there are several others. The town lies high, near the source of the small river Medlock. Its growth as a manufacturing centre gives it a wholly modern appearance. The oldest church dates from the later 18th century. The principal buildings and institutions include the town-hall, with tetrastyle portico, the reference library, art gallery and museum, the Union street baths, and the county court. The Lyceum contains schools of art and science, and an observatory; the largely-endowed blue-coat school was founded in 1808 by Thomas Henshaw. The Alexandra park, opened in 1865, stands on a picturesquely undulating and terraced site. Oldham is one of the most important centres of the cotton manufactures. The principal manufactures are fustians, velvets, cords, shirtings, sheetings and nankeens. There are also large foundries, mill and cotton machinery works and engineering works of various kinds. Oldham, incorporated in 1849, became a county borough in 1888. The parliamentary borough has returned two members since 1832.

A Roman road, of which traces are still left, passes through the township. It is not mentioned in Domesday; but in the reign of Henry III. Alwardus de Aldholme is referred to as holding land in Vernet (Werneth). A daughter of this Alwardus conveyed Werneth hall and its manor to the Cudworths, a branch of the Yorkshire family, with whom it remained till the 18th century. From the Oldhams was descended Hugh Oldham, who died bishop of Exeter in 1519. It appears that linens were manufactured in Oldham as early as 1630. Watermills were introduced in 1770, and with the adoption of Arkwright's inventions the cotton industry grew with great rapidity.

OLDMIXON, JOHN (1673–1742), English historian, was a son of John Oldmixon of Oldmixon, near Bridgwater. He wrote a number of miscellaneous works, but his most important book is his *Critical History of England* (1724–1726) which contains attacks on Clarendon and a defence of Bishop Burnet. Its publication led to a controversy between Dr. Zachary Grey and the author, who replied to Grey in his *Clarendon and Whitlock compared* (1727). In his *History of England during the Reigns of the Royal House of Stuart* (1730) he charged Bishop Atterbury and other of Clarendon's editors, unjustly, with tampering with the text of the *History*. He completed a continuous history of England by writing the *History of England during the Reigns of William and Mary, Anne and George I.* (1735); and the *History of England during the Reigns of Henry VIII., Edward VI., Mary and Elizabeth* (1739). Oldmixon died on July 9, 1742.

OLD OREGON TRAIL, an American highway from Independence, Mo., to Pendleton, Ore., about 1,975 m. long. Its route was planned by American pioneers and soldiers between 1810 and 1843. It crosses the Rocky mountains and the Great Salt Lake region, passes down the Snake river through the mountain country of Idaho and then down the Columbia river highway (*q.v.*) to the Pacific ocean. Localities touched between the Missouri border and Pendleton include Kearney and Ogallala (Neb.), Cheyenne and Rawlins (Wyo.), Montpelier, Pocatello and Boise (Ida.) and Baker (Ore.).

OLD POINT COMFORT, a summer and winter resort, in Elizabeth City county, Virginia, U.S.A., at the southern end of a narrow, sandy peninsula projecting into Hampton Roads (at the mouth of the James river), about 12 m. N. by W. of Norfolk. It is served directly by the Chesapeake and Ohio railway, and indirectly by the New York, Philadelphia and Norfolk (Pennsylvania system), passengers and freight being carried by steamer from the terminus at Cape Charles; by steamboat lines connecting with the principal cities along the Atlantic coast, and with cities along the James river; by ferry, connecting with Norfolk and Portsmouth; and by electric railway (3 m.) to Hampton and (12 m.) to Newport News. There is a U.S. garrison at Ft. Monroe, one of the most important fortifications on the Atlantic coast of the United States. The fort lies within a tract of 252 ac. and was first regularly garrisoned in 1823; in 1824 the Artillery School of Practice (now called the U.S. Coast Artillery school) was established to provide commissioned officers of the Coast Artillery with instruction in professional work and to give technical instruction to the non-commissioned staff. During the Civil War the fort was the rendezvous for several military expeditions, notably those of Gen. B. F. Butler to Hatteras inlet, in 1861; of Gen. A. E. Burnside, to North Carolina, in 1862; and of Gen. A. H. Terry, against Ft. Fisher, in 1865. Jefferson Davis was a prisoner here for two years. The expedition which settled Jamestown rounded this peninsula (April 26, 1607), opened its sealed instructions here and named the peninsula "Poynt Comfort," in recognition of the sheltered harbour. The "Old" was added subsequently to distinguish it from a Point Comfort settlement at the mouth of the York river on Chesapeake bay.

OLD SLAVONIC. By the language called Old Bulgarian or Old (Church) Slavonic, and here abbreviated as O.B., is meant that first fixed in writing towards the end of the 9th century, when, at the request of the Moravian prince Rostislav, the Byzantine emperor, Michael III., decided to send emissaries (Constantine, afterwards called Cyril—d. 869—and Methodius, his brother —d. 887) to convert the population of Moravia to Christianity. The term, Old Slavonic, frequently used by French and Czech scholars, is liable to misinterpretation as it may be confused with Common Slavonic, the postulated ancestral form of all the Slav languages, or be taken to refer to the earlier form of any particular Slavonic language. The expression Old Church Slavonic, used by many authorities, has the disadvantage of giving no clue to the area where the language was spoken. Almost all the early manuscripts which are held to represent most accurately the language of the Slavonic apostles or that of their disciples show the phonetic features which we should expect in an earlier form of Bulgarian, more particularly in Macedonian Bulgarian.

The more important of these features are: (1) The Common Slav groups *tj* and *dj* appear as *št* and *žd* respectively, a development which exists in Bulgarian only; (2) the sound transcribed as *ě* (derived from I.E. *ē* or a diphthong ending in *i*) was a palatal *a* (probably like that in English "sand"), and it still occurs in the dialects of precisely that neighbourhood from which the brothers came; (3) the affricate *dz*, which in most Slavonic languages has become *z*, was characteristic of O.B. and is still found in Macedonian dialects.

We do not possess the actual translations made by Cyril and Methodius, but only copies, the earliest dating from the end of the 10th century, the work of those disciples who were engaged in spreading the Gospel in the Balkans. Although dialectical modifications betray the linguistic usage of the various scribes, modern research has been able to restore in great part the exact language of the brothers.

This ideal Old Bulgarian has preserved most of the archaic

features of the Slavonic spoken a few hundred years earlier, before the differentiation into several languages had occurred. It offers, however, such characteristically South Slav features as: (1) the change of *or, ol* and *er, el* between consonants, to *ra, la* and *rě, lě* respectively, (2) the simplification of *tl* and *dl* to *l*, and (3) the change of *kv* and *gv* before front vowels (still preserved in the Western group) to *cv* and *dzv*. The language is of the synthetic type and contains few foreign elements in its vocabulary. The Christian terminology is mainly Greek; the Latin words which occasionally occur are concessions to the Moravians and Pannonians, to whom they had become known through the proselytizing activity of the Western clergy.

O.B. underwent in course of time considerable modifications, both phonetic and structural, in the various countries in which it had become the liturgical language, and the various mss. are consequently classified as Serbian-Slavonic, Croatian-Slavonic, Russian-Slavonic and Bulgarian-Slavonic, according to the different recensions.

The mss. are preserved in two alphabets. In the older, Glagolitic, alphabet we have:

1. The so-called Kiev Leaves—a fragment of a missal—published in Cyrillic transcription by Jagić, under the title of *Glagolitica: Würdigung neuentdeckter Fragmente* (Vienna, 1900). Linguistically and historically, this monument is of great importance and may go back to the end of the 10th century.

2. Codex Zographensis, published by Jagić under a Latin title (Berlin, 1879).

3. Codex Marianus. The edition by Jagić, Berlin, 1883, contains a full critical apparatus.

4. Codex Assemanianus, published in a Latin transcription by J. Črnčić (Rome, 1878).

5. Psalterium Sinaiticum, published by L. Geitler (Zagreb, 1883).

6. Euchologium Sinaiticum, published by Geitler (Zagreb, 1882).

7. Glagolitica Clozianus, published by V. Vondrák (Prague, 1893).

There are also a few other fragments.

The other monuments are written in the Cyrillic alphabet and are:

1. A short burial inscription, dated 993.

2. The Sava Gospel (*Savvina Kniga*), published by V. Ščepkin (St. Petersburg, 1903).

3. Codex Suprasliensis, published by Severjanov (St. Petersburg, 1904).

BIBLIOGRAPHY.—*Entstehungsgeschichte der kirchenslavischen Sprache*, by V. Jagić (Berlin, 1913), gives a mass of reliable miscellaneous information. The best grammars are: V. Vondrák, *Altkirchenslavische Grammatik* (Berlin, 1912); A. Leskien, *Grammatik der altbulgärischen (altkirchenslavischen) Sprache* (Heidelberg, 1909), which is more comparative and historical than his *Handbuch d. altb. (altk.) Sprache* (Heidelberg, 1922). There is also an excellent manual in Polish by J. Łoś (Lwów-Warszawa-Kraków, 1922) and a Czech translation (Prague, 1928), by B. Havránek, of S. Kul'bakin's ms. grammar, which will soon appear in French as one of the publications of the Institut d'Etudes slaves of Paris. Vondrák's *Kirchenslavische Chrestomathie* (Göttingen, 1910) is invaluable as a collection of extracts. The dictionary of F. Miklosich, *Lexicon palaeoslovenico-graeco-latinum emendatum auctum* (Vienna, 1862–65), has not been replaced, but it must be used with caution, as many words belonging to the later ecclesiastical language of the Slavs are quoted.

Bulgarian Language.—Out of Old Slavonic emerged the modern Bulgarian language. Most authorities hold that Bulgarian, together with Serbo-Croat and Slovene, belongs to the Southern branch of the Slavonic languages, but its precise affinities are disputed. Leskien, in his Serbian Grammar (1914), while admitting certain special affinities with Serbo-Croat, regards it as an independent branch. Belić asserts that it belongs to the Southern branch only because of its geographical position. The most noteworthy South Slav development which it shows, is the change of Common Slavonic (C.S.) *or* and *ol*, either in initial position or between consonants, to *ra* and *la*, and a parallel transposition of consonant and vowel for *er* and *el;* but even this characteristic is not conclusive, as it is also partly shared by Czechoslovak, which belongs to the Western branch. As to phonetics, we may note the following features of the literary language: C.S. *tj* and *dj* become *št* and *žd* respectively (a development found in no other modern Slav language); the nasal vowels *ǫ* but *ę* have become oral, the first having changed into a sound (roughly like that of the vowel in English *but*), which does not occur in any cognate language; the softening of consonants before front vowels has been, as also in Serbo-Croat, largely given up, nor have the old distinctions of quantity and intonation survived. In this last feature Bulgarian agrees with Russian, although the accented syllable often varies in the two languages, and is in marked contrast to Serbo-Croat, where length and intonation are preserved in almost all the dialects of the Kingdom. No less remarkable are the peculiarities in other domains of the grammar, the analytical character of which runs counter to the general trend of Slavonic and shows distinct points of resemblance to the development undergone by the languages of Western Europe. Thus, whereas the cases are retained in every other Slav language and dialect, Bulgarian has discarded them almost as completely as the Romance languages and contents itself with a single case, the nominative, the others being expressed by means of prepositions. Bulgarian has a definite article and has lost the infinitive. Parallels are to be found in the other Balkan languages, both Rumanian and Greek, for example, having fewer cases than the classical languages from which they are descended: Rumanian and Albanian have a postpositive article, the uses of which largely agree with that of Bulgarian; lastly, the infinitive has entirely disappeared in Greek and has nearly gone both in Rumanian and Albanian.

This agreement with other Balkan languages has led many scholars to believe that Bulgarian has received the impress of a specifically Balkan type. This would seem incontrovertible if the modern language only were in question, but once we consider the earlier stages of the language we encounter difficulties. The language of the first translators of the Bible (*see* above), the ancestor of present-day Bulgarian, shows no trace whatever of "balkanization." It has a complete case system, no articles, and makes full use of the infinitive. It is therefore best to regard modern Bulgarian as having undergone a development parallel with, but not dependent on, that of its neighbours. Some of the other Slav languages show in embryo the same tendencies which Bulgarian has so completely carried through. Serbian, the nearest neighbour of Bulgarian, has not only almost entirely abandoned the infinitive in the spoken language, but makes one case in the plural do duty for three (locative, dative and instrumental).

The dialects are numerous, chiefly distinguished by phonetic differences. The most usual division is into an Eastern and a Western group, according to how C.S. *ě* is pronounced. In the West, the sound—which in O.B. is thought to have been that of *a* in "sand," with palatalization of the preceding consonant—is *e*, as in Serbian, but in the East the old sound has been maintained before non-palatal consonants. East Bulgarian is further divided into two zones, according to whether the articulated noun ends in *o* or *ъ*. In the main the modern literary language is based on the *ъ* dialects of East Bulgarian.

The Slav dialects spoken in Macedonia represent a transitional stage between Bulgarian and Serbo-Croat. None of them is used for literary purposes, but they have been carefully investigated in recent years, with a view to determining to what extent they have preserved characteristics of their lineal ancestor, the old ecclesiastical language (O.B.). A feature shared by many of them, but not occurring in O.B., is the development of C.S. *tj* and *dj* to fronted *k* and *g*, in place of literary Bulgarian *št* and *žd*.

In some Bulgarian dialects, notably those in the neighbourhood of Salonica and Castoria, there are distinct traces of the O.B. nasal vowels, which are not elsewhere preserved except in Polish and, also in traces, in some Slovene dialects.

In the vocabulary of modern Bulgarian there are many foreign elements, chiefly Turkish and Greek, but also some Rumanian and Albanian words. Russian supplied literary models, and its vocabulary has been very freely drawn upon, although there is now a tendency to restrict the loan words to expressions belonging to more abstract thought. The phraseology of Russian, French and German has had considerable influence on the sentence con-

struction.

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Dictionaries: N. Gerov, *Rečnik na blgarskyj jazyk* (Dictionary of the Bulgarian Language, 5 vols., Philippopolis, 1895–1904); C. Stephanove, *Complete English-Bulgarian Dictionary* (Sofia, 1914), is the best work for English users. For those able to read Bulgarian the *Sbornik za narodni umotvorenija i narodopis,* published by the Bulgarian Academy, is the standard publication, and the *Bulgarska Reč,* a monthly linguistic periodical published at Sofia since 1921, will prove useful.

There are no scientific grammars, nor annotated and accented texts in English, but beginners able to read German will find G. Weigand's grammar and addition of *Baj Ganja* of great assistance. (N. B. J.)

OLD SPANISH TRAIL, an American highway skirting the southern border of the United States from St. Augustine, Fla., the oldest city in the United States, to San Diego, Calif., a distance of 2,743 miles. It passes through the parts of the United States that were first permanently settled by white men and its historic background therefore affords unusual interest. From the Atlantic to San Antonio, Tex., the roadway is more than half paved and the remainder improved except in a few short stretches. Other cities touched by the highway are Mobile, Ala., New Orleans, La., Houston and El Paso, Texas, and Tucson and Phoenix, Ariz.

OLD TESTAMENT: *see* BIBLE.

OLD TOWN, a city of Penobscot county, Maine, U.S.A., on the Penobscot river, 12 m. above Bangor. It is served by the Bangor and Aroostook and the Maine Central railways. Pop. (1920), 6,956. The city occupies Marsh island, formed by a tributary of the Penobscot which unites with it at two points 9 m. apart, and considerable land on the west bank of the Penobscot. Opposite, on Indian island, is the principal settlement of the Penobscot Indians, who are wards of the State. The Abbé Louis Pierre Thury was sent here from Quebec about 1687 and built a mission church. Permanent settlement began when John Marsh (about 1774) bought the "island" now occupied by the city. Old Town was incorporated as a town in 1840, and chartered as a city in 1891. The first railroad in Maine was built from Bangor to Old Town in 1836.

OLDYS, WILLIAM (1696–1761), English antiquary and bibliographer, natural son of Dr. William Oldys, chancellor of Lincoln, was born on July 14, 1696, probably in London. He devoted most of his life to the collection of rare books and papers. In 1731 he sold his collections to Edward Harley, earl of Oxford, who appointed him his literary secretary in 1738. Three years later his patron died, and from that time he worked for the booksellers. In April 1755 he was appointed Norroy king-at-arms by the duke of Norfolk. He died on April 15, 1761.

Oldys's chief works are: *The British Librarian,* a review of scarce and valuable books in print and in manuscript (1737–38); the *Harleian Miscellany* (1744–46), a collection of tracts and pamphlets in the earl of Oxford's library, undertaken in conjunction with Dr. Johnson; twenty-two articles contributed to the *Biographia Britannica* (1747–60); an edition of Raleigh's *History of the World,* with a *Life* of the author (1736); *Life of Charles Cotton* prefixed to Sir John Hawkins's edition (1760) of the *Compleat Angler.* In 1727 Oldys began to annotate another Langbaine to replace the one he had lost. This valuable book, with a MS. collection of notes by Oldys on bibliographical subjects, is preserved in the British Museum.

OLEACEAE, in botany, the olive family, dicotyledonous shrubs and trees of warm, temperate and tropical regions, especially abundant in the East Indies. *Fraxinus* includes the ash (*q.v.*) and flowering ash (*F. Ornus*). *Olea* includes the olive (*q.v.*) and the black ironwood tree (*O. laurifolia*). The family includes also numerous valuable ornamental trees and shrubs, as privet, jasmine, lilac, golden-bells, and fringe-tree. There are 21 genera and about 500 species, some 40 of which occur in North America.

OLEAN, a city of Cattaraugus county, New York, U.S.A., on the Allegheny river, at the mouth of Olean creek, 70 m. S.S.E. of Buffalo. It is served by the Erie, the Pennsylvania and the Pittsburgh, Shawmut and Northern railways. Pop. (1920) 20,506 (84% native white); 1928 local estimate, 25,500. The city lies in a valley 1,440 ft. above sea-level, almost encircled by hills. The surrounding country is rich in oil and gas. Six miles S.W. is "Rock City," a group of immense rocks, strangely regular in shape, covering 40 acres. At Allegany, a village 3 m. W., is St. Bonaventure's college (Roman Catholic; 1859). The city has railroad shops, oil refineries and various other manufacturing industries, with an output in 1925 valued at $23,979,049. It is the headquarters of a "demonstration" in rural public-health work, a ten-year experiment begun in 1923 with financial help from the Milbank Memorial fund. Settlement in this region began in 1804. The city was incorporated in 1893.

OLEANDER, the common name for the shrub known to botanists as *Nerium Oleander.* It is a native of the Mediterranean region, and is characterized by its tall shrubby habit and its thick lance-shaped opposite leaves, which exude a milky juice when punctured. The flowers are borne in terminal clusters, and are of a rose colour, rarely white. The hairy anthers adhere to the thickened stigma. The fruit or seed-vessel consists of two long pods, which liberate a number of seeds, each of which has a tuft of silky hairs. The genus *Nerium* belongs to the family Apocynaceae (*q.v.*). The oleander was known to the Greeks under three names, viz. *rhododendron, nerion* and *rhododaphne,* and is well described by Pliny (xvi. 20), who mentions its rose-like flowers and poisonous qualities. The oleander has long been cultivated in greenhouses, being, as Gerard says, "a small shrub of a gallant shewe"; numerous varieties, differing in the colour of their flowers, which are often double, have been introduced. In warm countries, as the southern United States, it is grown in gardens.

OLEASTER (*Elaeagnus hortensis* family Elaeagnaceae), a handsome deciduous tree, 15 to 20 ft. high, growing in the Mediterranean region and temperate Asia, where it is commonly cultivated for its edible fruit. The brown smooth branches are more or less spiny; the narrow leaves have a hoary look from the presence of a dense covering of star-shaped hairs; the small fragrant yellow flowers, which are borne in the axils of the leaves, are scaly on the outside. The genus contains other species of ornamental shrubs or small trees.

OLEFINE, in organic chemistry (*q.v.*), the generic name given to a hydrocarbon containing one or more pairs of doubly linked carbon atoms. The simplest olefines or monolefines, containing only one of these pairs, are represented by ethylene (*q.v.*), $CH_2{:}CH_2$, the simplest member of the series, which is prepared by dehydrating ethyl alcohol and is used in manufacturing ethylene glycol (*see* GLYCOLS) and in producing "mustard gas." (*See* CHEMICAL WARFARE.) The word olefine is derived from the French *oléfiant* (from *oléfier,* to make oil) and was given to ethylene by four Dutch chemists J. R. Deiman, Paets van Troostwyk, N. Bondt and A. Lauwerenburgh in 1795 owing to the fact that the gas yielded an oily liquid when mixed with chlorine.

Simple Olefines (Monolefines).—The simple olefines, which have the general formula C_nH_{2n}, are now produced on a manufacturing scale by the thermal decomposition ("cracking") of petroleum oils. These oils, which are mixtures of saturated hydrocarbons (paraffins), when heated at a temperature higher than the normal boiling points of their constituents (approximately a range of 300° to 550° C.), break up into mixtures of simpler paraffins and olefines. Thus decane breaks up into pentane and amylene

$$CH_3[CH_2]_8CH_3 = CH_3[CH_2]_3CH_3 + CH_3[CH_2]_2CH{:}CH_2.$$

Other similar mixtures arise, and the olefines can be removed by absorption in strong sulphuric acid. The acid is added on to the double linking in such a way as to form a terminal methyl group, the ester from the above example being $CH_3[CH_2]_2CH(HSO_4)\cdot CH_3$. The crude liquid, when diluted with water and distilled, gives rise to a series of secondary alcohols, $R\cdot CH(OH)\cdot CH_3$. In this way *iso*propyl alcohol (2-propanol), $(CH_3)_2\cdot CHOH$; secondary butyl alcohol (2-butanol), $CH_3\cdot CH_2\cdot CH(OH)\cdot CH_3$; secondary amyl alcohol (2-pentanol), $CH_3[CH_2]_3CH(OH)\cdot CH_3$, and higher secondary alcohols are now being produced commercially. From these alcohols the corresponding pure olefines can be regenerated by dehydration with such agents as sulphuric acid, zinc chloride, phosphoric oxide or acid, and anhydrous

oxalic acid.

The higher olefines are found in the tar from bituminous shales, in illuminating gas, and in the products formed by distilling paraffin under pressure (T. E. Thorpe and J. Young, 1873).

Physical Properties.—The lower members of the monolefinic series (carbon content C_2 to C_4) are inflammable gases and the members with carbon content C_5 to C_{14} are liquids insoluble in water. The formulae and boiling points of the series of normal olefines, $R{\cdot}CH{:}CH_2$, are shown in the following table:—

Name	Formula	M.p.	Boiling point
		°C	°C
Ethylene	$CH_2{:}CH_2$	−169	−102·7 (757 mm.)
Propylene	$CH_3CH{:}CH_2$	..	−48·2 (749 mm.)
Butylene	$C_2H_5{\cdot}CH{:}CH_2$	..	−5
Amylene	$C_3H_7{\cdot}CH{:}CH_2$	..	39–40
Hexylene	$C_4H_9{\cdot}CH{:}CH_2$	..	68–70
Heptylene	$C_5H_{11}{\cdot}CH{:}CH_2$	..	95
Octylene	$C_6H_{13}{\cdot}CH{:}CH_2$	..	122–123
Decylene	$C_8H_{17}{\cdot}CH{:}CH_2$	..	172
Undecylene	$C_9H_{19}{\cdot}CH{:}CH_2$	..	84 (18 mm.)
Duodecylene	$C_{10}H_{21}{\cdot}CH{:}CH_2$	−31	96 (15 mm.)

Chemical Properties.—In chemical properties the monolefines differ profoundly from the paraffins. Owing to the unsaturation typified in the foregoing table by the double linking, hydrogen is absorbed at the ordinary temperature in the presence of platinum black with formation of paraffins. Chlorine and bromine combine directly with olefines giving dihalogen addition compounds, the halogen hydrides also combine to yield alkyl halides; hydrogen iodide reacts most readily, hydrogen chloride least. With hypochlorous acid the olefines form chlorohydrins. The higher members of the olefines readily polymerize in the presence of dilute sulphuric acid, zinc chloride, etc. For example, gaseous *iso*butylene, $(CH_3)_2C{:}CH_2$ (b.p. −5° C), polymerizes to *iso*dibutylene, C_8H_{16}, and *iso*tributylene, $C_{12}H_{24}$, liquid products which boil at 110–113° C and 178–181° C respectively.

Diolefines.—The most important of the diolefines, C_nH_{2n-2}, are those containing the two double linkings separated by one single linking (conjugated double linkings). 1:3-Butadiene (Erythrene), $CH_2{:}CH{\cdot}CH{:}CH_2$, the simplest member of this type, is an easily liquefiable gas (b.p. −5° C) formed by chlorinating *n*-butyl chloride and passing the product over heated soda lime (W. H. Perkin, junr., *J. Soc. Chem. Ind.*, 1912).

(G. T. M.)

OLEIC ACID: *see* GLYCERIDES.

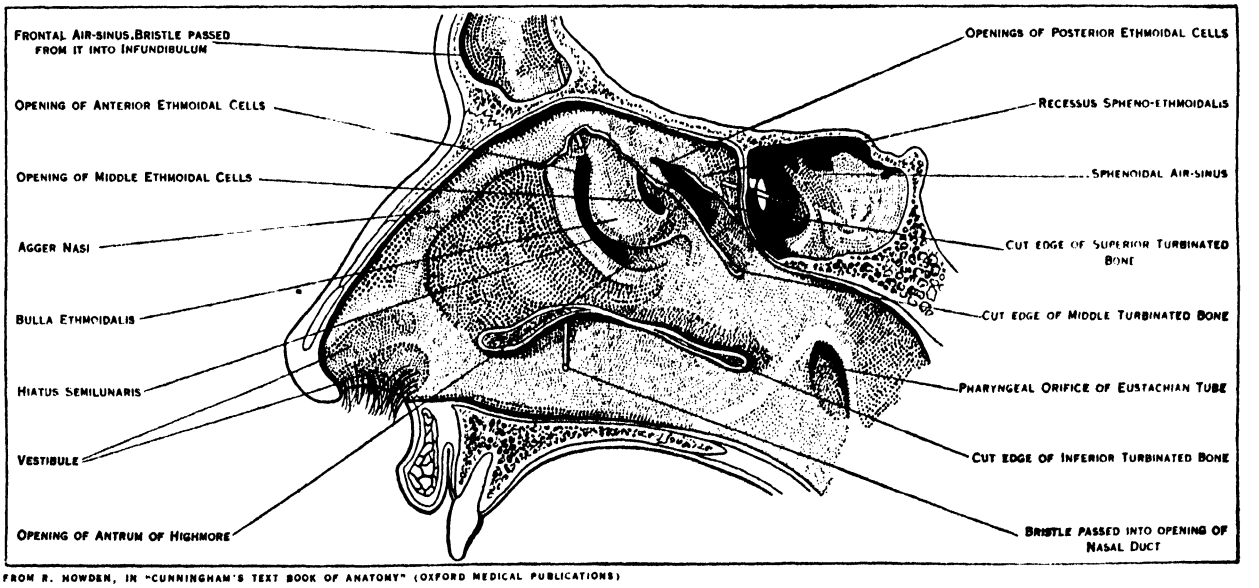
OLEN, a legendary poet and prophet, reputed author of certain hymns to Apollo, sung at Delos in historical times (Gr. Ὠλήν) Boio, a Delphic poetess, made him a Hyperborean (*see* HYPERBOREANS), founder of the oracular shrine at Delphi, first prophet there, and inventor of the hexameter. Herodotus makes him a Lycian (as follower of Apollo Λύκειος). Whether any real person lies behind these stories is unknown.

See Höfer in Roscher's *Lexikon* (bibl.).

OLÉRON, an island lying off the west coast of France, opposite the mouths of the Charente and Seudre, and included in the department of Charente-Inférieure. In 1926 the population numbered 15,363. Oléron, the *Uliarus Insula* of Pliny, formed part of the duchy of Aquitaine, and came into the possession of the French Crown in 1370. It is about 18 m. in length from north-west to south-east, and 7 m. in extreme breadth; area 66 sq.m.; the strait (*Pertuis de Maumusson*) separating it from the mainland is at one point less than a mile wide. The chief places are St. Pierre (pop. 1,451 in 1926), Le Château d'Oléron (1,430), and the watering-place of St. Trojan-les-Bains.

OLFACTORY SYSTEM. In anatomy, the olfactory system consists of the nose and the nasal cavities which support the olfactory mucous membrane for the perception of smell in their upper parts, and act as respiratory passages below.

The bony framework of the nose is part of the skull (*q.v.*), but the outer nose is only supported by bone above; lower down its shape is kept by cartilaginous plates. The expanded lower part of the side of the nose, the "ala," is only formed of skin, both externally and internally, with fibro-fatty tissue between the layers. The nasal cavities are separated by a septum covered in its lower two-thirds by thick, highly vascular mucous membrane composed of columnar ciliated epithelium with masses of acinous glands embedded in it, while in its upper part it is covered by the less vascular but more specialized olfactory membrane. Near the front of the lower part of the septum a slight opening into a short blind tube, which runs upward and backward, may sometimes be found; this is the vestigial remnant of "Jacobson's organ." The supporting framework of the septum is made up of ethmoid above, vomer below, and the "septal cartilage" in front. The outer wall of each nasal cavity is divided into three meatus by the overhanging turbinated bones (*see* fig. 2). Above the superior turbinated is a space between it and the roof known as the "recessus spheno-ethmoidalis," into the back of which the "sphenoidal air sinus" opens. Between the superior and middle turbinated bones is the "superior meatus," containing the openings of the "posterior ethmoidal air cells," while between the



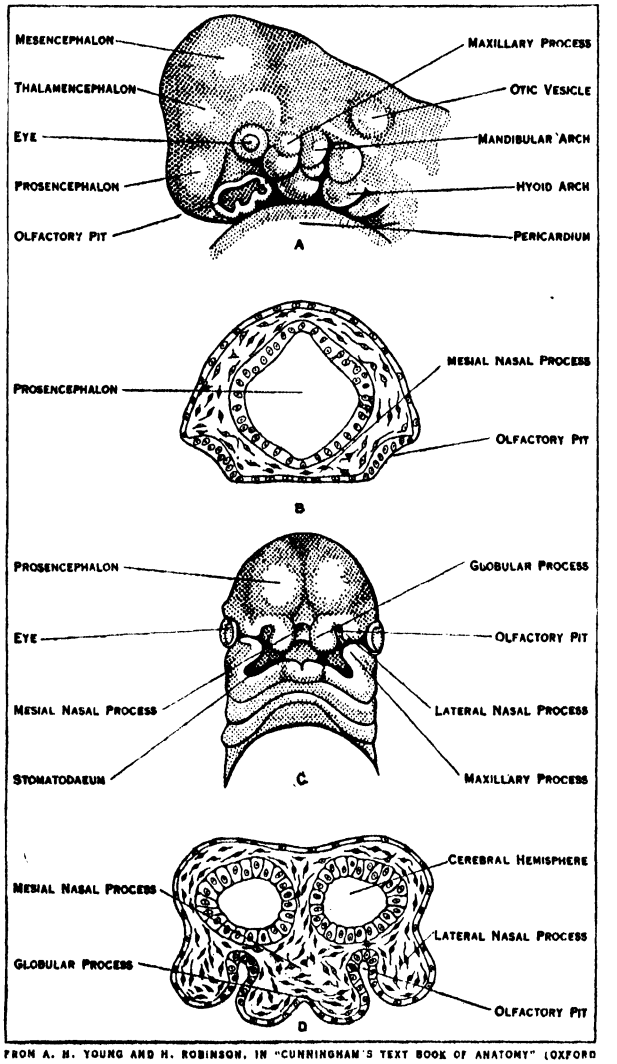
FROM R. HOWDEN, IN "CUNNINGHAM'S TEXT BOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 1.—VIEW OF THE OUTER WALL OF THE NOSE, THE TURBINATED BONES HAVING BEEN REMOVED

middle and inferior turbinateds is the "middle meatus," which is the largest of the three and contains a rounded elevation known as the "bulla ethmoidalis." Above and behind this is often an opening for the "middle ethmoidal cells," while below and in front a deep sickle-shaped gutter runs, the "hiatus semilunaris," which communicates above with the "frontal air sinus" and below with the opening into the "antrum of Highmore" or "maxillary antrum." The "inferior meatus" is below the inferior turbinated bone, and, when that is lifted up, the valvular opening of the nasal duct (*see* EYE) is seen. The roof of the nose is narrow, and here the olfactory nerves pass in through the cribriform plate. The floor is wider so that a coronal section through each nasal cavity has roughly the appearance of a right-angled triangle.

Embryology.—In the third week of intra-uterine life two nasal pits appear on the under side of the front of the head; they are the first appearance of the true olfactory region of the nose, and some of their epithelial lining cells send off axons (*see* NERVOUS SYSTEM) which arborize with the dendrites of the cells of the olfactory lobe of the brain and so form the olfactory nerves. Between the olfactory pits the broad median fronto-nasal process grows down from the forehead region to form the dorsum of the nose (*see* fig. 2), and the anterior part of the nasal septum, while outside them the lateral nasal processes grow down, and later on meet the maxillary processes from the first visceral arch. In this way the nasal cavities are formed, but are separated from the mouth by a thin bucco-nasal membrane which eventually is broken through; after this the mouth and nose are one cavity until the formation of the palate in the third month (*see* MOUTH AND SALIVARY GLANDS). In the third month Jacobson's organ may be seen as a well-marked tube lined with respiratory mucous membrane; no explanation of the function of Jacobson's organ in man is known, and it is probably entirely atavistic. At birth the nasal cavities are shallow from above downward, but rapidly deepen till the age of puberty.

Comparative Anatomy.—In Amphioxus among the Acrania there is a ciliated pit above the anterior end of the central nervous system, which is probably a rudiment of an unpaired olfactory organ. In the Cyclostomata (lampreys and hags) the pit is at first ventral, but later becomes dorsal and shares a common opening with the pituitary invagination. It furthermore becomes divided internally into two lateral halves. In fishes there are also two lateral pits, the nostrils of which open sometimes, as in the elasmobranchs (sharks and rays), on to the ventral surface of the snout, and sometimes, as in the higher fishes, on to the dorsal surface. Up to this stage the olfactory organs are mere pits, but in the Dipnoi (mud-fish) an opening is established from them into the front of the roof of the mouth, and so they serve as respiratory passages as well as organs for the sense of smell. In the higher Amphibia the nasal organ becomes included in the skull and respiratory and olfactory parts are distinguished. In this class, too, turbinal ingrowths are found, and the naso-lachrymal duct appears. In the lizards, among the Reptilia, the olfactory and respiratory parts are very distinct, the latter being lined only by stratified epithelium unconnected with the olfactory nerves. There is one true turbinal bone growing from the outer wall, and close to this is a large nasal gland. In crocodiles the hard palate is formed, and there is henceforward a considerable distance between the openings of the external and internal nares. In this order, too (Crocodilia) air sinuses are first found extending from the olfactory cavities into the skull-bones. The birds' arrangement is very like that of the reptiles; olfactory and respiratory chambers are present, and into the latter projects the true turbinal, though there is a pseudo-turbinal in the upper or olfactory chamber. In mammals the olfactory chamber of the nose is variously developed; most of them are "macrosmatic," and have a large area of olfactory mucous membrane; some, like the seals, whalebone whales, monkeys and man are "microsmatic," while the toothed whales have the olfactory region practically suppressed in the adult, and are said to be "anosmatic." There are generally five turbinal bones in macrosmatic mammals, so that man has a reduced number. The lowest of the series or "maxillo-turbinal" is the equivalent of the single true turbinal bone of birds and reptiles, and in most mammals is a double scroll, one leaf turning upward and the other down. Jacobson's organ first appears in amphibians, where it is found as an anteroposterior gutter in the floor of the nasal cavity. In reptiles the roof of the gutter closes in on each side, and a tube is formed lying below and internal to the nasal cavity, opening anteriorly into the mouth and ending by a blind extremity, posteriorly to which branches of the olfac-



FROM A. M. YOUNG AND H. ROBINSON, IN "CUNNINGHAM'S TEXT BOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 2.—VIEWS OF THE DEVELOPMENT OF HUMAN EMBRYONIC HEADS A. Side views of the head of human embryo about 27 days old, showing olfactory pit and visceral arches and clefts. B. Transverse section through head of an embryo, showing relation of olfactory pits to forebrain and to roof of stomatodaeal space. C. Head of human embryo about 29 days old, showing division of lower part of mesial frontal process into two globular processes. D. Transverse section of embryo head, showing deepening of olfactory pits and their relation to hemisphere vesicles of forebrain

tory and tri-geminal nerves are distributed. In the higher reptiles (crocodiles and chelonians) the organ is suppressed in the adult, and the same applies to birds; but in the lower mammals, especially the monotremes, it is very well developed, and is enclosed in a cartilaginous sheath, from which a turbinal process projects into its interior. In other mammals, with the exception of the Primates and perhaps the Chiroptera, the organ is quite distinct, though even in man, as has been shown, its presence can be demonstrated in the embryo.

See J. Symington on the organ of Jacobson in the Ornithorynchus, *P. Zool. Soc.* (1891), and in the kangaroo, *J. Anat. and Phys.*, vol. 26 (1891); also G. Eliot Smith on Jacobson's organ, *Anatom. Anzeiger*, xi. Band No. 6 (1895). For general literature on the comparative anatomy of the olfactory system, *see* R. Wiedersheim's *Comparative*

Anatomy of Vertebrates, translated and adapted by W. N. Parker (London, 1907). (F. G. P.)

OLGA, wife of Igor, prince of Kiev, and afterwards (from 945) regent for Sviatoslav her son, was baptized at Constantinople about 955 and died about 969. She was canonized in the Russian church; her feast is on July 11.

OLGIERD (d. 1377), grand-duke of Lithuania, was one of the seven sons of Gedymin, grand-duke of Lithuania, among whom on his death in 1341 he divided his domains, leaving the youngest, Yavnuty, in possession of the capital, Vilna, with a nominal priority. With the aid of his brother Kiejstut, Olgierd in 1345 drove out the incapable Yavnuty and declared himself grand-duke. His reign (1345–1377) saw the development and extension of Lithuania to one of the greatest states in Europe of that time. The Teutonic knights in the north and the Tatar hordes in the south were equally bent on the subjection of Lithuania, while Olgierd's eastern and western neighbours, Muscovy and Poland, were far more frequently hostile competitors than serviceable allies. Olgierd not only held his own, but acquired influence and territory at the expense of both Muscovy and the Tatars, and extended the borders of Lithuania to the shores of the Black sea. He desired to establish the Lithuanian power in those Russian lands which had formed part of the ancient grand-duchy of Kiev. He procured the election of his son Andrew as prince of Pskov, and a powerful minority of the citizens of the republic of Novgorod held the balance in his favour against the Muscovite influence, but his ascendancy in both these commercial centres was precarious. But he acquired the principalities of Smolensk and Bryansk in central Russia. His relations with the grand-dukes of Muscovy were friendly, and twice he married orthodox Russian princesses; nevertheless, he besieged Moscow in 1368 and again in 1372, both times unsuccessfully.

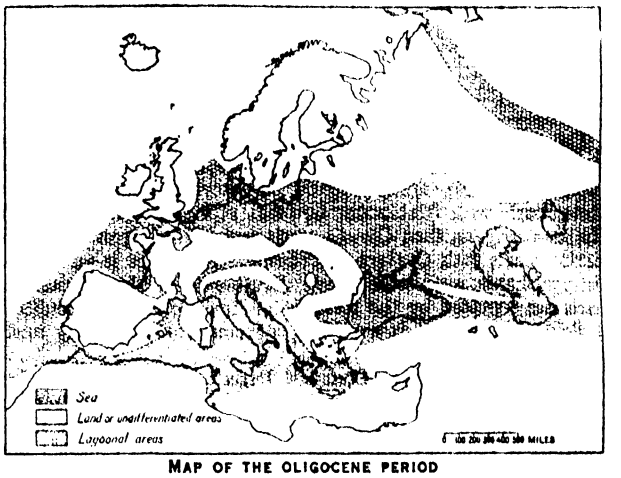
Olgierd won a great victory over the Tatars at Siniya Vodui on the Bug in 1362, which practically broke up the great Kipchak horde and compelled the khan to migrate farther south and make his headquarters for the future in the Crimea. Indeed, but for the unceasing simultaneous struggle with the Teutonic knights, the burden of which was heroically borne by Kiejstut, Russian historians frankly admit that Lithuania, not Muscovy, must have become the dominant power of eastern Europe. Olgierd died in 1377, accepting both Christianity and the tonsure shortly before his death. His son Jagiello ultimately ascended the Polish throne, and founded the dynasty which ruled Poland nearly 200 years.

See Kazimierz Stadnicki, *The Sons of Gedymin* (Pol.) (Lemberg, 1849–53); Vladimir Bonifatevich Antonovich, *Monograph on the History of Western Russia* (Rus.), vol. i. (Kiev, 1885). (R. N. B.; X.)

OLIGARCHY, in political philosophy, the term applied to a government exercised by a relatively small number of the members of a community (Gr. *oligoi*, few, *arche*, rule).

OLIGOCENE (Gr. ὀλίγος, few, and καινός, recent), in geology, the name given to the second period of the Tertiary era. The Oligocene system thus includes those strata which occur above the Eocene and below the Miocene. These rocks were originally classed by Sir Charles Lyell as Older Miocene, the term Oligocene being proposed by H. E. Beyrich in 1854 and again in 1858. The Oligocene is thus the upper division of the older Tertiary period or Palaeogene. (*See* TERTIARY, EOCENE.)

Conditions During the Oligocene.—The Oligocene deposits are of fresh-water, brackish, marine and terrestrial origin; they include sands, soft sandstones, grits, marls, shales, limestones, conglomerates and lignites. Here and there, as in northern Germany, the sea gained ground that had been unoccupied by Eocene waters, but important changes were in progress, and a general relative upliftting took place which caused much of the Eocene sea-floor to be occupied at this time by lake basins and lagoons. Thus there is a general tendency for marine Oligocene deposits to occupy a more restricted area than the marine Eocene. Amongst the earliest of the Tertiary mountain chains to arise were the Pyrenees and the mountains of Provence (the Alpine chain properly speaking) which were already in existence at the end of the Eocene. Thus relatively unfolded Oligocene sediments are found on the flanks of belts of folded Eocene strata. In some areas the folding of the margins of Eocene gulfs resulted in the deepening of the centre of the trough and permitted huge thicknesses of Oligocene to be deposited. This, for example, is the case in the Burmese gulf where Oligocene sediments reach a thickness of over 10,000 feet. As in the Eocene period, minor oscillations of level gave rise to cycles of sedimentation. Perhaps



MAP OF THE OLIGOCENE PERIOD

the most striking change from Eocene topography in Europe, shown on the accompanying map, is the extension of the Oligocene sea over north Germany, whence it extended eastward through Poland and Russia to the Aral-Caspian region, communicating thence with Arctic waters by way of a Ural depression. It was later in the period when the widespread emersion set in.

Life of the Period.—In its general features the life of the period resembles that of the Eocene (*q.v.*); foraminifera were abundant; nummulites were still numerous but of smaller size and are characteristically associated with lepidocyclines. Corals and bryozoa were abundant in the clear waters of southern seas but echinoids rather less numerous. Cephalopods were still fewer but gastropods and lamellibranchs assumed more and more their present-day importance, and the genera are those already noted in the Eocene. Amongst vertebrates, rays and dog-fish were the dominant marine fish; tortoises were abundant and the genus *Rana* made its appearance. The most interesting feature of the land fauna is the great variety of mammals, especially from the interior of North America and the continental Oligocene of Europe and Asia. The mammals are the most important fossils for distinguishing subdivisions of the period. Whilst many of the mammals were of mixed types, others are clearly representatives of modern groups and forerunners of existing genera. Thus it is possible to distinguish carnivores (*Canidae* and *Felidae*), insectivores, rodents, ruminants and camels. Forerunners of the rhinoceros, elephant and horse are all clearly separable. An account of the flora will be found in the article dealing with PALAEOBOTANY. The abundance of *Chara*, associated with such molluscan genera as *Limnaea* and *Planorbis* in fresh-water deposits is especially noteworthy.

Oligocene Stratigraphy.—Neither the lower nor the upper limit of the Oligocene is well defined. As mentioned in the article on the Eocene (*q.v.*), the lower limit is usually taken as the top of the Bartonian stage (including the Ludian). The *Aquitanian stage* is classed sometimes with the Oligocene, sometimes with the Miocene. The first opinion is adopted by those who pay first attention to the mammalian faunas—the Aquitanian fauna is an impoverished representative of preceding faunas and is not marked by the appearance of new forms. On the other hand the Aquitanian deposits seem to mark the feeble beginning of the Miocene transgression.

The type areas for Oligocene stratigraphy lie mainly in France—among the lagoons left by the retreat of the Eocene seas. The following is the classification of the Oligocene now generally

adopted (reading downwards):—

Marine stages	Mammalian faunas
Aquitanian	Impoverished Stampian fauna; true *Anthracotherium* absent.
Stampian — Upper or Chattian	Numerous large *Anthracotherium* and *Aceratherium;* first tapirs.
Stampian — Lower	*Anthracotherium; Aceratherium;* the last Palaeotherids.
Sannoisian	The first *Anthracotherium* and Rhinoceratids; the last *Anoplotherium* and *Xiphodon.*

The *Sannoisian Stage* (Sannois hill, near Argenteuil, north-west of Paris) is represented by the famous series of supra-gypseous marls. At the base are blue marls, laid down in salt lagoons, then white marls with fresh-water horizons represented by beds with *Limnaea strigosa,* then *Cyrena* marls and finally a group of green marine marls with *Cytherea incrassata.* The latter is an horizon distinguishable over wide areas. South-east of the Marne, the marls are replaced by the fresh-water limestones and "meulière" of Brie. "Meulière" is a porous, siliceous rock, formerly much worked for building stone.

The *Stampian Stage* (Étampes, Paris basin) is the most important and most easily recognized of the Oligocene horizons in the Paris basin. At the base are the widespread oyster marls (Marnes à Huîtres) containing especially *Ostrea cyathula* and *O. longirostris,* followed by the well-known Fontainebleau sands with an average thickness of 125 feet. These are the "sables supérieurs" of the older French geologists. They are generally white and very pure, and are exploited as glass-sands. Except at a few points in the neighbourhood of Étampes (Jeurre, Morigny, Pierrefitte, etc.) they are rarely fossiliferous but there contain *Pectunculus obovata, Cytherea splendida.* Consolidated blocks (grès de Fontainebleau) comparable with the "sarsens" of the English Eocene are common. After the deposition of the marine Fontainebleau sands, the sea left the Paris basin; a huge lake covered the south-west of the Paris basin. In this were deposited the fresh-water Beauce limestones, representing both the Chattian and Aquitanian. The lower part (Chattian) of this limestone is now usually called the Étampes limestone of which the Meulière de Montmorency is a lateral equivalent.

The *Aquitanian Stage* (Aquitaine, France) owes its name to its development in the great Aquitaine basin of south-western France where there are marine limestones and brackish water intercalations in a series of shelly sands with *Melongena,* the whole passing southwards into a mass of conglomerates (poudingues de Palasson).

In Britain, if one excepts the possible Oligocene age of the beds of the Bovey Tracey basin in Devonshire and of some of the sediments intercalated with the lavas of the west of Scotland (leaf beds of Mull), Oligocene beds are found only in the Hampshire basin. The classic exposures are in the cliffs of the Isle of Wight. The base is ill-defined and may be taken perhaps at the base of the Middle Headon beds (brackish and marine). These are succeeded by the fresh-water clays, marls and limestones of the upper Headon beds, then the Osborne and Bembridge beds (a series of brackish and fresh-water sands, clays, marls, and limestones) and finally the Hamstead beds, estuarine and fresh-water below and marine above. The correlation of the Hampshire sequence with the French stages is still uncertain; probably the highest marine Hamstead beds are equivalent to the Oyster marls of the lower Stampian. In this case the whole of the Hampshire Oligocene, except the highest beds, is Sannoisian.

In Belgium the Sannoisian sands and clays are important and extensive and known as the Tongrian. The Stampian is represented by a thick series of clays—the Argiles de Boom (Rupelian) whilst the Chattian seems to be absent unless represented by pockets of marine sands in the Ardennes massif. There is no deposit corresponding to the Aquitanian. In northern Germany and Denmark the Oligocene is, in contrast to the Eocene, thick, important, and fossiliferous. The Sannoisian (or Lattorfian) is represented by marine sands with *Nummulites germanicus;* the Stampian continues the Sannoisian transgression and occurs in the Mainz basin and even as far south as Alsace. The Chattian (or Casselian) derives its name from the Chattes, an ancient tribe of the Cassel country and consists of fine glauconitic sands well developed in the Cassel gulf. In the Mainz basin are *Cyrena* marls and *Cerithium* limestones. The Aquitanian is, probably, represented by the "Littorinellenkalk" of the Mainz basin, difficult to separate from the overlying Miocene. Brown coal is important in the Oligocene of Germany. Continental Oligocene beds are found in several basins of the central European continent, notable in the Rhone basin (deposits of Alais, Aix, Marseille, etc.) and in the trenches of the Loire and Allier.

In the alpine geosyncline it is probable that the only Oligocene are Sannoisian—notably the sandstones with small nummulites above the Priabonian and the higher beds of the Flysch. Oligocene deposits occur in the Carpathian region and the Tirol, in the Spanish Pyrenees and the flanks of the Cantabrian mountains, in Calabria, Dalmatia, Istria, and Bosnia. Glauconitic sands occur in south Russia, Flysch in the Caucasus, marine deposits in the Aral-Caspian region, Armenia, and Persia. Oligocene rocks are known also in north Africa, Algeria, Tunis and Egypt. In general Oligocene beds succeed Eocene in the epicontinental and geosynclinal gulfs around the continents of Asia (including the Nari series of India and the lower Peguan of Burma) and the Americas. Of special interest are the continental Oligocene deposits of North America, including the White River beds of South Dakota. (*See* references given under EOCENE.) (L. D. S.)

OLIGOCHAETA, a class of segmented worms (Annelida *q.v.*), including the earthworms (*q.v.*) and certain small fresh-water forms.

OLIGOCLASE, a rock-forming mineral of the plagioclase (*q.v.*) group of felspars. (Gr. ὀλίγος, little, and κλᾶν, to break, in allusion to a supposed less perfect cleavage than that of the related albite.) The name is usually reserved for those mixed crystals of the albite-anorthite series ranging from $Ab_{90}An_{10}$ to $AB_{70}An_{30}$. The best known specimens of oligoclase are the iridescent, aventurine or "sunstone" crystals occurring in gneiss at Tvedestrand in southern Norway. The mineral is a common constituent of acid and alkaline igneous rocks as granite, syenite, trachyte, etc., and also in metamorphosed felspathic sediments. (C. E. T.)

OLIPHANT, LAURENCE (1829–1888), British author, son of Anthony Oliphant (1793–1859), was born at Cape Town. His father was then attorney-general in Cape Colony, but was soon transferred as chief-justice to Ceylon. The boy's education was of the most desultory kind. In the years 1848 and 1849 he accompanied his parents on a tour on the continent of Europe. In 1851 he accompanied Jung Bahadur from Colombo to Nepal and found material for his first book, *A Journey to Katmandu* (1852). From Nepal he returned to Ceylon, and thence to England, then to Russia, after which he wrote *The Russian Shores of the Black Sea* (1853). Between 1853 and 1861 he was successively secretary to Lord Elgin during the negotiation of the Canada Reciprocity treaty at Washington, the companion of the duke of Newcastle on a visit to the Circassian coast during the Crimean War, and Lord Elgin's private secretary on his expedition to China. Each of these experiences produced a pleasant book of travel. In 1861 he was appointed first secretary in Japan, and might have made a successful diplomatic career if it had not been interrupted, almost at the outset, by a night attack on the legation, in which he nearly lost his life. It seems probable that he never properly recovered from this affair. He returned to England and resigned the service, and was elected to parliament in 1865 for the Stirling Burghs.

Oliphant did not show any conspicuous parliamentary ability, but made a great success by his vivacious and witty novel, *Piccadilly* (1870). He fell, however, under the influence of the spiritualist prophet Thomas Lake Harris, who about 1861 had organized a small community, the Brotherhood of the New Life, which at this time was settled at Brocton on Lake Erie where Oliphant spent many years living as a farm labourer. As late

as December 1878 he continued to believe that Harris was an incarnation of the Deity.

In 1879 he visited Palestine and in 1881 he crossed again to America. On this visit he finally broke with Harris. He and his wife (Miss Alice Le Strange) settled at Haifa in Palestine.

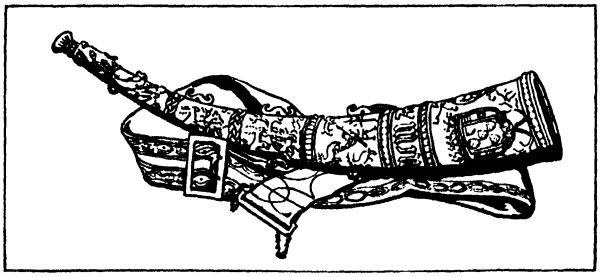
There they wrote together the strange book called *Sympneumata: Evolutionary Forces now active in Man* (1884), and in the next year Oliphant produced there his novel *Masollam*, which may be taken to contain its author's latest views with regard to the personage whom he long considered as "a new Avatar." One of his cleverest works, *Altiora peto*, had been published in 1883. In 1886 his wife died of fever. He was persuaded that after death he was in much closer relation with her than when she was still alive, and conceived that it was under her influence that he wrote his *Scientific Religion*. In November 1887 he went to England to publish that book. By the Whitsuntide of 1888 he had completed it and started for America. Oliphant married, as his second wife, a granddaughter of Robert Owen. They were starting for Haifa, when he died, at Twickenham, on Dec. 23, 1888. Oliphant was a brilliant writer and talker, and a notable figure in any society.

See Mrs. (Margaret) Oliphant, *Memoir of the Life of Laurence Oliphant and of Alice Oliphant his Wife* (1892). (M. G. D.; X.)

OLIPHANT, MARGARET OLIPHANT (1828–1897), British novelist and historical writer, daughter of Francis Wilson, was born at Wallyford, near Musselburgh, Midlothian, in 1828. Her childhood was spent at Lasswade (near Dalkeith), Glasgow and Liverpool. She had long been a regular contributor to *Blackwood's* and had written some novels when she married, in 1852, her cousin, Frank Wilson Oliphant. They settled at Harrington Square, in London. Her husband was an artist, principally in stained glass. Two of their children died in infancy, while the father himself developed alarming symptoms of consumption. They moved in Jan. 1859 to Florence, and thence to Rome, where Frank Oliphant died. His wife, left almost entirely without resources, returned to England and worked with amazing industry to maintain her children. She experienced heavy bereavement, losing all three children. After the death of the third, in 1894, her own health declined, and she died at Wimbledon on June 25, 1897. Her *Autobiography* gives a touching picture of her domestic life.

Mrs. Oliphant was one of the most popular writers of her time. She wrote more than 120 books. Among the best known are the novels *Adam Graeme* (1852), *Miss Marjoribanks* (1866) and the short stories collected in the *Chronicles of Earlingford*.

OLIPHANT or **OLIFANT,** the large signal horn of the middle ages, made, as its name indicates, from the tusk of an elephant. The oliphant was the instrument of knights and men of high degree, and its loss in battle was considered as shameful as the loss of sword or banner.



FROM HIPKIN, "MUSICAL INSTRUMENTS, HISTORIC, RARE AND UNIQUE"

EARLY 16TH CENTURY OLIPHANT

A large signal horn bearing the arms of Ferdinand and Isabella

OLIVA, FERNAN PEREZ DE: *see* PEREZ DE OLIVA, HERNAN.

OLIVARES, GASPAR DE GUZMAN, count of Olivares and duke of San Lucar (1587–1645), Spanish royal favourite and minister, born at Rome, Jan. 6, 1587. He kept his inherited title of count in combination with the new honour of duke granted him by Philip IV.: hence he was commonly spoken of as *el conde-duque*. During the life of Philip III. he was appointed to a post in the household of the heir-apparent, and obtained such influence over the young prince that Philip IV. on his accession ordered that all papers requiring the royal signature should first be sent to the count-duke. For 22 years Olivares directed the policy of Spain. It was a period of disaster abroad and of rebellion at home. The Spaniards too thoroughly monarchical to blame the king, held his favourite responsible for the country's misfortunes, and the count-duke became the accepted model of a grasping and incapable favourite, but under the inspiration of Canovas, there was a certain reaction in his favour.

It would be unjust to blame Olivares alone for the decadence of Spain. The gross errors of his policy—the renewal of the war with Holland in 1621, the persistence of Spain in taking part in the Thirty Years' War, the lesser wars undertaken in Sicily, and the entire neglect to promote the unification of the different states forming the peninsular kingdom—were shared by him with the king, the Church and the commercial classes. His fall was immediately due to the revolts of Portugal and Catalonia in 1640. The king parted with him reluctantly and only under the pressure of a strong court intrigue headed by Queen Isabella. Driven from office in 1643, Olivares, by the king's order retired to Toro, where he composed the apology *El Nicandro*, written, some say, by an agent, but undeniably inspired by the fallen minister. The *Nicandro* was denounced to the Inquisition, and it is not impossible that Olivares might have ended in the prisons of the Holy Office, if he had not died on July 22, 1645.

See A. Canovas, *Estudios del reinado de Felipe IV.* (Madrid, 1889); F. Silvela, introduction to the *Cartas de Sor Maria de Agreda y del rey Felipe IV.* (Madrid, 1885–86).

OLIVE (*Olea europaea*), the plant that yields the olive oil of commerce, belonging to a section of the family Oleaceae, of which it has been taken as the type. The genus *Olea* includes about 35 species, very widely scattered, chiefly over the Old World, from the Mediterranean basin to South Africa and New Zealand. The wild olive is a small tree or bush of rather straggling growth, with thorny branches and opposite oblong pointed leaves, dark greyish-green above and, in the young state, hoary beneath with whitish scales; the small white flowers, with four-cleft calyx and corolla, two stamens and bifid stigma, are borne on the last year's wood, in racemes springing from the axils of the leaves; the drupaceous fruit is small in the wild plant, and the fleshy pericarp, which gives the cultivated olive its economic value, is hard and comparatively thin. In the cultivated forms (*O. europaea* var. *Sativa.*) the tree acquires a more compact habit, the branches lose their spinous character, while the young shoots become more or less angular; the leaves are always hoary on the under-side, and are generally lanceolate in shape. The fruit is usually oval or nearly globular, in some sorts it is egg-shaped, in others much elongated; while the dark hue that it commonly assumes when ripe is exchanged in many varieties for violet, green or almost white. At present the wild olive is found in most countries around the Mediterranean, extending its range on the west to Portugal, and eastward to the vicinity of the Caspian, while, locally, it occurs even in Afghanistan. An undoubted native of Syria and the maritime parts of Asia Minor, its abundance in Greece, and the frequent allusions to it by the earliest poets, seem to indicate that it was there also indigenous. It shows a marked preference for calcareous soils and the proximity of the sea.

The varieties of olive known to the modern cultivator are extremely numerous—according to some authorities equalling or exceeding in number those of the vine. In France and Italy at least 30 kinds have been enumerated, but comparatively few are grown to any large extent. The olive tree, even when free increase is unchecked by pruning, is of very slow growth; but, where allowed for ages its natural development, the trunk sometimes attains a considerable diameter. De Candolle records one exceeding 23 ft. in girth, its age being estimated at 700 years. The tree in cultivation rarely exceeds 30 ft. in height, and in France and Italy is generally kept much smaller by frequent pruning. The wood, of a yellow or light greenish-brown hue, is often finely veined with a darker tint, and, being very hard and close grained,

is valued by the cabinetmaker and turner.

Propagation and Cultivation.—The olive is propagated in various ways, but cuttings or layers are generally preferred; the tree roots in favourable soil almost as easily as the willow, and throws up suckers from the stump when cut down. Branches of various thickness are cut into lengths of several feet each, and, planted rather deeply in manured ground, soon vegetate; shorter pieces are sometimes laid horizontally in shallow trenches, when, covered with a few inches of soil, they rapidly throw up sucker-like shoots. In Greece and the islands grafting the cultivated tree on the wild form is common. In Italy embryonic buds, which form small swellings on the stems, are carefully excised and planted beneath the surface, where they grow readily, these "uovoli" soon forming a vigorous shoot. Occasionally the larger boughs are inarched, and young trees thus soon obtained; the olive is also sometimes raised from seed. Where carefully cultivated, the olive is planted in rows at regular intervals, the distance between the trees varying in different "olivettes," according to the variety grown. Careful pruning is practised, the object being to preserve the flower-bearing shoots of the preceding year, while keeping the head of the tree low, so as to allow the easy gathering of the fruit; a dome or rounded form is generally the aim of the pruner. The fruit when ripe is preferably picked by hand and deposited in cloths or baskets for conveyance to the mill where the oil is expressed; but in many parts of Spain and Greece, and generally in Asia, the olives are beaten down by poles or by shaking the boughs, or even allowed to drop naturally, often lying on the ground until the convenience of the owner admits of their removal; much of the inferior oil owes its bad quality to the carelessness of the proprietor of the trees. The amount of oil contained in the fruit differs much in the various sorts; the pericarp usually yields from 60 to 70%. A calcareous soil, however dry or poor, seems best adapted to its healthy development, though the tree will grow in any light soil, and even on clay if well drained; but, as remarked by Pliny, the plant is more liable to disease on rich soils, and the oil is inferior to the produce of the poorer and more rocky ground the species naturally affects.



OLIVE (OLEA EUROPA)

The unripe fruit of the olive is largely used in modern as in ancient times as dessert, to enhance the flavour of wine, and to renew the sensitiveness of the palate for other viands. For this purpose the fruit is picked while green, soaked for a few hours in an alkaline lye washed well in clean water and then placed in bottles or jars filled with brine.

In England the olive is not hardy, though in the southern counties, it will stand ordinary winters with only the protection of a wall, and will bear fruit in such situations.

The genus *Olea* includes several other species of some economic importance. *O. paniculata* is a larger tree, attaining a height of 50 or 60 ft. in the forests of Queensland, and yielding a hard and tough timber. The yet harder wood of *O. laurifolia*, an inhabitant of Natal, is the black ironwood of the South African colonist.

Distribution.—At what remote period of human progress the wild olive became the fruitful garden olive it is impossible to conjecture. The frequent reference in the Bible to the plant and its produce, its implied abundance in the land of Canaan, the important place it has always held in Syria, lead us to consider that country the birthplace of the cultivated olive. An improved variety, possessed at first by some small Semitic sect, it was probably slowly distributed to adjacent tribes; and, yielding profusely, with little labour, a valuable oil, the gift of the fruitful tree became in that primitive age a symbol of peace and goodwill among the warlike barbarians. At a later period, with the development of maritime enterprise, the oil was conveyed, as an article of trade, to the neighbouring Pelasgic and Ionian nations, and the plant, doubtless, soon followed. In the Homeric world as depicted in the *Iliad*, olive oil is known only as a luxury of the wealthy, an exotic product prized chiefly for its value in the heroic toilet, but there is no mention of the cultivation of the tree. Whenever it may have been introduced, tradition points to the limestone hills of Attica as the seat of its first cultivation on the Greek peninsula. By the time of Solon the olive had so spread that he found it necessary to enact laws to regulate the cultivation of the tree in Attica, from which country it was probably distributed gradually to all the Athenian allies and tributary states. To the Ionian coast, where it abounded in the time of Thales, it may have been in an earlier age brought by Phoenician vessels; the olives of Rhodes and Crete had perhaps a similar origin. Samos, if we may judge from the epithet of Aeschylus (ἐλαιόφυτος), must have had the fruitful plant long before the Persian wars.

It is not unlikely that the olive was taken to Magna Graecia by the first Achaean colonists, and the assertion of Pliny (quoted from Fenestella), that no olives existed in Italy in the reign of Tarquinius Priscus, must be received with caution. In Latin Italy the cultivation seems to have spread slowly, for it was not until the consulship of Pompey that the production of oil became sufficient to permit of its exportation. In Pliny's time it was already grown abundantly in the two Gallic provinces and in Spain; indeed, in the earlier days of Strabo the Ligurians supplied the Alpine barbarians with oil, in exchange for the wild produce of their mountains. Africa was indebted for the olive mainly to Semitic agencies. Along the southern shore of the Mediterranean the tree was carried by the Phoenicians, at a remote period, to their numerous colonies in Africa. The tree was most likely introduced into southern Spain, and perhaps into Sardinia and the Balearic Islands, by Phoenician merchants.

Yielding a substitute for the butter and animal fats consumed by the races of the north, the olive, among the southern nations of antiquity, became an emblem not only of peace but of national wealth and domestic plenty; the branches borne in the Panathenaea, the wild olive spray of the Olympic victor, the olive crown of the Roman conqueror at ovation, and those of the equites at their imperial review alike typified gifts of peace that, in a barbarous age, could be secured by victory alone. Among the Greeks the oil was valued as an important article of diet, as well as for its external use. The Roman people employed it largely in food and cookery—the wealthy as an indispensable adjunct to the toilet; and in the luxurious days of the later empire it became a favourite axiom that long and pleasant life depended on two fluids, "wine within and oil without." Pliny vaguely describes 15 varieties of olive cultivated in his day. The *gourmet* of the empire valued the unripe fruit, steeped in brine, no less than his modern representative; and pickled olives have been found among the buried stores of Pompeii.

In modern times the olive has been spread widely over the world; and, though the Mediterranean lands that were its ancient home still yield the chief supply of the oil, the tree is now cultivated successfully in many regions unknown to its early distributors. Soon after the discovery of the American continent it was conveyed thither by the Spanish settlers. In Chile it flourishes as luxuriantly as in its native land, the trunk sometimes becoming of large girth, while oil of fair quality is yielded by the fruit; to Peru it was carried at a later date. Introduced into Mexico by the Jesuit missionaries of the 17th century, it was planted by similar agency in California, where it is now an important crop. Its cultivation is also carried on in the south-eastern states, especially in South Carolina, Florida and Mississippi. In the eastern hemisphere the olive has been established in many inland districts which would have been anciently considered ill-

adapted for its culture. To Armenia and Persia it was known at a comparatively early period of history, and many olive-yards now exist in upper Egypt. The tree has been introduced into Chinese agriculture, and has become an important addition to the resources of the Australian planter. In Queensland the olive has found a climate specially suited to its wants; in South Australia, near Adelaide, it also grows vigorously; it has likewise been successfully introduced into parts of Cape Colony.

OLIVEIRA MARTINS, JOAQUIM PEDRO DE (1845–1894), Portuguese writer, was born in Lisbon, and in 1870 was appointed manager of the mine of St. Eufemia near Cordova. In Spain he wrote *O Socialismo*, and developed that sympathy for the industrial classes of which he gave proof throughout his life. Returning to Portugal in 1874, he became administrator of the railway from Oporto to Povoa, residing in Oporto. He entered parliament in 1886, became minister of finance on Jan. 17, 1892, and later vice-president of the Junta do Credito Publico. He died on Aug. 24, 1894. A psychologist, a profound sociologist, a stern moralist and an ardent patriot, Oliveira Martins deserved his European reputation. His *Bibliotheca das sciencias sociaes*, a veritable encyclopaedia, comprises literary criticism, socialism, economics, anthropology, histories of Iberian civilization, of the Roman Republic, Portugal and Brazil. Towards the end of his life he specialized in the 15th century and produced two notable volumes, *Os fithos de D. João I.* (1891) and *A vida de Nun' Alvares* (1893), leaving unfinished *O principe perfeito* (1896), a study on King John II., which was edited by his friend Henrique de Barros Gomes. The chief characteristics of the man—psychological imagination combined with realism and a gentle irony—make his strength as a historian and his charm as a writer. He drew admirable portraits; in his *Historia de Portugal* and *Portugal Contemporaneo* (1881) those of King Pedro I. and Herculano are among the best known.

See Moniz Barreto, *Oliveira Martins, estudo de psychologia* (Paris, 1887), a remarkable study; F. Diniz D'Ayalla, *Os Ideaes de Oliveira Martins* (1897), which contains an admirable statement of his ideas, philosophical and otherwise; Anthero de Quental, *Oliveira Martins* (1894) and *Diccionario bibliographico portuguez*, xii. 125.

OLIVENITE, a mineral consisting of basic copper arsenate with the formula $Cu_2(OH)AsO_4$. It crystallizes in the orthorhombic system, and is sometimes found in small brilliant crystals of simple prismatic habit terminated by domal faces. More usually, however, it occurs as globular aggregates of acicular crystals, these fibrous forms often having a velvety lustre. A characteristic feature, and one to which the name alludes, is the olive-green colour, which varies in shade from blackish-green in the crystals to almost white in the variety known as "wood-copper."

OLIVE OIL. An oil expressed from the fleshy part (pericarp) of the fruit of the olive tree, which is chiefly cultivated in the countries bordering on the Mediterranean, and recently with some success in California, South Africa and Australia. The ripe fruit contains from 20 to 60% of oil, depending on climatic conditions and on the care exercised in cultivation. Californian and North African olives usually contain less oil than those grown in France or Italy.

The fruit intended for oil production should be gathered just before it is fully ripe. The finest quality oil, termed "virgin oil," is prepared by peeling the hand-picked fruit and gently pressing the pulp after removal of the kernel; this oil is not exported. The apparatus used in expressing the oil from the pulp varies from the most primitive form of press, consisting of two boards weighted with stones, to the most modern types of hydraulic presses (*see* COCONUT OIL; also COPRA). In order to obtain the best quality edible oil it is essential that the oil be removed from contact with the putrescible marc (pulp) as soon as possible, particularly if the fruit was bruised; otherwise rancidity sets in with consequent formation of free fatty acids. In practice the pulp is pressed twice, yielding first and second grade edible oils; it is then mixed with hot water and subjected to further pressure, yielding technical oils. The press residues are ground up with hot water and run into settling tanks; the oil which rises to the top, termed "huile de ressence," is skimmed off. A still lower quality oil, "sulphur olive oil," is obtained by extracting the residue with a volatile solvent, usually carbon disulphide.

The product known as "Tournant oil" is obtained by allowing the expressed marc to ferment, whereby the cells are ruptured and more oil is liberated. As this oil contains a large amount of free fatty acids it forms a stable emulsion with sodium carbonate which is used as a Turkey-red oil.

Olive oil for edible purposes, which should be practically devoid of free fatty acids, varies in colour from water-white to golden yellow, and possesses a smooth bland taste, varying with the district in which the olive is grown and also the degree of ripeness of the fruit. In general the oils from North Africa and Greece have a harsher taste than those from Provence and Tuscany. Olive oils intended for use in cold climates should remain limpid at 10° C, and are prepared by cooling the oil to below that temperature and settling-out the deposited "stearine." Olive oil is extensively adulterated, chiefly with tea-seed, arachis and sesame oils. The bulk of the oil produced is used for comestible purposes (preserving sardines, etc.); it is also used for oiling wool and for the manufacture of high-class toilet and textile soaps (*q.v.*), known as Castile soap. The production of oil in the principal olive growing countries for 1926 is given below:—

Country	Tons
Spain	228,000
Italy	200,000
Greece	103,000
Tunis	39,000
Portugal	15,700
Syria	13,700
Algeria	10,800
France	7,800
	618,000

See also OILS.

See J. Lewkowitsch, *Oils, Fats and Waxes* (1922).

(E. L.; G. H. W.)

OLIVER, ISAAC (*c.* 1566–1617), English miniature painter, was probably born in London, as in 1571 a certain Peter Olivier of Rouen was residing in London with his wife and one "chylde" named "Isake." He died in 1617 and lies buried in the church of St. Anne, Blackfriars. He was probably a pupil of Nicholas Hilliard, and connected through his wife, whose name is unknown, with the artists Gheeraerts and De Critz. Examples of his work are at Montagu House, Windsor Castle, Sherborne Castle and in the collections of Mr. J. Pierpont Morgan and the late Baroness Burdett-Coutts, also in the British Museum.

His eldest son, PETER OLIVER (1594–1648), also became a miniature painter and achieved greater fame than his father. He lived at Isleworth and on his death in 1648 was buried beside his father at St. Anne's, Blackfriars. Several of his works were bought from his widow by Charles II. and some of his water-colour copies from old masters are still in Windsor Castle. His most important work is the group of the three grandsons of the 1st Viscount Montacute with their servant, belonging to the marquess of Exeter. His miniatures are found in the private collection of the Queen of Holland and in English collections.

OLIVES, MOUNT OF, the ridge, 2,680ft. above sea-level, facing the Temple mount at Jerusalem on the east and separated from it by the vale of Kidron: Arabic, *Jebel et-Tôr*. Of the four distinct elevations on the ridge the southernmost is the scene of Solomon's idolatrous worship. The mount is referred to four times only in the Old Testament. Jesus crossed it on his entry into Jerusalem. The Ascension took place "over against Bethany" (Lk. xxiv.–50), probably in one of the secluded ravines of the eastern slope. The tradition that the Ascension was from the central eminence of the hill dates from Eusebius Caesarea, and over a sacred cave in that place there has been built a succession of sanctuaries. The chapel at present on the site was built by the crusaders and modified by the Muslims, its present holders, who erected beside the entrance to the *harâm* a minaret. Close by is the grotto of St. Pelagia (d. 457) and a short way down the hill the rock-cut cave with columbaria called the "Tomb of the Prophets." A tradition of the middle ages identified Olivet with

the Mount of Transfiguration. At its foot was the Garden of Gethsemane (*q.v.*).

At the present day there stands on Mt. Scopus, a continuation of the Mt. of Olives, the new Hebrew university opened by Lord Balfour in 1925. The German hospice, opened in 1910, is now used by the British administration in Palestine as Government house. The earthquake of July 11, 1927, was particularly severe in the area of the mount. (E. Ro.)

OLIVETANS, one of the lesser monastic orders following the Benedictine Rule, founded by St. Bernard Tolomei, a Sienese nobleman. At the age of forty, when the leading man in Siena, he retired along with two companions to live a hermit's life at Accona, a desert place fifteen miles to the south of Siena, 1313. Soon others joined them, and in 1324 John XXII. approved of the formation of an order, the Benedictine Rule being taken as the basis of the life. Partly from the olive trees that abound there, and partly out of devotion to the Passion, Accona was christened Monte Oliveto, whence the order received its name. By the end of the 14th century, there were upwards of a hundred monasteries, chiefly in Italy; and in the 18th there still were eighty, one of the most famous being San Miniato at Florence. The Olivetans have a house in Rome and in a few other cities.

OLIVIER OF RAMSDEN, SYDNEY OLIVIER, 1ST BARON, cr. 1924 (1859–), English statesman and writer, was educated at Towbridge at Corpus Christi college, Oxford. He entered the colonial office in 1882 and held a series of important posts, being governor of Jamaica from 1907 to 1913. After his return from Jamaica he was permanent secretary of the board of agriculture (1913–17), and assistant comptroller of the exchequer (1917–20). In 1924 Olivier received a barony, and took office in the Labour Government as Secretary for India. He is a well known writer on colonial questions.

OLIVINE, a rock-forming mineral composed of magnesium and ferrous orthosilicate, the formula being $(Mg,Fe)_2SiO_4$. The name alludes to its olive-green colour and is often applied incorrectly by jewellers to various green stones. The transparent varieties, or "precious olivine" used in jewellery, are known as chrysolite (*q.v.*) and peridot.

Olivine crystallizes in the orthorhombic system, but distinctly developed crystals are comparatively rare, the mineral more often occurring as compact or granular masses or as grains and blebs embedded in the igneous rocks of which it forms a constituent part. The hardness is 6½; the sp. gr. 3·27–3·37, but reaching 3·57 in the highly ferruginous variety known as hyalosiderite. The amount of ferrous oxide varies from 5% (about 9% in the gem varieties) to 30% in hyalosiderite. The depth of the green, or yellowish-brown colour, also varies with the amount of iron. The lustre is vitreous. The indices of refraction (1·66 and 1·70) and the double refraction are higher than in many other rock-forming minerals; and these characters, together with the indistinct cleavage, enable it to be readily distinguished in thin rock-sections under the microscope. The mineral is decomposed by hot hydrochloric acid with separation of gelatinous silica; it often contains small amounts of nickel and titanium dioxide; the latter replaces silica, and in the variety known as titan-olivine reaches 5%.

Olivine is a common constituent of many basic and ultrabasic rocks, such as basalt, dolerite, gabbro and peridotite; and the dunite, of Dun mountain near Nelson in New Zealand, is an almost pure olivine-rock. It also occurs as an accessory constituent of some granular dolomitic limestones and crystalline schists. With enstatite it forms the bulk of the material of meteoric stones; and in another type of meteorites large blebs of glassy olivine fill spaces in a cellular mass of metallic iron.

Olivine is especially liable to alteration into serpentine (hydrated magnesium silicate); the alteration proceeds from the outside of the crystals and grains or along irregular cracks in their interior, and gives rise to the separation of iron oxides and an irregular net-work of fibrous serpentine, which in rock-sections presents a very characteristic appearance. Large greenish-yellow crystals from Snarum in Buskerud, Norway, at one time thought to be crystals of serpentine, really consist of serpentine pseudomorphous after olivine. Many of the large rock-masses of serpentine have been derived by the serpentinization of olivine-rocks. Olivine also sometimes alters, especially in crystalline schists, to a fibrous, colourless amphibole, to which the name pilite has been given. By weathering processes it alters to limonite and silica.

Closely related to olivine are several other species, which are included together in the olivine group: they have the orthosilicate formula R''_2SiO_4, where R″ represents calcium, magnesium, iron, manganese and rarely zinc; they all crystallize in the orthorhombic system, and are isomorphous with olivine. These include: monticellite, $CaMgSiO_4$, a rare mineral occurring as yellowish-grey crystals and grains in granular limestone at Monte Somma, Vesuvius; Forsterite, Mg_2SiO_4, as colourless or yellowish grains embedded in many crystalline limestones; Fayalite, Fe_2SiO_4, or iron-olivine, a dark brown or black variety occurring as nodules in volcanic rock; Tephroite, Mn_2SiO_4, a grey (τεφρὸς, ash-coloured), mineral occurring in Sweden and New Jersey. (L. J. S.)

OLLIVIER, OLIVIER ÉMILE (1825–1913), French statesman, was born at Marseilles on July 2, 1825. On the establishment of the Second Republic his father, DEMOSTHENES OLLIVIER (1799–1844), secured for him the position of commissary-general of the department of Bouches-du-Rhône. His repression of a socialist outbreak at Marseilles commended him to General Cavaignac, who made him prefect of the department. His removal to the prefecture of Chaumont (Haute-Marne) he ascribed to his father's enemies. He therefore resigned from the civil service to take up practice at the bar.

He re-entered political life in 1857 as deputy for the 3rd circumscription of the Seine. His candidature had been supported by the *Siècle*, and he joined the constitutional opposition. With Alfred Darimon, Jules Favre, J. L. Hénon and Ernest Picard he formed the group known as *Les Cinq*, which wrung from Napoleon III. some concessions in the direction of constitutional government. The imperial decree of Nov. 24, permitting the insertion of parliamentary reports in the *Moniteur*, and an address from the Corps Législatif in reply to the speech from the throne, were welcomed by him as a first instalment of reform. This acquiescence marked a considerable change of attitude, for only a year previously a violent attack on the imperial government, in the course of a defence of Étienne Vacherot, brought to trial for the publication of *La Démocratie*, had resulted in his suspension from the bar for three months. He gradually separated from his old associates, who grouped themselves around Jules Favre, and during the session of 1866–1867 Ollivier helped to form a third party, which definitely supported the principle of a Liberal Empire. This led to a struggle of personal rivalry between Ollivier and Rouher, the minister of state, who attempted, by the issue of his *Senatus-consulte* (July 1866), to uphold the constitution of 1852. On Jan. 19, 1867, an imperial decree was issued, restoring the right of interpellation to the deputies. A promise was also inserted in the *Moniteur* of a relaxation of the stringency of the press laws and of concessions in respect of the right of public meeting. On June 28, 1869, the third party, which consisted of 116 members, with the support of the Left, obtained a majority in the chamber for their demand for a responsible ministry "and the right of the Legislative Body to regulate the essential conditions of its own activity." The emperor prorogued the legislative body on July 13, and on the same day appointed Rouher president of the Senate. The *sénatus-consulte* of Sept. 8, 1869, gave the two chambers the ordinary parliamentary rights. On Nov. 29 the chambers again met and on Dec. 28 the emperor was obliged to give in to the Third party's demands. He dismissed Rouher and entrusted Ollivier with the formation of a responsible ministry of which Ollivier was really premier, although that office was not nominally recognized by the constitution. The new cabinet, known as the ministry of the 2nd of January, had a hard task before it, complicated a week after its formation by the hostile manifestation following the shooting of Victor Noir by Prince Pierre Bonaparte. Ollivier immediately summoned the high court of justice for the judgment of Prince Bonaparte and Prince Joachim Murat. His ministry included 4 members of the Right Centre and 4 of the Left Centre. In March his position obliged him to propose a revision of the Constitution, and on April 20, a *sénatus-consulte*

was issued which accomplished the transformation of the Empire into a constitutional monarchy. Ollivier, however, still had to face violent opposition from the Republicans and Socialists. He had arrested Rochefort on Feb. 9 for his presence at the funeral of Victor Noir, and he arrested also the editors of the *Marseillèien.* Neither concessions nor firmness sufficed to appease the "Irreconcilables" of the opposition, who since the relaxation of the press laws were able to influence the electorate. On May 8, however, the amended constitution was submitted to a plebiscite, which resulted in a vote of nearly seven to one in favour of the government. The most distinguished members of the Left in his cabinet—L. J. Buffet, Napoléon Daru and Talhouët Roy—resigned in April on the question of the plebiscite. Ollivier himself held the ministry of foreign affairs for a few weeks, until Daru was replaced by the duc de Gramont.

The revival of the candidature of Prince Leopold of Hohenzollern-Sigmaringen for the throne of Spain early in 1870 disconcerted Ollivier's plans. The French government, following Gramont's advice, instructed Benedetti to demand from the king of Prussia a formal disavowal of the Hohenzollern candidature. Ollivier allowed himself to be gained by the war party. The story of Benedetti's reception at Ems and of Bismarck's manipulation of the Ems telegram is told elsewhere. (*See* BISMARCK.) It is unlikely that Ollivier could have prevented the eventual outbreak of war, but he might perhaps have postponed it at that time, if he had taken time to hear Benedetti's account of the incident. He was outmanoeuvred by Bismarck, and on July 15 he made a hasty declaration in the Chamber that the Prussian government had issued to the powers a note announcing the rebuff received by Benedetti. He obtained a war vote of 500,000,000 francs, and used the fatal words that he accepted the responsibility of the war "with a light heart," saying that the war had been forced on France. On Aug. 9, with the news of the first disaster, the Ollivier cabinet was driven from office, and its chief sought refuge in Italy. He returned to France in 1873, and occupied himself with writing the apology for his government, *L'Empire libéral* (1895 *seq.*). His first wife, Blandine Liszt, was the daughter of the Abbé Liszt by Mme. d'Agoult (Daniel Stern). She died in 1862, and Ollivier married in 1869 Mlle. Gravier. He died at St. Gervais-les-Bains on Aug. 30, 1913.

His other works include *Démocratie et liberté* (1867), *Le Ministère du 2 janvier, mes discours* (1875), *Principes et conduite* (1875), *L'Église et l'État au concile du Vatican* (2 vols., 1879), *Solutions politiques et sociales* (1893), *Nouveau Manuel du droit ecclésiastique français* (1885).

See M. T. Ollivier, *Emile Ollivier; sa jeunesse d'apres son journal et sa correspondance* (1918).

OLMEDO, JOSÉ JOAQUÍN DE (1780–1847), Ecuadorian poet and politician, was born in Guayaquil on March 20, 1780. Sent to Europe in 1825 as Peruvian diplomatic representative, he returned in 1828 and in 1830 was elected vice president of the recently created (1830) independent republic of Ecuador, but declined the honour. In 1845 he headed a successful revolt and, having been chosen first member of the provisional government, was a candidate for the presidency, but was not elected. He died in Guayaquil on Feb. 19, 1847. A neo-classicist, Olmedo has been called by a distinguished Spanish critic "one of the three or four great Spanish-American poets, if not the first." He is best known for his ode *La Victoria de Junín, Canto a Bolívar* (1825), commemorating the final overthrow of Spain in America, and the ode *Al General Flores, Vencedor en Miñarica* (1835), written after the defeat of a revolt against the government.

See M. L. Amunátegui, *Juicio crítico de algunos poetas hispano-americanos* (Santiago de Chile, 1861); P. Herrera, *Apuntes biográficos de Don José Joaquín Olmedo* (Quito, 1887); J. L. Mera, *Ojeada histórico-crítico sobre la poesía ecuatoriana* (2nd ed. Barcelona, 1893); J. J. Olmedo, *Poesías* (ed. by C. Ballén, Paris, 1896); V. M. Rendón, *Olmedo* (Paris, 1904); E. Piñeyró, *Biografías americanas* (Paris, 1907); A. Coester, *The Literary History of Spanish-America* (New York, 1916); E. C. Hills, ed., *The Odes of Bello, Olmedo and Heredia* (New York, 1920). The *Enciclopedia Universal Ilustrada* (Barcelona, 1919), has a full bibliography. (W. B. P.)

OLMSTED, FREDERICK LAW (1822–1903), American landscape architect, was born in Hartford (Conn.), on April 27, 1822. He already had an adventurous career when he published his *Journeys and Explorations in the Cotton Kingdom* (1861), which gave a picture of the conditions surrounding American slavery that had great influence on British opinion, and was much quoted in the controversies at the time of the Civil War. During the war he was the untiring secretary of the U.S. sanitary commission.

When Central Park, New York city, was projected, he, in conjunction with Vaux, proposed the plan which, in competition with more than 30 others, won first prize. Olmsted was made superintendent to carry out the plan. This was practically the first attempt in the United States to apply art to the improvement or embellishment of nature in a public park; it attracted great attention, and the work was so satisfactorily done that he was engaged thereafter in most of the important works of a similar nature in America—Prospect park, Brooklyn; Fairmount park, Philadelphia; South park, Chicago; Riverside and Morningside parks, New York; Mount Royal park, Montreal; the grounds surrounding the Capitol at Washington, and at Leland Stanford University at Palo Alto (Calif.), and many others. He developed the bare stretch of lake front at Chicago into the World's Fair grounds, contributing much to the architectural beauty and the success of the exposition. He was greatly interested in the Niagara reservation, made the plans for the park there, and also did much to influence the State of New York to provide the Niagara park.

He was the first commissioner of the national park of the Yosemite and the Mariposa grove, directing the survey and taking charge of the property for the State of California. He also held directing appointments under the cities of New York, Boston, Philadelphia, Baltimore, Wilmington and San Francisco, the joint committee on buildings and grounds of Congress, the Niagara Falls Reservation commission, the trustees of Harvard, Yale, Amherst and other colleges and public institutions. After 1886 he was largely occupied in laying out an extensive system of parks and parkways for the city of Boston and the town of Brookline, and on a scheme of landscape improvement of Boston harbour. He died on August 28, 1903.

OLMÜTZ: *see* OLOMOUC.

OLNEY, RICHARD (1835–1917), American statesman, was born at Oxford, Mass., on Sept. 15, 1835. He graduated at Brown university in 1856, and at the law school of Harvard university in 1858. In 1859 he began the practice of law at Boston, Mass., and attained a high position at the bar. He served in the State House of Representatives in 1874, and in March 1893 became attorney-general of the United States in the cabinet of President Cleveland. In this position, during the strike of the railway employees in Chicago in 1894, he instructed the district attorneys to secure from the Federal courts writs of injunction restraining the strikers from acts of violence, and thus set a precedent for "government by injunction." He also advised the use of Federal troops to quell the disturbances in the city, on the ground that the Government must prevent interference with its mails and with the general railway transportation between the States. Upon the death of Secretary W. Q. Gresham (1832–95), Olney succeeded him as secretary of State on June 10, 1895. He became specially prominent in the controversy with Great Britain concerning the boundary dispute between the British and Venezuelan Governments (*see* VENEZUELA), and in his correspondence with Lord Salisbury gave an extended interpretation to the Monroe Doctrine which went considerably beyond previous statements on the subject. In 1897, at the expiration of President Cleveland's term, he returned to the practice of the law. He died in Boston, Mass., on April 8, 1917.

OLNEY, a market town of Buckinghamshire, England, on the Ouse, 59 m. N.W. by N. of London on the L.M.S. railway. Pop. (1921) 2,651. The church of St. Peter and St. Paul is Decorated. William Cowper lived here from 1767 until 1786. John Newton, curate of Olney, had the assistance of Cowper in the production of the Olney hymns. The trade of Olney is principally agricultural; the town also manufactures boots and shoes.

OLNEY, a city of Young county, Texas, U.S.A., 90 m. N.W. of Fort Worth, on the Gulf, Texas and Western and the Wichita Falls and Southern railways. The population was 1,164 in 1920,

and was estimated locally at 6,000 in 1928. A great shallow oil field was discovered here in 1923, and by 1928 there were 3,300 producing wells within a radius of 15 m.

OLOMOUC, a town in Moravia, Czechoslovakia, at the confluence of the Bystrice and the Morava. Pop. (1921) 57,206, of which 15,818 are Germans. Being near the head of a fertile gulf, floored with sandy loam and loess, and having a sheltered climate, it is important as a market for cereals and cattle and such prepared materials as malt, meal, beer, spirits, starch and sugar.

Until 1640 Olomouc was the recognized capital of Moravia. Originally fortified by Maria Theresa it was, until 1886, one of the strongest fortresses in Central Europe and withstood a seven-weeks' attack of Frederick the Great in 1758, but the site of the fortification is now occupied by park, gardens and promenade. Notable buildings are the 14th century cathedral in Gothic style, with a 328 ft. tower, the 15th century Mauritius church, also Gothic, and the 15th century town-hall and museum. Olomouc was made the see of a bishop in 1073 and in 1777 was raised to the rank of an archbishopric.

OLONA (*Touchardia latifolia*), a shrub of the nettle family (Urticaceae), native to the Hawaiian islands, where it has long been cultivated as a fibre plant. The bast fibre obtained from the young shoots possesses remarkable tensile strength, being three times as strong as that of the finest grades of manila hemp (*q.v.*). Because of its great pliability olona fibre is readily woven into cloth or made into cordage. Another valuable quality is its unusual durability in water, making it especially suitable for fish nets.

OLONETS, a former government of north-western Russia (*see* KARELIA).

OLORON-SAINTE-MARIE, a town of south-western France, capital of an arrondissement in the department of Basses-Pyrénées, 21 m. S.W. of Pau on a branch of the Southern railway. Pop. (1926) 7,884. It lies at the confluence of the mountain torrents (locally known as *gaves*) Aspe and Ossau, which, after dividing it into three parts, unite to form the Oloron, a tributary of the Pau. A Celtiberian and then a Gallo-Roman town, known as *Iluro*, occupied the hill on which the old feudal town of Sainte-Croix now stands, still surrounded by remnants of its 14th century ramparts, between the two rivers; Sainte-Marie lies on the left bank of the Aspe, and the new town on the right bank of the Ossau. Oloron is the seat of a sub-prefect. The town carries on a thriving trade with Spain by way of the passes of Somport and Anso, chiefly in wool and skins, salt pork and hams, cattle and horses.

OLTEN (1,312 ft.), a town in the canton of Solothurn, Switzerland, at the south foot of the Jura. An important railway centre at the junction of the railways Basle-Luzern (Lucerne), Berne-Zürich and Solothurn-Zürich. Pop. 12,600.

OLUSTEE, a village of Baker county, Fla., U.S.A., in the precinct of Olustee, about 46 m. W. by S. of Jacksonville. Pop. of the precinct (1925) 903. The village is served by the Seaboard Air Line railway. The battle of Olustee, or Ocean Pond (the name of a small body of water in the vicinity), one of the most sanguinary engagements of the Civil War in proportion to the numbers engaged, was fought on Feb. 20, 1864, about 2 m. east of Olustee, between about 5,500 Federal troops, under Gen. Truman Seymour (1824–91), and about 5,400 Confederates, under Gen. Joseph Finegan, the Federal forces being decisively defeated, with a loss, in killed and wounded, of about one-third of their number, including several officers. The Confederate losses, in killed and wounded, were about 940.

OLYBRIUS, Roman emperor of the West from July 11, to Oct. 23, 472, was a member of a noble family and a native of Rome. After the sack of the city by Genseric in 455, he fled to Constantinople, where, about 464, he married Placidia, daughter of Valentinian III. This afforded Geiseric the opportunity of claiming the empire of the West for Olybrius. In 472 Olybrius was sent to Italy by the emperor Leo to assist the emperor Anthemius against his son-in-law Ricimer, but, having entered into negotiations with the latter, was himself proclaimed emperor and on the murder of his rival ascended the throne unopposed.

See Gibbon, *Decline and Fall*, ch. xxxvi.; J. B. Bury, *Later Roman Empire*.

OLYMPIA, the scene of the Olympic games, is in western Peloponnese on the N. bank of the Alpheus (mod. Ruphia), about 11 m. E. of modern Pyrgos, where the ancient Cladeus tributary flows in from the north. Olympia is bounded on the W. by the Cladeus, on the S. by the Alpheus, on the E. by the ancient racecourses and on the N. by low heights. Here a conical hill, about 400 ft. high, cut off from the rest by a cleft, descends abruptly on Olympia. This is the *Cronion* hill sacred to Cronus.

HISTORY

The importance of Olympia in the history of Greece is religious and political. Religious associations date from the prehistoric age, when a centre of worship is attested by house-remains and early votive offerings found beneath the Heraeum. The earliest extant building is the temple of Hera, which may date in its original form from about 1000 B.C. and retained till Pausanias' time one original column of wood. There were various traditions as to the origin of the games. According to one the first race was between Pelops and Oenomaus, who used to challenge the suitors of his daughter Hippodameia and then slay them. Another attributed the festival to Heracles, either the well-known hero or the Idaean Dactyl of that name. In early times the control of the festival belonged to Pisa, but Elis seems to have claimed some share in it. Sixteen women, representing eight towns of Elis and eight of Pisatis, wove the festal robe for the Olympian Hera. Olympia thus became the centre of an amphictyony (*q.v.*), or federal league under religious sanction, for the west coast of Peloponnese. It suited the interests of Sparta to join this amphictyony; and, before the list of Olympic victors begins in 776 B.C., Sparta had formed an alliance with Elis. Aristotle saw in the temple of Hera a bronze disk, recording the traditional laws of the festival, on which the name of Lycurgus of Sparta stood next to that of Iphitus, king of Elis. Whatever may have been the age of this disk, the relation which it indicates is well attested. Elis and Sparta, making common cause, had no difficulty in excluding the Pisatans from their proper share in the management of the Olympian sanctuary. Pisa had, indeed, a brief success, when Pheidon of Argos celebrated the 28th Olympiad under its presidency. But this festival, from which Eleans and Spartans were excluded, was afterwards struck out of the official register. The destruction of Pisa (before 572 B.C.) by Sparta and Elis put an end to the rivalry: Pisatis, and also Triphylia to the south of it, becoming dependent on Elis. On the religious side of the festival the Eleans had unquestioned supremacy. All candidates were tested at Elis, in the gymnasium, before they were admitted to the athletic competitions at Olympia, and training (usually of ten months) at Elis was regarded as the most valuable preparation. Elean officials, who not only adjudged the prizes, but decided who should be admitted to compete, assumed the title of *Hellanodicae*.

Long before the overthrow of Pisa the list of contests had been so enlarged as to give the celebration a Panhellenic character. Exercises of Spartan type—testing endurance and strength with an especial view to war—had almost exclusively formed the earlier programme. But as early as the 25th Olympiad the four-horse chariot-race was added, an invitation to wealthy competitors from every part of the Hellenic world, and the recognition of a popular spectacular element, as distinct from athletic or military. Horse-races were added later. For such contests the *hippodrome* was set apart. Meanwhile the list of contests on the old racecourse, the *stadium*, had been enlarged. Besides the original foot-race in which the course was traversed once only, there were the double course (*diaulos*) and the "long" foot-race (*dolichos*). Wrestling and boxing were combined in the *pancration;* leaping, quoit-throwing, javelin-throwing, running and wrestling in the *pentathlon*. Under the protection of the Spartans, the festival acquired new importance for, having failed in their plans of actual conquest in the Peloponnese, they sought at least acknowledged predominance. While therefore the Eleans were the religious supervisors of Olympia the Spartans constituted

themselves its political protectors, enforcing the sanction which the Olympian Zeus gave to the amphictyones, whose federal bond was symbolized by common worship, and punishing violation of that "sacred truce" which was indispensable if Hellenes from all cities were to have peaceable access to the Olympian festival.

Olympia thus became a recognized Panhellenic institution after the establishment of Elean supremacy in 572 B.C.; and to the last remained a central expression of the Greek ideas that the body of man has a glory as well as his intellect and spirit, that body and mind should alike be disciplined, and that it is by the harmonious discipline of both that men best honour Zeus. The significance of Olympia was larger and higher than the political fortunes of the Greeks who met there, and it survived the overthrow of Greek independence. In the Macedonian and Roman ages the temples and contests of Olympia still interpreted the ideal at which free Greece had aimed. Philip of Macedon and Nero are among those who have record in the Altis. According to Cedrenus, a Greek writer of the 11th century (*Synopsis*, i. 326), the Olympian festival ceased to be held after A.D. 393, the first year of the 293rd Olympiad. The list of Olympian victors, which begins in 776 B.C. with Coroebus of Elis, closes with the name of an Armenian, Varastad, who is said to have belonged to the race of the Arsacidae. In the 5th century desolation had set in. The chryselephantine statue of the Olympian Zeus, by Pheidias, was carried to Constantinople, and perished in a great fire, A.D. 476. The Temple of Zeus was dismantled, either by Goths or by Christian zeal, in the reign of Theodosius II. (A.D. 402–450). The temple of Zeus, probably thrown down by earthquakes in the 6th century A.D., and the region south of it became a fortress, constructed from materials found among the ancient buildings.

Excavations.—The German excavations were begun in 1875, and completed in 1881. The deposit of earth over the Altis from the overflowing of the Cladeus had an average depth of 16 ft.; it was also necessary to excavate, especially on the west, the south and the east, several ancient buildings not included within the sacred precinct. Moreover in many places early Greek work had later Greek on top of it, or late Greek work had been overlaid with Roman.

The form of the Altis is not regularly rectangular. The west side is about 215 yd.; the south side is about equally long; the east side, about 200 yd.; the north side, behind the treasure-houses, about 275 yd.

REMAINS WITHIN THE ALTIS

Within the Altis are three main groups of buildings:—(A) chief centres of religious worship; (B) votive buildings; (C) buildings connected with the administration or with the reception of visitors.

A. **Chief Centres of Religious Worship.**—1. There are traces of an altar near the Heraeum older than the great altar of Zeus, and probably the original centre of worship. The great altar of Zeus was of elliptic form; imposed on this basis, in two tiers, and also, lozenge-shaped, was the famous "ash-altar" at which the Iamidae, the hereditary family of seers, practised rites of divination by fire in virtue of which Olympia is saluted by Pindar as "mistress of truth."

2. The *Pelopium*, to the west of the Altar of Zeus, was a small walled precinct in which sacrifices were offered to the hero Pelops. In the middle was a low tumulus of elliptic form. A Doric gateway with three doors gave access on the south-west side.

The three temples of the Altis were those of Zeus, Hera and the Mother of the gods. All were Doric and completely surrounded by a colonnade.

3. *The Temple of Zeus*, south of the Pelopium, stood on a high substructure with three steps. It was probably built about 470 B.C. The colonnades at the east and west ends were of six columns, the north and south sides of thirteen. The cella had a prodomos on the east and an opisthodomos on the west. It was itself divided longitudinally by a double row of columns. The central, and widest, partition was in three sections; the western containing the throne and image of the Olympian Zeus; the middle section, a table and stelae, where, probably, the wreaths were presented to the victors; the eastern was open to the public. On the east pediment was represented in twenty-one colossal figures the moment before the contest between Oenomaus and Pelops; on the western the fight of the Lapithae and Centaurs. The statement of Pausanias that the two pediments were made by Paeonius and Alcamenes is now generally supposed to be an error. On the metopes of the prodomos and opisthodomos were depicted the Twelve Labours of Heracles.

Near this temple was found the statue of a flying goddess of victory—the Nike of Paeonius. (*See* GREEK ART.)

4. *The Temple of Hera* (Heraeum), north of the Pelopium, was on two steps. It is the oldest of extant Greek temples, and may date from about 1000 B.C. It was smaller than the temple of Zeus, and of unusual length relatively to its breadth. It has colonnades of six columns at east and west, and of sixteen at north and south. When Pausanias saw it, one of the two columns of the opisthodomos was of wood; and for long, probably, all the columns of this temple had been wooden, gradually replaced as they decayed in progressively later styles. Only the lower part of the cella wall was of stone, the rest of unbaked brick; the entablature was of wood covered with terra-cotta. The cella—divided, like that of Zeus, by a double row of columns—had four small screens, projecting at right angles from its north and south walls. In the third niche thus formed, from the east, on the north side, was found the Hermes of Praxiteles still preserved in the local museum. (*See* GREEK ARCHAEOLOGY.)

5. *The Temple of the Great Mother of the Gods* (Metroum) was smaller than the Heraeum. It stood to the east of it and had a different orientation. It was on three steps, and had six columns east and west by eleven north and south. The cella had prodomos and opisthodomos. It was probably built in the 4th century, and underwent a Roman restoration.

B. **Votive Edifices.**—These were erected, either by states or by individuals.

1. Twelve *Treasure-houses* on the north side of the Altis, immediately under the Cronion, have the same general character of a Doric temple *in antis*, facing south. Of several the fragments are sufficient for reconstruction. The 2nd and 3rd from the west had been dismantled early for a roadway winding upward towards the Cronion, which is itself older than A.D. 157. This explains the fact that, though we can trace twelve, Pausanias names only ten. Each treasure-house was erected by a Greek state, either as a thank-offering for Olympian victories gained by its citizens, or as a general mark of homage to Olympian Zeus, and to contain the dedicated gifts in which the wealth of the sanctuary consisted. Temple inventories discovered at Delos and at Lindus in Rhodes illustrate how such possessions accumulated at a shrine of Panhellenic celebrity. The treasure-houses were founded by the following states, in order from the west: 1. Sicyon; 2, 3, unknown; 4, Syracuse (referred by Pausanias to Carthage); 5, Epidamnus; 6, Byzantium; 7, Sybaris; 8, Cyrene; 9, Selinus; 10, Metapontum; 11, Megara; 12, Gela. While the majority are the Greek colonies, from Libya to Sicily, from the Euxine to the Adriatic, Greece proper is represented only by Megara and Sicyon. The dates of the foundations cannot be fixed. The Megarian treasury had pedimental figures of gods fighting with giants; others supplemented stonework with painted terra-cotta.

2. The *Philippeum* near the north-west corner of the Altis was dedicated by Philip of Macedon, after his victory at Chaeronea (338 B.C.), illustrating how his position and power enabled him without risking any revolt of Hellenic feeling to erect a monument of the overthrow of Greek freedom in the very heart of the Panhellenic sanctuary. The building had a circular Ionic colonnade about 15 metres in diameter, raised on three steps enclosing a circular cella, with fourteen Corinthian half-columns. It contained portraits by Leochares of Philip, Alexander and other members of their family, in gold and ivory.

3. The *Exedra of Herodes Atticus* at the north limit of the Altis by the N.E. angle of the Heraeum consisted of a half-dome of brick (54 ft. diam.), containing twenty-one marble statues, representing the family of Antoninus Pius, of Marcus Aurelius and of the founder. In front was a drinking trough, its ends adorned by very small temples with circular colonnade.

C. Official Buildings for the management of the sanctuary or the accommodation of guests.

1. Olympia, besides its religious character, originally was the centre of a political amphictyony. So, like a Greek city, it should have a public hearth, where fire should always burn, and where Olympia should exercise hospitality. The *Prytaneum* was at the N.W. corner of the Altis, close to the Heraeum. It was a square building containing a chapel of Hestia at the front.

2. The *Porch of Echo,* also called the "Painted Porch," extended 100 yd. along the east Altis wall. A single Doric colonnade, on three steps, open towards the Altis, afforded a place from which to view processions and the sacrifices at the great altar. Built in the Macedonian period, it replaced an earlier portico. In front were pedestals for votive offerings.

3. The *Agora* was that part of the Altis which had the Porch of Echo on the E., the Altar of Zeus on the W., the Metroum on the N., and the precinct of the Temple of Zeus on the S.W. Here stood altars of Zeus Agoraios and Artemis Agoraia.

4. The *Zanes* were bronze images of Zeus, erected out of the fines exacted for breaches of the rules of the contests. They stood at the N. side of the Agora, in a row, from the Metroum to the gate of the private entrance into the Stadium. Sixteen pedestals were here discovered *in situ.*

REMAINS OUTSIDE THE ALTIS

A. *West Side.*—The wall bounding the Altis of the time of Nero has two gates, at its N. and S. ends. Each had on the west a portico of four columns. A smaller gate is nearly opposite the Pelopium.

West of this wall, between the Altis and the Cladeus, the following buildings succeed each other from north to south.

1. *The Gymnasium,* a large open space, enclosed on two sides at least by Doric colonnades, on the east by a double portico, more than a stadium in length (220 yd.), served as a racecourse for practice in bad weather. At the south-east corner was a Corinthian doorway, leading to the N.W. gate of the Altis. The gymnasium was used by competitors during the last month's training.

2. *The Palaestra,* for wrestlers and boxers, about 70 yd. square, containing rooms of different sizes, and enclosing a building surrounded by a Doric colonnade.

3. *A Byzantine Church* occupies the site of an older brick building, perhaps the "workshop of Pheidias" seen by Pausanias. Among adjacent structures an inscribed altar marks the *Heroum,* where worship of heroes was practised. The *Theocoleon,* a large building of Roman age, was probably the house of the priests. A long narrow building S. of the church may have been occupied by those alleged "descendants of Pheidias" (Pausanias v. 14) whose privilege it was to keep the statue of Zeus clean. The so-called "workshop of Pheidias" evidently continued to be used for actual work, and a lodging was required for the artists.

4. *The Leonidaeum,* dedicated by an Elean in the 4th century B.C., for the reception of distinguished visitors. Its orientation is from W.S.W. to E.N.E. An outer Ionic colonnade encloses suites of rooms, round a small interior Doric peristyle. In Roman times it was altered to distribute the rooms into four suites. The porticos show traces of much carriage traffic.

B. *South Side.*—The limits of the Altis towards the Alpheus can only be traced approximately, since architectural changes were numerous down to the latest times.

1. The *Council Hall* (*Bouleuterium*), nearly at the middle of the south wall, comprised two Doric buildings of different date but identical oblong form, divided by a single row of columns, terminating to W. in an apse. In the space between stood a small square building. In front, on the E. a portico covered the front of all three with a large fore-hall, enclosed by a colonnade.

2. *The South Colonnade,* a late but handsome structure, closed on the north side, with Doric colonnade to S.E. and W., and Corinthian columns within, served as a promenade and to view the processions.

3. *A Triumphal Gateway* of Roman age, with triple entrance, opens on the Altis, a little E. of the *Bouleuterium.*

C. *East Side.*—The line of the east wall can be followed from the N.E. corner of the Altis till it breaks off at the remains known as Nero's house.

1. *Nero's House* is a building of 4th-century date and uncertain purpose, afterwards absorbed into a Roman house, to make room for which the S. part of the E. Altis wall was destroyed. A leaden water-pipe bears NER. AVG., and since only a Roman master could have dealt thus with a building within the sacred precinct, it cannot be doubted that the Roman house—from which three doors gave access to the Altis—was that occupied by Nero when he visited Olympia. Later the building, further enlarged, may have been occupied by Roman officials.

2. *The Stadium* extends E. of the Altis from W.S.W. to E.N.E., and is entered from the N.E. angle. This position was due simply to the curve of the slopes which bound the valley. The Stadium is only cleared so far as was necessary for ascertainment of essential points. Low embankments had been built on W., E. and S., the N. boundary being formed by the natural slope. The space thus defined was about 234 yd. long by 35 broad. There were no artificial seats. From 40,000 to 45,000 spectators could have found sitting room. The exact length of the Stadium itself—which was primarily the course for the foot-race—was 192·27 metres (about 210 yd.), and consequently the Olympian foot was 0·3204 metre or 1·05 English foot. In the Heraeum, however, the unit adopted was not this Olympian foot, but an older one of 0·297 metre, and in the temple of Zeus an Attic foot of 1·08 English foot. The starting-point and the goal in the Stadium were marked by limestone thresholds. Drainage was by a marginal channel. The Stadium was used not only for foot-races, but for boxing, wrestling, leaping, quoit-throwing and javelin-throwing. The entrance from the N.E. corner of the Altis was reserved for the judges, competitors and heralds. It was a vaulted tunnel, 100 Olympian feet in length, probably constructed in Roman times. To the W. the Altis was entered by a gateway and vestibule.

3. *The Hippodrome,* in which chariot-races and horse-races were held, can no longer be accurately traced, owing to the overflowings of the Alpheus. But it is clear that it lay south and south-east of the Stadium, parallel with it, though stretching beyond it to the E. Its length was probably 770 metres or 4 Olympic stadia.

D. *North Side.*—A wall running E.-W. immediately N. of the Treasuries protects them from landslides off the *Hill of Cronus,* and carries the water channel of Herodes Atticus. Further W. it is doubtful whether the Altis was ever marked off from the "Hill of Cronus," which is associated with the oldest worship here.

See the official *Die Ausgrabungen zu Olympia* (5 vols., 1875–81); Laloux and Monceaux, *Restauration de l'Olympie* (1889); Curtius and Adler, *Olympia die Ergebnisse der Ausgrabungen* (1890–97), I. "Topographie und Geschichte," II. "Baudenkmäler," III. "Bildwerke in Stein und Thon," IV. "Bronzen," V. "Inschriften"; K. Boetticher, *Olympia* (1890); Daremberg-Saglio iv. (1904–05) *s.v.*; E. N. Gardiner, *Olympia, its History and Remains* (1925).

OLYMPIA, the capital city of Washington, U.S.A., and the county seat of Thurston county, at the extreme southern end of Puget Sound, 50 m. S.S.W. from Seattle. It is on Federal highways 99, 101 and 410; has an airport of 200 ac. on the Pacific Airway, 10 min. drive from the heart of the city; and is served by the Northern Pacific and the Union Pacific railways, motor-coach lines and steamboats. Pop. (1920) 7,795 (88% native white); 1928 local estimate, 14,500. The city occupies 7·07 sq.m., and is surrounded on the landward sides by low green hills. On the south the Deschutes river flows through a rocky canyon to the Sound. The snow-capped Olympics form the northern horizon, and to the east rises Mount Rainier. The streets are wide and straight; the public buildings stately. On a fir-clad promontory jutting into the Sound stands the beautiful group of new State buildings, built of white stone in classic design, at a cost of $15,000,000. The trade of the port was valued in 1927 at $5,550,800, consisting largely of floated logs, lumber and lumber products, sand and gravel, oysters and oyster shells. The aggregate output of the factories in 1927 was valued at $8,945,300. Since 1925 the city has had a commission form of government. The assessed valuation of property in 1928 was $4,987,082. Olympia is the

gateway to the Olympic peninsula, and is headquarters of the Olympia National Forest service. The first settlement on Puget sound was made in 1846 at the falls of the Deschutes river, on the site of Tumwater, a mile south of Olympia, under the leadership of Michael T. Simmons, from Kentucky, but in 1849 it was practically deserted when the men left for the California goldfields. In 1851 a town (at first called Smithfield) was laid out where Olympia now stands. In 1852 the first newspaper north of the Columbia was established here (the *Columbian*) and in 1853 the town became the capital of the newly created Territory of Washington. It was chartered as a city in 1859. The first governor's mansion still stands and a tablet indicates the site of the first capitol. A monument in Capitol Park marks the terminus of the Old Oregon Trail.

OLYMPIAD, in Greek chronology, a period of four years, used as a method of dating for literary purposes. The four years were reckoned from one celebration of the Olympian games to another, the first Olympiad beginning with 776 B.C., the last with A.D. 394, when they were abolished during the reign of Theodosius the Great. The system was first regularly used by the Sicilian historian Timaeus (352–256 B.C.) (*see* CHRONOLOGY).

OLYMPIAS, daughter of Neoptolemus, king of Epirus, wife of Philip II. of Macedon, and mother of Alexander the Great. The marriage took place in 359 B.C., shortly after Philip's accession, and Alexander was born in 356. Philip married a new wife, Cleopatra, in 337, and Olympias and Alexander withdrew into Epirus, whence they both returned in the following year, after the assassination of Philip, which Olympias is said to have countenanced. During the absence of Alexander, with whom she regularly corresponded on public as well as domestic affairs, she had great influence, and on Alexander's death in 323 withdrew to Epirus, owing to her hostility to Antipater the regent. In 319 she allied herself with Polyperchon, Antipater's successor, and became ruler of Macedonia. Cassander, Antipater's son, hastened from Peloponnesus, and, after an obstinate siege, compelled the surrender of Pydna, where she had taken refuge. One of the terms of the capitulation had been that her life should be spared; but she was brought to trial for the numerous executions which she had ordered during her reign. Condemned without a hearing, she was put to death in 316 by the friends of those she had slain, the promise to spare her life being disregarded.

See Plutarch, *Alexander*, 9, 39, 68; Justin, vii. 6, ix. 7, xiv. 5, 6; Arrian, *Anab.* vii. 12; Diod. Sic. xviii. 49–65, xix. 11–51; also the articles ALEXANDER III. THE GREAT and MACEDONIAN EMPIRE.

OLYMPIC GAMES (*see* ATHLETIC SPORTS, STADIUM, and GAMES, CLASSICAL). The modern revival of the Olympic Games is due to a Frenchman, Baron Pierre de Coubertin, who on Jan. 15, 1894, addressed a circular to all the governing bodies of sport in which he observed—"Before all things it is necessary that we should preserve in sport those characteristics of nobility and chivalry which have distinguished it in the past, so that it may continue to play the same part in the education of the peoples of to-day as it played so admirably in the days of ancient Greece. Imperfect humanity has ever tended to transform the Olympic athlete into the paid gladiator. But the two things are incompatible. We must choose between one formula and the other." If Baron de Coubertin's word of warning is heeded and his ideal of amateurism adhered to, the Olympic games will, in all human probability, become a permanent feature in the world's calendar of sport. Unfortunately, however, there appears to be a growing desire among some of the Continental nations to "transform the Olympic athlete into the paid gladiator."

Early Meetings.—It was by the British Olympic committee, headed by Lord Desborough and the late Rev. R. S. de C. Laffan, that the first real organization of these games was successfully carried through in 1908 in London. Previous meetings, though recorded, were neither representative nor properly organized. The third celebration at St. Louis in 1904 had attracted hardly any competitors from outside the United States. The second, in Paris in 1900, had suffered from inadequate preparation and control. The first of the revival, appropriately held in Athens in 1896, where the famous Marathon race was standardized, was made possible by the munificence of a private citizen (M. Averoff); but the marble stadium did not permit of a running-track suitable for the athletic championships of the world.

After the success of the London meeting in 1908, that of Stockholm in 1912 followed. The meeting of 1916, originally fixed for Berlin, was impossible owing to the World War; and it was the opinion of many that neither Belgium nor the rest of the world was ready for the games of 1920 in Antwerp. The 8th and 9th Olympiads (1924, 1928), with the most important results are described below.

Organization.—Of the International Olympic committee Baron Pierre de Coubertin was for many years president, being succeeded by Count Baillet-Latour. It is the central body by which the general policy of the Olympic movement is controlled. Forty-four nations are represented by one or more delegates each. It is hoped that by degrees this influential committee will realize such ideals as a world-wide amateur definition which will cover every sport; an Olympic programme restricted to those first-rate forms of sport in which at least half the competing nations have experience; a universally accepted code of laws to govern every competition in the games; and a body which will appoint juries and officials with power to inflict penalties that cannot be evaded.

TABLE I. *Olympic Records*

Race.	Date.	Place.	Winner.	Country.	Time or distance.
(1) 100 metres	1912	Stockholm	D. F. Lippincott	U.S.A.	10⅗s.
	1924	Paris	H. M. Abrahams	G.B.	10⅘s.
(2) 200 metres	1904	St. Louis	A. Hahn	U.S.A.	21⅗s.
	1924	Paris	J. V. Scholz	U.S.A.	21⅘s.
(3) 400 metres	1924	Paris	E. Liddell	G.B.	47⅗s.
(4) 400 metres relay.	1924	Paris	U.S.A.	U.S.A.	41s.
(5) 800 metres	1928	Amsterdam	D. G. A. Lowe	G.B.	1m. 51⁴/₁₀s.
(6) 1,500 m. tres	1928	Amsterdam	H. E. Larva	Finland	3m. 53⅕s.
(7) 1,600 metres relay	1924	Paris	U.S.A.	U.S.A.	3m. 16s.
(8) 3,000 metres steeplechase	1924	Paris	W. Ritola	Finland	9m. 33⅗s.
(9) 3,000 metres team	1924	Paris	Finland	Finland	8m. 32s.
(10) 5,000 metres	1924	Paris	P. Nurmi	Finland	14m. 31⅕s.
(11) 10,000 metres	1928	Amsterdam	P. Nurmi	Finland	30m. 18⁴/₁₀s.
(12) 10,000 metres walk	1912	Stockholm	G. H. Goulding	Canada	46m. 28⅖s.
(13) Marathon	1920	Antwerp	H. Kolehmainen	Finland	2h.32m. 35⁴/₁₀s.
(14) Hurdles (110 metres)	1920	Antwerp	E. J. Thomson	Canada	14⅘s.
(15) Hurdles (400 metres)	1924	Paris	F. M. Taylor	U.S.A.	52⅖s.
(16) High jump	1924	Paris	H. M. Osborne	U.S.A.	6ft. 5·95in.
(17) Long jump	1912	Stockholm	A. L. Gutterson	U.S.A.	24ft. 11⅕in.
(18) Pole vault	1920	Antwerp	H. K. Foss	U.S.A.	13ft. 5in.
(19) Putting the 16 lb. shot	1928	Amsterdam	J. Kuck	U.S.A.	52ft. 0¼in.
(20) Hammer (16 lb.)	1912	Stockholm	M. J. McGrath	U.S.A.	170ft. 8⅖in.
(21) Javelin	1928	Amsterdam	E. H. Lundovist	Sweden	218ft. 6in.
(22) Discus	1928	Amsterdam	E. Houser	U.S.A.	155ft. 3in.
(23) Hop, step and jump	1924	Paris	A. W. Winter	Australia	50ft. 11⅗in.

Besides this central committee, on which all nations are represented, each nation has its own Olympic association and its own Olympic council. The British Olympic council, which may be taken as typical of most of the rest, has one or more members of every association governing the sports in which Great Britain is represented at the games, and a few other co-opted members chosen for their special knowledge or experience in organization.

As regards the American organization, its most important aspect is its continuing character as exemplified in the structure of the American Olympic Association. The American Olympic Committee is created by the American Olympic Association in the second year before each meeting. Of the committee, the initial members are the President of the United States as honorary president; five honorary vice-presidents, the Secretaries of State, of War and of the Navy, the Ambassador or Minister of the United States to the country in which the games are to be held, the Ambassador or representative of such country to the United States; the honorary and regular officers of the Association and the officers of former American Olympic committees. The Executive Committee of the Association adds to the committee from representatives of members of the Association and the public at large. The committee chooses its own active officers, who carry out the details of organization.

Records.—Records obtained at the Olympic games from 1896 to 1928 in the various events to which most popular importance is attached are shown in Table I. and for purposes of comparison the corresponding world records are shown below in Table II.

It should be noted that 100 metres=109·3 yards; 200 metres=218·7 yards; 400 metres=2·6 yards less than a quarter of a mile; 1,500 metres=119·6 yards less than a mile. 110 metres (hurdles) is nearly 11 inches over 120 yards. The Marathon Race is 42·263 kilometres or 26 miles 385 yards.

TABLE II. *World Records*

Race.	Date.	Winner.	Time or distance.
(1) 100 metres	1921	C. W. Paddock	10⅘sec.
(2) 200 metres	1921 and 1924	C. W. Paddock	20⅘sec.
(3) 400 metres	1924	E. Liddell	47⅘sec.
(4) 400 metres relay	1924	U.S.A.	41 sec.
(5) 800 metres	1917	J. E. Meredith	1m. 51⁹⁄₁₀s.
(6) 1,500 metres	1924	P. Nurmi	3m. 52⅘s.
(7) 1,600 metres relay	1924	U.S.A.	3m. 16sec.
(8) 3,000 metres steeplechase	1924	T. A. Loukola	9m. 21⅕s.
(9) 3,000 metres team	1926	Finland (P. Nurmi 1st)	8m. 20⅘s.
(10) 5,000 metres	1924	P. Nurmi	14m. 28⅕s.
(11) 10,000 metres	1924	P. Nurmi	30m. 6⅕sec.
(12) 10,000 metres walk	1918	G. Rasmussen	45m. 26⅘s.
(13) Marathon	1926	J. C. Miles	2hr. 25m. 40⅘s.
(14) Hurdles (110 metres)	1928	G. C. Weightman-Smith	14⅘s.
(15) Hurdles (400 metres)	1924	F. M. Taylor	52⅘s.
(16) High jump	1925	H. M. Osborne	6ft. 8¼in.
(17) Long jump	1925	De Hart Hubbard	25ft. 10¼in.
(18) Pole vault	1927	W. Sabin Carr	14ft.
(19) Putting 16 lb. shot	1928	J. Kuck	52ft. 1/16in.
(20) Hammer (16 lb.)	1913	P. Ryan	189ft. 6¼in.
(21) Javelin	1928	S. A. Lay	222ft. 9in.
(22) Discus	1925	G. Hartranft	157ft. 1⅛in.
(23) Hop step and jump	1924	A. W. Winter	50ft. 11⅛in.

The 23 events cited above all occur in track and field athletics, which is only one division of the games. In 1908 the United Kingdom, with 839 entries, scored 57 first prizes and five more went to the Dominions; the United States with 160 entries scored 22 first prizes. The remaining 22 first prizes went to the 1,529 entries from all other nations. In 1912 the United Kingdom, with 526 entries, scored ten first prizes and eight more went to the Dominions; the United States with 572 entries scored 24 first prizes; the remaining 36 first prizes went to the 3,651 entries from other nations. In 1920 the United States won 22 first prizes; Great Britain took eight; the Dominions four; Belgium, the organizing country, one; and the remaining 65 first prizes were divided among all the other nations. In 1924, with 424 entries, the United States won 27 first prizes; Great Britain with 443 entries, won six; and the Dominions four; France, the organizing country, won four. The remaining 69 first prizes (without counting winter sports, in which Norway won easily with Finland second) were divided among all the other nations. These figures are not taken from victories in the athletic sections only, but from the full programme.

The Games in 1924.—The 8th Olympiad began with winter sports at Chamonix on Jan. 25, 1924, and 39 entries represented Great Britain. There were 14 events in all, in skating (speed and figure), ice hockey, curling, bobsleighing, ski-racing and ski-jumping. The programme in Paris was opened at Colombes on July 5, 1924, and consisted of athletics (26 events), swimming (ten events for men and seven for women), boxing (eight events), cycling (six events), wrestling (two styles, 13 events), shooting (eight events), lawn tennis (five events, including ladies), gymnastics (two events), fencing (four events), rowing (seven events), weight lifting (five events), the modern pentathlon and polo. Association football was held in Paris from May 15 to June 9, 1924, Uruguay beating Switzerland by three goals to nil in the final. Rugby football was held in Paris from May 3 to 18, the United States defeating France in the final by 17 points to 3. Neither baseball nor cricket has been included in the games. In 1924, in polo, Argentina won four games, the United States three, Great Britain two, Spain one and France none. Many other sports were omitted.

During the six months the games were in progress the United States of America came out top with championships in track and field athletics, rowing, swimming, lawn tennis, boxing, catch-as-catch-can wrestling, target shooting and Rugby football. Norway was next on the list with victories in winter sports, hunting marksmanship and yachting. France and Sweden each claimed two titles, the former taking the fencing and cycling and the latter country the modern pentathlon and the equestrian events. Other championships were won by Finland, Graeco-Roman wrestling; Uruguay, Association football; Argentina, polo; Italy, weight-lifting; while the gymnastic honours were divided between Czechoslovakia and Switzerland. The Norwegians scored heavily in the winter sports, through the proficiency of their ski experts, their representatives, indeed, filling the first four places in two of the tests. Canada secured the ice hockey championship, while the Austrian figure skaters and Skutnab, of Finland, in the speed skating, were in a class almost by themselves. Rugby football was not representative since America, France and Rumania were the only countries taking part. Association football proved very popular and some 60,000 spectators witnessed the final match in which Uruguay defeated Switzerland by 3 goals to nil.

In the important athletic section of the games American supremacy was again hotly contested by Finland. Of the 26 events comprising the programme, America claimed 12 first places, Finland 9, Great Britain 3 and Austria and Italy 1 each. Of the eight new world's records created at the Colombes stadium five must be placed to the credit of America, while the other three were made by representatives of Great Britain, Australia and Finland. Of the Olympic records broken or equalled, however, Finland established five new records, while America broke two records and equalled another and one record was equalled by an English runner.

America, moreover, won all five tennis titles and of the 16 swimming events took 13, the water polo match being won by France. (*See* ATHLETIC SPORTS.)

The Games in 1928.—The ninth Olympiad began with winter sports at St. Moritz. The 11 events decided included ski-racing and jumping; speed and figure skating; bobsleighing and ice-hockey. The Norwegian ski-ing experts were again remarkably successful, but found their masters at the longest distance ski-

race in three Swedes, who took the premier places. In speed and ladies' figure-skating, however, they achieved fresh laurels, Norway thus taking the winter games championship with five victories, as against the two each of Sweden and America. Canada again won the ice-hockey, with Sweden second and Switzerland third.

The programme in Amsterdam was opened at the new Olympic Stadium on July 28 and comprised athletics (22 events for men and 5 for women), swimming (9 events for men and 7 for women), boxing (8 events), cycling (6 events), wrestling (13 events), gymnastics (3 events), fencing (3 events for men and 1 for women), rowing (7 events), weight-lifting (5 events), and the modern pentathlon. Field hockey took place between May 17 and May 26, the Indian empire team, which had recently concluded an all-conquering tour in England, defeating Holland by 3 goals to nil in the Olympic final. Association football commenced on May 27, Great Britain not competing, on account of the "broken time" controversy. Uruguay retained the Olympic championship, won in 1924, with a victory over Argentina at Amsterdam by 2 goals to 1, after a draw.

During the period the Games were in progress the United States came out on top only in athletics (9 first places), swimming (10 first places), and rowing (2 first places), a vastly different state of things from 1924, in which year America won championships in no fewer than eight different branches of Olympic sport, as may be seen from the preceding account of the eighth Olympiad. Sweden came next, with first place in the modern pentathlon and equal firsts in wrestling and yachting. The third position was divided jointly by Norway (first winter sports and first equals yachting), Germany (first weight-lifting and first equals horse-riding), and France (first fencing and first equals yachting). Other championships were won by Italy (boxing), Denmark (cycling) and Switzerland (gymnastics). Equal championship honours were obtained by Finland (wrestling) and Holland (horse-riding).

Once again American supremacy was sternly challenged in the all-important athletic section of the games. For the first time in Olympic history America won but one individual track event (the 400 metres), and lost both hurdle races, but good team work and excellent field-events men enabled her to retain the laurels held since the revival of the games, in 1896.

On points, reckoning from 6 to 1, going from the first to the sixth place, America scored 169 points, as against Finland, 80; Germany, 63; Canada, 55; Sweden, 47; Great Britain, 38; France, 26, and Japan, 20. On first places alone the United States won 9, Finland 5, Canada 4, Great Britain 2; while France, Germany, Ireland, Japan, Poland, South Africa and Sweden, each won a single event.

New World's Records.—Of the five new world's records created at Amsterdam, America and Finland each made two and South Africa the other; an American team also equalled the world's record in the 400 metres relay. The Olympic record for 100 metres was equalled by representatives of America, Canada and Great Britain, and that for 200 metres by H. Koernig (Germany) in a preliminary heat. Ten Olympic records were broken—as to U.S.A. 3, Finland 3, Great Britain 2 and South Africa and Sweden 1 each.

The ninth Olympiad, at Amsterdam, was carried through in the best sporting spirit which has yet prevailed at any celebration of the Games since their revival at Athens in 1896, particular credit being due to the Americans for the sporting way in which they accepted their unexpected reverses on the track and in the hurdle races. The much more even distribution of premier honours in all classes of competition, combined with the fact that the ninth Olympiad was almost entirely free from unpleasant or untoward incidents, proves clearly that the Olympic Games are performing admirably their function of spreading the cult of sport and sportsmanship throughout the whole world, while the successes of such countries as Egypt, Japan and the South American republics, previously regarded as non-athletic nations, are entirely satisfactory. The roughness of the water polo matches, the discontent with the boxing decisions and the demand of the Association football players for payment as compensation for broken time, indicate clearly, however, that all sports involving personal physical contact, or in which the element of professionalism largely prevails, should be expunged from the schedule of Olympic contests.

No fewer than 46 nations were represented in the athletic section of the ninth Olympiad, at Amsterdam, and of such nations 20 succeeded in scoring points.

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OLYMPIODORUS, the name of several Greek authors, of whom the chief are: (1) An historical writer (5th century A.D.), born at Thebes in Egypt, who was sent on a mission to Attila by the emperor Honorius in 412, and later lived at the court of Theodosius. He was the author of a history (Ἱστορικοὶ Λόγοι) in 22 books of the Western Empire from 407 to 425. The original is lost, but an abstract is given by Photius. A MS. on alchemy ascribed to him and preserved in the National Library in Paris, was printed with a translation by P. E. M. Berthelot in his *Collection des alchimistes grecs* (1887–88).

(2) A Neoplatonist philosopher, also of Alexandria, who flourished in the 6th century A.D., during the reign of Justinian. He seems to have carried on the Platonic tradition after the closing of the Athenian School in 529. He is important as a critic and a commentator, and preserved much that was valuable in the writings of Iamblichus, Damascius and Syrianus. He made a close and intelligent study of the dialogues of Plato, and his notes, formulated and collected by his pupils (ἀπὸ φωνῆς Ὀλυμπιοδώρου τοῦ μεγάλου φιλοσόφου), are extremely valuable. In one of his commentaries he makes the interesting statement that the Platonic succession had not been interrupted by the numerous confiscations it had suffered. Zeller points out that this refers to the Alexandrian, not to the Athenian, succession; but internal evidence makes it clear that he does not draw a hard line of demarcation between the two schools. The works which have been preserved are a life of Plato, an attack on Strato and Scholia on the *Phaedo, Alcibiades I., Philebus* and *Gorgias*.

See Überweg, *Grundriss der Gesch. der Philosophie*, Bd. I. (1926).

OLYMPUS, the name of many mountains in Greece and Asia Minor, and of the fabled home of the gods; also a city name and a personal name.

I. Of the mountains (1) the most famous is the lofty ridge (mod. Gk. *Elympo*) on the borders of Thessaly and Macedonia; nearly 10,000 ft. high, covered with snow for a great part of the year. The great gorge of Tempe close below the south-eastern end separates it from Mount Ossa. Olympus is of massive appearance, rising in precipices broken by ravines, above which is the summit of naked rock concave toward the north-west. The lower parts are densely wooded. (2) The peak of Mount Lycaeus in the south-west of Arcadia. (3) East of Olympia, on the north bank of the Alpheus; (4) beside Sellasia in Laconia. The name was even commoner in Asia Minor: a lofty chain in Mysia (Keshish Dagh), a ridge east of Smyrna (Nif Dagh), other mountains in Lycia, in Galatia, in Cilicia and in Cyprus.

II. In the *Iliad* the gods are described as dwelling on a lofty peak, rising high above the clouds of the lower atmosphere into the clear ether; in the *Odyssey* Olympus is more remote and less definite; the notions of later poets vary from a definite mountain to a vague conception of heaven. In literary mythology, though each deity had special haunts, all had residence at the court of Zeus on Olympus; here were their assemblies and feasts.

OLYNTHUS, an ancient city at the head of the Gulf of Torone, in Chalcidice, near the neck of the peninsula of Pallene, about 60 stadia (7 or 8 m.) from Potidaea. It may have been a colony of Chalcis, and struck coins early, but the district belonged to a Thracian tribe, the Bottiaeans, who held the town

till 479 B.C., when the Persian general Artabazus, on his return from escorting Xerxes to the Hellespont, suspecting that a revolt from the Great King was meditated, slew the inhabitants and handed the town over to Greeks from Chalcidice. Olynthus thus became a Greek *polis*, but it remained insignificant in the lists of the Delian League until 432. King Perdiccas of Macedon added to its population the inhabitants of Chalcidian towns in the neighbourhood (Thucyd. i. 58). Henceforward the chief Hellenic city west of the Strymon, it revolted from Athens, formed a base for Brasidas's expedition (424) and was never again reduced. In the 4th century it was the head of the Chalcidic League which may be traced back to the peace of Nicias (421), when the Chalcidians acted in common and were enrolled as allies of Argos. The motive for its formation is almost certainly to be found in fear of Athens. Coins of the league can be dated as early as 405; one specimen may go back to 415–420. After the Peloponnesian War the league concluded an important treaty, about 390, with Amyntas, king of Macedon (the father of Philip), and by 382 it had absorbed most of the Greek cities west of the Strymon, and even held Pella, the chief city in Macedonia. But in this year Sparta was induced by an embassy from Acanthus and Apollonia, not yet included by the league, to attack; and Olynthus, after three years of indecisive warfare, formally dissolved the confederacy (379). Chalcidians, however, appear among the Athenian naval confederacy of 378–377. Twenty years later, in the reign of Philip, the power of Olynthus is asserted by Demosthenes to have been much greater than before the Spartan expedition, and the league included thirty-two cities. When war broke out between Philip and Athens (357), Olynthus was at first in alliance with Philip. Subsequently, it concluded an alliance with Athens; but in spite of all the efforts of the Athenians and their orator, Demosthenes, Philip razed it in 348.

BIBLIOGRAPHY.— erodotus viii. 127; Thucydides i. 58; Xenophon, *Hell.* v. 2; Demosthenes *Olynthiacs* and *De fals. leg* 263–6; Diodorus xvi. 53, 2; Hicks *Manual of Greek Inscriptions* Nos. 74, 81; Head, *Historia Numorum s.v.*; British Museum *Catalogue of Greek Coins, s.v.* Excavations by an American mission are in progress.

OLYPHANT, an anthracite-mining borough of Lackawanna county, Pennsylvania, U.S.A., on the Lackawanna river, 6 m. N.N.E. of Scranton; served by the Delaware and Hudson and the New York, Ontario and Western railways, and for freight also by the Erie and the Lackawanna. Pop. (1920) 10,236 (29% foreign-born white).

OMAGH (ō'mah), a market town and the county town of Co. Tyrone, Ireland, on the Strule, 129¼ m. N.W. by N. from Dublin by the Great Northern railway. Pop. (1921) 4,836. The town is situated on a steep slope above the river. There are milling and linen industries, and monthly fairs are held. The castle, of which there are scanty remains, was besieged in 1509 and 1641, being rebuilt after its total destruction in the first case.

OMAHA. This Siouan tribe of Nebraska, closely associated with the Ponca, combined agriculture with seasonal buffalo hunting. Since 1829 they have numbered between 1,200 and 1,500. They were organized into moieties and ten patrilineal clans. *See* J. O. Dorsey, *Bur. Am. Ethn. Rep.* xv., (1897); A. C. Fletcher and F. La Flesche, *ibid.* xxvii. (1911).

OMAHA, the largest city of Nebraska, U.S.A., a port of entry, and the county seat of Douglas county; on the west bank of the Missouri river, 500 m. W. by S. of Chicago. It is on Federal highways 30 (the Lincoln), 38, and 75; is the central station on the main transcontinental airway, and has a municipal airport of 200 ac.; and is served by the Burlington, the Chicago and North Western, the Chicago Great Western, the Chicago, Milwaukee, St. Paul and Pacific, the Chicago, St. Paul, Minneapolis and Omaha, the Illinois Central, the Missouri Pacific, the Rock Island, the Union Pacific, the Wabash, and electric railways, and by 15 motor-bus lines. The population was 191,601 in 1920 (18·5% foreign-born white and 5·2% negroes) and was estimated locally at 219,200 in 1928.

The city has an altitude ranging from 940 to 1,123 feet. The original town site of 270 blocks, an elongated terrace above the river, is now entirely a business quarter, and gradually the city has extended over the hills and bluffs beyond, until it covers 39 sq.m. The stockyards and the packing plants are in South Omaha (formerly an independent municipality, with a population in 1910 of 26,259), which was annexed in 1915. There are 30 parks, with an aggregate area of 3,600 acres, connected by 37 m. of boulevard; 17 supervised playgrounds for children, 3 municipal golf courses, 6 country clubs, and a fine tourist camp. The Fontenelle Forest Reserve covers 1,800 acres. Ft. Crook (10 m. S.) and Ft. Omaha, in the northern part of the city, are important military posts. The public school system comprises 58 elementary and 5 high schools, representing an investment of $20,000,000 and an annual expenditure of $4,000,000 for salaries and maintenance, and the parochial system adds 29 elementary and 5 high schools. Among the other educational institutions are the State School for the Deaf (1867); the College of Medicine, part of the University of Nebraska; Creighton university (1879; conducted by the Jesuits), comprising seven colleges and a high school; the University of Omaha (Presbyterian; 1908); and the Presbyterian Theological seminary (1891). The principal newspapers are the Omaha *Bee-News*, a merger (1927) of the *Bee* (established in 1871 by Edward Rosewater, who made it one of the influential Republican journals of the Middle West) and the *News* (1899); and the *World-Herald*, formed in 1889 by the combination of papers established in 1865 and 1885, and edited from 1894 to 1896 by William Jennings Bryan. Among the 70 other periodical publications are the *Duroc Journal-Bulletin* and a daily devoted to the livestock industry. The city has a symphony orchestra, a community playhouse, a drama club, and a large musical club. Ak-Sar-Ben (Nebraska spelled backwards) is an organization of 5,000 business men (formed in 1894 to promote interest in the history and progress of the city and the State) which holds an annual carnival attracting hundreds of thousands of visitors and conducts two running race meetings a year at its own track. Omaha is the see of Roman Catholic and Protestant Episcopal bishoprics and a district headquarters of the Methodist Episcopal Church. There are 183 churches and missions in the city. The 21 hospitals (most of which conduct training schools for nurses) have 400 physicians and surgeons on their staffs, and treat annually about 12,000 patients from outside the city. Thirty of the charitable organizations are financed jointly through a community chest, which has an annual budget of about $400,000. The proportion of homes owned by their occupants is high and is increasing (39·8% in 1910; 55·5% in 1926). The percentage of illiteracy is low. There is a telephone for every 3·4 persons, and an automobile for every 5. The city operates under a "home rule" charter of 1923, providing for a commission form of government, with biennial elections. The assessed valuation of property for 1927 was $342,321,905.

Omaha is the headquarters of the air-mail branch of the postal service; the Seventh Corps Area of the U.S. army; the Union Pacific railway system and the western divisions of the Chicago, Burlington and Quincy and the Chicago and North Western Lines; the Northwestern Bell Telephone company and the Central Division of the Western Union Telegraph company; and the Western Newspapers Union. It has the largest Federal land bank in the country (on the basis of loans granted) and is the seat of a branch bank of the Federal Reserve system. It is one of the principal railroad centres of the country. The ten trunk-line roads entering the city have 62,547 m. of track. Over 9,000,000 tons of freight is received and forwarded annually. In volume of business as measured by debits to individual banking accounts ($2,386,855,000 in 1926) Omaha ranks 20th among the cities of the United States, though 34th (1920) in population. It is the largest retail centre between Chicago and Denver; an important insurance centre, with 33 home-office companies and branches of many others, receiving $50,000,000 annually in premium income; and one of the leading manufacturing and wholesale distributing centres of the country. The total output of its 706 manufacturing firms in 1926 was valued at $406,866,090 (about three-fourths of the total for the State), of which $210,795,250 represented packing-house products. Its 550 wholesale and jobbing houses distributed merchandise valued at $486,357,570 in 1926. It ranks first in the production of butter and pig lead, as a primary grain market and a

feeder sheep market, and disputes with Kansas City for second place as a general livestock market and meat-packing centre.

History.—In 1804 Meriwether Lewis and William Clark camped on the Omaha plateau, and in 1825 a licensed Indian trading post was established here. Fur traders and trappers frequented the region through the first half of the 19th century. In 1846 the Mormons settled at "Winter Quarters" (called Florence after 1854, and annexed to Omaha in 1917), but in 1848 they were obliged to move, as it was within the Indian reservation. Some 12,000 of them built camps in this vicinity, on both sides of the Missouri, in 1846 and 1847, from which gradually they emigrated to Utah, but their local influence was strong for nearly a decade. Speculative "squatters" intruded on the Indian lands in 1853, and a rush of settlers followed the opening of Nebraska Territory in 1854. Omaha (named from the Omaha Indians) was laid out in 1854 and chartered as a city in 1867. Prairie freighting and river traffic were important before the construction of the Union Pacific railroad, which was begun in Dec. 1863. The city was an important outfitting point during the rush to the Colorado gold-fields. Connection by telegraph was established with San Francisco in 1861, with Chicago and St. Louis in 1863. The Union Pacific Railroad bridge across the Missouri was completed in 1869. The Rock Island, the Burlington, and the North Western railways entered the city in 1867 and 1868. Meat packing began as early as 1871, and grew rapidly after 1884, when the Union Stock Yards company was formed and yards established in South Omaha. In 1860 the population was 1,883; 16,083 in 1870; and 30,518 in 1880. In the next 20 years it increased 236%, and between 1900 and 1920, 87%. In the first quarter of the 20th century receipts of grain increased about threefold, the value of the manufactures almost fourfold; the volume of the wholesale business was multiplied (roughly) by 8; bank clearings by 7; and the city's assessed valuation by 4½.

OMALIUS D'HALLOY, JEAN BAPTISTE JULIEN D' (1783–1875), Belgian geologist, was born on Feb. 16, 1783, at Liége, and educated in Liége and Paris. He became *maire* of Skeuvre in 1807, governor of the province of Namur in 1815, and from 1848 senator. He died on Jan. 15, 1875. His chief works were: *Mémoires pour servir à la description géologique des Pays-Bas, de la France et de quelques contrées voisines* (1828); *Eléments de géologie* (1831, 3rd ed. 1839); *Abrégé de géologie* (1853, 7th ed. 1862); *Des races humaines, ou éléments d'ethnographie* (5th ed., 1869).

OMAN, SIR CHARLES WILLIAM CHADWICK (1860–), British historian, was born at Mozufferpore, India, the son of a tea planter, on Jan. 12, 1860. Educated at Winchester and at New college, Oxford, he was made a fellow of All Souls in 1883. In 1905 he became Chichele professor of modern history at Oxford and he was chosen a fellow of the British Academy in the same year. He was president of the Royal Historical Society 1917–21. In 1919 he was elected M.P. for the University of Oxford and in 1920 he was knighted. His most important work was done in military history. His works include: *History of the Art of War in the Middle Ages* (1898, new ed. 1924); *History of Greece* (1890); *A Short History of England* (1895, new ed. 1920); and a *History of the Peninsular War 1807–13* (6 vols., 1902–22).

OMAN, a nominally independent State in south-eastern Arabia, extending from Ras Musandam, on the Gulf of Oman, to the eastern limits of Hadhramaut at Ras Sajar (lat. 16° 8″ N.) on the Indian ocean. Inland the State is bounded by the great desert of Arabia. The population is given as 500,000, chiefly Arabs, with a strong negro element in the coastal regions. Area (roughly), 82,000 sq. miles.

Oman is a mountainous district forming part of the ancient land mass of Arabia, granite and limestone rocks being most in evidence. The high ground culminates in Jeb. Akhdar (9,900 ft.), coast. In this way access from the harbours (of which that of which is flanked by steps of the old mountain block down to the Muscat [*q.v.*] is alone important) to the interior is very difficult. The lateral valleys between the various steps are often fertile and cultivated, especially where a good supply of water is available. The oasis of Tyin is the most important. The wadis of Oman, which cut across the mountainous area to the coast, are merely torrential channels, dry for the greater part of the year, often flowing in narrow precipitous gorges, the only means of entering the interior. Of these ways, always difficult, the best known are those by the Wadi Kahza, from the port of Matrah; by the Wadi Hail from the port of Kuryat, and by the Semail valley, leading into the Wadi Munsab from a point 50 m. N.W. of Muscat. All routes give access to Wadi Tyin, the garden of Oman.

The climate is tropical, with a mean annual rainfall of under 10 in., and a mean annual temperature of 80° or more. The vegetation is, however, tolerably abundant; tamarisks, oleanders, kafas, euphorbias, the milk-bush, rhamus and acacias being the most common.

Muscat, the capital, was in Portuguese hands from 1508 to the middle of the 17th century. In 1741 it was recovered by Ahmed bin Sa'id, a descendant of those Yemenite imams who consolidated Arab power in Zanzibar and on the East African coast. His family has ruled Oman ever since. It was the most powerful State in Arabia during the first half of the 19th century, but subsequent raids by the nomadic tribes of the interior, as in 1913–14, and the opportunities for foreign intervention, particularly on the part of Britain, afforded by these occurrences, have now reduced the country to a dependency of the Government of India. The ruling sultan of Oman resides in India for the greater part of his time, and takes no active part in the government of his State.

The State is best known for its date cultivation, which has reached a high level in the interior. It is cultivated alongside of cereals and vegetables, as well as vines, peaches, apricots, oranges, mangoes and melons. Cultivation would be extended if the water supply were assured. The trade of Oman is mainly to and from India. Dates, pomegranates and dried fish are exported, while rice, coffee and cotton goods are the chief imports. The little port of Gwadar, on the coast of Baluchistan, the outlet for most of the trade of Makran, is still a dependency of Oman.

OMAR (*c.* 581–644), in full 'OMAR IBN AL-KHAṬṬAB, the second of the Mohammedan caliphs. (*See* CALIPHATE.) Originally opposed to Mohammed, he became later one of the ablest advisers both of him and of the first caliph, Abu Bekr. His own reign (634–644) saw Islam's transformation from a religious sect to an imperial power. The chief events were the defeat of the Persians at Kadisiya (637) and the conquest of Syria and Palestine. The conquest of Egypt followed (*see* EGYPT and AMR IBN EL-ASS) and the final rout of the Persians at Nehāwend (641) brought Iran under Arab rule. Omar was assassinated by a Persian slave in 644, and though he lingered several days after the attack, he appointed no successor, but only a body of six Muhajirun who should select a new caliph. Omar was a wise and far-sighted ruler and rendered great service to Islam. He is said to have built the so-called "Mosque of Omar" ("the Dome of the Rock") in Jerusalem, which contains the rock regarded by Mohammedans as the scene of Mohammed's ascent to heaven, and by the Jews as that of the proposed sacrifice of Isaac.

'OMAR KHAYYĀM [GHIYĀTHUDDĪN ABULFATH 'OMAR BIN IBRĀHĪM AL-KHAYYĀMĪ], the great Persian mathematician, astronomer, free thinker and epigrammatist, who derived the epithet Khayyām (the tentmaker) most likely from his father's trade, was born in or near Nishāpūr, where he is said to have died in A.H. 517 (A.D. 1123). His standard work on algebra, written in Arabic, and other treatises of a similar character raised him at once to the foremost rank among the mathematicians of that age, and induced Sultān Malik-Shāh to summon him in A.H. 467 (A.D. 1074) to institute astronomical observations on a larger scale, and to aid him in his great enterprise of a thorough reform of the calendar. The results of 'Omar's research were—a revised edition of the *Zīj* or astronomical tables, and the introduction of the Ta'rīkh-i-Malikshāhī or Jalālī, that is, the so-called Jalālian or Seljūk era, which commences in A.H. 471 (A.D. 1079, 15th March).

'Omar's great scientific fame, however, is eclipsed in the West, by his still greater poetical renown, which he owes to his *rubā'īs* (made famous in the west by FitzGerald's translation, *The Rubáiyát*) or quatrains, a collection of about 500 epigrams Although

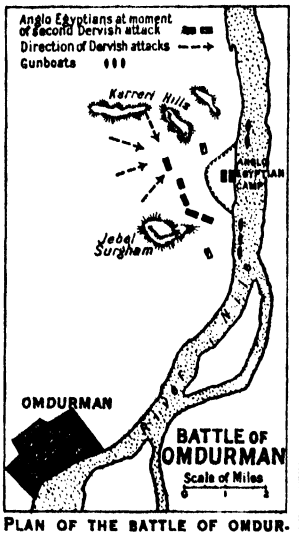
some of his quatrains are purely mystic and pantheistic, most of them bear quite another stamp; they are the breviary of a radical freethinker, who protests in the most forcible manner both against the narrowness, bigotry and uncompromising austerity of the orthodox ulemā and the eccentricity, hypocrisy and ravings of advanced Sūfīs.

BIBLIOGRAPHY.—The Leyden copy of 'Omar Khayyām's work on algebra was noticed as far back as 1742 by Gerald Meerman in the preface to his *Specimen calculi fluxionalis;* further notices of the same work by Sédillot appeared in the *Nouv. Jour. As.* (1834) and in vol. xiii. of the *Notices et extraits des MSS. de la Bibl. roy.* The complete text, together with a French translation (on the basis of the Leyden and Paris copies, the latter first discovered by M. Libri, *see* his *Histoire des sciences mathématiques en Italie*, i. 300), was edited by F. Woepcke, *L'Algebrè d'Omar Alkhayyāmi* (Paris, 1851). Articles on 'Omar's life and works are found in Reinaud's *Géographie d'Aboulféda*, pref., p. 101; *Notices et extraits*, ix. 143 *seq.*; Garcin de Tassy, *Note sur les Rubā'iyāt de 'Omar Hhaïyām* (Paris, 1857); Rieu, *Cat. Pers. MSS. in the Br. Mus.*, ii. 546; A. Christensen, *Recherches sur les Rubā'iyāt de 'Omar Hayyām* (Heidelberg, 1905); V. Zhukovski's *'Umar Khayyām and the "Wandering" Quatrains*, translated from the Russian by E. D. Ross in the *Journal of the Royal Asiatic Society*, xxx. (1898); E. G. Browne, *Literary History of Persia*, ii. 246. The quatrains have been edited at Calcutta (1836) and Teheran (1857 and 1862); in English verse, by Edward FitzGerald (London, 1859, 1872 and 1879). FitzGerald's translation has been edited with commentary by H. M. Batson (1900), and the 2nd ed. of the same (1868) by E. Heron Allen (1908). A new English version was published in Trübner's "Oriental" series (1882) by E. H. Whinfield, and the first critical edition of the text, with translations, by the same (1883). Important later works are N. H. Dole's variorum edition (1896), J. Payne's translation (1898), E. Heron Allen's edition (1898) and the Life by J. K. M. Shirazi (1905); but the literature in new translations and imitations has recently multiplied exceedingly. *See* A. G. Potter, *A bibliography of printed editions of the quatrains of Omar Khayyám in foreign languages* (Needham, Mass., 1923).

OMBRE, a card game, very fashionable at the end of the 18th century, but now practically obsolete. It was played with a pack of 40 cards (8, 9, 10 being omitted) and bore some similarity to whist.

See T. Palmer, *The Royal game of the Ombre, written at the request of divers Honorable Persons* (1665).

OMDURMAN, a town of the Anglo-Egyptian Sudan, opposite Khartum on the west bank of the Nile and immediately north of the junction of the White and Blue Niles. Pop. (1926 census) 78,624 Europeans. The town covers a large area, being over 5 m. long and 2 broad. It consists for the most part of mud-huts, but there are some houses built of sun-dried bricks. Save for two or three wide streets which traverse it from end to end the town is a network of narrow lanes. In the centre facing an open space are the ruins of the tomb of the Mahdi and behind is the house in which he lived. The Khalifa's house (a two-storeyed building), the mosque, the Beit el Amana (arsenal) and other houses famed in the history of the town also face the central square, Omdurman is the headquarters of the native traders in the Anglo-Egyptian Sudan, the chief articles of commerce being ivory, ostrich feathers and gum arabic from Darfur and Kordofan. There is also an important camel and cattle market. The town is connected with Khartum by a bridge and an electric tramway. The government maintains elementary and technical schools. Mission work is undertaken by various Protestant and Roman Catholic societies.



PLAN OF THE BATTLE OF OMDURMAN, SEPT. 2, 1898

Omdurman, then an insignificant village, was chosen in 1884 by the Mahdi Mahommed Ahmed as his capital and so continued after the fall of Khartum in January 1885. Its growth was rapid, the Khalifa (who succeeded the Mahdi) compelling large numbers of disaffected tribesmen to live in the town under the eye of his soldiery. Here also were imprisoned the European captives of the Mahdists—notably Slatin Pasha and Father Ohrwalder. On Sept. 2, 1898 the Anglo-Egyptian army under Lord Kitchener totally defeated the forces of the Khalifa at Kerreri, 7 m. N. of the town. A marble obelisk marks the spot where the 21st Lancers made a charge. *See* EGYPT AND SUDAN, CAMPAIGNS IN.

OMELETTE: *see* EGG COOKERY.

OMEN, a sign in divination, favourable or unfavourable as the case may be (*see* DIVINATION, AUGURS and ORACLE).

OMICHUND (d. 1767), an Indian whose name is indelibly associated with the treaty negotiated by Clive before the battle of Plassey in 1757. His real name was Amir Chand; and he was not a Bengali, as stated by Macaulay, but a Sikh from the Punjab. It is impossible now to unravel the intrigues in which he may have been engaged, but some facts about his career can be stated. He had long been resident at Calcutta, where he had acquired a large fortune by providing the "investment" for the Company, and also by acting as intermediary between the English and the native court at Murshidabad. Several houses owned by him in Calcutta are mentioned in connection with the fighting that preceded the tragedy of the Black Hole in 1756, and it is on record that he suffered heavy losses at that time. He had been arrested by the English on suspicion of treachery, but afterwards he was forward in giving help to the fugitives and also valuable advice. On the recapture of Calcutta he was sent by Clive to accompany Mr. Watts as agent at Murshidabad. It seems to have been through his influence that the nawab gave reluctant consent to Clive's attack on Chandernagore. Later, when the treaty with Mir Jafar was being negotiated, he put in a claim for 5% on all the treasure to be recovered, under threat of disclosing the plot. To defeat him, two copies of the treaty were drawn up: the one, the true treaty, omitting his claim; the other containing it, to be shown to him, which Admiral Watson refused to sign, but Clive directed the admiral's signature to be appended. When the truth was revealed to Omichund after Plassey, Macaulay states (following Orme) that he sank gradually into idiocy, languished a few months, and then died. As a matter of fact, he survived for ten years, till 1767; and by his will he bequeathed £2,000 to the Foundling Hospital (where his name may be seen in the list of benefactors as "a black merchant of Calcutta") and also to the Magdalen Hospital in London.

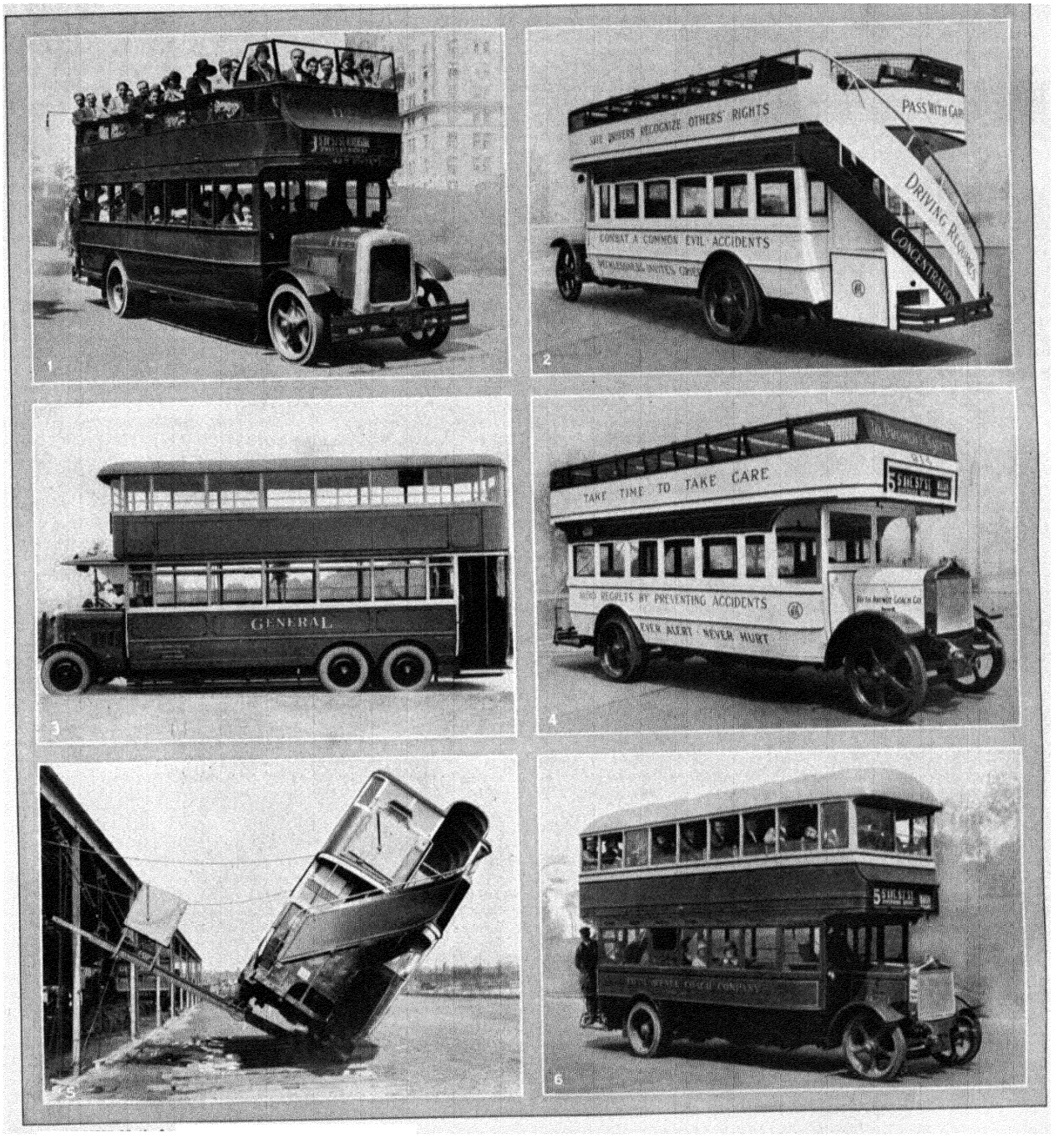
(J. S. Co.)

OMNIBUS. A term often shortened to "'bus," signifying a public passenger-carrying vehicle of large seating capacity. It has become synonymous in popular use with the word "motorbus." Horse drawn and steam driven omnibuses have been superseded by motor propelled omnibuses.

In several particulars an omnibus must conform with regulations laid down by public authorities, especially in connection with dimensions and weights. The carried load, consisting of the passengers and the omnibus body, will at most be less than the regulation weight by a figure termed the chassis weight. The proportion borne by the carried load to the total weight, is largely determined by the speed, hill climbing and other performances characteristic of the omnibus and such proportion is always made as large as possible to obtain the maximum earning power. For any specified purpose, designers have in recent years been able to increase this proportion without prejudicing either the reliability of the vehicles or the lowness of their running costs.

Body design aims at making the proportion borne by the passenger load to the carried load as great as possible, and is influenced very greatly by public requirements in the matter of comfort and safety. This proportion tends to become less as more exacting conditions have to be met in the provision of seating, shelter, ventilation and lighting. Passengers may be taken to weigh on an average one sixteenth of a ton each, but so soon as an omnibus body is provided to carry them, the weight that must be credited to each passenger becomes much greater.

The almost universal practice in omnibus design in 1928 was to employ two axles, the rear wheels being used for driving and braking, and the front wheels being used for steering. The weight



AMERICAN AND ENGLISH MOTOR COACHES FOR PUBLIC TRANSPORT

1. Fifth Avenue omnibus in New York city. This vehicle is a double-decked model, the upper deck having windshield in front to protect passengers while the omnibus is in motion. Entrance platform and winding stair are at the rear

2 and 4. Safety coach, Fifth avenue system, New York; designed to aid in an educational campaign for increased carefulness in city traffic

3. London six-wheeler omnibus, capacity 68 passengers; equipped with two driving axles, six cylinder engine, and pneumatic tyres all round

5. Stability test of a large London omnibus. The vehicle is tilted by means of an inclined platform and pulley blocks; wheels are prevented by ledges from slipping. Under the conditions shown, the safety ropes are quite slack with the vehicle tilted at 30 degrees

6. Double-decked omnibus, New York city, similar to the coach shown in fig. 1 but having upper deck roofed over and the sides enclosed with adjustable windows which slide into the partition below. These coaches have sleeve-valve motors and solid tyres all round

distribution, as indicated by the front and rear axle weights, must be such as to give the adhesion necessary for rapid acceleration and good braking on normal road surfaces. Skidding and inferior performance are the natural consequences of bad weight distribution. The limit is set to front axle weight by the consideration that the driver must be able to turn the front wheels easily in order to steer the vehicle. This limit is reached before the other, which otherwise would affect both axles alike (but which, in consequence of the earlier limit on the front axle, affects the rear axle alone), viz. the limiting axle weight tolerated by local authorities.

Low Centre of Gravity.—In the complete omnibus, under all conditions of loading, the centre of gravity must be so low in relation to the width of the vehicle as to render exceedingly remote the possibilities of over-turning. Where conditions permit, the centre of gravity should occupy a position even lower than that which gives the desired stability. All deviations of a 'bus from uniform motion in a straight line will bring about changes in the loading of every wheel, and these changes become smaller as the centre of gravity approaches the plane of the road. With a low centre of gravity, it will be usual to work very close to the adhesion figures calculated for the stationary omnibus, since the greatest acceleration and braking effects that these figures allow, can be actually approached in practice under all conditions. Where the centre of gravity is high, braking is liable to promote skidding at corners, and on cambered surfaces; rapid acceleration will give rise to the same tendency. Since the carried load in a modern omnibus forms the large proportion of the total weight, and since the carried load comprises very nearly everything which is above floor level, it follows that the problem of making further reductions in the height of the centre of gravity, resolves itself simply into the problem of reducing the floor height.

To obtain the lowest possible floor height, omnibus designers have developed the double reduction driving axle. In this axle, the driving shafts do not transmit the torque direct to the road wheels, but communicate their motion to them through gearing. Each wheel bears a drum coaxial with the brake drum, but of smaller diameter, on which teeth are cut internally. Pinions on the ends of the driving shafts engage with these drums at their lowest points. This arrangement permits the use of full size driving wheels with an axle whose height is considerably less than that of the wheel centres. It permits, moreover, the use of a smaller housing for the right angled drive in the centre of the axle. This drive no longer effects the whole torque multiplication, but only a part of it; whereas the whole multiplication may be nearly 10 to 1, the right angled drive may be called upon to give a multiplication of only 2 to 1, and may therefore be much more compact than one giving the full multiplication.

The centre of gravity is lower in the "N.S." omnibus than in other types. Under the worst conditions, when the upper deck is laden and the lower deck is unladen, the ground may tilt to the extent of 28° beneath the car before over-turning can occur. The best figure obtained with the more usual construction, and without a top cover, was 25°. With the advent of cross seating, omnibus axle weights became so great as to approach the limit tolerated by road authorities. Rear axle weights, reaching that limit, could no longer be increased, and the need arose, as bigger omnibus weights were required, for throwing the weight forward. To this end the forward drive omnibus was introduced in London, and subsequently in all parts of the world.

The modern 'bus body is continued forward to a point only an inch or two behind the rear cylinder block. The driver sits forward alongside the engine, and is actually in a much more favourable position to steer his vehicle round blind corners than formerly. The drawbacks to the forward drive omnibus, are, firstly, the heaviness of steering consequent upon the increased front axle loading, and secondly, the difficulty of access to the engine on the off-side. Neither of these drawbacks has, however, proved serious. There is a tendency among vehicle builders of six wheelers to return to the conventional driving position of many years ago, but the day cannot long be postponed when forward drive will be forced upon designers of six wheelers, as it has been forced upon designers of four wheelers.

Transmission Problem.—Common to all road vehicles employing the internal combustion engine, is the problem of transmitting the power developed by a relatively inflexible prime mover to the road wheels. In the omnibus, above all other vehicles, this problem is one of great difficulty to which no entirely satisfactory solution has yet been found. The high power weight ratio of an ordinary car makes possible the employment of a lightly constructed clutch and gearbox, since the car will normally run in top or direct gear. Only motoring enthusiasts care for driving on the gears and obtaining thereby a splendid performance out of a small capacity engine. Nevertheless, the omnibus driver is called upon to do this, and in consequence, the transmission must be of great robustness and be simple to manipulate. In addition to the need for gear changing, ever present on undulating roads, with the relatively low powered omnibus there is the constant stopping to let down and take up passengers which also calls for gear manipulation. With the very heavy omnibus used in services necessitating a great many stops, it has become impossible to achieve, without high maintenance costs, the propulsion of the load through the agency of the clutch and gearbox. It is probably only a matter of a year or two before other forms of transmission—electric transmission in particular—will live down their many drawbacks, and show on the whole a saving in costs.

For the right angled drive in an omnibus rear axle, bevel, and other forms of gearing have yet to be proved superior to worm gearing. Within recent years, the old fashioned motion communicating screw and wheel has been developed to meet modern automobile and industrial requirements, and in its original form it can scarcely claim a relationship with the highly efficient reversible worm gearing of the present day. The difficulties inherent in the many forms of bevel drive are to make them compact and also silent.

Suspension.—The suspension of an omnibus is effected through longitudinally disposed semi-elliptic leaf springs mounted on the axles, supplemented by rubber buffers, steel volute springs, or other energy absorbing devices over the axles. The latter augment the stiffness of the suspension to meet exceptional load or road conditions.

Rear springs are often allowed to take the driving and braking torque reactions of the rear axle. Where this is not permissible, a torque arm is provided, and the rear springs are shackled at both ends. Tractive effects are often communicated to the vehicle through the rear springs also, though, where a torque arm is provided, the springs must, in view of their being shackled at both ends be relieved of this duty. Where it is provided, the torque arm usually swings from a well braced frame cross-member that has sufficient strength to withstand the pushing and tugging in a horizontal plane to which it will be subjected by the driving and braking exertions of the rear axle. Some vehicles are made with a torque tube surrounding the propeller shaft.

No effort is made by designers to produce completely rigid chassis frames for omnibuses. All things carried on the frame are mounted so as to flex with it or be able to take up a new position without strain. Such rigid structures as engine, gearbox and radiator, are mounted on frame attachments or bearers with rubber or other resilient pads interposing and permitting small relative movements. Where severe conditions must be met, the engine and gearbox are mounted on three such bearers only. Three points of support, however, situated, remain always in a plane, and there can be no distortion from twisting with three point suspension. The drive between units, disposed none too rigidly in relation to one another, is effected by means of shafts bearing flexible couplings or universal joints at their extremities.

The enormous mileages accomplished by the omnibus as compared with the light car, prohibit the adoption by omnibus engineers of light car greasing methods. There is no part of an omnibus which can be packed with grease and left to itself from one year's end to another. Grease nipples and filler caps are provided everywhere in accessible positions, and positive action grease feeding guns which can be relied upon to urge lubricant where

lubrication is necessary, are used under service conditions at frequent intervals.

Tyre-makers, anticipating the call for higher omnibus speeds which had been heard for some considerable time, developed the pneumatic tyre that will carry heavy loads. With higher running speed, better braking must be provided on all vehicles. Rear wheel adhesion becomes insufficient and all four wheels must be fitted with drums and brake shoes. Four wheel braking is, in any event, often forced upon designers by the difficulty of accommodating two sets of brake drums on the very small wheel centres that accompany these deep section tyres.

OMRI, an Israelite general, chosen by the army as ruler when, during a campaign against the Philistines, reports came that Zimri, a captain of the chariots, had murdered the king, Elah, in the royal city of Tirzah and proclaimed himself king. Omri promptly marched against Zimri, and captured Tirzah; Zimri, recognizing the hopelessness of his position, set fire to the palace and perished in the flames. A rival party set up Tibni—with whom the Greek versions associate his brother Joram—as king, but Omri defeated this faction and became undisputed king of Israel *c.* 884 B.C. The one deed of his reign recorded in I Kings xvi. 24 is his purchase of the hill of Samaria, upon which he founded a new royal city. But Mesha of Moab mentions him as "having afflicted Moab many days." In spite of the fact that he suffered some reverses at the hand of Syria (I Kings xx. 34), he must have been an accomplished statesman who consolidated his kingdom and made it respected, because for generations after his death Israel is known to the cuneiform writers as "House (or Land) of Omri," and the Israelite Jehu as a "son of Omri." He reigned twelve years and was succeeded by his son AHAB (*q.v.*).

OMSK, a town in the Siberian area of Asiatic Russia, in lat. 55° N., long. 73° 38′ E., on the right bank of the Irtysh, where the Om joins it. It is in the midst of a treeless steppe; violent winds bring snow, often to a depth of 6 ft., in winter, and sandstorms in summer. Average January temperature 5° F, July 68° F; annual rainfall 12·4 in.; altitude 285 ft. It is on the trans-Siberian railway, and has a branch linking with Sverdlovsk through Ishim and Tyumen. Steamer routes connect it with the Ob northwards along the Irtysh, and southwards with the Altai towns and Lake Zaisan, and caravan routes from the Central Asiatic republics and Kazakstan converge upon it. Its population has grown from 37,376 in 1897 to 115,523 in 1926, but its appearance is still that of a frontier town, with one-storeyed wooden huts and unpaved streets, through which Kirghiz ponies and camel caravans thread their way. Stone buildings are being constructed and the cathedral is built of stone; there is a municipal electricity, water and bus service. Its industries include the making of agricultural and other machinery, distilling, brewing, cloth manufacture and foodstuffs, especially sausage. It is a centre for the collection and export of meat, butter, hides and skins. The Russian Geographical society has a museum here and there is much educational and dramatic activity.

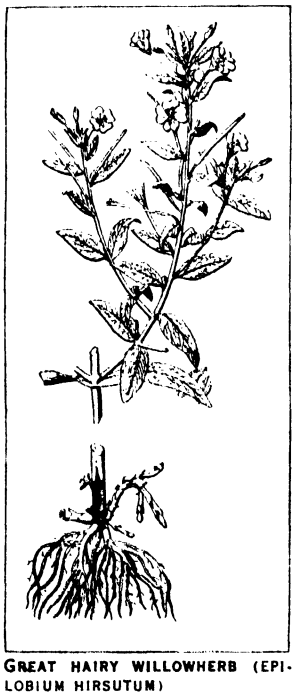
A fort was established here in 1716 to protect the Russian settlers from Kirghiz raids. Later, with the increasing colonization of the area and the coming of the railway, the town developed rapidly and became a military centre, with large barracks. After the 1917 revolution, it was the nucleus of Siberian political activity and various governments rapidly succeeded one another; Admiral Kolchak declared himself Dictator of Siberia at Omsk. With the advance of the Bolshevik army, refugees from the west crowded into the town and the insanitary conditions resulted in a plague of spotted fever and typhus. On the capture of the town the refugees fled further eastwards carrying infection with them, though many died of cold, hunger and disease.

ONA, an Indian tribe who once occupied the interior of Tierra del Fuego except the south-western corner, which was uninhabited, and the south-eastern corner, where dwelt a related tribe known as the Haush. The Ona in speech, physique and culture were similar to the giant Tehuelche of Patagonia. They subsisted by hunting and were expert archers. Their chief food was the flesh of the guanaco, a wild camel related to the llama. In addition they ate birds, fish, shellfish, berries and fungi. Ona culture was very primitive. Their dress was a large robe of guanaco fur, moccasins, a petticoat for the women and a fur diadem for the men. In spite of their cold environment they rarely used houses, and habitually slept behind a windbreak of hides. Their manufactures included bows and arrows, short fishing spears, slings, baskets, braided necklaces, wristlets and anklets and a few simple tools. Ona society was organized into hunting groups of relatives. Each group controlled a well-defined territory which it vigorously defended from poachers. As a result blood feuds were common. At times each hunting group assembled to perform initiation ceremonies. Candidates were taught tribal lore, were terrified by masked apparitions and were forced to live in solitude for two years that they might become strong and self-reliant. Ona religion consisted in a fear of certain malevolent spirits and belief in a supreme deity. Ona mythology is rich. The tribe has almost died out.

See S. K. Lothrop, "The Indians of Tierra del Fuego" (Museum of the American Indian, Heye Foundation, *Contributions,* vol. x. 1928); J. M. Cooper, *Analytical and Critical Bibliography—of Tierra del Fuego* (Bureau of American Ethnology, Bulletin 63, 1917).

(S. K. L.)

ONAGRACEAE, in botany, a family of dicotyledons belonging to the order Myrtiflorae, to which belongs also the myrtle family, Myrtaceae. It contains about 40 genera and 500 species, and occurs chiefly in the temperate zone of the New World, especially on the Pacific side. It is represented in Britain by several species of *Epilobium* (willow-herb), *Circaea* (enchanter's nightshade), and *Ludvigia,* a small perennial herb very rare in boggy pools in Sussex and Hampshire. In the United States, especially in the Pacific States, the family is well represented, the principal genera being *Oenothera* (containing as a native the evening primrose, now naturalized in certain parts of Europe), *Epilobium* (willow herb), and *Ludvigia* (false loosestrife). The plants are generally herbaceous, sometimes annual, as species of *Epilobium, Clarkia, Godetia,* or biennial, as *Oenothera biennis*—evening primrose—or sometimes become shrubby or arborescent, as *Fuchsia* (*q.v.*). The simple leaves are generally entire or inconspicuously toothed, and are alternate, opposite or whorled in arrangement; they are generally exstipulate. The flowers are often solitary in the leaf-axils, as in many *Fuchsias, Clarkia,* etc., or associated, as in *Epilobium* and *Oenothera,* in large showy terminal spikes or racemes; in *Circaea* the small white or red flowers are borne in terminal and lateral racemes. The regular flowers have the parts in fours, the typical arrangement as illustrated by *Epilobium, Oenothera* and *Fuchsia* being as follows: 4 sepals, 4 petals, two alternating whorls of 4 stamens, and 4 inferior carpels. The floral receptacle is produced above the ovary into the so-called calyx-tube, which is often petaloid, as in *Fuchsia,* and is sharply distinguished from the ovary, from which it separates after flowering.



GREAT HAIRY WILLOWHERB (EPILOBIUM HIRSUTUM)

In *Clarkia* the inner whorl of stamens is often barren, and in *Eucharidium* it is absent. In *Circaea* the flower has its parts in two's. Both sepals and petals are free; the former are valvate in bud, and reflexed in the flower; in *Fuchsia* they are petaloid. The petals are generally convolute in bud; they are entire (*Fuchsia*) or bilobed (*Epilobium*); in some species of *Fuchsia* they are small and scale-like, or absent (*F. apetala*). The stamens are free, and those of the inner whorl are generally shorter than those of the outer whorl. The flowers of *Lopezia* (Central

America) have only one fertile stamen. The large spherical pollen grains are connected by viscid threads. The typically quadrilocular ovary contains numerous ovules on axile placentas; the 1-to-2-celled ovary of *Circaea* has a single ovule in each loculus. The long slender style has a capitate (*Fuchsia*), 4-rayed (*Oenothera, Epilobium*) or 4-notched (*Circaea*) stigma. The flowers, which have generally an attractive corolla and honey secreted by a swollen disk at the base of the style or on the lower part of the "calyx-tube," are adapted for pollination by insects, chiefly bees and lepidoptera; sometimes by night-flying insects when the flowers are pale and open towards evening, as in evening primrose. The fruit is generally a capsule splitting into four valves and leaving a central column on which the seeds are borne as in *Epilobium* and *Oenothera*—in the former the seeds are scattered by aid of a long tuft of silky hairs on the broader end. In *Fuchsia* the fruit is a berry, which is sometimes edible, and in *Circaea* a nut bearing recurved bristles. The seeds are exalbuminous. Several of the genera are well known as garden plants, e.g., *Fuchsia, Oenothera, Clarkia* and *Godetia*. Evening primrose (*Oenothera biennis*), a native of North America, occurs apparently wild as a garden escape in Britain. *Jussieua,* a tropical genus of 50 species of water- and marsh-herbs, shows a development of well-developed aerating tissue.

ONATAS, a Greek sculptor of the time of the Persian wars, a member of the flourishing school of Aegina. Many of his works are mentioned by Pausanias; they included a Hermes carrying the ram, and a strange image of the Black Demeter made for the people of Phigaleia; also some groups in bronze at Olympia and Delphi, including a bronze chariot for Hieron I. of Syracuse. From Pausanias' descriptions we may assume that the figures on the pediments of Aegina represent his style. They are manly, vigorous, athletic, showing great knowledge of the human form, but somewhat stiff and automaton-like.

ON-COSTS: *see* OVERHEAD CHARGES.

ONEGA (ŏn'e-gah), the largest lake in Europe next to Ladoga, area, 3,764 sq.m. and coast line 870 m. in length. It lies mostly in the Karelian A.S.S.R., though its southern portion is in the province of Leningrad. The lake basin extends north-west and south-east, the direction characteristic of the lakes of Finland and the line of glacier-scoring observed in that region. The southern coast is comparatively regular and has few islands, but the north is broken into inlets, the largest being Povyenets bay, and is crowded with islands (*e.g.*, Klimetsk) and submerged rocks. The north-western shore between Petrozavodsk and the mouth of the river Lumbosha consists of dark clay slates, generally arranged in horizontal strata and broken by protruding, parallel ridges of diorite, which extend far into the lake. The eastern shore, as far as the mouth of the Andoma, is for the most part alluvial, with outcroppings of red granite and in one place (the mouth of the Pyalma) diorite and dolomite. To the south-east are sedimentary Devonian rocks, and the general level of the coast is broken by Mt. Andoma and Cape Petropavlovskiy (160 ft. above the lake); to the south-west a quartz sandstone (used as a building and monumental stone in Leningrad) forms a fairly bold rim. Lake Onega lies 125 ft. above the sea. The greatest depths, 318 to 408 ft., occur at the entrance to the double bay of Lizhemsk and Unitsk. On the continuation of this line the depth exceeds 240 ft. in several places. In the middle of the lake the depth is 120 to 282 ft., and less than 120 ft. in the south. The lake is 145 m. long, with an average breadth of 50 m. The most important affluents, the Vodka, the Andoma and the Vytegra, come from the east. The Kumsa, a northern tributary, is sometimes represented as if it connected the lake with Lake Seg, but at the present time the latter drains to the White sea. The Onega canal (45 m. long) was constructed in 1818–51 along the southern shore in order to connect the Svir (and hence Lake Ladoga and the Baltic) with the Vytegra, which connects with the Volga. In 1928 an electric station was constructed on the Svir river. Lake Onega remains free from ice for 209 days in the year (middle of May to second week of December). The water is at its lowest level in the beginning of March; by June it has risen 2 ft. A considerable population is scattered along the shores of the lake, mainly occupied in the timber trade, fisheries and mining industries. The opening of the Murmansk railway along the western shore in 1917 is developing settlement. Salmon, *palya* (a kind of trout), burbot, pike, pike perch and perch are among the fish caught in the lake.

The River Onega rises in Lake Vozhe, and is navigable for boats and rafts to Kargopol on Lake Lacha to the Gulf of Onega, an inlet of the White sea. It flows through the provinces of Vologda and Archangel and has no connection with Lake Onega. At the mouth of this river (on the right bank) in 63° 55′ N., 38° 55′ E., in the province of Archangel, stands the town and port of Onega. Pop. (1926) 5,254. It dates from settlements made by the people of Novgorod in the 15th century, known in history as Ustenskaya or Ustyanskaya. It has a saw-milling industry, and has summer steamer routes to Soroka, Kem and Archangel, but the season is short owing to the persistence of land floes and loose pack. Telegraphic communication is by the Archangel railway.

ONEIDA, the only city of Madison county, New York, U.S.A., on Oneida creek, 6 m. S.E. of Oneida lake, midway between Utica and Syracuse. It is served by the New York Central, the New York, Ontario and Western and electric railways. Pop. (1920), 10,541 (89% native white). Adjoining Oneida on the west is the village of Wampsville (pop. 272 in 1925), the county seat. Across the creek, to the south-east, is the village of Oneida Castle (pop. 463 in 1925), formerly the gathering-place of the Oneida Indians. Oneida is the headquarters of the Oneida Community (*q.v.*), which controls important industries (notably the manufacture of silver-plated ware) here and elsewhere. The city also manufactures caskets and furniture. The aggregate factory output in 1925 was valued at $5,302,380. Oneida was founded by Sands Higinbotham, who bought the site in 1829–30. It was incorporated as a village in 1848 and as a city in 1901.

ONEIDA (a corruption of their proper name *Oneyotka-ono,* "people of the stone," in allusion to the Oneida stone, a granite boulder near their former village, which was held sacred by them), a tribe of North American Indians of Iroquoian stock, forming one of the Six Nations. They lived around Oneida Lake in New York state, in the region southward to the Susquehanna. They were not loyal to the League's policy of friendliness to the English, but inclined towards the French, and were practically the only Iroquois who fought for the Americans in the War of Independence. As a consequence they were attacked by others of the Iroquois under Joseph Brant and took refuge within the American settlements till the war ended, when the majority returned to their former home, while some migrated to the Thames river district, Ontario. Early in the 19th century they sold their lands, and most of them settled on a reservation at Green Bay, Wisconsin, a few remaining in New York state. In 1926 the Oneidas in the United States numbered 3,238 persons, of whom 2,976 were in Wisconsin and 262 in New York state. They are civilized and prosperous. *See* NORTH AMERICA: *Ethnology.*

ONEIDA COMMUNITY, an American communistic society at Oneida, New York. It was founded at Putney, Vt., in 1842, by John Humphrey Noyes (1811–86), a graduate of Dartmouth college and a former Congregationalist minister. Having received a second conversion at a revival he announced himself a "perfectionist," or one who, believing that Christ had come again in A.D. 70, was absolved of all past and future sin. On this tenet he and his followers established a commune, eventually pooling all their property, renouncing all religious observances and allegiance to the United States and instituting a "complex marriage" system, any desire toward monogamy being frowned upon as naturally antagonistic to communistic ideals. In 1847, dissension having brought them before the courts and their theories and practices before the public, they were forced to leave Putney. They purchased, near Oneida, N.Y., 600ac. of forest-land which proved extremely productive. They planted orchards, lumbered, blacksmithed, farmed and made steel traps—their most profitable industry. In Jan., 1847, their first annual inventory revealed them to be worth about $67,000.

They were mostly New England farmers and mechanics. They had the reputation of being excellent citizens only remarkable for

their earnest interest in eugenics. They sought to make practical application of what scientific information they possessed endeavouring by change and experiment to produce the best possible offspring.

Owing to increasing pressure of public sentiment, which had been anticipated though for 25 years it was unexpressed, Noyes, with a few adherents, removed to Canada in 1880 and the community at Oneida voluntarily dissolved as a communistic experiment and formed a stock company known as the Oneida Community, Limited. At that time it manufactured sewing and embroidery silk, steel traps and silverware, and canned large quantities of fruits and vegetables, but has gradually confined itself to the manufacturing of silverware. The present company has "no connection with the old beyond the personnel and traditions which it inherited from its 40 years' experience as a community."

Among the chief writings of J. H. Noyes dealing with the origin, principles and history of the Oneida Community are *The Berean* (1847), a manual for the use of members; *Salvation from Sin the End of Christian Faith* (1869); *History of American Socialisms* (1870); *Home-Talks* (1875); and *Essay on Scientific Propagation* (*c.* 1875). *See* also *Bible Communism* (1853), a compilation summarizing the community's religious and social theories; Allan Estlake, *The Oneida Community* (1900); and George Wallingford Noyes, comp. and ed., *Religious Experiences of John Humphrey Noyes* (1923).

O'NEILL, the name of an Irish family descended from Niall, king of Ireland in the 5th century, and known as Niall of the Nine Hostages. He is said to have made war against rulers in Ireland, Britain and Gaul, stories of his exploits being related in the *Book of Leinster* and the *Book of Ballymote*. This king had 14 sons, one of whom was Eoghan (Owen), from whom the O'Neills were descended. The descendants of Niall were divided into two main branches, the northern and the southern Hy Neill, to one or other of which nearly all the high-kings (ard-ri) of Ireland from the 5th to the 12th century belonged; the descendants of Eoghan being the chief of the northern Hy Niell[1]. Eoghan was grandfather of Murkertagh (Muircheartach) (d. 533), said to have been the first Christian king of Ireland, whose mother, Eirc or Erca, became by a subsequent marriage the grandmother of St. Columba. Of this monarch, known as Murkertagh MacNeill (Niall), and sometimes by reference to his mother as Murkertagh Mac Erca, the story is told, illustrating an ancient Celtic custom, that he emphasized the inviolability of a treaty with a tribe in Meath by having it written with the blood of both clans mixed in one vessel. Murkertagh was chief of the great north Irish clan, the Cinel Eoghain, and after becoming king of Ireland in 517, he seized a tract in the modern Co. Derry, which remained till the 17th century in the possession of the Cinel Eoghain. The inauguration stone of the Irish kings, the Lia Fail, or Stone of Destiny, fabled to have been the pillow of the patriarch Jacob when he dreamed of the heavenly ladder, was said to have been presented by Murkertagh to the king of Dalriada, by whom it was conveyed to Dunstaffnage castle in Scotland. (*See* SCONE.) A lineal descendant of Murkertagh was Niall Frassach (*i.e.*, of the showers), who became king of Ireland in 763. His grandson, Niall (791–845), drove back the Vikings who began to infest the coast of Donegal. Niall's son, Aedh (Hugh) Finnlaith, was father of Niall Glundubh (*i.e.*, Niall of the black knee), one of the most famous of the early Irish kings, from whom the family surname of the O'Neills was derived. His brother Domhnall (Donnell) was king of Ailech, a district in Donegal and Derry; the ruined masonry of the royal palace is still to be seen on a hill overlooking loughs Foyle and Swilly. On the death of Domhnall in 911 Niall Glundubh became king of Ailech, and, after defeating the kings of Dalriada and Ulidia he became king of Ireland in 915. To him is attributed the revival of the ancient meeting of Irish clans known as the Fair of Telltown. He fought many battles against the Norsemen, in one of which he was killed in 919 at Kilmashoge, where his place of burial is still to be seen.

His son Murkertagh, who gained a victory over the Norse in 926, is celebrated for his triumphant march round Ireland, the *Moirthimchell Eireann*, when he captured many kings and chieftains. From the dress of his followers in this expedition he was called "Murkertagh of the Leather Cloaks." The exploit was celebrated by Cormacan, the king's bard, and a number of Murkertagh's other exploits are related in the *Book of Leinster*. He was killed in battle against the Norse in 943, and was succeeded as king of Ailech by his son, Donnell Ua Niall (*i.e.*, O'Neill, grandson of Neill, or Niall, the name O'Neill becoming about this time an hereditary family surname), whose grandson, Flaherty, made a pilgrimage to Rome in 1030.

Aedh (Hugh) O'Neill, chief of the Cinel Eoghain, or lord of Tir-Eoghain (Tir-Owen, Tyrone) at the end of the 12th century, came into conflict with the Anglo-Norman monarchy, whose pretensions he disputed in Ulster. His son (or nephew), Hugh O'Neill, lord of Tyrone, was styled "Head of the liberality and valour of the Irish." Hugh's son, Brian, was inaugurated prince, or lord, of Tyrone in 1291; and his son Henry became lord of the *Clann Aodha Buidhe* (Clanaboy or Clandeboye) early in the 14th century. Henry's son Murkertagh the Strongminded, and his great-grandson Hugh, greatly consolidated the power of the O'Neills. Niall Og O'Neill, one of the four kings of Ireland, accepted knighthood from Richard II.; and his son Eoghan formally acknowledged the supremacy of the English crown, though he afterwards ravaged the Pale, and was inaugurated "the O'Neill" (*i.e.*, chief of the clan) on the death of his kinsman Domhnall Boy O'Neill. He was deposed (1455) by his son Henry, who in 1463 was acknowledged as chief of the Irish kings by Henry VII. Contemporary with him was Neill Mor O'Neill, lord of Clanaboy. From Neill Mor O'Neill's son Brian was descended the branch of the O'Neills who, settling in Portugal in the 18th century, became Portuguese nobles. This branch represents the male line of the ancient Irish kings of the house of O'Neill.

CONN O'NEILL (*c.* 1480–1559), 1st earl of Tyrone, surnamed Bacach (the Lame), grandson of Henry O'Neill mentioned above, was the first of the O'Neills to come to the front as a leader of the Irish against the English in the 16th century. Conn became chief of the Tyrone branch of the O'Neills (Cinel Eoghain) about 1520. Tyrone having been invaded in 1541 by Sir Anthony St. Leger, the lord deputy, Conn delivered up his son as a hostage, attended a parliament held at Trim, and, crossing to England, made his submission at Greenwich to Henry VIII., who created him earl of Tyrone for life. He was also made a privy councillor in Ireland, and received a grant of lands within the Pale. O'Neill's submission to the English king, and his acceptance of an English title were resented by his clansmen and dependents. The earl maintained a feud with his son Shane (John), arising out of his transaction with Henry VIII. The nomination of O'Neill's reputed son Matthew as his heir with the title of baron of Dungannon by the English king conflicted with the Irish custom of tanistry (*q.v.*), which regulated the chieftainship of the Irish clans; moreover, Matthew, if indeed he was O'Neill's son at all, was illegitimate, and Shane, Conn's eldest legitimate son, would not permit any invasion of his rights. The fierce family feud ended in the murder of Matthew by agents of Shane in 1558; Conn dying about a year later. Conn was twice married, Shane being the son of his first wife, a daughter of Hugh Boy O'Neill of Clanaboy. An illegitimate daughter of Conn married the celebrated Sorley Boy MacDonnell (*q.v.*).

SHANE O'NEILL (*c.* 1530–1567), rejected overtures from the earl of Sussex, the lord deputy, and refused to help the English against the Scottish settlers on the coast of Antrim, allying himself instead with the MacDonnells, the most powerful of these immigrants. Nevertheless Queen Elizabeth was disposed to come to terms with Shane, who after his father's death was *de facto* chief of the O'Neill clan. She recognized his claims to the chieftainship, thus throwing over Brian O'Neill, son of the murdered Matthew, baron of Dungannon, on terms. O'Neill, however, refused to put himself in the power of Sussex without a guarantee for his safety; and his claims were so exacting that Elizabeth determined to restore Brian. An attempt to incite the O'Donnells against him was frustrated by Shane's capture of Calvagh O'Donnell, whom he

[1] A list of these kings will be found in P. W. Joyce's *A Social History of Ancient Ireland* (London, 1903), vol. i., pp. 70, 71.

kept a prisoner for nearly three years. Elizabeth, who was not prepared to undertake the subjugation of the Irish chieftain, urgently desired peace with him, especially when the devastation of his territory by Sussex brought him no nearer to submission. Sussex was not supported by the queen, who sent the earl of Kildare to arrange terms with O'Neill. The latter agreed to present himself before Elizabeth. Accompanied by Ormonde and Kildare he reached London on Jan. 4, 1562. Elizabeth temporized; but finding that O'Neill was in danger of becoming a tool in the hands of Spanish intriguers, she permitted him to return to Ireland, recognizing him as "the O'Neill," and chieftain of Tyrone; though a reservation was made of the rights of Hugh O'Neill, who had succeeded his brother Brian as baron of Dungannon, Brian having been murdered in April 1562 by his kinsman Turlough Luineach O'Neill.

There were at this time three powerful contemporary members of the O'Neill family in Ireland—Shane, Turlough and Hugh, 2nd earl of Tyrone. Turlough had been elected tanist (*see* TANISTRY) when his cousin Shane was inaugurated the O'Neill, and he schemed to supplant him during Shane's absence in London. The feud did not long survive Shane's return to Ireland, where he re-established his authority, and renewed his turbulent tribal warfare. Elizabeth at last authorized Sussex to take the field against Shane, but two expeditions failed. Shane now laid the whole blame for his lawless conduct on the lord deputy's repeated alleged attempts on his life. Elizabeth consented to treat, and practically all O'Neill's demands were conceded. O'Neill now turned his hand against the MacDonnells, claiming that he was serving the queen of England in harrying the Scots. He fought an indecisive battle with Sorley Boy MacDonnell near Coleraine in 1564, and in 1565 routed the MacDonnells and took Sorley Boy prisoner near Ballycastle. This victory strengthened Shane O'Neill's position, and preparations were made for his subjugation. O'Neill ravaged the Pale, failed in an attempt on Dundalk, made a truce with the MacDonnells, and sought help from the earl of Desmond. The English, on the other hand, invaded Donegal and restored O'Donnell. O'Neill was routed by the O'Donnells at Letterkenny; and seeking safety in flight, he threw himself on the mercy of his enemies, the MacDonnells. Attended by a small body of gallowglasses, and taking his prisoner Sorley Boy with him, he presented himself among the MacDonnells near Cushendun, on the Antrim coast. Here, on June 2, 1567, he was slain by the MacDonnells. In his private character Shane O'Neill was a brutal, uneducated savage.

TURLOUGH LUINEACH O'NEILL (*c.* 1530–1595), earl of Clanconnell, was inaugurated chief of Tyrone on Shane's death. He sought to strengthen his position by alliance with the O'Donnells, MacDonnells and MacQuillans. An expedition under the earl of Essex was sent against him, which effected little, and in 1575 O'Neill received by treaty extensive grants of lands and permission to employ 300 Scottish mercenaries. In 1578 he was created baron of Clogher and earl of Clanconnell for life; but for the next few years he continued to intrigue against the English authorities. The latter, as a counterpoise to Turlough, supported his cousin Hugh, brother of Brian, whom Turlough had murdered. Eventually Turlough resigned the headship of the clan in favour of Hugh, who was inaugurated O'Neill in 1593. Turlough died in 1595.

HUGH O'NEILL (*c.* 1540–1616), 2nd earl (known as the great earl) of Tyrone, was the second son of Matthew, reputed illegitimate son of Conn, 1st earl of Tyrone. He succeeded his brother, Brian, when the latter was murdered by Turlough in 1562, as baron of Dungannon. He was brought up in London, but returned to Ireland in 1567 after the death of Shane, under the protection of Sir Henry Sidney. He served with the English against Desmond in Munster in 1580, and assisted Sir John Perrot against the Scots of Ulster in 1584. In the following year he attended parliament as earl of Tyrone, though Conn's title had been for life only, and had not been assumed by Brian. Hugh's constant disputes with Turlough were fomented by the English, but after Hugh's inauguration as the O'Neill on Turlough's resignation in 1593, he was supreme in the north. Having roused the ire of Sir Henry Bagnal (or Bagenal) by eloping with his sister in 1591, he afterwards assisted him in defeating Hugh Maguire at Belleek in 1593; and then again went into opposition and sought aid from Spain and Scotland. Sir John Norris was ordered to Ireland to subdue him in 1595, but Tyrone took the Blackwater fort and Sligo castle before Norris was prepared; he was thereupon proclaimed a traitor of Dundalk. In spite of the traditional enmity between the O'Neills and the O'Donnells, Tyrone allied himself with Hugh Roe O'Donnell, nephew of Shane's former enemy Calvagh O'Donnell, and the two chieftains opened communications with Philip II. of Spain, their letters to whom were intercepted by the viceroy, Sir William Russell. They presented themselves as champions of the Catholic religion, claiming religious and political liberty for the Irish. In April 1596 Tyrone received promises of help from Spain. He temporized successfully for more than two years, making professions of loyalty which deceived Sir John Norris and the earl of Ormonde. In 1598 a formal pardon was granted to Tyrone by Elizabeth. Within two months he was again in the field, and on Aug. 14, he destroyed an English force under Bagnal at the Yellow ford on the Blackwater. If the earl had known how to profit by this victory, he might now have successfully withstood the English power in Ireland; for in every part of Ireland—and especially in the south, where James Fitzthomas Fitzgerald, with O'Neill's support, was asserting his claim to the earldom of Desmond at the head of the Geraldine clansmen—discontent broke into flame. But Tyrone procrastinated. Eight months after the battle of the Yellow ford, the earl of Essex landed in Ireland. He met Tyrone at a ford on the Lagan on Sept. 7, 1599, when a truce was arranged; but Elizabeth objected to the conditions allowed to the O'Neill and to Essex's treatment of him as an equal. Tyrone then issued a manifesto to the Catholics of Ireland summoning them to join his standard. After an inconclusive campaign in Munster in January 1600, he returned to Donegal, where he received supplies from Spain and a token of encouragement from Pope Clement VIII. In May of the same year armies under Sir Henry Docwra and Mountjoy compelled O'Neill to retire to Armagh, a large reward having been offered for his capture alive or dead.

The appearance of a Spanish force at Kinsale drew Mountjoy to Munster in 1601; Tyrone followed him, and at Bandon joined forces with O'Donnell and with the Spaniards under Don John D'Aquila. The attack failed. O'Donnell went to Spain, where he died and Tyrone with a shattered force went to the north, where he renewed his temporizing policy. Early in 1603 Elizabeth instructed Mountjoy to open negotiations; and in April, Tyrone, in ignorance of Elizabeth's death, made his submission. In Dublin he heard of the accession of King James, at whose court he presented himself in June accompanied by Rory O'Donnell, who had become chief of the O'Donnells after the departure of his brother Hugh Roe. James confirmed Tyrone in his title and estates, but new disputes arose on his rights over certain of his feudatories, of whom Donnal O'Cahan was the most important. This dispute dragged on till 1607, when Tyrone arranged to go to London to submit the matter to the king. Warned, however, that his arrest was imminent, and possibly persuaded by Rory O'Donnell (created earl of Tyrconnel in 1603), Tyrone resolved to fly from the country.

"The flight of the earls," one of the most celebrated episodes in Irish history, occurred on Sept. 14, 1607, when Tyrone and Tyrconnel embarked at midnight at Rathmullen on Lough Swilly, with their wives, families and retainers, numbering 99 and sailed for Spain. Driven by contrary winds to take shelter in the Seine, the refugees passed the winter in the Netherlands, and in 1608 went to Rome, where they were entertained by Pope Paul V., and where Tyrconnel died the same year. In 1613 Tyrone was outlawed and attainted by the Irish parliament, and he died in Rome on July 20, 1616. He was four times married, and had a large number both of legitimate and illegitimate children.

SIR PHELIM O'NEILL (*c.* 1603–1653), a kinsman and younger contemporary of the earl of Tyrone, took a prominent part in the rebellion of 1641. In that year he was elected member of the

Irish parliament for Dungannon, and joined the earl of Antrim and other lords in supporting Charles I. against the parliament. On Oct. 22, 1641, he surprised and captured Charlemont castle; and having been chosen commander-in-chief of the Irish in the north, he forged and issued a pretended commission from Charles I. sanctioning his proceedings. Phelim and his followers ravaged Ulster on the pretext of reducing the Scots, but failed to take Drogheda, being compelled by Ormonde to raise the siege in April 1642. During the summer his fortunes ebbed, and he was superseded by his kinsman Owen Roe O'Neill.

OWEN ROE O'NEILL (*c.* 1590–1649), one of the most celebrated of the O'Neills, the subject of the well-known ballad "The Lament for Owen Roe," was the son of Art O'Neill, a younger brother of Hugh, 2nd earl of Tyrone. Having served with distinction in the Spanish army he was immediately recognized on his return to Ireland as the leading representative of the O'Neills. Phelim resigned the northern command in his favour, and escorted him from Lough Swilly to Charlemont. But jealousy between the kinsmen was complicated by differences between Owen Roe and the Catholic council which met at Kilkenny in 1642. Owen Roe's real aim was the complete independence of Ireland, while the Anglo-Norman Catholics represented by the council desired to secure religious liberty and an Irish constitution under the English crown. In 1646 a cessation of hostilities was arranged between Ormonde and the Catholics; and O'Neill, furnished with supplies by the papal nuncio, Rinuccini, turned against the Scottish parliamentary army under General Monro. On June 5, 1646, O'Neill routed Monro at Benburb, on the Blackwater; but, being summoned to the south by Rinuccini, he had to leave Monro unmolested at Carrickfergus. For the next two years confusion reigned, O'Neill supporting the party led by Rinuccini, though continuing to profess loyalty to Ormonde as the king of England's representative. Isolated by the departure of the papal nuncio from Ireland in 1649, he made overtures to Ormonde, and to Monk, who had superseded Monro in command of the parliamentarians in the north. O'Neill's chief need was supplies, and failing to obtain them from Monk he turned once more to Ormonde and the Catholic confederates, with whom he prepared to co-operate more earnestly when Cromwell's arrival in Ireland in August 1649 brought the Catholic party face to face with serious danger. Before anything was accomplished by this combination, however, Owen Roe died on Nov. 6, 1649.

The alliance between Owen Roe and Ormonde had been opposed by Phelim O'Neill, who after his kinsman's death expected to be restored to his former command. In this he was disappointed; but he continued to fight against the parliamentarians till 1652, when a reward was offered for his apprehension. Betrayed by a kinsman while hiding in Tyrone, he was tried for high treason, and executed on March 10, 1653. Phelim married a daughter of the marquis of Huntly, by whom he had a son Gordon O'Neill, who was member of parliament for Tyrone in 1689; fought for the king at the siege of Derry and at the battles of Aughrim and the Boyne; and afterwards commanded an Irish regiment in the French service, and died in 1704.

DANIEL O'NEILL (*c.* 1612–1664), a member of the Clanaboy branch of the family, spent much of his early life at the court of Charles I., and became a Protestant. He commanded a troop of horse in Scotland in 1639; was involved in army plots in 1641, for which he was committed to the Tower, but escaped; and on the outbreak of the Civil War returned to England and served with Prince Rupert, being present at Marston moor, the second battle of Newbury and Naseby. He then went to Ireland to negotiate between Ormonde and his uncle, Owen Roe O'Neill. He was made a major-general in 1649, and but for his Protestantism would have succeeded Owen Roe as chief of the O'Neills. He joined Charles II. at the Hague, and took part in the expedition to Scotland and the Scottish invasion of England in 1652.

HUGH O'NEILL (d. *c.* 1660), son of Owen Roe's brother Art Oge, and therefore known as Hugh Mac Art, had served with distinction in Spain before he accompanied his uncle, Owen Roe, to Ireland in 1642. After the death of Owen he defended Clonmel in 1650 against Cromwell, on whom he inflicted the latter's most severe defeat in Ireland. In 1647 he so stubbornly resisted Ireton's attack on Limerick that he was excepted from the benefit of the capitulation, and, after being condemned to death and reprieved, was sent as a prisoner to the Tower. He was released in 1652, and died, some time after 1660, probably in Spain.

The Clanaboy (or Clandeboye) branch of the O'Neills descended from the ancient kings through Neill Mor O'Neill, lord of Clanaboy in the time of Henry VIII., ancestor (as mentioned above) of the Portuguese O'Neills. Neill Mor's great-great-grandson, Henry O'Neill, was created baronet of Killeleagh in 1666. His son, Sir Neill O'Neill fought for James II. in Ireland, and died of wounds received at the battle of the Boyne. Through an elder line from Neill Mor was descended Brian Mac Phelim O'Neill, who was treacherously seized in 1573 by the earl of Essex, whom he was entertaining, and executed together with his wife and brother, some 200 of his clan being at the same time massacred by the orders of Essex. (*See* ESSEX, WALTER DEVEREUX, 1st earl of.) Brian Mac Phelim's son, Shane Mac Brian O'Neill, was the last lord of Clanaboy, and from him the family castle of Edenduffcarrick, on the shore of Lough Neagh in Co. Antrim, was named Shane's Castle. He joined the rebellion of his kinsman Hugh, earl of Tyrone, but submitted in 1586.

In the 18th century the commanding importance of the O'Neills in Irish history had come to an end. But John O'Neill (1740–1798), took an active part in debate in the Irish parliament, being a strong supporter of Catholic emancipation. He was one of the delegates in 1789 from the Irish parliament to George, prince of Wales, requesting him to assume the regency. In 1793 he was raised to the peerage of Ireland as Baron O'Neill of Shane's Castle, and in 1795 was created a viscount. In defending the town of Antrim against the rebels in 1798 O'Neill received wounds from which he died on June 18, being succeeded as Viscount O'Neill by his son Charles Henry St. John (1779–1841), who in 1800 was created Earl O'Neill. Dying unmarried, when the earldom therefore became extinct, Charles was succeeded as Viscount O'Neill by his brother John Bruce Richard (1780–1855), a general in the British army; on whose death without issue in 1855 the male line in the United Kingdom became extinct. The estates then devolved on William Chichester, great-grandson of Arthur Chichester and his wife Mary, only child and heiress of Henry (d. 1721), eldest son of John O'Neill of Shane's Castle.

WILLIAM CHICHESTER (1813–1883), 1st Baron O'Neill, a clergyman, on succeeding to the estates as heir-general, assumed by royal licence the surname and arms of O'Neill; and in 1868 was created Baron O'Neill of Shane's Castle. On his death in 1883 he was succeeded by his son Edward, 2nd Baron O'Neill, who was member of parliament for Co. Antrim 1863–80, and who married in 1873, Louisa, daughter of the 11th earl of Dundonald.

For the history of the ancient Irish kings of the Hy Neill see *The Book of Leinster*, edited with introduction by R. Atkinson (Royal Irish Academy, Dublin, 1880); *The Annals of Ulster*, edited by W. M. Hennessy and B. MacCarthy (4 vols., Dublin, 1887–1901); *The Annals of Loch Cé*, edited by W. M. Hennessy (Rolls Series, London, 1871). For the later period *see* P. W. Joyce, *A Short History of Ireland* (London, 1893), and *A Social History of Ancient Ireland* (2 vols., London, 1903); *The Annals of Ireland by the Four Masters*, edited by J. O'Donovan (7 vols., Dublin, 1851); Sir J. T. Gilbert, *History of the Viceroys of Ireland* (Dublin, 1865), and, especially for Owen Roe O'Neill, *Contemporary History of Affairs in Ireland, 1641–1652* (Irish Archaeol. Soc., 3 vols., Dublin, 1879); also *History of the Irish Confederation and the War in Ireland* (Dublin, 1882); John O'Hart, *Irish Pedigrees* (Dublin, 1881); *The Montgomery MSS.* "The Flight of the Earls, 1607" (p. 767), edited by George Hill (Belfast, 1878); Thomas Carte, *History of the Life of James, Duke of Ormonde* (3 vols., London, 1735); C. P. Meehan, *Fate and Fortunes of Hugh O'Neill, Earl of Tyrone, and Rory O'Donel, Earl of Tyrconnel* (Dublin, 1886); Richard Bagwell, *Ireland under the Tudors, with an Account of the Earlier History* (3 vols., London, 1885–90); J. F. Taylor, *Owen Roe O'Neill* (London, 1896); John Mitchell, *Life and Times of Hugh, Earl of Tyrone, with an Account of his Predecessors, Con, Shane, Turlough* (Dublin, 1846); L. O'Clery, *Life of Hugh Roe O'Donnell* (Dublin, 1803). For the O'Neills of the 18th century, and especially the 1st Viscount O'Neill, see *The Charlemont Papers*, and F. Hardy, *Memoirs of J. Caulfield, Earl of Charlemont* (2 vols., London, 1812). *The O'Neills of Ulster: Their History and Genealogy*, by Thomas Mathews (3 vols., Dublin, 1907), an ill-arranged and

uncritical work has little historical value, but contains a mass of traditional and legendary lore, and a number of translations of ancient poems, and genealogical tables of doubtful authority.

O'NEILL, EUGENE GLADSTONE (1888–), American dramatist, was born in New York city, Oct. 16, 1888, the son of the well-known actor James O'Neill. His early education was received at Roman Catholic schools and at the Betts academy. He went to Princeton university for one year. He worked as sailor before the mast, actor, reporter, and in other capacities. He began assimilating his crowded experiences and impressions at a sanatorium to which he was ordered because of tuberculosis; in 1914–15 attended Harvard university; and in 1916 spent the summer at Provincetown, thus making contact with the group who produced nearly all his short plays. He rapidly became the most conspicuous of the younger American dramatists, and thrice was awarded the Pulitzer prize: in 1920 for his play, *Beyond the Horizon,* in 1922 for *Anna Christie;* and in 1928 for his *Strange Interlude.*

Among his works are: *Thirst and Other One-Act Plays* (1914); *The Moon of the Caribbees and Six Other Plays of the Sea* (1919); *Gold* (1920); *Emperor Jones* (1921); *The Hairy Ape* (1922); *All God's Chillun's Got Wings* and *Welded* (1924). An edition of his plays in two volumes, which included *Desire under the Elms,* was published in 1924, and in four volumes in 1925. His *Fountain* was produced in 1925 and *The Great God Brown,* one of the most mystical of his plays, in 1926. Other plays by O'Neill are *Marco Millions* and *Lazarus Laughed.*

See Barrett H. Clark, *Eugene O'Neill* (1926).

ONEONTA, the only city of Otsego county, New York, U.S.A., on the Appalachian highway and the Susquehanna river, 80 m. S.W. of Albany. It is served by the Delaware and Hudson and the Ulster and Delaware railways. Pop. (1920), 11,582 (92% native white); 1928 local estimate, 12,500. Oneonta is beautifully situated among the western foothills of the Catskills, at an altitude of 1,150 ft., in a fertile farming and dairying region. It is the seat of a State normal school (1889), a State armory and Hartwick college (United Lutheran; 1928). The manufacturing industries include extensive railroad shops, silk and flour mills, shirt and glove factories and had an output in 1925 valued at $4,963,673. Oneonta was founded about 1780, and until 1830 was known as Milfordville. It was incorporated as a village in 1848 and as a city in 1908. The name is derived from the Indian name for the creek flowing through the city.

ONION, *Allium Cepa* (family Liliaceae), a hardy bulbous biennial, which has been cultivated from time immemorial. It is one of the earliest of cultivated plants; it is represented on Egyptian monuments, and one variety cultivated in Egypt was accorded divine honours. It is commonly cultivated in India, China and Japan. A. de Candolle regards it as a native of western Asia.

In Great Britain the onion should be grown in an open situation, and on a light, rich, well-worked soil, which has not been recently manured. The principal crop may be sown at any time from the middle of February to the middle of March, if the weather is fine and the ground sufficiently dry. The seed should be sown in shallow drills, 10 in. apart, the ground being made as level and firm as possible, and the plants should be regularly thinned, hoed and kept free from weeds. At the final thinning they should be set from 3 to 6 in. apart, the latter distance in very rich soil. About the beginning of September the crop is ripe; the bulbs are then to be pulled, and exposed on the ground till well dried, and they are then to be stored in a cool, dry place.

About the end of August a crop is sown to afford a supply of young onions in the spring months. Those which are not required for the kitchen, if allowed to stand, and if the flower-bud is picked out on its first appearance, and the earth stirred about them, produce bulbs of large size. A crop of very large bulbs may also be secured by sowing about the beginning of September, and transplanting early in spring to very rich soil. Another plan is to sow in May on dry poor soil, when a crop of small bulbs will be produced; these are to be stored in the usual way, and planted in rich soil about February.

To obtain a crop of bulbs for pickling, seed should be sown thickly in March, in rather poor soil, the seeds being very thinly covered, and the surface well rolled; these are not to be thinned, but should be pulled and harvested when ripe.

Onions may be forced like mustard and cress if required for winter salads, the seeds being sown thickly in boxes which are to be placed in a warm house or frame. The young onions are pulled while quite small.

For growing onions in the United States *see* under VEGETABLES.

ONNES, HEIKE KAMERLINGH (1853–1926), Dutch physicist, was born in Groningen on Sept. 21, 1853. He studied mathematics and physics in his native town. In 1871 he went to Heidelberg, where he studied under Bunsen and Kirchhoff (*qq.v.*). Later he returned to Groningen, where in 1879 he took his doctor's degree on presenting a dissertation entitled *New Proofs of the Earth's Rotation.* He became professor of experimental physics at Leyden in 1882. Here he founded and developed the famous Cryogenic Laboratory. Stimulated by van der Waals, Onnes became interested in the equations of state and the general thermodynamic properties of liquids and gases. (*See* THERMODYNAMICS.) He appreciated that the need for exact measurements was greater than that for fresh theoretical developments.

Onnes set himself the task of making measurements over a large range of pressure and temperature. His name is associated particularly with the measurement and attainment of low temperatures; in this direction Onnes showed himself a master of experimental physics. In 1908 he succeeded in liquefying helium, but was unable to solidify it; this was subsequently done by his successor Keesom. Onnes obtained the isothermals for a number of gases and mixtures of gases at low temperatures; he also studied the optical, magnetic and magneto-optical properties of bodies. He carried out important investigations on the influence of low temperatures on nickel and manganese iron alloys. He also demonstrated that the resistance of electric conductors disappeared suddenly at a temperature near the absolute zero, and termed this phenomenon "super-conductivity." His systematic researches on super-conductivity (started in 1914) are of extreme importance on account of their bearing on the theory of electrical conduction in solids (*see* ELECTRICITY, CONDUCTION OF: SOLIDS), and also because the facilities offered by the Cryogenic Laboratory for investigating this subject are practically unique.

In 1913 the Nobel Prize for physics was conferred on him. He became a foreign member of the Royal Society in 1916, and a corresponding member of the Prussian Academy of Sciences at Berlin in 1923, the year in which he resigned his chair at Leyden. He was the recipient of a number of honorary degrees, medals and other honours. His published work includes *Algemeine Theorie der Vloeistoffen* (*General Theory of the Fluids,* 1881). He died at Leyden on Feb. 21, 1926.

See J. P. Kuenen, *De Toekenning van den Nobelprys aan H. Kamerlingh Onnes* (*Chemisch Weekblad, 1913*).

ONOMACRITUS (*c.* 530–480 B.C.), seer, priest and poet of Attica. He had great influence on the development of the Orphic religion and mysteries, and was said to have composed a poem on initiatory rites. The works of Musaeus, the legendary founder of Orphism in Attica, are said to have been reduced to order (if not actually written) by him (Clem. Alex. *Stromata,* i. p. 143 [397]; Pausanias i. 22, 7). He was in high favour at the court of the Peisistratidae till he was banished by Hipparchus for making additions of his own in an oracle of Musaeus. When the Peisistratidae were themselves expelled and were living in Persia, he furnished them with oracles encouraging Xerxes to invade Greece and restore the tyrants in Athens (Herod. vii. 6).

See F. W. Ritschl, "Onomakritos von Athen," in his *Opuscula,* i. (1866), and p. 35 of the same volume: Smith, *Dict. of Gk. and Roman Biography* s.v. (bibl.).

ONONDAGA, a tribe of North American Indians of Iroquoian stock, forming one of the Six Nations. The tribal headquarters was about the lake and creek of the same name in New York state. Their territory extended northward to Lake Ontario and southward to the Susquehanna river. They were the official guardians of the council-fire of the Iroquois. Their chief town,

near the site of the present Onondaga, consisted of some 140 houses in the middle of the 17th century, when the tribe was estimated as numbering between 1,500 and 1,700. During the 18th century the tribe divided, part loyally supporting the Iroquois league, while part, having come under the influence of French missionaries, migrated to the Catholic Iroquois settlements in Canada. Of those who supported the league, the majority, after the War of Independence, settled on a reservation on Grand river, Ontario, where their descendants still are. In 1926 there were 568 upon the Onondaga reservation in New York state.

For Onondaga cosmology see *21st Ann. Report Bureau Amer. Ethnol.* (1899–1900). *See* also NORTH AMERICA: *Ethnology*.

ONTARIO, a province of Canada, having the province of Quebec to the east, the states of New York, Ohio, Michigan, Wisconsin, and Minnesota to the south, Manitoba to the west, and part of Hudson Bay with James Bay to the north. In most cases the actual boundary consists of rivers or lakes, the Ottawa to the north-east, the St. Lawrence and its chain of lakes and rivers to the south as far as Pigeon river, which separates Ontario from Minnesota. From this it follows small rivers and lakes to the Lake-of-the-Woods, which lies between Ontario, Minnesota and Manitoba. From Lake Temiscaming northwards the eastern boundary is the meridian of 79° 30′.

Physical Geography.—Ontario extends 1,000 m. from east to west and 1,050 from north to south, between latitudes 57° and 42°, including the most southerly point in Canada. Its area is 407,262 sq.m. (41,382 water), and it is the most populous of the provinces, nine-tenths of its inhabitants living, however, in one-tenth of its area, between the Great Lakes, the Ottawa and the St. Lawrence. This forms part of the plain of the St. Lawrence, underlain by Palaeozoic limestones and shales, forming a good soil.

The south-western part is naturally divided into two tracts by the Niagara escarpment, a line of cliffs capped by hard Silurian limestones, running from Queenston Heights near the falls of Niagara west to the head of Lake Ontario near Hamilton, and then north-west to the Bruce Peninsula on Georgian Bay. The tract north-east of the escarpment has an area of 9,000 sq.m. and an altitude of 250 to 1,000 ft., and the south-western tract includes 15,000 sq.m. with an elevation of 600 to 1,700 feet. In the last petroleum, natural gas, salt and gypsum are obtained, but elsewhere in southern Ontario there are no economic minerals except building materials. Covering the higher parts there are rolling hills of boulder clay or moraines; while the lower levels are plains gently sloping toward the nearest of the Great Lakes and sheeted with silt deposited in more ancient lakes when the St. Lawrence outlet was blocked with ice at the end of the glacial period. The old shore cliffs and gravel bars of these glacial lakes are still well-marked topographical features, and provide favourite sites for roads, towns and cities. St. Catharines, Hamilton and Toronto are on the old shore of Lake Iroquois, the lowest. The Niagara escarpment mentioned above is the cause of waterfalls on all the rivers which plunge over it, Niagara Falls being, of course, the most important. Between the Palaeozoic area near Ottawa, and Georgian Bay to the north of the region just referred to, there is a southward projection of the Archaean protaxis consisting of granite and gneiss of the Laurentian, enclosing bands of crystalline limestone and schists, which are of interest as furnishing the only mines of "Old Ontario." From these rocks in the Ottawa valley are quarried or mined granite, marble, felspar, talc, mica and graphite.

While all the larger cities and most of the manufacturing and farming districts of the province belong to southern Ontario, there is in process of development a "New Ontario," stretching for hundreds of miles to the north and north-west of the region just described and covering a far larger area, chiefly made up of ancient rocks forming the Archaean protaxis. The rocky hills of the tableland to the north long repelled settlement, the region being looked on as a wilderness useless except for its forests and its furs, but the finding of great ore deposits, the opening up of farming areas and the development of the wood pulp industry are constantly extending settlement toward the north. The building of the Canadian Pacific Railway led to the discovery of the Sudbury nickel region, where segregations of nickel-copper ores which occur round the edge of a sheet of norite supply 90 per cent. of the world's nickel, large amounts of copper and thousands of ounces of gold, silver, platinum and palladium. The Frood mine is known to contain 200,000,000 tons of ore.

The building of the Temiskaming and Northern Ontario Railway led to the discovery of the cobalt mines, from which silver to the value of $240,000,000 has been obtained; and still farther north are the gold fields of Kirkland Lake and Porcupine, whose output gives Ontario third place in the production of gold, only South Africa and the United States surpassing it. In 1926 the value of the metals produced in Ontario reached $59,218,297, almost wholly derived from the northern mines.

Lakes and Rivers.—All parts of Ontario are well provided with lakes and rivers, the most important chain being that of the St. Lawrence and the Great Lakes with their tributaries, which drain the more populous southern districts, and, with the aid of canals, furnish communication by fairly large vessels between the lower St. Lawrence river and Lake Superior. Lake Nipigon, a beautiful body of water 852 ft. above the sea, 70 m. long and 50 m. wide, may be looked upon as the headwaters of the St. Lawrence, since Nipigon river is the largest tributary of Lake Superior, though several other important rivers, such as the Kaministiquia, the Pic and the Michipicoten, enter it from the north. All these rivers have high falls not far from Lake Superior, and several of them supply power for industries of the region. The twin cities of Fort William and Port Arthur are the great shipping ports for western wheat during the summer. The north shore of Lake Superior is bold and rugged with many islands, such as Ignace and Michipicoten, but with very few settlements, except fishing stations, owing to its rocky character. At the south-eastern end St. Mary's river carries its waters to Lake Huron, with a fall from 602 to 581 ft., most of which takes place at Sault Sainte Marie, where locks permit vessels of 10,000 tons to pass from one lake to the other, and where water-power has been greatly developed for use in the rolling mills and wood pulp industry. The north-east shores of Lake Huron and its large expansion Georgian Bay are fringed with thousands of islands, mostly small, but one of them, Manitoulin Island, is 80 m. long and 30 m. broad. French river, the outlet of Lake Nipissing, and Severn river, draining Lake Simcoe, come into Georgian Bay from the east, and the Trent canal connects Lake Huron with Lake Ontario.

Georgian Bay is cut off from the main lake by Manitoulin Island and the long promontory of Bruce Peninsula. Lakes Superior and Huron both reach depths hundreds of feet below sea-level, but the next lake in the series, St. Clair, towards which Lake Huron drains southward through St. Clair river, is very shallow and marshy. Detroit river connects Lake St. Clair with Lake Erie at an elevation of 570 ft.; and this comparatively shallow lake, running for 240 m. east and west, empties northwards by Niagara river into Lake Ontario, which is only 246 ft. above the sea. Niagara Falls, with rapids above and below, carry the waters of the upper lakes over the Niagara escarpment. Power from the falls supplies the needs of a region within 150 m. Welland canal, between Port Colborne on Lake Erie and Dalhousie on Lake Ontario, carries vessels of 14 ft. draught from one lake to the other. A new canal with a depth of 27 ft. is nearly finished. From Lake Ontario the St. Lawrence emerges through the meshes of the Thousand Islands, where it crosses Archaean rocks, after which follow several rapids separated by quieter stretches before Montreal is reached at the head of ocean navigation. Steamers not of too great draught can run the rapids going down, but must come up through the canals. All the other rivers in southern Ontario are tributaries of the lakes or of the St. Lawrence, the Ottawa, navigable in many parts, being the largest, and the Trent next in importance. In northern Ontario lakes are innumerable and often very picturesque, forming favourite summer resorts, such as Lake Temagami, the Muskoka Lakes and Lake-of-the-Woods. The latter lake, Rainy Lake and other connected bodies of water belong to the Hudson Bay system of waters, their outlet being by Winnipeg river to Lake Winnipeg, from which flows Nelson river. In Ontario the Albany, Moose, Missanabi and

Abitibi flow into Hudson Bay, but none of these rivers is navigable except for canoes.

Climate.—The climate of Ontario varies greatly, as might be expected from its wide range in latitude and the relationships of the Great Lakes to the southern peninsula of the province. The northern parts as far south as the north shore of Lake Superior have long and cold but bright winters, sometimes with temperatures reaching 50° F below zero; while their summers are delightful, with much sunshine and some hot days but pleasantly cool nights. Between Georgian Bay and Ottawa the winters are less cold, but usually with a plentiful snowfall; while the summers are warm. The south-west peninsula of Ontario has its climate greatly modified by the lakes which almost enclose it. As they never freeze, the prevalent cold north-west winds of North America are warmed in their passage over them, and often much of the winter precipitation is in the form of rain, so that the weather has much less certainty than in the north. The summers are often sultry, though the presence of the lakes prevents the intense heat experienced in the states to the west and south. Owing to the mildness of its winters, the south-west peninsula is a famous fruit country with many vineyards and orchards of apples, plums and peaches. Indian corn (maize) is an important field crop, and tobacco is cultivated on a large scale. Small fruits and tomatoes are widely grown for the city markets and for canning, giving rise to an important industry.

Population.—The province is divided into two sections, the older and more thoroughly settled portion, Southern Ontario, with an area of some 77,000 square miles, and Northern Ontario, with an area of 330,000. Of the total area, water forms 10·16 per cent. The approximate population of the province in 1925 was 3,103,000, and the growth since 1900 is reflected in the decennial census of the Dominion:

	1901	1911	1921
Population of Province	2,182,947	2,527,292	2,933,662
Percentage of the Dominion's population	40·64	35·07	33·38

The percentage increase of the population in fifty years (1871–1921) was 80·99. In 1921 the density of population (number of persons per square mile of land area) was 8·02, whereas the average for Canada was 2·41. An increasing percentage of people live in cities, towns or villages, as is illustrated in the following figures:

	1901	1921
Percentage of population rural	57·12	41·83
Percentage of population urban	42·88	58·17

The smallest urban unit, the village, must by provincial law have a population of 750 in an area not exceeding 500 acres. Some 160 municipalities have populations between 1,000 and 5,000 inhabitants. The largest city and capital of the province is Toronto, with a population over 560,000. Hamilton, a manufacturing centre, comes next with 127,000, and Ottawa, the federal capital, follows Hamilton with over 110,000. Another important and handsome city—but with a population under 100,000—is London, situated in the rich agricultural area of western Ontario. Racially the population of the province is dominantly of Anglo-Saxon stock. In the last census (1921) seventy per cent. of the people were of British origin; about nine per cent. French, and four per cent. German. The French settlements are largely in that portion of the province bordering on the St. Lawrence, and in the newer areas of the north. Over 26,000 Indians dwell within Ontario, mainly on reservations long ago set apart for them. The numerically strongest sectarian group is the United Church, which as in other provinces resulted from union of the Methodists, Congregationalists and Presbyterians. Its influence has given a puritan tone to social life, instanced in the legislation for the strict observance of the Sabbath. The Roman Catholic Church followed by the Anglican ranks next in strength of membership.

Government.—The government of Ontario differs little from that of the other Canadian provinces. Executive power is vested in a lieutenant-governor appointed for five years by the federal administration and assisted by an executive council, the members of which have seats in and are responsible to the local legislature. This consists of one house, 112 members, elected by a wide suffrage that places women on the same footing as men. The legislature has the right only of direct taxation, and the principal taxes are those on corporations, succession duties, licences, permits of various kinds, etc. A goodly income is derived from the sale or lease of crown lands, timber and minerals, and an annual subsidy from the federal government. A popular system of municipal administration has existed since 1849. The act of that year has been the Magna Charta of municipal institutions, not only for Ontario, but for the more recent provinces that have largely copied Ontario's institutions. It has undergone amendments, but the essentials of a popular system of local government with elected councils have been maintained and strengthened. There are in the province over 900 local self-governing units, embracing townships, counties, villages, towns and cities.

Education.—The inhabitants of Ontario have been distinguished by special devotion to the maintenance of an educational system. In the early years of provincial history, the legislature made considerable grants of land for such purposes, and to-day few departments of government are deemed so important as that of education. A minister in the executive council is nominally responsible to the legislature for policy, and his departmental deputy exercises scarcely less influence on the educational system. School inspectors seek to uphold throughout the province uniform and high standards, while in every district a body of trustees levies taxes, appoints the teachers, and in general provides for the maintenance of the local school. Attendance is compulsory between the ages of eight and sixteen. The primary or public schools are free and undenominational, but not secular, as prayer and Bible reading hold a place in the daily programme. Since 1863 the Roman Catholics have exercised the right to separate schools, which may be set up in any district upon the request of not less than five heads of families. Taxes levied on the supporters of these institutions are devoted wholly to their maintenance. Under prescribed conditions, Protestants and coloured persons may also claim the right to separate schools, but the right is rarely exercised.

Secondary education is provided in high schools and collegiate institutes, of which 186 existed in 1925. These institutions may require fees or give free education at the option of the local trustees. There are also many incorporated private schools, exempt from municipal taxation. They are grouped principally in Toronto and its neighbourhood, the most distinguished being Upper Canada College, founded in 1829.

Higher education is provided by the provincial university in Toronto and four other universities: Queen's in Kingston, Western in London, McMaster (Baptist) in Toronto, and the University of Ottawa (Roman Catholic) in the federal capital. The provincial institution, known as the University of Toronto, had in 1926 a total staff of 672, including junior instructors and demonstrators, and a student body of 5,466. It is a federation of colleges, and boasts of scholars no less distinguished than those in the finest universities of the United States and Great Britain. In all the universities women are admitted on the same terms as men, and generally form about two-fifths of the whole student body. In addition to the universities, model and normal schools exist for the training of teachers, while the cause of scientific agriculture is promoted by the Ontario Agricultural College at Guelph, founded and endowed by the government.

Agriculture.—Ontario is the richest agricultural province in the Dominion. Her agricultural wealth in 1927 was estimated to be $2,265,000,000 (*c.* £453,000,000). Yet the percentage of the value of the net production in the industry to the total net output of production of all industries is overtopped by that of manufactures, agriculture representing 27 per cent. and manufactures 40 per cent. Field crops are responsible for more than half of the annual revenue from the farms, while dairy products come next in importance. Wheat production has ceased to hold

the dominant sway that it still retains in the three prairie provinces, with the consequence that farmers are not subjected to rapid changes of good or ill fortune, so common to their compatriots further west, who depend upon the fickle wheat crop. In the number of milch cows, cattle, sheep and swine, Ontario leads the other Canadian provinces, and the valuation placed on its live stock ($261,673,000, or *c.* £52,334,600) is more than one-third of that on all live stock in Canada. Rich fruit growing areas extend throughout the Niagara peninsula and along the shores of lakes Erie and Ontario. Apples, peaches, pears, plums, cherries and grapes are the principal commercial fruits, and fruit canning is a local industry of some importance. Over 33,000 acres in the south-western part of the province are devoted to the production of tobacco. The average farm varies from 100 to 200 acres, and the majority of farms are worked by their owners.

Manufactures.—The manufactures of Ontario steadily increase in importance, and the province has little difficulty in maintaining supremacy among the provinces of the Dominion in gross value of manufactured products, which in 1925 represented nearly 52 per cent. of those of the whole Dominion. At that date there were 9,386 establishments with an annual production of $1,527,154,660 (*c.* £305,430,932). Some of the chief manufacturing industries and industrial products are: automobiles; flour and grist-mill products; slaughtering and meat-packing; pulp and paper; rubber goods; butter and cheese; electric light and power; castings and forgings; sawmills; hosiery, knit goods and gloves; bread and other bakery products; non-ferrous metal smelting; printing and publishing; agricultural implements; planing mills, and steel and rolling mill products. Most of Ontario's leading manufactures are dependent upon the primary products of forest or farm, but the automobile industry is a striking exception, since the largest quantity of its materials is imported from the United States. The province has no coal, a disadvantage offset by the presence of immense water power.

Water Power.—Among Canadian provinces Ontario ranks second to Quebec in the amount of horse power developed and in potential power resources. The estimated amount of power developed in the province in January, 1928, was 1,816,000 h.p. (turbine installation), while the undeveloped amounted to 5,330,000 h.p. This power is developed principally in central electric stations, but a considerable amount is produced by pulp and paper mills and other industries. Ontario was the pioneer province in the public ownership of hydro power. In 1906 it formed the Hydro-Electric Power Commission, which bought power generated at Niagara and transmitted it at cost to the municipalities, the initial capital being provided by issues of bonds, guaranteed by the Government of Ontario. Since then the Commission has become much more than a merchant purchasing power. It has extended its control over the generation of power on the Niagara river, and retains for public ownership the most vital force in the industry of the province. In 1926, 249 municipalities with 420,590 consumers were supplied by the Commission.

Mining.—In mineral production Ontario has the largest output and the greatest variety of products of any Canadian province, and she dominates the world's nickel market. Judged by value, gold is the most important metal, with nickel, silver, and copper following in the order named. The production by quantity of these metals in three succeeding years was as follows:

	1924	1925	1926
Gold, fine, oz.	1,241,728	1,461,039	1,407,215
Nickel, lb.	69,536,350	73,857,114	65,714,294
Silver, fine, oz.	11,272,567	10,520,131	9,274,065
Copper, lb.	37,113,193	39,718,777	41,312,867

Practically all the commercial non-metallic minerals except coal are produced within the province, the principal ones being corundum, graphite, mica and talc, felspar, petroleum, and salt. The richest mining territories are in Northern Ontario, where pre-Cambrian rock stretches for hundreds of miles to James Bay. Petroleum and salt are found, however, in south-western Ontario.

Lumber.—In lumber production Ontario ranks second to British Columbia. Twenty-five different woods are commercially produced, of which eight are softwoods and seventeen are hardwoods. White pine proves to have the widest market, with red pine, spruce, jack pine and hemlock ranking next in importance. Although the forest area steadily contracts with the spread of settlement, the province makes efforts at reforestation, and distributes at least 7,000,000 trees annually from its six nurseries. In the Algonquin National Park the ancient forest and its life are preserved intact, affording opportunity for a study of the problems of scientific forestry and providing in addition an excellent retreat for the tourist and sportsman. Due to her resources of timber—covering some 240,000 squares miles—Ontario is a leading province in pulp and paper production. In 1926 there were 45 mills in operation, of which 12 were pulp, 17 paper and 16 combined pulp and paper.

Communications.—Ontario is richly dowered with numerous lakes and rivers, which have the double value of fresh water fishing grounds and natural avenues of communication. The obstacles on these natural waterways have been largely overcome by the construction of canals. The most important canal system is that connecting the grain ports of Fort William and Port Arthur with Montreal through the chain of great lakes, a total sailing distance by canal and lake of 1,000 miles. The populated areas are well supplied with railways. The province has one-fourth of the total single track mileage of the Dominion, some 10,870 miles. The construction of the railways was at the outset aided by municipal and provincial subsidies, and gradually the various lines were consolidated into the great rail systems of the country. Very important in opening up the mining areas of Northern Ontario has been the publicly owned line, known as the Temiskaming and Northern Ontario Railway, which now extends almost to James Bay. Ontario also boasts of some 63,000 miles of roads, which in Southern Ontario radiate in every direction, facilitating the movement of more than 400,000 automobiles owned by citizens of the province. As a consequence of the good roads—gravel, macadam, concrete and cement—the traffic of American tourists has become a substantial source of provincial income. No other province has drawn so many tourists and obtained from them so large a revenue. (A. Br.)

HISTORY

Champlain was the first European to record anything about the present Ontario. In 1613 he went up the Ottawa in a vain search for the Northern Ocean; and in 1615 he pushed westward and reached the eastern shores of Lake Huron, the first to tell of the Great Lakes with their vast stretches of fresh water.

Missions to the natives were a chief interest of the French pioneers in Canada and within Ontario is found their earliest important effort. Huronia, on the borders of Lake Simcoe and the Georgian bay, the scene of a promising Jesuit mission, was devastated by the Iroquois in 1649 with the martyrdom of Fathers Brébeuf, Lalemant and others, making one of the most tragic stories in Jesuit annals. Meanwhile, the fur trade expanded and, before the British conquest, the French had trading posts at strategic points; Fort Frontenac, where now is Kingston—a defiance of the Iroquois—on the south side of Lake Ontario; Toronto, on its north shore, near the west end; Niagara; Detroit; Michilimackinac at the entrance to Lake Michigan; Sault Ste. Marie and on the greatest and farthest lake, Superior, a fort where now stands the city of Fort William.

They did, however, little settlement and, apart from such posts, Ontario was virgin wilderness when in 1763 it became British. In 1774, by the Quebec Act, it became a part of the Province of Quebec ruled from Quebec. The American Revolution began in the next year and for the first time, came serious settlement by exiled loyalists from the United States, bitterly hostile to that country. The Quebec Act entrenched the civil law of France; but the loyalists wished English law and a representative assembly, and in 1792 two Canadas were created; Lower Canada, east of the Ottawa River; Upper Canada, west; each with its own legislature. At once Upper Canada adopted English law. The first

governor, John Graves Simcoe, considered the seat of Government at Niagara was too near the American frontier; and it was quickly changed to York, the present Toronto.

The mind of Simcoe, a soldier, appointed later commander-in-chief in India, was, with justice, alert on problems of defence. When war with the United States broke out in 1812, the Americans captured and burned York, for which later the British retaliated by burning the Capitol at Washington. Only after peace in 1814 and the fall of Napoleon in 1815 was there adequate opening for development. English, Scots and Irish arrived in considerable numbers, until, by 1837, there were 350,000 people in Upper Canada. Political differences became acute; one extreme wing, composed chiefly of the loyalist elements, was reactionary; the other, led in the end by a Scot, William Lyon Mackenzie, was radical. In Lower Canada there was a similar issue with Papineau as the radical leader. Holding the middle ground, on clear-cut principles of constitutional right, was Robert Baldwin. He claimed that in Upper Canada as in England the head of the State must govern through advisers who had the confidence of the people. After abortive rebellion in both provinces in 1837–38 a striking political evolution took place. Upper and Lower Canada were united in 1842 under a parliament in which they had equal representation. Sectionalism as between French and English endured and the solution was found in 1867 in a federal system. (*See* CANADA: *History.*)

Apart from its few burning issues about self-government, Ontario has a quiet history. With a population chiefly British in political traditions, it has played an important part in solving problems of self-government of moment for the whole British empire. When in 1792 Upper Canada was created, the Protestant religion was endowed with public lands. First the Church of England alone benefited. But its members were a minority of the population; other religious bodies protested angrily; and, in the end, the principle of the state endowment of religion was abandoned in Upper Canada. Baldwin's clear cut teaching made also inevitable cabinet government on the model developed in England.

The federal constitution of 1867 gave Ontario a legislature, and cabinet government on this developed model. There was the new feature in Ontario of the abolition of the second chamber. The legislature might, indeed, at its discretion create one but this has not been done. The most populous of the Canadian provinces has still but one chamber; and so far has this been from involving capricious change that one prime minister remained in office for a quarter of a century. The system has worked so well as now to be accepted in all the Canadian provinces except Quebec. While Sir Oliver Mowat was prime minister of Ontario from 1871 to 1896 disputes arose as to the limits of federal and provincial authority. Mowat was a strenuous supporter of the rights of the provinces; and appeals to the privy council and experience have united to establish the principle that, within their defined rights, the provinces are supreme, and not under the supervision of the federal authority. By a curious paradox they have, in some respects, fuller powers, for they can alter their own constitutions.

The long Liberal ministry of Mowat was followed by a decline of the party's prestige and in 1905 the Conservatives, led by Sir James Whitney, came into power. In 1916 during the World War, Whitney's successor, Sir William Hearst, passed a drastic Prohibition law relating to the sale of intoxicating liquors. They could be bought only at Government stores and on a medical certificate of illness; and all public drinking places were closed. An election in 1919 gave the new Farmers' party a larger number of members than had either the Conservatives or the Liberals and they took office under C. A. Drury. They showed a lack of experience, and in 1923, while the Liberal party made a poor showing, the Conservatives under G. Howard Ferguson came into power with a large majority. There was discontent with the rigour of the Prohibition law and in 1926 Ferguson carried his second election by securing a large majority for the system now in effect in Ontario of State control of the liquor traffic. Drinking places remain closed; but, under individual licenses and strict supervision, purchase is permitted and the Government gets a considerable revenue from its monopoly of the trade. Apart from this there has been recently no acute division on provincial policy. The powers of the province are so limited that issues relate chiefly to the details of administration.

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ONTARIO, a city of San Bernardino county, California, U.S.A., 38 m. E. of Los Angeles, at an altitude of 1,000 feet. It is served by the Pacific Electric, the Santa Fe, the Southern Pacific and the Union Pacific railways. Pop. 7,280 in 1920 (86% native white); estimated locally at over 15,000 in 1928. Ontario lies on a sloping plateau at the foot of Mt. San Antonio ("Old Baldy," 10,080 ft. high). Through the heart of the city and on up to the foot-hills runs a straight avenue 8 m. long and 200 ft. wide, with tree-shaded roadways on either side of a central strip. Citrus fruits, peaches, apricots, grapes, walnuts, dairy and poultry products and rabbits are conspicuous among the diversified products of the region. The city has packing plants, canneries and nurseries, and its manufactures include pectin, orange juice and citric acid, and electric irons and other household appliances. Ontario was founded in 1882 by George and William B. Chaffey, and was incorporated in 1891. It is governed by a board of trustees. In 1900 the population was only 722.

ONTARIO, LAKE, the smallest and most easterly of the Great Lakes of North America, is bounded on the north by the Province of Ontario and on the south by the State of New York. It is roughly elliptical, its major axis, 180 m. long, lies nearly east and west, and its greatest breadth is 53 miles. The area of its water surface is 7,540 sq.m. and the total area of its basin 34,630 sq. miles. Its greatest depth is 738 ft., its average depth much in excess of that of Lake Erie, and it is, as a general rule, free from outlying shoals or dangers.

Physiography.—On the north side of the lake the land rises gradually from the shore, and spreads out into broad plains, which are thickly settled by farmers. A marked feature of the topography of the south shore is what is known as the Lake ridge, or, as it approaches the Niagara river, the Mountain ridge. This ridge extends, with breaks, from Sodus to the Niagara river, and is distant from the lake 3 to 8 miles. The low ground between it and the shore is a celebrated fruit-growing district, covered with vineyards, peach, apple and pear orchards and fruit farms. The Niagara river is the main feeder of the lake; the other largest rivers emptying into the lake are the Genesee, Oswego and Black from the south side, and the Trent, which discharges into the upper end of the bay of Quinte, a picturesque inlet 70 m. long, on the north shore, between the peninsula of Prince Edward, near the eastern extremity of the lake, and the mainland. The east end of the lake, where it is 30 m. wide, is crossed by a chain of five islands, and the lake has its outlet near Kingston, where it discharges into the head of the St. Lawrence river between a group of islands. Elsewhere the lake is practically free from islands. There is a general surface current down the lake towards the eastward of about 8 m. a day, strongest along the south shore, but no noticeable return current. As a result of its relatively great depth there are seldom any great fluctuations of level in this lake due to wind disturbance, but the lake follows the general rule of the Great Lakes of seasonal and annual variation. Its mean surface elevation above mean sea-level, for a period of 68 years, is 246·09 ft., which is some 326·33 ft. below the level of Lake Erie. The lake never freezes over except near land, but the harbours are closed by ice from about mid-December to mid-April.

Ports.—The principal Canadian ports are Kingston, at the head of the St. Lawrence river; Toronto, where the harbour is formed by an island with improved entrance channels constructed both east and west of it; and Hamilton, at the head of the lake, situated on a land-locked lagoon, connected with the main lake by Burlington channel, an artificial cut. The principal U.S. port is Oswego, where a breakwater has been built, making an outer harbour.

Commerce.—The commerce of Lake Ontario is limited in comparison with that of the lakes above Niagara Falls, and is in general confined to vessels which can pass the Welland canal and the St. Lawrence canals; the harbours on the lake are planned to accommodate vessels limited to the size determined by the dimensions of the smallest locks, which are: length 270 ft., width 45 ft. and depth 14 ft. on sills. The commerce on the lake is generally confined to coal shipped from Rochester, Sodus bay, Little Sodus bay and Oswego to Canadian ports on the lake and U.S. and Canadian ports on the St. Lawrence river; to coal from Oswego to upper lake ports; to grain and other products shipped from upper lake ports through the Welland canal to the St. Lawrence; to lumber from Canadian ports; and to pleasure traffic.

Canals.—The completion, about 1930, of the New Welland canal by the Canadian Government (*see* NIAGARA RIVER) will permit the large lake vessels now operating on the upper Great Lakes to enter Lake Ontario. Negotiations under way in 1928 between the United States and the Canadian Governments will undoubtedly result in the improvement of the St. Lawrence river for power and navigation, thereby providing a navigable channel to the sea, suitable for ocean-going vessels. For a century, the Erie and Oswego canals, built and operated by the State of New York, have been important water outlets from Lake Erie and Lake Ontario to the Hudson river and to New York city. The present canal is 12 ft. deep and is designed for use by boats drawing 10½ feet. The canal distance from Oswego to New York city is 338 miles. The Murray canal extends from Presqu'ile bay, on the north of the lake, to the head of the bay of Quinte, and enables vessels to avoid 70 m. of open navigation. It is 11 ft. deep below the lowest lake level and has no locks.

Trent canal is the term applied to a series of rivers and lakes connected by short canals, designed to form a continuous system of light-draught navigation between Lake Ontario and Georgian bay, Lake Huron. Six-foot navigation is now available for 224 m. from Lake Ontario to Swift Rapids on the Severn river and, upon completion of the Severn division at the Georgian bay end, will be possible for the entire route. Even now facilities are provided whereby small motor boats proceed through from Lake Ontario to Lake Huron. At Kingston the Rideau canal, extending 128 m. to Ottawa, enters the St. Lawrence river at the foot of the lake. This canal has 47 locks, with minimum dimensions of 134 ft. by 33 ft., and a depth of 5 feet.

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ONTENIENTE, a town of eastern Spain, in the province of Valencia; on the right bank of the Clariano or Onteniente, a subtributary of the Júcar, and on the Játiva-Villena railway. Pop. (1920) 12,470. Onteniente has a parish church remarkable for its lofty square tower, and a palace of the dukes of Almodovar. Linen and woollen cloth, paper, brandy, furniture and earthenware are manufactured.

ONTOLOGY, the name given to that branch of philosophy which deals specially with the nature of being, *i.e.*, reality in the abstract. The idea, denoted in modern philosophy by the term "ontology" in contrast to the broader "metaphysics" and the correlative "epistemology," goes back to such phrases as ὄντωςὄντα, which Plato uses to describe the absolute reality of ideas; Plato, however, uses the term "dialectic" for this particular branch of metaphysics. Aristotle, likewise, holding that the separate sciences have each their own subject matter, postulates a prior science of existence in general which he describes as "first philosophy." So far, therefore, the science of being is distinguished not from that of knowing but from that of the special forms of being: as to the possibility of objective reality there is no question. A new distinction arises in the philosophy of Wolff who first made "ontology" a technical term. Theoretical philosophy (metaphysics) is by him divided into that which deals with being in general whether objective or subjective, as contrasted with the particular entities, the soul, the world and God. The former is ontology. This intermediate stage in the evolution of the science of being gave place to the modern view that the first duty of the philosopher is to consider knowledge itself (*see* EPISTEMOLOGY), and that only in the light of conclusion as to this primary problem is it possible to consider the nature of being. The evolution of metaphysics has thus relegated ontology to a secondary place. On the other hand it remains true that the science of knowing is inseparable from, and in a sense identical with that of being. Epistemological conclusions cannot be expressed ultimately without the aid of ontological terms.

See METAPHYSICS; PHILOSOPHY; and KNOWLEDGE, THEORY OF.

ONYCHOPHORA, a small but unusually interesting group of animals of the phylum Arthropoda (*q.v.*), differing in so many important respects from all other Arthropoda that a special class has been created for them. The class Prototracheata or Onychophora, containing only about 50 species, is equivalent in rank to the classes Crustacea, Insecta, Myriapoda and Arachnida, although these groups contain many thousands of genera and species.

A small group of genera which necessitates the creation of a separate class is usually the recipient of particular interest, for it will present highly important indications of the evolutionary relations between other groups of the animal kingdom. It is often to be regarded as the survivor of a group more extensive in range and more numerous in species and individuals in past times.

The Onychophora is such a case. It presents features which are typically arthropod. At the same time it possesses many features which recall the segmented worms (Annelida, *q.v.*), the group to which the Arthropoda are structurally most closely related. It might be regarded as a relic of the evolutionary transition between these big groups, the representative of an ancient group although probably it has evolved along its own special line.

The Onychophora contains only seven genera but these are so much alike that it is still common to use the term *Peripatus* as the generic name for all. The different species resemble each other externally so closely that, but for the differences in the number of legs, a picture in black and white like fig. 1 would stand for any of them. Notwithstanding this resemblance it appears necessary to restrict the use of the old generic name *Peripatus* to a few species.



AFTER SEDGWICK

FIG. 1.—PERIPATOPSIS CAPENSIS, DRAWN FROM LIFE, LIFE SIZE

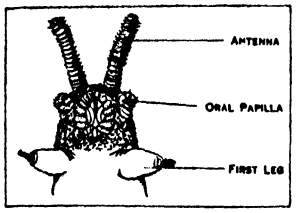
The geographical distribution of the group is very wide but discontinuous and very local. Specimens have been found in the West Indies, Central America and Chile, the Congo region of West Africa, South Africa, Malaya, India, Melanesia and Australasia. Specimens are only met with here and there, even where favourable conditions exist over a wider area. This discontinuity of occurrence coupled with the obviously poor powers of distribution of these creatures is strong evidence of a more continuous range in the past and of a group now on the way to extinction. The distribution of the genera is as follows:—*Peripatus*—America and Africa; *Eoperipatus*—Indo-Malaya; *Peripatoides* and *Ooperipatus*—Australia; *Opisthopatus*—Chile and South Africa; *Paraperipatus*—New Britain; *Peripatopsis*—Central Africa.

Since the present account is a short general summary we shall continue to use the term "Peripatus" to include all species of the group. It will be understood, however, that this is for convenience only.

The animal is always found in moist situations (although the district itself may not be moist during the whole year). It is generally found under rotting branches lying on the ground, under stones, under bark and in the crevices of tree stumps. It is extremely sensitive to a dry atmosphere (specimens frequently will not withstand 24 hours in a dry cardboard box, whereas they will be happy for twice this time in a small glass tube containing moist soil although the tube may be tightly corked). It never comes out into day-light and specimens in captivity are much more active at night. It is probably entirely carnivorous, feeding on small insects and other small animals.

Peripatus is a segmented animal, and at a first glance looks

somewhat like a caterpillar; but the long antennae, the peculiar body-surface and the legs soon dispel that view. The actual segmentation is only shown externally by the occurrence of paired legs, one pair to each segment. The surface of the body is marked by ring-like ridges far more numerous than the segments. Some of these are almost continuous round the circumference of the animal (they are all broken by a fine groove down the middle of the dorsal surface), others are less complete and arise between the former. The skin and body wall is highly characteristic, the superficial cuticle being very thin (as in the worms, in contrast to the usual arthropod condition) and raised everywhere on the ridges into delicate microscopic papillae. These close papillae give the skin a velvety appearance and their presence makes it difficult to wet the creature.



FROM SEDGWICK IN "TEXTBOOK OF ZOOLOGY" (G. ALLEN & UNWIN)

FIG. 2.—VENTRAL VIEW OF HEAD OF P. CAPENSIS

The colours of these animals are dark grey, olive green, or brown to brick red on the dorsal surface and light, often almost white on the under surface. Different species present slightly different colour-patterns, but in more than one locality the same species ranges from black through olive green to reddish brown.

Both head- and tail-ends taper and there is no distinct head. The anterior end bears two characteristic antennae, very mobile and extensible. In fact the whole animal is remarkably extensible and there is a great difference in length between a living specimen in motion (especially if this is rapid) and one in spirit.

Slightly posterior and ventral to the antennae are two small blunt oral papillae, and between these the buccal cavity is situated (fig. 2). An anal aperture is found at the extreme posterior end of the animal and further forward on the ventral surface between the last pair of legs is the reproductive aperture in both sexes. The males may sometimes be distinguished from the females by slight differences in the appearance of the genital opening. In many cases, however, the only difference, not always distinct, is the presence of little apertures of crural glands on the legs of the male (fig. 3).

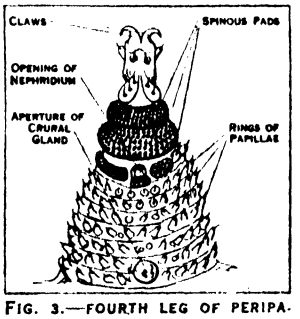


FIG. 3.—FOURTH LEG OF PERIPATOIDES (MALE)

The other apertures on the surface of the body are those of the tracheae (respiratory organs—*see* below) and the excretory organs. None of the former can be seen with the naked eye and only four of the latter, on the 4th and 5th pairs of legs (fig. 3).

The limbs of Peripatus are characteristic. Each consists of a cone-like stumpy leg bearing distally a narrower foot which carries two sickle-shaped claws. The skin of the legs bears rings of tiny papillae like those of the body and near the apex there may be spinous pads. The structure of the appendages is thus quite unlike the jointed arthropod leg.

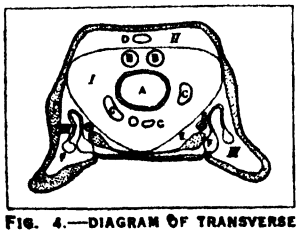
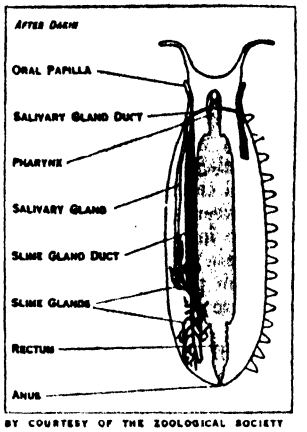


FIG. 4.—DIAGRAM OF TRANSVERSE SECTION THROUGH MIDDLE OF BODY OF PERIPATUS

Internal Structure.—A transverse section through an adult shows clearly how the body cavity, which is a haemocoele, is subdivided by delicate sheets of tissue (fig. 4) into (I.) a large central space extending the whole length and containing the gut (A), slime glands (B) and reproductive organs (C); (II.) a shallow dorsal space above the central cavity, containing the heart (D); (III.) two lateral spaces each with a nerve cord (E), nephridia (F), and salivary glands (G). The excretory organs are also found in these compartments, especially in the extensions which exist in the legs.

The *Alimentary Canal.* The buccal cavity contains a pair of horny jaws (fig. 5) which may just be seen from the exterior. Each consists of two cutting plates lying in contact. These jaws are the only mouth appendages present. The mouth at the posterior end of the buccal cavity leads into a short muscular pharynx and from this a short oesophagus opens into the stomach (fig. 5). This forms the greater part of the alimentary canal. It is a straight and wide tube leading almost to the posterior end where a short, narrow rectum opens at the terminal anus.



BY COURTESY OF THE ZOOLOGICAL SOCIETY

FIG. 5.—PERIPATOIDES OCCIDENTALIS, SHOWING PARTS

The only glands connected with the alimentary canal are two salivary glands (fig. 5) which open by a common duct into the buccal cavity. Each gland is a long tubular structure lying in a lateral cavity close to the nerve cord.

The *Slime Glands* (fig. 5) are another peculiar feature. There are two of these, each opening on an oral papilla. Each consists of a long dilated tube which acts as a reservoir and lies over the stomach in the central cavity of the body. This reservoir extends back a considerable distance and then gives off numerous diverticula in which the slime is secreted. These diverticula lie around the posterior part of the stomach, often entangled in the coils of the reproductive organs. When a living specimen is touched the slime is shot out from the oral papillae to a distance of several inches. Contact with the air causes it to congeal into white, sticky threads. It is supposed that the substance is used for offence or defence.

The *tracheae* are amongst the most noteworthy features of the Onychophora because so characteristic of certain other Arthropoda. They arise in bunches from the bottom of little epidermal pockets, tracheal pits. It is impossible, however, to see these pits externally. From each pit a large or small bunch of parallel tracheae start off, without branching; then they separate and finally branch, when they reach the organs they supply. Since the small single tubes require a high magnification to see them, one can only see readily the little rosettes of tubes where they are bunched at the tracheal pits and then only by examining the internal surface of the body-wall in fresh specimens.

The tracheal pits are numerous and arranged in definite positions. In the West Australian species there are two main rows, one on each side, between the mid-dorsal line and the level of the legs. There are also four longitudinal series on the ventral surface. E. Gaffron stated that there were about 75 openings to a segment in *P. edwardsi*. The present author has counted 32 without difficulty in *Peripatoides occidentalis*. The tracheal tubes have a spiral thickening in the walls similar to that in other Arthropoda.

The *excretory organs* are probably the most surprising of all the structures found in this animal and at once call to mind the annelid worms, being not at all like the excretory organs of the arthropod groups. They are paired structures, one pair to each pair of legs. With the exception of those of the 4th and 5th pairs, each excretory tube opens on the ventral surface at about the point where its corresponding leg joins the body. The 4th and 5th pairs open on papillae near the distal end of the corresponding legs (fig. 3). It is a striking fact that this distinction should be found constantly in the different species.

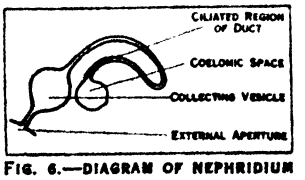


FIG. 6.—DIAGRAM OF NEPHRIDIUM OF PERIPATOIDES OCCIDENTALIS

The excretory organs have been termed *nephridia* and there is some evidence from embryology in support of this. Anatomical study, however, is insufficient to indicate the exact homologies of

these organs and the embryological evidence requires confirmation. Each "nephridium" (fig. 6) consists of a tube with an enlargement, the collecting vesicle, near its aperture and another, corresponding to a coelomic cavity, at its internal blind end. In the West Australian *Peripatoides* the author discovered that cilia were present in that part of the tube leading out from the coelomic vesicle. This is the second part of the body where cilia have been found in these animals and since cilia are characteristically absent in the Arthropoda, it is a point of importance. Their other site is the reproductive organs of the female.

The *blood system* appears to consist only of a feebly developed dorsal tubular heart.

The *nervous system* consists of a pair of large supraoesophageal ganglia completely united in the middle line and occupying most of the head space, and a pair of cords which run backward. These latter, instead of being close together in the mid-ventral line, are situated at the sides in the lateral cavities of the haemocoele. Numerous commissures, 8–10 between successive pairs of legs, connect the lateral cords. There are indications of ganglia, corresponding to the legs in number, where the lateral cords are slightly thickened. Nerves pass out from the supraoesophageal ganglia to the tentacles, eyes and skin sense organs and also leave the lateral nerve cords.

The only sense-organs are the eyes and numerous skin sense-organs all of which look alike in structure.

The eyes are moderately well-developed, situated on the head near the base of the antennae. They are simple eyes, not compound like those so characteristic of the Arthropoda. They differ also fundamentally from the arthropod type of simple eye, the ocellus. It is sufficient here to point out that on the whole the visual organ presents features of a simple type met with in both annelid worms and arthropods, but it has followed its own line of evolution.

The skin sense-organs consist of little packets of cells associated with a projecting spine. They look like and are usually regarded as tactile organs. Peripatus is, however, extremely sensitive to chemical stimuli as well as to vibrations and the presence of a very little chloroform vapour or acetic acid in the air produces a quick reaction.

Reproduction.—The sexes are separate. The reproductive organs consist of a pair of tubular testes in the male and a pair of ovaries in the female. In both sexes the reproductive organs are continuous with the tubes which lead their products to the exterior, opening at the single aperture already described. In the female, part of each duct is differentiated to form a uterus in which the young develop. Slight differences in the arrangement occur in the different species. Almost all produce living young.

One feature of special note is the varying amount of yolk in the eggs and its result. The Australian species have large yolk-laden eggs, and all species come near to laying eggs. At least one species of eastern Australia is actually oviparous and eggs are laid in sculptured shells. In all others the eggs are retained within the female and after a period of several months the young are born.

The South African and Australian species give birth to the young in April–June. Fertilization in one of the latter species takes place in the preceding August or September and the period of gestation would thus be 8–9 months. It has been given as 13 months for the Cape species.

The eggs are fertilized internally and it has been stated that the male of the Cape species deposits its spermatozoa on the surface of the female. Since the uterus is said never to contain spermatozoa, the mode of entrance into the body would be a complete mystery. There can be no doubt that in the Australian species copulation of the two sexes takes place and the spermatozoa pass up the vagina of the female.

The embryology of the Cape species has been worked out and reference should be made to A. Sedgwick (*see* below) for details. Further work is required in this direction and would be of undoubted interest and importance.

BIBLIOGRAPHY.—A. Sedgwick, "A Monograph of the Development of *Peripatus capensis*" (originally published in various papers in the *Quart. Journ. Mic. Sci.*, 1885–1888); "A Monograph of the Species and Distribution of the Genus *Peripatus*, Guilding," *Quart. Journ. Mic. Sci.* xxviii. 431–494 (1888); T. Steel, "Observations on Peripatus," *Proc. Linn. Soc. New South Wales*, p. 94 (1896); Bouvier, "Monographie des Onychophores" *Ann. des Sci. Nat.* (Paris, 1905–1907); W. J. Dakin, "The Anatomy, etc., of West Australian Peripatoides" *Proc. Zool. Soc.* (London, 1920); "The Eye of Peripatus," *Q.J.M.S.* (1921); "Infracerebral organs of Peripatus," *Q.J.M.S.* (1922). (W. J. D.)

ONYX, a striped agate in which white layers alternate with black. When brown or red bands occur instead of black the stone is termed sardonyx (*q.v.*). The Romans applied this name originally to a species of marble, now called onyx-marble, because of a resemblance between its well-defined white and yellow veins and the shades in the finger-nail (ὄνυξ). When this marble became less important the name was transferred to the striped agate. Onyx has always been largely employed in cameo-work because the design and background could be cut so as to occur in differently coloured layers. The best cameos are those produced by the ancients, though a revival of the art was occasioned by the discovery in the middle of the last century of the South American sources of onyx. Many inferior agates are now made suitable for the cutting of cameos by artificially dyeing the layers (*see* AGATE) and glass imitations are also extensively produced. Beads, brooches, ring-stones and other small ornaments are frequently made of onyx and larger pieces are fashioned into cups and vases.

Onyx-marble is much softer and less precious than true onyx and includes the following ornamental stones; Mexican onyx or Tecali marble, which is often of a delicate green shade, Algerian onyx and Gibraltar-stone.

The chief localities for onyx are South America and India.

See C. W. King, *Precious Stones, Gems and Precious Metals* (London, 1865); A. Eppler, *Die Schmuck und Edelsteine* (Stuttgart, 1912). For onyx-marbles *see* G. P. Merrill, *Rep. U.S. Nat. Mus. for* 1893 (1895). (W. A. W.)

OOLITE, a geological term used in two senses; the commonest use refers to a particular type of structure common in limestones and ironstones, where the rock is composed of small rounded grains, resembling the roe of a fish (Gr. ὄον, an egg, λίθος, a stone). This structure is apparently produced in more than one way, most commonly perhaps by accretion of $CaCO_3$ from solution in water around tiny sand grains or shell-fragments in moving water, where the grains are kept in constant motion. Grains formed in this way show radial or concentric crystalline structure when cut open. In some instances the grains are merely minute rounded pebbles of an older limestone, and such may show no particular structure. Many fine examples of oolitic deposits are formed by calcareous algae in hot springs, as at Carlsbad and Vichy. Such grains consist of aragonite, not calcite. Oolitic ironstones are apparently formed in a way similar to that first described, but the exact manner of precipitation of the iron is still somewhat doubtful. Bacteria may play a part.

The second use of the term is stratigraphical, to indicate the British rocks forming the middle and upper divisions of the Jurassic system (*q.v.*) where oolitic rocks are common. This usage is now out of date. (R. H. Ra.)

OOLOGY, the science of eggs, especially birds' eggs. *See* EGG; BIRD; NEST AND NIDIFICATION; REPRODUCTION; ORNITHOLOGY.

OOTACAMUND, town, British India, headquarters of the Nilgiris district in Madras, approached by a rack railway from Mettupalaiyam station on the Madras railway. Pop. (1921) 19,467. It is the principal sanatorium of southern India and summer residence of the governor of Madras and is noted for hunting, fishing and shooting. It is placed on a plateau 7,220 ft. above the sea, with a fine artificial lake, and mountains rising above 8,000 ft. The mean annual temperature is 58° F, with a minimum of 38° in January and a maximum of 76° in May; mean annual rainfall, 49 in. The houses are scattered on the hillsides amid luxuriant gardens. In the neighbourhood are plantations of coffee, tea and cinchona. The Lawrence Memorial school for the children of European soldiers was founded in 1858.

OPAH (*Lampris luna*), a pelagic fish of the order *Allotriognathi*. The body is compressed and deep, with minute scales. A dorsal fin, high anteriorly, runs along nearly the whole length of the back; the caudal is strong and deeply cleft, for rapid swim-

ming. The pelvic fins contain numerous (15–17) rays. In its gorgeous colours the opah surpasses even the dolphin. The fins are bright scarlet, and the sides bluish-green above, violet in the middle, red beneath, variegated with oval spots of brilliant silver. Its home is the Atlantic, especially near Madeira and the Azores. It is rare in the Mediterranean. It grows to a length of 4 to 5ft. and a weight exceeding 100 lb., and its flesh is excellent.

OPAL, a mineral, in chemical composition an amorphous hydrated silica, some forms of which are highly prized as gems. Many varieties of opal (Lat. *opallus,* Gr. ὀπάλλιον), are recognised but of these few have any value as gem stones. The most beautiful is precious opal which displays a wonderful scintillating coloured brilliance, known as opalescence. In early times it excited the keenest admiration, witnessed by Pliny's enthusiastic description, "For in them you shall see the living fire of the ruby, the glorious purple of the amethyst, the green sea of the emerald, all glittering together in an incredible mixture of light." Orange or yellow stones which exhibit opalescence are called fire opals. Black opals are stones in which the background is extremely dark. Really black stones are extremely valuable and rather rare. Common opal is a term applied to the varieties which do not exhibit opalescence. Most of the names applied are self-explanatory, *e.g.,* milk opal, resin opal, liver opal, agate opal, etc. Prase and jasper opals are green and red respectively. A curious, very porous variety, which can absorb surprising quantities of water is called hydrophane. It will adhere to the tongue. It is almost opaque when dry, but becomes practically transparent when saturated with water. Another porous variety is cachelong, which has a lustre like mother of pearl.

Opal is the silicious material of the tests of radiolaria and the frustules of diatoms. These may accumulate as deposits of tripoli or kieselguhr, used for polishing. Opal is often found as pseudomorphs after gypsum, glauberite, calcite and other minerals. Pseudomorphic aggregates are sometimes known as pineapple opal. Opal has been discovered in a fibrous form much like asbestos, from which it may be distinguished by its harsh touch.

Occurrence.—Opal is widely distributed as nodules and stalactitic masses in the cavities of volcanic rocks, deposits from hot springs, etc. It is deposited as a gel or sol. Precious opal is found only in a few places. Cserwenitsa in Hungary was for long the only source; probably all the ancient stones were found there. Since the discovery of the rich fields in Australia, the Hungarian mines have lost most of their importance. The discovery of opals at White Cliff, New South Wales, was followed in a few years by the field on the boundary between New South Wales and Queensland. Many "black opals" are found there, but truly black stones are found at Lightning Ridge. The black opal has been thus described:—"It combines the iridescence of the dewdrop with the colour of the rainbow, set in the blackness of night. It is a smothered mass of hidden fire." Precious opals have been found in Hōsako, Japan, which are nearly colourless and transparent with a bluish tint, and show a change rather than a play of colours, from emerald green to apple red. Esperanza, Queretana and Timapan in Mexico are noted particularly for fire opals. A fine mass of precious opal was found recently in Nevada.

Coloration.—Pure opal, which is colourless, is rarely found. It is usually stained dull colours by ferric oxide, alumina, lime or magnesia. That the coloration is not ordinary absorption is shown by the fact that the transmitted light is complementary to the reflected. If for example a blue stone is held up to the light, it appears yellow. The opalescence is not due to any pigmentation, but to the fact that as the original gel dried and cooled it became riddled with cracks, which were subsequently filled up by another gel containing a different amount of water. The resulting heterogeneity of the opal gives it a varying refractive index, which affects the light in the same way as a soap bubble. The thinner and more uniform the cracks the greater the splendour of the colours, the shade depending on the direction in which it is viewed. In the variety known as harlequin opal the rainbow colours are flashed from little angular surfaces forming a mosaic.

Opals are usually cut *en cabochon.* If they are too thin for this, they are used for inlay work, and if scattered in small pieces throughout the matrix, they are sold as such, under the name "root of opal." Fire opal shows to best advantage if facetted. Opal is not placed among the most precious of stones because of its softness, but Pliny placed it after the emerald. He relates that Mark Antony exiled a rich senator, Nonius, for the sake of an opal the size of a hazel nut. Many superstitions have centred round opal, and even in modern times it has been regarded as unlucky.

Properties.—Opal contains from 3–13% of water, precious opal between 6 and 10%. It is soluble in caustic alkalis, and when mixed with soda easily fusible. It is soft, 5·5–6 on Mohs' scale and is therefore easily scratched. It is brittle and has a conchoidal fracture. Opals are porous, and it is dangerous to immerse them in liquids. Normally opal is isotropic, but owing to internal strains it is sometimes doubly refracting. The refractive index ranges from 1·444–1·464. They are said to be more brilliant on warm days, but a high temperature, by withdrawing water, destroys their value. Recently milk opal has been coloured by oils and pigments to imitate the rare blue and dark red stones. The colour is fixed with Canada balsam.

See A. Eppler, *Die Schmuck- und Edelsteine* (Stuttgart, 1912); G. F. Herbert Smith, *Gemstones* (London, 1926). (W. A. W.)

OPAVA, the capital of Silesia, Czechoslovakia, lies on the Opava, a tributary of the Oder, in the middle of a wide fertile plain. The old town, founded in the 13th century, is girdled by parkland beyond which stretch extensive suburbs of the new town, in which are centred the industries. These comprise brewing, sugar refining, the manufacture of cloth and industrial machinery. Pop. (1921), 33,457 of whom 22,008 were Germans.

OPELIKA, a city of eastern Alabama, U.S.A., the county seat of Lee county; on Federal highway 29, and served by the Central of Georgia and the Western of Alabama railways. Pop. 4,960 in 1920 (46% negroes); estimated locally at 6,500 in 1928. It is a trade centre and shipping point for a rich agricultural region. It was founded in 1773, incorporated 1858.

OPELOUSAS, a city of southern Louisiana, U.S.A., capital of St. Landry parish; 130 m. W.N.W. of New Orleans, on the Missouri Pacific, the Southern Pacific and the Texas and Pacific railways. Pop. (1920) 4,437 (46% negroes). It is a shipping point for cotton, corn, rice, live stock, and the products of its own saw and shingle mills and other manufacturing plants.

OPEN BILL. A curious stork (*q.v.*) of the genus *Anastomus* so called from the formation of the lower mandible, which is hollowed out so as to meet the maxilla at the base and tip. There is an African and an Indian species.

OPEN-FIELD SYSTEM. The "open," or "common" field was a characteristic feature of manorial agriculture (*see* LAND TENURE). It had its origin, however, in primitive conditions long antecedent to the development of feudalism. Three or four centuries before the Roman occupation the Celtic inhabitants of Britain had evolved a system of co-operative tribal husbandry on the open-field system. The cultivated, or arable, land occupied by the kindred, or tribe, was divided into narrow strips separated by balks of turf. The strips were about a furlong in length and of varying widths. It may be surmised that the length of the strips became more or less standardised at an early date, as the disadvantage of irregular lengths for adjoining strips was obvious. The furlong—clearly "furrow-long"—is generally agreed to have represented the distance which oxen would conveniently plough at a stretch, and the ploughman could keep a fairly straight line. In due course persistent trial and error would result in the general acceptance of the most suitable length which when once adopted would become the standard enforced by tradition. The width of the ordinary strip was, in like manner, gradually fixed at four times the length of an ox-goad, which was 5½ yards. Land measurements were no doubt not very exact in those days but the result was eventually to establish the standard size of the strip at approximately 220×22 yd., or in other words an acre.

In the Celtic open-field each free tribesman was allotted five strips. The allocation of the strips was made in accordance with strict tribal regulations, and the cultivation of the land was carried out co-operatively. The plough was common property but the oxen appear to have been individually owned.

This system fitted very readily into the manorial organisation introduced by the Normans. The status of the cultivators was changed, but the open-field with its separate acre or half-acre strips and its co-operative methods of husbandry continued. The administration of the manor became in form autocratic and the land was held in servile tenure, but in practice the rules governing the allocation of the strips and the cultivation of the land

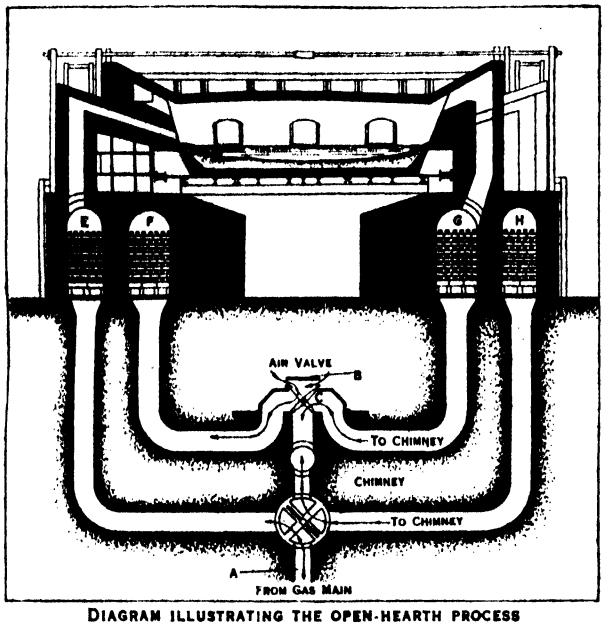


DIAGRAM ILLUSTRATING THE OPEN-HEARTH PROCESS

were settled by the tenants. Gradually the rigidity of the manorial organisation broke down, the relations of lord and tenants were changed and only the forms of feudalism lingered. But the open-field system survived in thousands of parishes until the wholesale enclosures of the end of the 18th and early part of the 19th centuries abolished it generally, although it lingered in isolated cases until the beginning of the 20th century. Indeed at least two open-fields—at Laxton in Nottinghamshire and Braunton in Devon—still existed in 1928. (R. H. R.)

OPEN-HEARTH STEEL PROCESS. In recent years two distinct modifications of steel making process have been included under this common title: (1) the Siemens process, in which pig-iron and ore are the materials used, and (2) the Siemens-Martin process, which uses a mixture of pig-iron and scrap steel. A combination of the two is also in general use.

Steel-making by this process was not a success until the brothers Siemens perfected their system of regenerative gas heating. The principle involved is simple and consists in utilizing the waste heat of the products of combustion to raise the temperature of the gas and air employed in heating the furnace, and so increasing very considerably the temperature obtained. The furnace is of the reverberatory type but instead of having a fire-box at one end and a chimney flue at the other both ends are built with ports for gas and air; the latter are generally arranged above the former in order to promote mixing of the gas and air and at the same time to afford some protection for the roof against the intense heat of the furnace. The ports are connected by flues with chambers filled with brickwork—called regenerators—which in turn are connected with the gas and air supply through a system of valves; these last named allow the direction of the gas and air through the furnace to be reversed from time to time. The roof of the furnace must be built with very refractory bricks, generally silica, and the hearth made of sand or dolomite according to the process for which the furnace is to be used.

A diagrammatic sketch of the furnace is given above. Gas from a producer and atmospheric air are admitted to the furnace through the valves A and B, from which they pass to the reversing valves C and D and from them through the regenerators E and F into the hearth where combustion takes place; from here through the hearth of the furnace the waste gases pass into the regenerators G and H and then through flues to the chimney via the reversing valves. The gas and air are reversed in direction every 20 to 30 min., by which means it is possible to maintain the high temperature required in the furnace.

Two methods of working the process are in general use—acid and basic. In the former the hearth is made of silica sand mixed with a small quantity of oxide of iron, in the latter it is of dolomite mixed with a small amount of tar; in both cases the hearth is fritted together under the intense heat of the furnace before any melting is done.

In the acid process no elimination of sulphur and phosphorus is possible during the working of the charge, and it is necessary to start with pig-iron and scrap which are low in these elements. The amount of silicon admissible depends upon the amount of scrap in the charge; when the amount is high, pig-iron containing a higher percentage of silicon can be used than when the quantity of scrap is small, but the total amount of silicon present should be about 1·5%. Assuming the furnace already hot from previous working, the pig-iron and scrap are charged into it in the order given; during the melting down the greater part of the silicon and manganese is oxidised and unites with the oxide of iron derived from the scrap to form a slag consisting mainly of silicates of iron and manganese. From time to time additions of iron ore are made to the slag in order to render it oxidising and so capable of removing by oxidation the impurities in the charge. Of these, silicon and manganese are the first to go, and carbon in the form of gaseous carbon monoxide follows, the gas liberated causing the bath to boil vigorously. Towards the close of the operation great care must be taken to avoid the addition of more ore than is necessary to make the carbon sufficiently low, otherwise steel of poor quality will be produced. Ferro-manganese and ferro-silicon are now added to deoxidise the metal and the charge tapped into a ladle and then cast into ingots.

In the basic process the procedure is somewhat different. In this case the elimination of the phosphorus and sulphur is possible on account of the nature of the slag, which consists of phosphate and silicate of calcium containing a large quantity of lime in suspension; additions of iron ore are made as in the acid process, and small quantities of lime must also be added from time to time to maintain the basicity of the slag; excess, however, must be prevented, otherwise the slag will become pasty and incapable of carrying on its work. Precautions must also be taken to secure the removal of the phosphorus and carbon in the order mentioned; otherwise the bath will go off the boil, and great difficulty will be experienced in getting rid of the phosphorus. The nature of the slag also necessitates the postponement of the deoxidation of the bath until the charge is in the ladle; should the ferro-manganese necessary be added in the furnace, there is great risk of the phosphorus being reduced from the slag and passing back into the metal. Pig-iron for use in the basic process may contain from 1 to 2% of phosphorus and should be low in both sulphur and silicon but fairly high in manganese. (*See* also IRON AND STEEL.)

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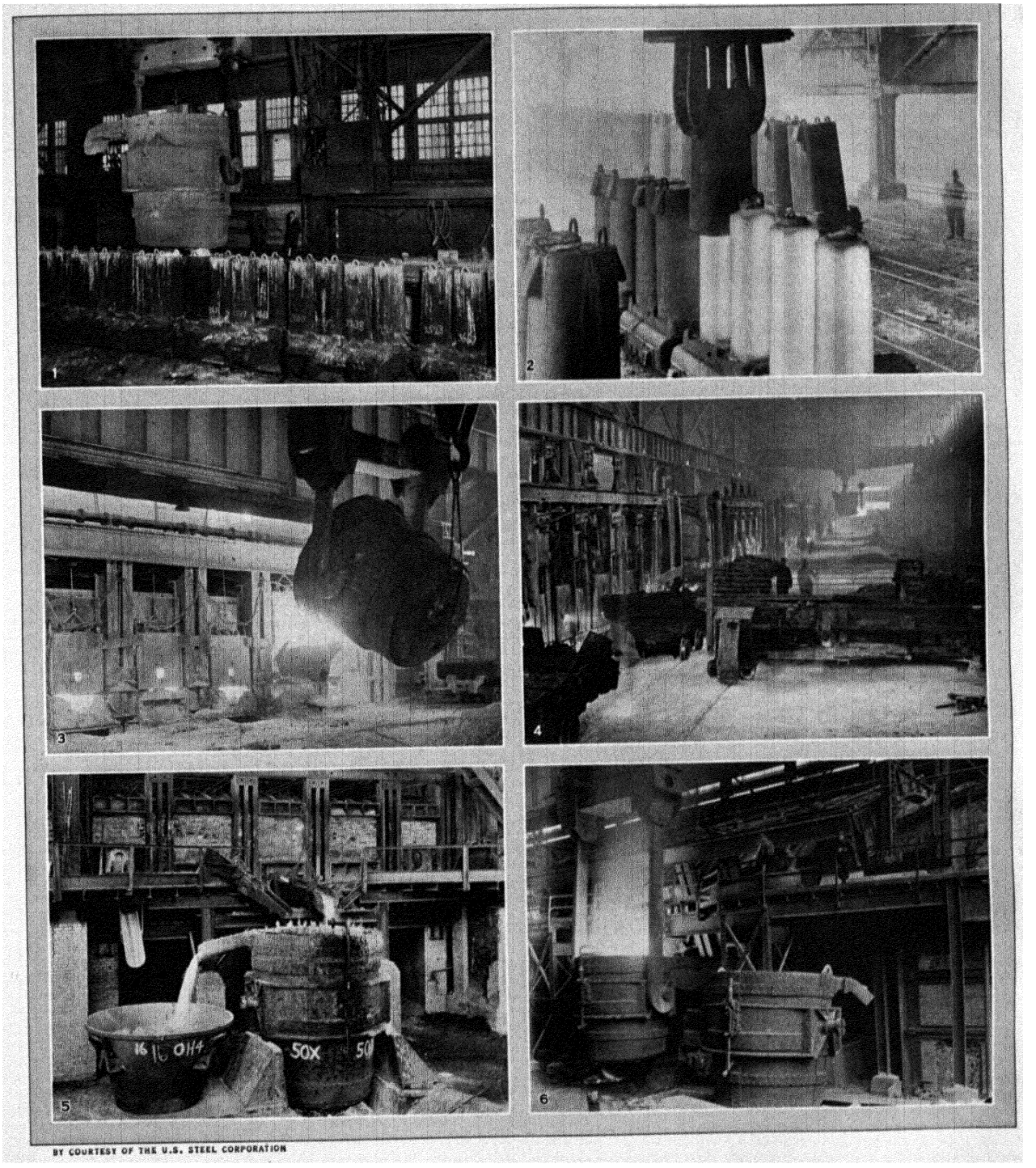
OPEN SHOP: *see* CLOSED SHOP.

OPERA, a drama set to music, as distinguished from plays in which music is merely incidental.

Italian Beginnings.—The historian, Doni, tells us that in the last years of the 16th century a group of amateurs held meetings at the house of the Bardi in Florence with the object of trying experiments in musical declamation by solo voices supported by instruments. Hitherto the only high musical art was unaccompanied choral music; its expression was perfect within such limits that dramatic music within those limits was as inconceivable as dramatic architecture. But the literary *dilettanti* who met at the house of the Bardi were not mature musical artists; and no technical scruples interfered with their glorious project of restor-

OPEN-HEARTH STEEL PROCESS



BY COURTESY OF THE U.S. STEEL CORPORATION

HEATING, REFINING AND MOULDING OF OPEN-HEARTH STEEL

1. Ladle filled with liquid steel being poured into ingot moulds
2. Removing moulds when liquid steel has "frozen" to a solid
3. Refining process, molten iron being poured into an open hearth furnace for refining into steel
4. Battery of furnaces, to the left, being charged with scrap iron and other raw materials
5. Discharging process. Liquid steel being poured into huge ladle. Steel being heavy stays at the bottom and the impurities which rest on top are poured into small ladle in the form of slag, which is used in cement manufacture
6. Tilting process. Open hearth furnaces so designed as to tilt for discharging of liquid metal

ing the musical glories of the Greek tragedy. Vincenzo Galilei, the father of Galileo, warbled the story of Ugolino to the accompaniment of the lute, much to the amusement of expert musicians; but he gained the respectful sympathy of literary listeners.

The first public production in this "monodic" style was Jacopo Peri's *Euridice* (1600), which was followed by a less successful effort of Caccini's on the same subject. Feeble as were these efforts, they impressed contemporary imagination as infinitely more suggestive of life and passion than the forlorn attempts then in vogue, to provide good music for a music-drama by means of a polyphonic chorus behind the scene, with actors in dumb-show on the stage. As Parry happily points out in this connection, the laying of a foundation stone suggests a future so inspiriting as to exclude all sense of the triviality of the present achievement. A great master of pure polyphony, Orazio Vecchi, had already, in 1594, the year of Palestrina's death, laughed the madrigal-opera to extinction in his *Amfiparnasso*. The woodcuts which adorn its first edition show how the actors sang or mimed in front, while the other singers completed the harmony behind the stage.

With the decadence of the madrigal, Monteverdi (*q.v.*) brought a real musical power to bear on the new style. At the beginning of the 17th century no impressionable young musician could fail to be profoundly stirred by Monteverdi's *Orfeo* (1602), *Arianna* (1608) and *Il Combattimento di Tancredi e Clorinda* (1624), works in which instruments were used with the same archaic boldness, the same rhetorical force and the same lack of artistic organization as vocal style and harmonic resources. So explosive was the spark of Monteverdi's genius that the next step necessary for the progress of opera was a development of forms, not only non-dramatic but anti-dramatic.

The types of monody conceivable by the pioneers of opera were codified in the system of free musical declamation known as *recitative*. This is said to have been used by Emilio del Cavalieri as early as 1588. Formal melody, such as that of popular songs, was as much beneath the dignity of monody as it had been beneath that of the highest forms of polyphony; but in the absence of any harmonic system but that of the church modes, which was ruined by the new unprepared discords, formal melody proved a godsend as the novelty of recitative faded. Tunes were soon legalized at moments of dramatic repose; it was in the tunes that the strong harmonic system of Neapolitan tonality took shape; and by the early days of Alessandro Scarlatti, before the end of the 17th century, the art of tune-making had blossomed into the musically safe and effective form of the *aria* (*q.v.*).

The poet Metastasio realized that there was nothing unnatural in a scheme of drama which allowed each stage of the action to culminate in a tableau marked by a burst of lyric poetry and lyric music. Some 30 such tableaux would give occasion for 30 arias (including a few duets, rarely a trio and only once in Handel's 42 operas a quartet) while the connecting action and dialogue was set in recitative. Metastasio devoted his whole life to opera-libretti on this plan, which he executed with consummate skill. He was far from satisfied with the way in which most composers set his texts. The scheme was fatally easy for small musicians and did not stimulate the higher faculties of great ones; while great and small were equally at the mercy of singers.

Before this stagnation of baroque opera there was a provincial outburst of life in the wonderful patchwork of Purcell's art (1658–95). In the early *Dido and Aeneas* he and the humble Nahum Tate (of Tate and Brady) produced, perhaps, the most perfect opera before Gluck. Dryden was less accommodating. He had been so disgusted by the stupid vanity of the fashionable Monsieur Grabu that when he wrote *King Arthur* he insisted on arranging that the musical characters should be quite independent of the main action, and with the infliction of this condition upon Purcell, English opera was relegated to a permanent musical squalor which even endured to ruin Weber's last work, *Oberon*, in 1826.

Gluck.—Another sign of life was present in the farcical operas and intermezzi or comic entre-actes of certain Neapolitan composers (*see* LEO, PERGOLESI, LOGROSCINO), one of which (Pergolesi's *La Serva Padrona*) occasioned the war of Buffonistes and Antibuffonistes in Paris (*see* MUSIC, sec. 6).

The forms of music known before 1750 were architectural or decorative, but essentially non-dramatic. Baroque opera required something more than reform, and the opportunity for progress came with the rise of the sonata style. The music of Gluck's time was too firmly organized to be upset by new discoveries; in fact the chief need for opera was retrenchment in rhetorical forms. Gluck, as Handel had remarked of his early works, was no contrapuntist, and to the end of his life this hampered him in "jining his flats." But he had a genius for phrasing (*see* RHYTHM), which went far to promote dramatic movement, and another aspect of this was a sense of symphonic form as vigorous as could find scope in opera at all; while his melodic power was of the kind which Matthew Arnold calls "touchstones of poetry."

The lasting effect of his work on French music left the course of Italian *opera seria* unchecked. Mozart's *Idomeneo* is the grave of some of his greatest music, including many genuinely dramatic strokes, and his perfunctory *Clemenza di Tito* is the last *opera seria* that contains any music worth extracting. The unmistakable influence of Gluck could not save *Idomeneo;* and Mozart's triumphs belong to the comedy of manners, until he entered the transcendental world of *Die Zauberflöte*. His first impulse was inveterately musical, and his power of dramatic movement and characterization grew steadily without always preventing him from yielding to singers and indulging himself in dramatically vicious musical luxuries. But after his first exuberant German opera, *Die Entführung aus dem Serail*, it is not so easy as it seems to catch Mozart napping. He is a dangerously subtle parodist, and in *Così fan tutte* the heroic coloratura arias of the virtuous Fiordiligi and Dorabella are the arias of ladies who do protest too much; and in *Die Zauberflöte* the vocal fire works of the Queen of Night are the rhetoric of a formidable person who, we are told, "hopes to cajole the people with illusions."

Mozart.—The article MOZART contains further remarks on his operas. They are organized so thoroughly on the basis of their libretti that it is a serious mistake, not made by scholars like Jahn, to underrate the wits of his literary collaborator, Da Ponte. Goethe did not even underrate the rapscallion Schikaneder, but took the symbolical aspects of *Die Zauberflöte* so seriously as to sketch a sequel to it. Since boyhood Mozart never wrote an opera without thoroughly controlling its dramatic movement. Where he relaxes the relaxation is complete. The movement in *Die Entführung* is intermittent and the static elements excessively favoured, but the movement exists and is powerful. In *Figaro*, the fourth act, with its tangle of assignations in the garden, has five arias in succession which would make a mere concert on the stage if they were all performed; but there is an ironic dramatic tension behind the last of them (*Deh vieni, non tardar*); and when the librettist provides action Wagner is not as quick as Mozart in his timing of the details and the whole. One of Wagner's English propagandists, Hueffer, cited the duet in which Cherubino and Susanna are trying to find a way out of the locked room before the Count returns, and accused Mozart of keeping the Count waiting at the door until this effective piece of music had run its formal course. But every stage manager finds that Mozart has barely given Cherubino time for a natural hesitation before jumping out of the window, in spite of Susanna's terrified protest.

The Qualities of Opera.—And here we may profitably consider what are the qualities necessary for success in opera. It is notorious that the absolute value of the music comes last, if it is a factor of success at all. Unquestionably it is a factor in immortality; and the music of *Idomeneo* is immortal, though that opera is revived only in Mozart festivals. But operas cannot wait for immortality, and can manage on quite flimsy music to achieve as much immortality as musical history has given time for. It might be thought that success depends on dramatic power; and this is nearer the truth. But dramatic power comes only third in the conditions, and coherence is not necessary at all.

Two qualities take precedence of dramatic power as conditions for success in opera; one is the theatrical sense, and the other the histrionic sense. They are inseparable but not identical. The theatrical sense can thrill the listener before the curtain rises.

as in the modulation to F major at the end of the overture to *Don Giovanni;* the histrionic sense can save the stage-manager the trouble of telling the actors what to do with their hands. The beginning of Rossini's *Barbiere* is an excellent example, especially when compared with that of Paisiello's setting, which dominated the stage until Rossini's ousted it. Paisiello's opening is good music for any moderately cheerful situation, Rossini's opening consists of a scale rising for nine notes and descending again, with long halts and water-beetle glides. Actors may be defied to walk on during this music with any steps but those of conspirators! And the scoring (which is so perfunctory that literally half of the bulk of the opera is expressed by abbreviations) gives in perfection the theatrical atmosphere of a night scene. The same ridiculous scale in another ridiculous rhythm hisses up and down in thirds *sul ponticello* (close to the violin bridge) while Basilio describes the destructive effects of a well managed calumny. Poor Paisiello's famous duet between two stammerers was no asset wherewith to outbid Rossini's ubiquitous histrionic sense in the contest for popularity.

But when brilliant writers tell us that Rossini is superior to Mozart in the sense of pace, it is high time to study the elements of Mozart's art. Three senses of pace enter into music. There is that of the athlete, relying on his own limbs, the limbs of his horse or the wheels which he directly controls. There is that of the passenger reclining in his car; and there is the cosmic motion of the stars among which our own humble earth moves hundreds of times faster than a cannon ball, yet takes several minutes to traverse its own diameter. Of these three senses of movement that of the passenger in his car is equivalent to repose, and to nothing else; while cosmic movement, discernible in Bach, Beethoven and Wagner must be related to human measurements before it means anything at all. The one directly exhilarating sense of movement is that of the athlete; and we are asked to believe that Rossini exemplifies this when Figaro rattles his "Largo al factotum" at some nine syllables a second, immovable for six minutes except for semaphore gestures once in 12 bars, to the right when the music halts on the dominant, to the left when it halts on the tonic. No, let us be accurate; there is another tradition which identifies the tonic with the right and the dominant with the left. Mozart's *Figaro* contains one piece of patter-singing even faster than "Largo al factotum," but he pronounces judgment on this kind of movement by giving it to the decrepit Dr. Bartolo ("se tutto il codice dovesse leggere," etc.).

The decline of *opera seria* and *opera buffa* led to an approximation between tragic and comic styles till the distinction became too subtle to be distinguished by any but experts. Dance rhythms became the only Italian forms of accompaniment, and vocal scale exercises remained the last resource of the dying Desdemona. Yet Rossini retained so much histrionic force that an English spectator of his *Otello* is recorded to have started out of his seat at the catastrophe, exclaiming "Good Heavens! the tenor is murdering the soprano!" And in times of political unrest more than one opera became as dangerous as censorship could make it. An historical case is brilliantly described in George Meredith's *Vittoria.* But what has this to do with the progress of music? The history of Italian opera from after its culmination in Mozart to its subsidence on the big drum and cymbals of the Rossinians is the history of "star" singers.

Verdi's art, both in its burly youth and in its shrewd old age, changed all that. He reformed nothing except by slow experience; but he gradually found a meaning for everything. Even the vile Italian brass is used in his last works in just the same style as in his earliest, with the enormous difference that he appreciates its brutality and uses it only where brutality is wanted. Verdi's development belongs to a later stage of operatic history.

France.—After Mozart the next forward step in operatic art was again made in France. The French histrionic atmosphere had a stimulating effect upon every foreign composer who visited Paris. Rossini himself, in *Guillaume Tell,* was electrified into a higher dramatic and orchestral life than the rollicking rattle of his serious and comic Italian operas. The grave defects of its libretto were overcome by unprecedented efforts at the cost of an entire act. Anywhere but in Paris Rossini's music would have pulled a worse drama through or else failed outright; but in Paris the composer found it worth while to learn how to rescue his best music from failure.

The French contribution to musical history between Gluck and Rossini is of austere nobility worthy of a better crown than Meyerbeer's music. If Cherubini and Méhul had had Gluck's melodic power, the classics of French opera would have been the greatest achievements in semi-tragic music-drama before Wagner. As it is, their austerity is negative, failing to achieve beauty rather than rejecting what is irrelevant. The histrionic sense is good, but the sense of movement rejects patter-singing without achieving anything more real. Cherubini's *Medée, Les Deux Journées* and *Faniska,* however, did achieve grand musical forms and had a great influence on Beethoven.

Beethoven's *Fidelio* gives occasion to consider the function of the librettist, who obviously has the composer at his mercy unless the composer is prompt to get the upper hand. Mozart (*q.v.*) learnt betimes to bully his librettist. Beethoven did not; and the expansion of Bouilly's pretty *opéra comique, Fidelio ou l'amour conjugal* into the powerful *Leonore* (afterwards renamed *Fidelio*), was executed according to Beethoven's general intentions but with many blunders as to the *mise-en-scène.* French *opéra-comique* is not comic opera, but opera with spoken dialogue. It thus includes Cherubini's tragic *Medée* and Méhul's biblical *Joseph.* It has a tendency (which culminates in Bizet's *Carmen*) to arrange that much of the music should happen more or less as it might occur in an ordinary play. For instance, necessary antecedents may be told in "that dear old song which I am never tired of hearing," whereupon the family history follows in a ballad. Other occasions for music are the plighting of troth in a little private ceremony, the entry of a company of soldiers, and, less realistically, ordinary entries and tableau-situations in general, until we recapture the Metastasio scheme. Opera, viewed from this point, lacks opportunity for great musical forms, which can deal with more than one action; but the influence of Mozart's wonderful concerted finales was not to be resisted, and Cherubini's librettists arranged that the second act in *Les deux Journées, Lodoiska,* and one or two other operas, should end with continuous music for something like 20 minutes, with various changes of action. The last act French taste did not allow to expand, and in all French operas the end is perfunctory; whereas Mozart and Beethoven love to expatiate on the final happiness.

It is not known where the concerted finale originated, since its reputed invention by Logroscino (*q.v.*) is not borne out by his extant works; but it is already fully developed in the second act of Mozart's *La finta Giardiniera* (written at the age of 18). In his first *Singspiel, Die Entführung,* Mozart ends the second act with a highly developed quartet, while the whole opera ends with a vaudeville, *i.e.*, a series of verses delivered by each character in turn, with a burden in chorus; followed by a short movement for full chorus. But in his other *Singspiel, Die Zauberflöte,* the finales to both acts, like those in *Figaro, Don Giovanni* and *Così fan tutte,* cover so much action within their half-hour's extent that it would evidently cost Mozart little effort to extend the finale backwards over the whole act and so to achieve, without transcending his own musical language, the perfect continuity of Verdi's *Falstaff.* This would have suited neither his singers nor his public; but we do not know how he might have crushed opposition if he had lived longer and had seen the possibilities of French opera, with its thrilling tales of heroic adventure.

Fidelio.—As fate befell, Beethoven took the problem in hand too late. The original libretto of Fidelio was by the author of *Les Deux Journées,* and was on the usual French lines with (as Brahms once put it) vaudeville turns for each person in succession. Two acts were occupied with the love of the jailor's daughter, Marceline, for Fidelio, the mysterious new assistant who is really the disguised wife of the hero, who has been secretly imprisoned by the villain, and whom she has been seeking for two years. She reluctantly uses Marceline's delusion in order to further her design of penetrating to the lowest dungeons of this jail, where a mysterious prisoner is being starved to death. In the

original libretto a trio begins on the occasion of the father's giving his blessing on their engagement. And on the operatic vaudeville scale this is well enough timed. But Fidelio-Leonora's heroic project and the martyrdom of her Florestan in Pizarro's dungeon are themes too sublime for this light style of opera, which was all very well for the adventures of the hero of *Les Deux Journées,* carted out of Paris in his humble friend's water cart. It was the sublime themes that attracted Beethoven; and in *Leonore* (as his opera was first named) his librettist, Sonnleithner, tried to expand them without the necessary recasting of the whole action. So the trio of plighted troth was begun earlier, so as to take in half of the previous conversation, which dealt with the project of getting permission for Fidelio to assist in the work of the dungeons, and with Fidelio's imperfectly suppressed excitement thereat. We thus have the music bursting into the conversation in an inexplicable way; and two revisions barely saved the first two acts even when an experienced dramatist named Treitscke compressed them into the first act of *Fidelio.*

The rest, from the rise of the curtain on Florestan in the dungeon, was not beyond mending; and spectators who are insensible to its power should confine their criticisms to the customs of the box-holders. *Fidelio* is one of the most important works in the history of opera; and *The Messiah* has not a firmer hold of the British public than *Fidelio* has of every class of unspoilt music-lover in Germany. The story is one of the finest ever put on the stage, and everybody in Germany knows it; which is fortunate, since nobody could ever make it out from the action, until it begins to explain itself in the dungeon scene. But in the first act the mystery is a mere puzzle, and even if Fidelio's disguise is as transparent as most operatic male parts for female voices, the spectator has no evidence beyond the playbill, that she is other than the strangely embarrassed lover of the adoring jailor's daughter.

The difficulties of *Fidelio* are thus very instructive. Turn back from it to the almost nonsensical *Zauberflöte* and observe how perfectly the comings and goings of Mozart's music explain themselves. Music begins naturally on the rise of the curtain, and stops naturally with the exits of all the characters except the youth who is lying unconscious. He revives, wonders where he is, hears a distant piping; and the approach of the bird catcher, Papageno, explains the piping and is accompanied by the orchestral introduction to his song. Later on, three veiled ladies give the hero a miniature portrait of the princess he is to rescue. He gazes at the portrait and falls in love; the orchestra heaves two sighs and Tamino's love-song begins. The scene darkens, the Queen of Night appears, enthroned among stars, pours out her woes and promises her daughter to the hero. She vanishes. Daylight returns. Tamino, wondering whether it was all a dream, is encountered by poor Papageno who, punished for his lies with a padlock on his mouth, can only sing *hm, hm, hmm;* another perfect occasion for music, worked up in a quintet in which the three veiled ladies remove his padlock and instruct him and Tamino how to set forth on their quest. And so from point to point the happy nonsense proceeds, always right and effective in matters the mishandling of which may ruin the finest story.

Co-ordination.—These are the matters in which Sullivan, with his Gilbert, is as right as Wagner. It makes little difference whether the opera be with spoken dialogue, with dialogue in the secco-recitative of *opera bufa,* with the accompanied recitative of Gluck and of Weber's *Euryanthe,* or in absolute Wagnerian continuity. The composer will always have to demand from his librettist an effective timing of the chief musical opportunities, and from himself a royal punctuality in the relation of his music to the drama. Wagner's advice to young opera writers was to begin with *Singspiele.* The *a priori* critic complains that spoken dialogue and music are on irreconcilably different planes; and so they are when the transitions are mishandled. But Mahler, one of the greatest opera conductors of all time, did not think the planes incompatible. He insisted on being his own stage manager (which laudable example has been followed by Sir Thomas Beecham), and he rehearsed every word and every pose in the dialogue of *Fidelio.*

Secco-recitative, *i.e.,* recitative accompanied on the pianoforte (or harpsichord) is no bad medium when it is properly done, viz., at the pace of spoken dialogue and, on the part of the conductor (who takes the pianoforte), with a light touch and some discreetly humorous "gagging." Modern composers, of course, might as well attempt prehistoric Chinese as try to revive this convention. With accompanied recitative and other more highly organized music the composer begins to lose the clear outlines of the problem of timing his chief musical events; and the wisdom of Wagner's advice appears. For only in the *Singspiele,* with *Freischütz* and *Zauberflöte* as examples, and with *Fidelio,* as both an inspiration and a warning, do we see the bones of opera laid bare.

These principles are more important than any details of chronological operatic history. The reader who has grasped them can afford to ignore most of the patriotic and political aspects that have made this or that opera famous. *Der Freischütz* was the first German opera that had a truly German subject; and Wagner, speaking at a reburial of Weber's remains, said that there never was a more German composer. Very true, but that did not prevent Weber from following *Freischütz* by *Euryanthe,* his greatest effort, on a subject of chivalry ruined by an incompetent librettist; nor from contributing his swan song, *Oberon,* to the English stage and the English operatic tradition which, ever since the time of Dryden and Purcell, inculcated an utter incoherence in the musical scheme. Weber's distress at being made to compose separate numbers as Planché sent them to him, with no information as to their order or context, was surpassed only by his disgust at finding that Planché was quite right in thinking that such information did not matter.

Euryanthe, with its elaborate accompanied recitative and its 13 distinct *Leitmotive* (to anticipate the Wagnerian term) is an opera on lines hardly less advanced than those of Wagner's *Lohengrin.* Weber retains the outward appearance of the division into separate numbers, as arias, duets, finales and so on; but the division is becoming artificial, and some vestiges of its real purport are useless. For example, the condemnation of *Euryanthe* at the end of the second act is expanded by Weber into a longish movement merely because he does not realize that a short outburst would suffice to round off the whole act far more grandly than a self-contained finale.

Wagner.—With Wagner's *Der Fliegende Holländer* extremes meet. It purports to be divided into nine "numbers," but the musical traces of such divisions are only a nuisance, and the formal expansion of the Dutchman's duet with Senta is as out of place as a Punch and Judy show, besides being very poor music. On the other hand, the division into three acts is a grudging concession to the brutal necessities of the first performances, for Wagner conceived and executed *Der Fliegende Holländer* as a one-act opera, with continuous music during its changes of scene. It has been divided into three as if by a butcher's chopper, cutting off the curtain music at the first available tonic chord, and restarting it at the cut or a little earlier. The opera ought always to be performed in one act. Spohr's comment on it was that it had too few full-closes and rounded off forms. This shows how far it still seemed recognizable to him as a classical opera.

Wagner's mature work solves the problem of a music on the same time-scale as the drama. Every other feature of Wagner's art results naturally from this. Musical dialogue becomes completely realistic, to such an extent that Wagner could not at first (in *Die Walküre*) make up his mind to let his lovers sing together. He overcame this scruple in *Tristan,* and so recovered the classical art of making a composite emotional tableau. This he developed to unprecedented heights in *Die Meistersinger von Nürnberg.* The continuity of such highly organized music demanded a rational organization of recognizable themes. What more inevitable principle could organize them but that of association with personal and dramatic ideas? Thus Wagner's system of *Leitmotiv* grew up as naturally as the thematic organization of sonatas. The illustrations at the end of the article MELODY give a typical example of his handling of a theme in various contexts. Other aspects of his music are illustrated in HARMONY and INSTRUMENTATION.

Not only was Wagner his own librettist, but he succeeded in

making clear and cogent upon the stage stories and ideas that no dramatist, musical or non-musical, had thought possible before. It is always a mistake to suppose that the libretto, however contemptible as literature, can be neglected in the enjoyment of an opera, however great as music. But Wagner's dramas, with all their affectations and amateurishnesses of style, are pieces of epoch making stage-craft and overwhelming tragic powers, except *Meistersinger,* which achieves the yet higher mark of a comedy full of kindly wisdom and bathed in sunshine, with no shadows deeper than moonshine; for even its poor little villain, Beckmesser, is only a critic.

It was not Wagner's fault that so many of his epigonoi neglected his advice and, instead of writing *Singspiele,* refused to tackle anything smaller than continuations of the sorrows of Wotan. Lighter forms of opera prospered, nevertheless. Bizet first wrote *Carmen* as an *opéra comique.* It is doubtful whether it has been improved by the compression of its spoken dialogue into accompanied recitative, though this is well done and the recitatives have their points. It carries to an extreme the device of rationalizing the musical occasions; for if it were performed as a play an enormous amount of the music would still remain as songs or dances. *Meistersinger* is almost as full of songs and choruses on the same realistic basis.

The last works of Verdi have a complete Wagnerian continuity, but they reveal that unless the music is inveterately polyphonic the *Leitmotiv* system is Wagner's private affair, which need concern nobody else.

Modern Opera.—Space fails for anything like a complete review of modern opera; but it may be noted that the prevalence of Wagnerian continuity eventually enabled composers to take extant dramas and set them without any extensive remodelling at all. If the operas *Pelléas et Mélisande, Salome* and *Elektra* are compared with the original plays by Maeterlinck, Wilde and Hofmannsthal, it will be found that the poets have suffered less from Debussy and Strauss than dramatic authors usually suffer from actor-managers. Debussy has omitted Maeterlinck's difficult and not musical first scene of the servants who, having heard of the prince's approaching return with a strange bride, must be speaking after the following scene, in which Golaud first meets Mélisande in the forest. By omitting the first scene Debussy secures an opening in the right atmosphere but loses the basis of the entry of the servants in the last scene of all. Here history repeats itself, for Weber offended the librettist of *Freischütz* by refusing to compose an opening scene with the hermit who appears as *deus ex machina* at the end. In both cases the composers are right, though the sacrifice is serious.

Debussy and Strauss have so treated these three plays that they are better acted when given as operas than when given without music. No actress except an opera singer ever has her declamation and movements so superbly timed, and timed permanently to the tenth of a second, as in these wonderful pieces of musical stage-craft. The methods of the two composers are poles asunder, and Debussy's language is, as has been said elsewhere, the exact opposite of Maeterlinck's. Yet from his opposite direction Debussy reaches the Maeterlinckian world. He has no *Leitmotiv,* hardly even a recurring figure. Strauss uses the whole Wagnerian system, together with his own *al fresco* technique (the term is also his own, *see* INSTRUMENTATION, sec. 6).

In later works Strauss and Hofmannsthal have shown that they accept no limits to the number of different kinds of opera that one composer may write. An annotated catalogue would be required to keep pace with the various types of modern opera from the parodistic to the tragic and the symbolical.

A few final definitions may serve to fill up lacunae in an account which has deliberately sacrificed historical order to the laying down of a few broad aesthetic criteria. Besides the matters already defined the following particulars should be noted:

1. *Singspiel* originated in farces, such as *Dittersdorf's Doktor und Apotheker.* But in France the *opéra comique,* which corresponds to *Singspiel,* had no comic origin at all, but arose from the refusal of the *Académie de Musique* to allow rival companies to infringe its monopoly of *Grand Opéra,* or opera in which every word is sung and even the recitatives have orchestral accompaniments.

2. French *Grand Opéra* has had a continuous history from the foundation of the *Académie de Musique* in 1669 to the present day. It absorbed the works of Meyerbeer, which so infuriated Wagner by producing "effects" without assuming any responsibility for causes. And this is all that can be said of Meyerbeer here.

3. *Opéra bouffe* has no historic connection with *opera bufja* but is the offshoot of vaudeville music in the early classical sense described above. Its chief representative on the Continent is Offenbach, and it is the ancestor of the Savoy operas of Gilbert and Sullivan.

4. *Melodrama* is the use of an orchestral accompaniment to spoken dialogue (*see* BENDA). It is promising in theory, but generally disappointing in effect, because the speaking voice becomes dragged by the music into an out-of-tune sing-song. Benda never lets the voice speak during any notes except a long-sustained chord. Mozart, after one example in an unfinished opera, *Zaide,* dropped this form, though he admired Benda's essays so much that he put them under his pillow during his travels. Other classical examples are significantly short and cautious. There is one in *Fidelio* which quotes from earlier movements in a thoroughly Wagnerian way. But the device is more prominent in incidental music to plays, as in Beethoven's music for Goethe's *Egmont.* Mendelssohn's music for *A Midsummer Night's Dream* contains the most brilliant and resourceful examples yet achieved; but they are beyond the musical capacity of the English non-operatic theatre, which, however, has practised the worst style of the method, till it has become a disease spreading an operatic continuity of bad music over large tracts of our drama.

In every period of musical fermentation the art of opera, while it has failed to sift good composers from bad, has instantly sifted the men of real ideas from the aesthetes and faddists; Monteverdi from the prince of Venosa, Gluck from Gossec, Wagner from Bruckner on the one hand and Liszt on the other. As the ferment subsides laziness levels opera sooner than anything else; but every revolutionary principle that enters into music to destroy and expand must, first or finally, seek its ratification on the stage.

See also ARIA, BALLET, OVERTURE, INSTRUMENTATION and the articles on individual opera composers. (D. F. T.)

OPHICLEIDE, a brass wind instrument, now almost obsolete, having a cup-shaped mouthpiece and keys, in fact a bass keyed-bugle. The name (from Gr. ὄφις serpent, and κλεῖδες keys), applied to it by Halary, the patentee of the instrument, is hardly a happy one, for there is nothing of the serpent about the ophicleide. The ophicleide is almost perfect theoretically, for it combines the natural harmonic scale of the brass wind instruments having cup-shaped mouthpieces, such as the trumpet, with a system of keys, twelve in number, one for each chromatic semitone of the scale and it is capable of absolutely accurate intonation. Unfortunately its timbre is not satisfactory, the lower register being rough, the medium coarse and the upper wild and unmusical, and it has been superseded by the bass tuba.

The invention of the ophicleide is frequently but falsely attributed to Alexandre Frichot, a professor of music at Lisieux, department of Calvados, France. Actually the first idea of adding keys to instruments with cupped mouthpieces, unprovided with lateral holes, with the aim of filling up some of the gaps between the notes of the harmonic scale, goes back, according to Gerber, to Kölbel, a hornplayer in the Russian imperial band, about 1760. Anton Weidinger, trumpeter in the Austrian imperial band, improved upon this first attempt, and applied it in 1800 to the trumpet. But the honour belongs to Joseph Halliday, bandmaster of the Cavan militia, of being the first to conceive, in 1810, the disposition of a certain number of keys along the tube, setting out from its lower extremity, with the idea of producing by their successive or simultaneous opening a chromatic scale throughout the extent of the instrument. Later, in 1817, Jean Hilaire Asté, known as Halary, a professor of music and musical instrument maker of Paris, extended the same principle with complete success to other instruments of the same family.

OPHIR, an unidentified region famous in Old Testament times for its fine gold. Solomon's Tyrian sailors brought its gold for that monarch. The geographical list of Genesis X. associates it with Sheba and Havilah, the latter also being a recognized gold bearing region (Gen. ii. 11). Solomon's ships set forth from Ezion-Geber at the head of the Gulf of Akaba. Presumably then it lay somewhat to the south of Suez, but where?

(1) *East Africa.*—The extensive and imposing ruins discovered at Zimbabwe in Mashonaland, about 200m. inland from Sofala, have been acclaimed as marking the site of long lost Ophir. But careful investigation has resulted in depriving the ruins of any claim to great antiquity. An identification with Zanzibar has been suggested.

(2) *The Far East.*—The fact that three years were occupied in the voyage to Ophir (1 Ki. x. 22) as well as the nature of the cargoes (gold, silver, ivory, apes and peacocks) suggests a distant voyage, although attempts have been made to minimize these arguments. The Indus delta; Johore; Supara in Goa; Farther India; Malabar; Malacca; Sumatra have all been adduced.

(3) *Abyssinia.*—The territory on the Abyssinian coast from ancient Adulis to Bab-el-Mandeb whose inhabitants call themselves Aphar.

(4) *Arabia.*—The most common and, indeed, the most plausible view is that Ophir was somewhere in Arabia. It has been sought in West Arabia at Asyr between the Hejāz and Yemen; but the view that it is some district on the southern coast appears the most atractive.

The lack of sufficient data for identification has given and no doubt will continue to give scope for imagination. There have not been wanting wild and fanciful surmisings. Spain, Armenia, Phrygia and even Peru have had their advocates. (E. Ro.)

OPHITES. Strictly speaking, this is the name given to an obscure sect of Gnostics, of which our knowledge is derived mainly from Origen (*Contra Celsum*, vi. 25) supplemented by Irenaeus (*Adv. Haer.*, i. 30) and Epiphanius (*Haer.*, xxxviii); but the more important use of the term is as the comprehensive name for a group of Gnostic sects which resemble one another, first, because no name of any personal founder or leading teacher is associated with any of them; and further, because they attach religious importance to the serpent. The type of mythology may be illustrated from the account of Irenaeus. It begins with a triad, the highest deity, described as "primal Man"; intellect or reason, his Son, the "second Man"; and the Spirit, introduced as a female principle. Through her the Christ is begotten as "third Man." Christ ascended, with the Spirit, but in their ascent a ray of light fell on the waters. This was Sophia (prudence or wisdom) and from this contact came Ialdabaoth the "demiurge." He in turn produced six powers, and (from the dregs of matter) the serpent. Ialdabaoth then announced himself as the supreme Being; and when man (created by the six powers) gave thanks not to Ialdabaoth but to the primal Man, the former created a woman (Eve) to destroy him. Then Sophia sent the serpent (as benefactor) to persuade Adam and Eve to eat of the tree of knowledge and so break the commandment of Ialdabaoth, who banished them from paradise to earth. After a long war between mankind, aided by Sophia, and Ialdabaoth (this is the inner meaning of the Old Testament story), the Spirit sent the Christ to earth to enter the pure vessel, the virgin-born Jesus. Jesus Christ worked miracles and declared himself the Son of the primal Man. Ialdabaoth instigated the Jews to kill him, but only Jesus died on the cross, for Christ had departed from him. Christ then raised the spiritual body of Jesus, which remained on earth for 18 months, initiating a small circle of elect disciples.

This form of Ophitism is Christianized to a larger extent than others of the kindred sects, in most of which the Christian element is slighter and less essential. They are also far less impregnated with Greek philosophy than the "classic systems of Gnosticism"; and the early sources warrant the inference that the mythology itself is only a covering for observances (ritual, initiation, secret pass-words, incantations) characteristic of mystery-religions.

Notwithstanding the conclusion based by De Faye on his instructive investigations, the prevalent view holds the field, namely, that Ophitism represents a primitive phase of Gnosticism, which was gradually developed and transformed into various great speculative systems by a series of historic teachers.

See E. F. Scott, art. "Ophitism" in Hastings, *Encyclopaedia of Religion and Ethics;* Lichtenhahn, art. "Ophiten" in Herzog-Hauck, *Realencyklopädie;* E. de Faye, *Gnostiques et Gnosticisme* (1913); Reitzenstein, *Peimandres* (1904). *See* also art. GNOSTICISM. (S. H. M.)

OPHIUCHUS, in astronomy, a constellation of the northern hemisphere, anciently named Aesculapius, and mentioned by Eudoxus (4th century B.C.) and Aratus (3rd century B.C.). According to the Greek fables, it variously represents: Carnabon (or Charnabon), king of the Getae, killing one of the dragons of Triptolemus, or Heracles killing the serpent at the river Sangarius (or Sagaris), or the physician Asclepius (Aesculapius), to denote his skill in curing snake bites. Like Sagittarius (which it adjoins) it includes a region of the sky rich in globular clusters and diffuse nebulae.

OPHIUROIDEA, a class of the Echinoderma (*q.v.*), comprising the brittle stars (*q.v.*). It is sometimes united with the Asteroidea as the class Stellaroidea.

OPHRYS, a genus of plants of the orchid family (*Orchidaceae*), comprising about 30 species native to Europe, western Asia and North Africa, including the bee-orchis (*O. apifera*), the spider-orchis (*O. aranifera*) and the fly-orchis (*O. muscifera*), the second of which is one of the few orchids that are self-fertilized. (*See* ORCHIDS; also C. Darwin, *The Fertilisation of Orchids.*)

OPHTHALMOLOGY (*see* EYE, ANATOMY OF; EYE, DISEASES OF). The science of ophthalmology deals with the processes by means of which the images of external objects are brought to our consciousness. It is therefore concerned with:

(*a*) the eye itself; (*b*) the nerve paths and tracts which convey visual impulses originating in the eye, through the different parts of the brain to the brain cortex, where these impulses are converted into conscious impressions; (*c*) the eyelids which cover and protect the eyes; (*d*) the tear glands and ducts; (*e*) the muscles that bring about the movements of the eyes and keep them trained in the desired direction; (*f*) the nerves and their complicated cerebral connections which supply these muscles; (*g*) the bony walls of the orbit; (*h*) the blood-vessels and lymph paths which maintain the nutrition of all these structures.

It treats of disease in these parts and derives importance from the fact that many diseases of the central nervous system and many general diseases manifest themselves by some derangement of function or structure which can be detected by the ophthalmic surgeon.

The eye is unique in the body in that its retina, which is available to minute examination by means of the ophthalmoscope, is the only portion of the brain available to inspection during life. Similarly, the arteries and veins which supply the retina can also be minutely examined during life, the diseases of them observed and followed in all their changes. The value of these observations is enhanced by the fact that the eye itself acts as a low-power microscope, providing a magnification of about 15 diameters for the examination of these structures. The eyes are the subject of a number of hereditary diseases, and form one of the most convenient media for the study of transmission of such diseases.

Affections of the Eye.—The function of the eyeball is to provide that a clear image of external objects shall be formed upon the retina, but in certain cases it departs from the normal and the acuity of sight is lowered. It may be too long, so that the retina lies behind the point at which the images of external objects are formed; this is myopia or short-sightedness, and may be compensated by the wearing of concave lenses in the form of spectacles. In other cases, the eyeball is too short and the retina lies in front of the point at which the image of external objects is formed. This is hypermetropia or long-sightedness; it can be compensated by the focusing muscle of the eye, making the lens more convex; or, preferably, by the wearing of appropriate convex lenses in the form of spectacles. In astigmatism the refractive power of the eye varies in different axes, so that, for instance, in an extreme case the verticle axis may be myopic whilst the horizontal axis is hypermetropic.

Normally the visual axes of the two eyes are parallel and images of external objects are formed upon corresponding points of each retina. This arrangement is largely responsible for stereoscopic vision, which enables us to judge the position of objects in space with accuracy. Should it be upset *e.g.* by paralysis of some of the muscles, stereoscopic vision is lost and double vision usually arises.

Eyeball and Camera Compared.—The eyeball may be likened to a photographic camera. Roughly speaking it is globular in shape and is an inch long in all dimensions. The front part, or cornea is curved, is perfectly transparent and functions as a lens. Behind it is a chamber filled by the aqueous humour—little more than water. Further back is the iris—the coloured part of the eye. The hole in its centre forms the pupil, and by contraction or dilation of the tissues of the iris the pupil can be varied in size through a wide range; it may be compared to the stop in the camera. In bright lights the pupil is small, and it becomes large in dull illumination. The iris rests behind upon the lens.

The lens is bi-convex, its back surface having the greater curvature. It is perfectly transparent, and the focusing of the eye for near or distant objects is brought about by alteration in its curvatures by contraction of the ciliary muscle. Here is an essential difference between the eye and the photographic camera, whose focus is adjusted by shifting the position of the lens. As age proceeds, opacities frequently develop in the lens; almost everyone at the age of 60 or over may be said to have the beginnings of cataract, though the sight is quite unaffected thereby. When, however, these opacities involve the centre of the lens, and render sight very imperfect, the term of cataract becomes applicable; in such a case the cataract can be removed by operation and the sight restored.

Vitreous Chamber and Retina.—Behind the lens is the vitreous chamber, which is occupied by a perfectly transparent, colourless substance, much like white of egg. Clothing the back of the eye, and extending forward some distance in front of its equator, is the retina. It rests upon a highly vascular membrane which is responsible for the nutrition of the greater part of it, namely the choroid; in man, however, the retina has its own blood vessels clearly visible with the ophthalmoscope. The retina may be likened to the sensitive plate of the camera for upon it images are formed which initiate impulses which, when conveyed to the cortex of the brain, give rise to the sensations of sight. Its sensitive layer is placed posteriorly, and is composed of delicate structures known as the rods and cones.

At the central spot or yellow spot of the retina, the point of distinct vision, cones alone are present. The rods are believed to be concerned with lights of lower intensities, and in accordance with this they alone are present in night-flying birds (*see* COLOUR VISION).

Optic Nerves and the Cerebral Cortex.—The nerve fibres from the retina converge upon the optic disk, and leave the eye as the optic nerve, which traverses the orbit to enter the skull. Inside the skull the two optic nerves meet and each is divided into two parts, one part continuing to the mid-brain on the same side, the other part crossing over to the opposite side. This crossing forms the chiasma; in many animals, the birds for instance, the whole of each optic nerve crosses over in this way. Beyond the chiasma the nerve fibres are again collected into a compact bundle known as the optic tract, which terminates in the mid-brain. From here nervous impulses are relayed in two chief directions; some connect up with the nerves which control the movements of the eyes and others, forming the so-called optic radiations, make a long sweep backwards to reach the cerebral cortex, where, as already stated, the impulses are transformed to sensations of sight.

The exact area of the cerebral cortex, in which these fibres end, is known with great accuracy and forms the visual cortex. It is placed at the extreme hind end of the brain, and the adjoining mesial surface of each hemisphere, in the region of the calcarine fissure (*see* BRAIN). Should a minute portion of this cortex be cut out as the result of injury or blocking of its blood supply, the precise area of the defect which will be found in the vision can be stated with certainty. This accurate localisation was much advanced as a result of observations made during the War.

General Diseases and the Eye.—Amongst the general diseases of the body in which important manifestations occur in connection with the eye a few may be mentioned.

In brain tumours or abscesses, swelling of the optic disk is seldom absent, and forms perhaps the most important sign in the diagnosis of the condition. In addition the ocular nerves may have their functions interrupted, so that the movements of the eyes are interfered with, they no longer move in unison and double vision occurs. If nothing can be done for the brain tumour the optic nerve atrophies and blindness ensues. In advanced renal disease changes in the retina develop and convey a particularly grave prognosis, for patients seldom live so long as two years after their discovery. In diabetes a similar change may also arise, which may greatly spoil the sight, and although of less serious import than in renal cases, it must be considered a bad omen. Venereal disease frequently attacks the eye, whether in the early or late stages, and is perhaps the most prolific source of blindness. Tuberculous disease occasionally occurs. In diseases of the blood in general, eye signs are very common, and there are many other diseases where the diagnosis may be greatly assisted by the discovery of changes in some part of the ocular apparatus. The introduction of the "slit lamp" has made many investigations possible which previously were quite outside our scope.

(R. F. M.)

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OPIE, AMELIA (1769–1853), English author, daughter of James Alderson, a physician in Norwich, where she was born on Nov. 12, 1769. Miss Alderson had inherited radical principles and was an ardent admirer of Horne Tooke. She was intimate with the Kembles and with Mrs. Siddons, with Godwin and Mary Wollstonecraft. In 1798 she married John Opie, the painter. In 1801 she produced a novel entitled *Father and Daughter*, which showed genuine fancy and pathos. She published a volume of graceful verse in 1802; *Adeline Mowbray* followed in 1804, *Simple Tales* in 1806, *Temper* in 1812, *Tales of Real Life* in 1813, *Valentine's Eve* in 1816, *Tales of the Heart* in 1818, and *Madeline* in 1822. In 1825 she joined the Society of Friends. She died at Norwich on Dec. 2, 1853.

A *Life*, by Miss C. L. Brightwell, was published in 1854.

OPIE, JOHN (1761–1807), English historical and portrait painter, was born at St. Agnes near Truro in May 1761. While quite young he won some local reputation by portrait-painting; and in 1780 he started for London, under the patronage of Dr. Wolcot (Peter Pindar), and was introduced to the town as "The Cornish Wonder," a self-taught genius. He became a fashionable portrait painter, but after a period of prosperity fell into neglect. He then set himself to make good the defects of his early education by studying Latin, French and the English classics as well as the technique of his art.

In 1786 he exhibited his first important historical subject, the "Assassination of James I.," and in the following year the "Murder of Rizzio," which secured his immediate election as associate of the Academy, of which he became a full member in 1788. He was employed on five subjects for Boydell's "Shakespeare Gallery"; and until his death on April 9, 1807, his practice alternated between portraiture and historical work. His painting shows breadth of handling and a certain rude vigour, individuality and freshness, but lacks grace and poetic feeling.

Opie's portraits of Mary Wollstonecraft, of himself, and the "Portrait of a Boy" are in the national collections. He also wrote a *Life of Reynolds* in Wolcot's edition of Pilkington and a *Letter on the Cultivation of the Fine Arts in England*, in which he advocated the formation of a national gallery. His Academy *Lectures* were published in 1809 with a memoir by his widow (*see* above). *See* also Claude Phillips,

"John Opie" (*Gazette des Beaux-Arts*, 1892, i. 299).

OPISTHOCOMIDAE: *see* HOATZIN.

OPISTHODOMUS, in architecture, a small room at the rear of the cella (*q.v.*) or enclosed portion of a classic temple, usually opening only upon the rear portico; sometimes called epinaos. It was used frequently as a temple treasury.

OPITZ VON BOBERFELD, MARTIN (1597–1639), German poet, was born at Bunzlau, Silesia, on Dec. 23, 1597, and studied at Frankfurt-on-Oder, Heidelberg and Leyden. He led a wandering life in the service of various territorial nobles. In 1624 he was appointed councillor to duke George Rudolf of Liegnitz and Brieg in Silesia, and in 1625, as reward for a requiem poem composed on the death of archduke Charles of Austria, was crowned laureate by the emperor Ferdinand II. who a few years later ennobled him under the title "von Boberfeld." He was elected a member of the *Fruchtbringende Gessellschaft* in 1629, and in 1630 went to Paris, where he made the acquaintance of Hugo Grotius. He settled in 1635 at Danzig, where Ladislaus IV. of Poland made him his historiographer and secretary. Here he died of the plague on Aug. 20, 1639.

Opitz was the head of the so-called First Silesian School of poets. His *Buch von der deutschen Poeterey* (1624) put an end to the hybridism that had until then prevailed, and established rules for the "purity" of language, style, verse and rhyme. Opitz's own poems are mostly a formal and sober elaboration of carefully considered themes, and contain little beauty and less feeling. To this didactic and descriptive category belong his best poems.

Collected editions of Opitz's works appeared in 1625, 1629, 1637, 1641, 1690 and 1746. His *Ausgewählte Dichtungen* have been edited by J. Tittmann (1869) and by H. Oesterley (Kürschner's *Deutsche Nationalliteratur*, vol. xxvii. 1889). There are modern reprints of the *Buch von der deutschen Poeterey* by W. Braune (2nd ed., 1882), and, together with *Aristarchus*, by G. Witkowski (1888), and also of the *Teutsche Poemata*, of 1624, by G. Witkowski (1902). *See* H. Palm, *Beiträge zur Geschichte der deutschen Literatur des 16ten und 17ten Jahrhunderts* (1877); K. Borinski, *Die Poetik der Renaissance* (1886); R. Beckherrn, *Opitz, Ronsard und Heinsius* (1888). Bibliography by H. Oesterley in the *Zentralblatt für Bibliothekswesen* for 1885.

OPIUM. The drug known in commerce as opium is derived from the immature fruits of *Papaver somniferum* (fig. 1), family *Papaveraceae*, by slightly incising the fruits and collecting and drying the exuded milky juice.

There are several forms of the plant in cultivation for yielding opium. The truly wild plant (*var. setigerum*) is found on the northern coast of the Mediterranean. It has acutely toothed leaves, the lobes sharp-pointed, each ending in a bristle. The leaves, flower stalks and sepals are covered with scattered bristly hairs, and the stigmata are seven or eight in number.

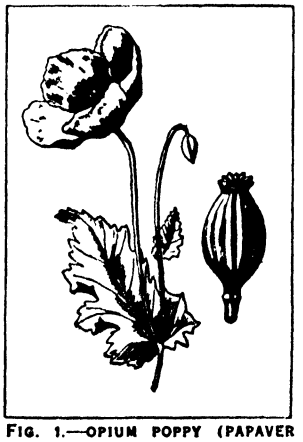

FIG. 1.—OPIUM POPPY (PAPAVER SOMNIFERUM)

The variety of the plant chiefly cultivated in Asia Minor and Egypt is distinguished by having a sub-globular fruit and 10 to 12 stigmata. It is glabrous and is known as *var. glabrum*.

The one cultivated in Persia is *var. album*, which has a fruit more or less egg-shaped; the pores below the stigmata do not open when the fruits are ripe. It varies in the colour and shape of the petals. Those (the majority) with white petals have usually white seeds, those with reddish or purple petals have usually slate-coloured seeds.

Cultivation.—The successful cultivation of the plant is only possible where there is not an excessive rainfall and where the climate is tropical or sub-tropical. The yield of opium is smaller in temperate than in tropical regions and the industry can only be profitably carried on where labour and land are sufficiently cheap and abundant.

The mode of cultivation adopted varies. In Turkey, from which the chief supplies of medicinal opium are obtained, the cultivation is carried on by peasant proprietors. A naturally light and rich soil is chosen, improved by manure and irrigation where necessary, and the land should be sloping and well drained, moisture in excess being injurious. The ground is ploughed twice, the second time crosswise. The seed is mixed with four times its weight of sand to prevent it being sown too thickly, ¼ to 1 lb.

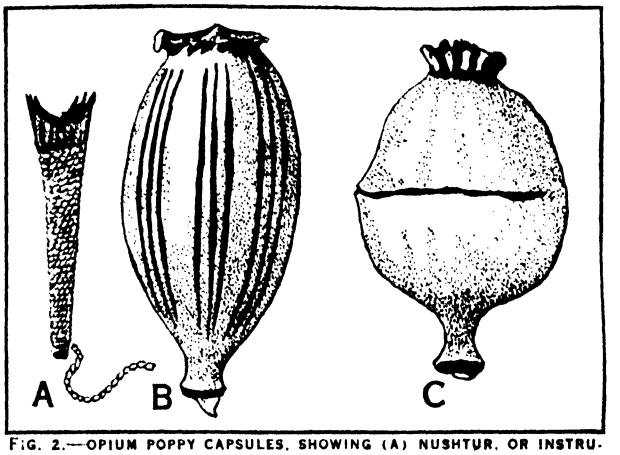

FIG. 2.—OPIUM POPPY CAPSULES, SHOWING (A) NUSHTUR, OR INSTRUMENT USED IN INDIA FOR MAKING THE INCISIONS, DRAWN FROM SPECIMENS IN THE MUSEUM OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN, (B) CAPSULE AS INCISED IN INDIA, (C) MODE OF INCISION PRACTISED IN TURKEY

being used to every *toloom* (1,600 sq.yd.). The crop is very uncertain owing to droughts, ground-frosts and locusts. To avoid failure, and to allow time for collecting the produce, every toloom has three sowings from October to March, the crops thus coming to perfection in succession. In localities where there is hoar frost in spring, the seed is sown in September, or at latest in the beginning of October. The yield of opium and seed is then greater than if sown later. After sowing, the land is harrowed and young plants are hoed and weeded, chiefly by women and children, from early spring until the time of flowering. In the plains the flowers expand at the end of May, and on the uplands in July. At this period gentle showers are of great value, as they cause an increase in the subsequent yield of opium. The petals fall in a few hours, and the capsules grow so rapidly that in a short time—generally from nine to 15 days—the opium is fit for collection. This period is known by the capsules yielding to pressure from the fingers, by assuming a lighter green tint, and by exhibiting a kind of bloom called "cougak," easily rubbed off with the fingers; they are then about 1½ in. in diameter. The incisions are made by holding the capsule in the left hand and drawing a knife two-thirds round it, or spirally beyond the starting point (fig. 2), great care being taken not to let the incisions penetrate to the interior, lest the juice should flow inside and be lost; in this case also it is said that the seeds will not ripen, and that no oil can be obtained from them. The operation is usually performed after the heat of the day, commencing early in the afternoon and continuing to nightfall, the exuded juice being collected next morning. This is done by scraping the capsule with a knife, transferring the concreted juice to a poppy-leaf held in the left hand, the edges of the leaf being turned up to avoid spilling the juice; the knife-blade is moistened with saliva by drawing through the mouth after every alternate scraping to prevent the juice from adhering to it. When as much opium has been collected as the size of the leaf will allow, another leaf or more is wrapped over the top of the lump, which is then placed in the shade to dry for several days. The pieces vary in size from about 2 oz. to 2 lb., being made larger in some districts than in others. The capsules are generally incised only once, but the fields are visited a second or even a third time to collect the opium from the poppy-heads subsequently developed by the branching of the stem. The yield of opium varies, even on the

same piece of land, from one-third to 7½ *chequis* (or 1·62 lb.) per *toloom*, the average being 1½ *chequis* of opium and 4 bushels (50 lb.) of seed. The seed, which yields 35 to 42% of oil, is worth about two-thirds the value of the opium. The whole of the operation must, of course, be completed in the few days, usually from five to ten, during which the capsules are capable of yielding the drug.

Macedonian Opium.—Four varieties of poppy are cultivated—two with white flowers and large oval capsules without holes under their "combs" (stigmata), and bearing respectively yellowish and white seed, and the other two having red or purple flowers and seeds of a slate colour with a reddish layer under the surface, one bearing small capsules perforated just below the top and the other larger capsules not perforated. The white varieties are recommended as bearing more abundant opium of superior quality. The yellow seed is said to yield the best oil; that obtained by hot pressure is used for lamps and for paint and the cold-pressed oil for culinary purposes.

Indian Opium.—The poppy grown in India is usually the white-flowered variety, but in the Himalayas a red-flowered poppy with dark seeds is cultivated. The land intended for poppy culture is usually near villages, in order that it may be more easily manured and irrigated. On a rich soil a crop of maize or vegetables is grown during the rainy season, and after its removal in September the ground is prepared for poppies. Under less favourable circumstances the land is prepared from July till October by ploughing, weeding and manuring. The seed is sown between Nov. 1 and 15, and germinates in 10 or 15 days. The fields are divided for purposes of irrigation into beds about 10 ft. square, which usually are irrigated between November and February; but if the season be cold, with hardly any rain, the operation is repeated five or six times. When the seedlings are 2 or 3 in. high, they are thinned out and weeded. The plants during growth are liable to injury by severe frost, excessive rain, insects, fungi and the growth of a root-parasite (*Orobanche indica*). The poppy flowers about the middle of February, and the petals, when about to fall, are collected for the purpose of making "leaves" for the spherical coverings of the balls of provision opium, or cannon ball opium as it is popularly called.

Persian Opium.—The variety grown in Persia appears to be *var. album*, having roundish ovate capsules. Several forms of this variety are grown. The best quality of Persian opium is said to be derived from the white-flowered form, which is the earliest to flower and most widely grown; a second quality from a bizarre flower with deeply cut petals and a central band of bluish-purple flanked with rich magenta; a third quality from a white flower with broad margins and an apex of salmon pink and magenta; a fourth from a dark scarlet flower with a central band of bluish purple to within a fifth of the apex of the petals; a fifth from a dark bluish purple flower; a sixth from a lilac flower suffused with faint purple colour, which is considered to yield a very poor quality indeed. The more fully exposed the plants are to the sun the finer the crop.

European Opium.—Experiments made in England, France, Italy, Switzerland, Greece, Spain, Germany, and even in Sweden prove that opium as rich in morphia as that of Eastern countries can be produced in Europe. In 1830, Young, a surgeon at Edinburgh, succeeded in obtaining 56 lb. of opium from an acre of poppies, and sold it at 36s. a pound. In France, the cultivation has been carried on since 1844 at Clermont-Ferrand by Aubergier. The juice, of which a workman is able to collect about 9·64 troy oz. in a day, is evaporated by artificial heat immediately after collection. The juice yields about one-fourth of its weight of opium, and the percentage of morphia varies according to the variety of poppy used, the purple one giving the best results. By mixing assayed samples he is able to produce an opium containing uniformly 10% of morphia. It is made up in cakes of 50 grammes but is not produced in sufficient quantity to become an article of wholesale commerce. Some specimens of French opium have been found by Guibourt to yield 22·8% of morphia, being the highest percentage observed as yet in any opium. Experiments made in Germany by Karsten, Jobst, and Vulpius have shown that it is possible to obtain in that country opium of excellent quality, containing 8 to 13% of morphia. It was found that the method yielding the best results was to make incisions in the poppy-heads soon after sunrise, to collect the juice with the finger immediately after incision, and evaporate it as speedily as possible, the colour of the opium being lighter and the percentage of morphia greater than when the juice was allowed to dry on the plant. Cutting through the poppy-heads caused the shrivelling up of the young fruit, but the heads which had been carefully incised yielded more seed than those which had not been cut at all. Newly manured soil was found to act prejudicially on the poppy. The giant variety of poppy yielded most morphia.

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Medicine.—Of the opium alkaloids only morphine and codeine are used to any extent in medicine. Thebaine is not so used, but is an important and sometimes very dangerous constituent of the various opium preparations, which are still largely employed, despite the complexity and inconstant composition of the drug. Of the other alkaloids narceine is hypnotic, whilst thebaine, papaverine and narcotine have an action which resembles that of strychnine. So complex a drug as opium is necessarily incompatible with a large number of substances. Tannic acid, for instance, precipitates codeine as a tannate, salts of many of the heavy metals form precipitates of meconates and sulphates, whilst the various alkalis, alkaline carbonates and ammonia precipitate the important alkaloids.

The pharmacology of opium differs from that of morphine (*q.v.*) in a few particulars. The chief difference is due to the presence in opium of thebaine, which readily affects the more irritable spinal cord of very young children. In infants especially opium acts markedly upon the spinal cord, and, just as strychnine is dangerous when given to young children, so opium, because of the strychnine-like alkaloid it contains, should never be administered, under any circumstances or in any dose, to children under one year of age.

When given by the mouth, opium has a somewhat different action from that of morphine. It often relieves hunger, by arresting the secretion of gastric juice and the movements of the stomach and bowel, and it frequently upsets digestion from the same cause. Often it relieves vomiting, though in a few persons it may cause vomiting, but in far less degree than apomorphine, which is a powerful emetic. Opium has a more marked diaphoretic action than morphine, and is much less certain as a hypnotic and analgesic.

Toxicology. (*See* also DRUG ADDICTION and POISONS).—Under this heading must be considered acute poisoning by opium, and the chronic poisoning seen in those who eat or smoke the drug. Chronic opium poisoning by the taking of laudanum—as in the familiar case of De Quincey—need not be considered here, as the hypodermic injection of morphine has almost entirely supplanted it.

The acute poisoning presents symptoms not easily distinguished from those produced by alcohol, by cerebral haemorrhage and by several other morbid conditions. The differential diagnosis is of the highest importance, but very frequently time alone will furnish a sufficient criterion. The patient who has swallowed a toxic or lethal dose of laudanum, for instance, usually passes at once into the narcotic state, without any prior excitement. Intense drowsiness yields to sleep and coma which ends in death from failure of the respiration. This last is the cardinal fact in determining treatment. The comatose patient has a cold and clammy skin, livid lips and ear-tips—a grave sign—and "pin-point pupils." The heart's action is feeble, the pulse being small, irregular and

often abnormally slow. The action on the circulation is largely secondary, however, to the all-important action of opium on the respiratory centre in the medulla oblongata. The centre is directly poisoned by the circulation through it of opium-containing blood, and the patient's breathing becomes progressively slower, shallower and more irregular until finally it ceases altogether.

Treatment.—In treating acute opium poisoning the first proceeding is to empty the stomach. The best emetic is apomorphine, which may be injected subcutaneously in a dose of about one-tenth of a grain. But the gastric wall is often paralysed in opium poisoning, so that no emetic can act. It is therefore better to wash out the stomach, at half-hour intervals, with a solution containing about ten grains of salt to each ounce of water. If apomorphine is obtainable, both of these measures may be employed. Potassium permanganate decomposes morphine by oxidation, the action being facilitated by the addition of a small quantity of mineral acid to the solution. The physiological as well as the chemical antidotes must be employed. The chief of these are coffee or caffeine and atropine. A pint of hot strong coffee may be introduced into the rectum, and caffeine in large doses—ten or twenty grains of the carbonate—may be given by the mouth. A twentieth, even a tenth of a grain of atropine sulphate should be injected subcutaneously, the drug being a direct stimulant of the respiratory centre. Every means must be taken to keep the patient awake. He must be walked about, have smelling salts constantly applied to the nose, or be stimulated by the faradic battery. But the final resort in cases of opium poisoning is artificial respiration, which should be persevered with as long as the heart continues to beat.

OPIUM-EATING AND OPIUM-SMOKING. *Opium-eating.*—Opium, like many other poisons, produces after a time a less effect if frequently administered as a medicine, or as a stimulant. According to the experimental work of Faust, the toleration towards the use of large quantities of opium is due to the gradually increasing power of the tissues to destroy the drug. Opium-eating is chiefly practised in Asia Minor, Persia and India. Opinions differ widely as to the injurious effect of the habit; the weight of evidence appears, however, to indicate that it is much more deleterious than opium-smoking.

Vincent Richards has collected some statistics regarding Balasor in Orissa which throw some light on the influence of this practice on the health. He examined about 600 opium-eaters who took, on an average, 5 to 7 grains daily. The diseases for which it was chiefly taken were malarial fever, dysentery, diarrhoea, spitting of blood, rheumatism and elephantiasis. Richards concluded that its moderate use may be and is indulged in for years without producing any decided or appreciable ill effect, except weakening the reproductive powers. Dr. W. Dymock of Bombay, speaking of Western India, concurs in Richards' opinion regarding the moderate use of the drug. Dr. Moore's experience of Rajputana strongly supports the same view. Among the Rajputs infused opium has long been a drink both of reconciliation and of ordinary greeting.

Opium-smoking.—This is chiefly practised by the inhabitants of China and the islands of the Indian Archipelago, and in countries where Chinese are largely employed. Opium-smoking began in China in the 17th century. Foreign opium was first imported by the Portuguese (early 18th century). In 1906 it was estimated that about 27% of the adult males in China smoked opium.

For smoking, the Chinese use an extract of opium known as prepared opium or *chandoo*, containing about 8% of morphine, and a cheaper preparation known as dross opium extract, containing about 7% of morphine. This latter is used chiefly by the poorer classes.

Prepared opium is made by a lengthy process of digestion of opium in water, boiling, evaporating, beating, followed by a peculiar toasting process which is very important and is very carefully done. The opium at this stage resembles dark coloured ginger-nut crackers. There is more boiling of this in water, straining, evaporating, filtering and further evaporating until the prepared opium results as a black treacly substance, having the fragrant opium-like odour which is characteristic.

Opium-smoking is performed by the smoker lying on his side. Then he takes a thin metal dipper and puts the sharp end into the opium. Twisting it round and round, he brings a drop over the flame of a lamp until it is sufficiently roasted. There is further manipulation of the opium, and eventually a little piece of opium, about the size of a grain of hemp-seed, is left adhering to the bowl of the pipe immediately over the orifice. The smoker then holds the bowl over the lamp. The heat causes the opium to frizzle, and the smoker takes three or four long inhalations which are exhaled through both the mouth and the nose. Moissan has shown that the smoke of chandoo contained only a very small quantity of morphine. F. Dent and also H. Fraser and B. J. Eaton found that the smoke from 100 grams of chandoo yielded 0·100 gram of morphine in two independent experiments. Frank Browne examined the smoke of dross opium extract which is very largely smoked in the East. Dross opium extract is prepared by boiling together opium dross or residues from the smoking of chandoo and residues from the smoking of dross opium extract, with a small quantity of demorphinated opium, and filtering and evaporating to a proper consistence. His results are shown in the table with an analysis of tobacco smoke by Pontag. The results are expressed in percentages.

	Carbon monoxide	Morphine	Nicotine	Ammonia	Pyridine	Hydrocyanic acid
	c.c.	Gram	Gram	Gram	Gram	Gram
Dross opium extract	0	0·016	...	0·395	0·147	0·0103
Tobacco	4 to 5	...	1·16	0·50	0·15	0·004 to 0·010

The following shows the nature of the dross opium extract used—expressed in percentages on the extract:—

Water	8·61	Morphine	7·35
Ash	28·45	Insoluble in water	3·84

A smoker of this extract would use from five to six grams daily. He is considered to smoke in excess when he burns about double this quantity.

This dross opium extract is admitted by smokers to be stronger in effect than chandoo. This strength must be attributed to the pyridine bases, ammonia, hydrocyanic acid, and other substances rather than to the morphine, which is present in much less amount than in the smoke of chandoo.

So far as can be gathered from the conflicting statements published on the subject, opium-smoking may be regarded much in the same light as the use of alcoholic stimulants. To the great majority of smokers who use it moderately it appears to act as a stimulant, and to enable them to undergo great fatigue and to go for a considerable time with little or no food. According to the reports on the subject, when the smoker has plenty of active work it appears to be no more injurious than smoking tobacco. In a large dock company in the Far East where 5,000 labourers were employed, the managers were unable to pick out any opium-smokers who, by any difference in physique, capacity for work or in behaviour, were different from the non-smokers.

When carried to excess, opium-smoking becomes an inveterate habit; but this happens chiefly in individuals of weak will power who would just as easily become the victims of intoxicating drinks, and who are practically moral imbeciles, often addicted also to other forms of depravity. The effect in bad cases is to cause loss of appetite, a leaden pallor of the skin and a degree of leanness so excessive as to make its victims appear like living skeletons. All inclination for exertion gradually becomes lost, business is neglected, and certain ruin to the smoker follows. By its Charter or Covenant, the regulation of the traffic of opium was expressly delegated to the League of Nations, whose efforts in endeavouring to secure the strictly legitimate use of the drug, may be seen in the pamphlet mentioned in the references below.

See *Pharmaceutical Journ.* (1) xi. p. 269, xiv. p. 395; (2) x. p. 434; Impey, *Report on Malwa Opium* (Bombay, 1848); *Report on Trade of Hankow* (1869); *New Remedies* (1876), p. 229; *Pharmacographia*

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OPIUM TRAFFIC. The use of the poppy and the coca leaf goes back to time immemorial. However, its organized use for the purposes of commerce and revenue seems to have developed in the last 200 years, in spite of protests against its use for other than medical and scientific purposes.

In 1783 Warren Hastings pronounced opium to be "a pernicious article of luxury which ought not to be permitted but for the purpose of foreign commerce only!" A few years later the directors of the East India company wrote: "If it were possible to prevent the use of the drug altogether except strictly for the purpose of medicine we would gladly do it in compassion to mankind," and Lord Ashley in 1843 proposed a resolution in the British parliament to the effect that the continuance of the opium monopoly and opium trade "was utterly inconsistent with the honour and duty of a Christian kingdom." Yet to-day there are still countries whose colonies obtain large revenues from such monopolies.

The importation of opium into China by foreign traders led to the war of 1840 between Great Britain and China. The Chinese, in spite of the fact that they were not the victors and despite any pressure brought to bear upon them, still refused to legalize the opium trade. China was now open to the world and a huge smuggling trade in opium sprang up which has given rise to endless difficulties ever since, both to the Chinese and to the British Governments.

The second war broke out between China and Great Britain, with France as her ally, 15 years later, and, after its close, not only was the cultivation of opium in China itself permitted, but the import of opium from India was also legalized. Yet the Chinese Government still continued to regard the use of opium as an important moral and economic question, and, in the year 1906, she decided to put an end to the use of the drug within ten years. For this reason, in the following year, she entered into what is known as the "Ten Years' Agreement with India," by which China should cease the cultivation of the poppy and forbid the consumption of opium on the understanding that the export of Indian opium to China should be reduced *pari passu* and cease altogether in ten years. At first this undertaking was carried out faithfully by both parties concerned, and according to a statement made by Sir John Jordan at one of the meetings of the opium advisory committee, China in 1917 had almost freed herself from the curse of the poppy. Political troubles, however, broke out, effective government in China was suspended, and to-day the production of opium in China is not only a great national but an international problem.

International Action.—It was first realized in 1906 that if the Chinese Government were able to suppress the opium evil, she must be assisted by other nations. In 1909 President Roosevelt proposed that an international investigation should be made. As a result, an international opium commission met that year at Shanghai, at which 13 Powers were represented. The recommendations made at this meeting formed the basis of the first Opium Convention, which was drawn up at The Hague in 1912. The articles of this convention may be summarized as follows:—

1. The distribution of raw opium to be controlled and the use of prepared opium to be gradually suppressed.

2. The export of raw opium to countries prohibiting its entry to be stopped and its export to countries restricting its import to be controlled.

3. The export and import of prepared opium to be prohibited except to those countries not yet ready to suppress its use.

4. The use of alkaloids of opium and its derivatives to be confined to medical and legitimate purposes; a Government licence to be obtained by all persons engaged in the manufacture, sale, distribution, import and export of the drugs.

5. The last chapter of the convention consisted of clauses dealing with assistance to China and with certain obligations undertaken by China herself.

6. Before the convention came into effect the adherence of the 34 non-signatory Powers in Europe and America was required.

International opium conferences were held at The Hague in July 1913 and June 1914, at which a number of Powers ratified the convention. During the World War all action in this connection was suspended until the Paris Peace Conference in 1919. In the peace treaties of 1919–20 the signatory Powers agreed that the ratification of these treaties should constitute a ratification of the convention of 1912 and the protocol adopted by the third Opium Conference of 1914 (according to which the convention should come into effect upon its ratification regardless of the non-signatory Powers).

The Advisory Committee and the League of Nations.—Under the Covenant (Article 23 c), the duty of supervising the execution of agreements with regard to the traffic in opium and other dangerous drugs devolved upon the League of Nations. In order to carry out this obligation, the first Assembly of the League constituted an advisory committee on opium and other dangerous drugs.

The committee, which sits once a year except in special circumstances, has obtained certain important and definite results, such as additional ratifications to The Hague Convention (56 States have now ratified, 50 of these States being members of the League) and the adoption by a very large number of countries of an important certificate system. Under this system no Government may allow the export from its territories of any dangerous drugs covered by The Hague Convention, except on the production by the exporter of a licence from the importing country, certifying that the drugs in question are required for legitimate purposes.

The Import Certificate.—The Council, on the recommendation of the advisory committee, invited the Governments and members of the League to prepare an estimate of total annual requirements for the inhabitants of their territories for medical, scientific and other uses, with a view to proposing at some future date to the States concerned a new distribution of production which would limit the total output of raw material to the amount required for legitimate medical and scientific purposes. Subsequently two conferences met during the latter part of 1924 and the early months of 1925.

The 1924 conference did not find it possible to recommend the immediate complete suppression of the use of prepared opium, but drew up an agreement which embodied the substitution of government monopoly for other systems in force. No general agreement could be reached regarding any provisions for registering or rationing addicts, nor was it found possible to embody in the agreement provisions for uniform prices or uniform penalties for the infraction of law, or to limit imports. It was held by the majority of members of the conference that no rationing could be enforced or total suppression imposed so long as a large illicit supply of opium remained uncontrolled. To this the representative of China objected, protesting against the refusal of the majority to take immediate steps to suppress opium-smoking until producing countries should find it possible to control smuggling. The conference, in a protocol to the agreement, decided to take any necessary measures not already taken for the entire suppression within a period of 15 years of the consumption of prepared opium in the territories under their authority, this period to begin so soon as the effective execution of the measures required to prevent illicit exportation of raw opium from their territories had been undertaken by the poppy-growing countries. Provision under the agreement is made for a League commission to decide when these measures have been effectively executed. The agreements reached took the form of an agreement, a protocol and a final act. Instruments of ratification have been deposited by all States

represented at the conference, other than China and Japan. The agreement is therefore now in force.

The Convention of 1925.—The result of the deliberations and discussions of the conference of 1925 was a convention providing for the more effective restriction of the production and manufacture of narcotics, and establishing stricter control and supervision of the international trade. It is not, however, in force as of the ten signatures required to bring the convention into effect seven must be deposited by members of the council, whereas on Jan. 1, 1928 only four members had ratified their signatures.

Among the suggestions made in the convention was the creation of a central board, whose task it would be to follow the course of international trade and the general acceptation of the export and import certificate system. The conference also drew up a protocol by which the signatory States, recognizing their obligations to establish such control over the production, distribution and exportation of raw opium as would put a stop to illicit traffic, agreed to take within five years of the date of the coming into force of the protocol such measures as might be required to prevent the smuggling of opium seriously interfering with the effective suppression of the use of prepared opium in those territories where such use is temporarily authorized. A final act, containing further recommendations, was drawn up. Among these special mention may be made of a request to the council to consider the possibility of sending a commission to various opium-producing countries to study the difficulties connected with the limitation of the production of opium, and to advise as to what measures should be taken to make it possible to limit the production of opium in those countries to the quantities required for medical and scientific purposes.

The result of this final act is shown in the League of Nations commission of enquiry sent to Persia to report on the possible substitution of crops for the existing opium crops. This commission, which consisted of one American, one Italian, and one French expert, presented its report to the Council of the League of Nations at its meeting in March 1927.

As a result of this report the representative of Persia made the following proposals on behalf of his Government. The programme which he undertook to submit to the Majliss, with recommendation for its enactment into law, is as follows:—

1. The approval of the recommendation of reduction in area under poppy cultivation of 10% per annum after three years on the plan proposed by the commission of enquiry. The annual reduction to continue for three years, after which time the Persian Government will reconsider its position, taking into account the effect the reduction has had on the welfare of the cultivator, the trade balance, the budget and the general economic condition of the country, and what action has been taken by other producing and manufacturing countries to curtail the production of the raw material and the manufacture and distribution of habit-forming drugs.
2. Acceptance of the opium export certificate system with an annual reduction beginning not later than the third year after the present, of 10% of the quantity annually permitted to leave the country without production of import certificates (subject to reservations indicated elsewhere).
3. The exemption of land taxes for a period of five years in the case of areas diverted from the cultivation of the poppy to that of substitute crops.
4. Preference in the granting of agricultural loans to be given by the State bank of Persia, when established, to cultivators who divert part or all of their land under opium cultivation to that of substitute crops.

Since the conference of 1925 discussed the possibility of limitation of the growth of the poppy and its export, India has also undertaken to reduce her export of opium 10% a year until all export ceases. Thus a material advancement has been made in two out of the four great countries of production.

With regard to the stricter control of manufactured drugs, two interesting schemes are, at the present time, receiving detailed examination by the opium advisory committee. One, submitted by the American assessor on the committee, proposes the nationalization of all factories manufacturing narcotic drugs; the other is a proposal made by the German member of the committee for the internationalization of manufacture by the formation of an international trust which should acquire a controlling interest in all the factories involved and with which the League of Nations itself should be closely associated.

A small expert body of the main committee was appointed to study the methods of drug control as enforced in the chief manufacturing countries, including the consideration of an interesting memorandum put forward by M. Cavazzoni, the Italian member of the committee on how such control might best be effected.

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OPON, a municipality (with administration centre and 29 *barrios* or districts), on the small island of Mactan (area about 45 sq.m.), province of Cebu, Philippine Islands. The island of Mactan, where Magellan was slain by the natives in March 1521, is separated from Cebu by a channel only about one mile wide. Pop. (1918), 20,988, of whom 42 were whites. Opon is a shipping and commercial suburb of the municipality of Cebu, the harbour of which is sheltered by Mactan island. It has large groves of coco-nut trees; other industries are the cultivation of corn and maguey, and fishing. In 1918, it had 202 household industry establishments with output valued at 49,300 pesos. Of the nine schools, eight were public. The language is Cebu-Bisayan. A monument to Magellan was erected during the Spanish régime.

OPOPONAX. A gum-resin obtained from the root of *Pastinaca opoponax*, formerly used as an anti-spasmodic medicine. The perfume known as opoponax is distilled from a *commiphora*.

OPORTO, the second city of Portugal, about 3 m. from the mouth of the Douro, in 41° 8′ N. and 8° 37′ W. Pop. (1920) 203,091. The part of the city south of the Douro is known as Villa Nova de Gaia. Oporto is the see of a bishop. It is the true capital of northern Portugal, and the commercial and political rival of Lisbon, in much the same way as Barcelona (*q.v.*) is the rival of Madrid. Three main railway lines meet here—from Lisbon, from Valença do Minho on the northern frontier, and from Barca d'Alva on the north-western frontier. Oporto is built chiefly on the north or right bank of the Douro; its principal suburbs are Bomfim on the east, Monte Pedral and Paranhos on the north, Villar Bicalho, Lordello and São João da Foz on the west, Ramalde, Villarinha, Matosinhos, Leça da Palmeira and the port of Leixões on the north-west. The mouth of the river is obstructed by a sandy spit of land which has been enlarged by the deposits of silt constantly washed down by the swift current; on the north side of this bar is a narrow channel varying in depth from 16 ft. to 19 ft. A fort in São João da Foz protects the entrance, and there is a lighthouse on a rock outside the bar. As large vessels cannot enter the river, a harbour has been made at Leixões (*q.v.*).

The approach to Oporto up the winding and fjord-like estuary is one of singular beauty. On the north the streets rise in terraces up the steep bank, built in many cases of granite overlaid with plaster, so that white is the prevailing colour of the city; on the south are the hamlets of Gaia and Furada, and the red-tiled wine lodges of Villa Nova de Gaia, in which vast quantities of port are manufactured and stored. The architecture of the houses and public buildings is often rather Oriental than European in appearance. Palms, oranges and aloes grow side by side with the flowers and fruits of northern Europe, for the climate is mild and very equable, the mean temperatures for January and July—the coldest and the hottest months—being respectively about 50° and 70°. The design of some of the native river craft is peculiar—among them may be mentioned the *caicos*, high-prowed canoe-like fishing boats, the *rascas* with their three lateen sails, and the *barcos rabello*, flat-bottomed barges with huge rudders, used for the conveyance of wine down stream. Two remarkable iron bridges, the Maria Pia and the Dom Luiz I., span the river. The first was built by Messrs. Eiffel and Company of Paris in 1876–77; it rests on a granite substructure and carries the Lisbon railway line across the Douro ravine at a height of 200 ft. The second was constructed in 1881–85 by a Belgian firm; its arch, one of the largest in Europe, has a span of 560 ft. The Douro is liable in winter to sudden and violent floods; in 1909–10 the water rose 40 ft. at Oporto, where it is confined in a deep and narrow bed.

The older quarters in the east are extremely picturesque, with their steep and narrow lanes overshadowed by lofty balconied houses. Overcrowding and dirt are common, for the density of population is nearly 13,000 per sq.m., or greater than in any other city of Portugal. The completion of the tramway system was long delayed. Ox-carts are used for the conveyance of heavy goods, and until late in the 19th century sedan-chairs were still occasionally used. As a rule the natives of Oporto are strong and of fine physique; they also show fewer signs of negro descent than the people of Lisbon. Their numbers tend to increase very rapidly; in 1864 the population of Oporto was 86,751, but in 1878 it rose to 105,838 and nearly doubled in the next half century. Many of the men emigrate to South America, where their industry usually enables them to prosper, and to return with considerable savings.

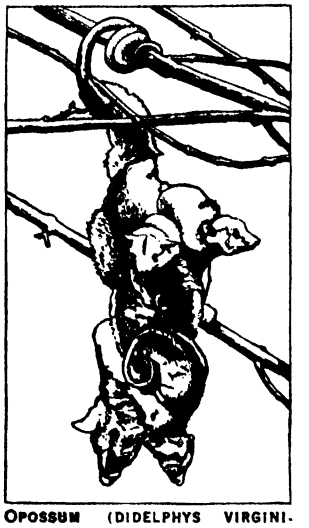
The cathedral, which stands at the highest point of eastern Oporto, on the site of the Visigothic citadel, was originally a Romanesque building of the 12th century; its cloisters are Gothic of the 14th century, but the greater part of the fabric was modernized in the 17th and 18th centuries. The interior of the cloisters is adorned with blue and white tiles, painted to represent scenes from the Song of Solomon. The Romanesque and early Gothic church of São Martinho de Cedo Feita is the most interesting ecclesiastical building in Oporto, especially noteworthy being the curiously carved capitals of its pillars. Though the present structure is not older, except in details, than the 12th century, the church is said to have been "hastily built" (*cedo feita, cito facta*) by Theodomir, king of the Visigoths, in 559, to receive the relics of St. Martin of Tours, which were then on their way hither from France. The Torre dos Clerigos is a granite tower 246 ft. high, built in the middle of the 18th century at the expense of the local clergy (*clerigos*); it stands on a hill and forms a conspicuous landmark for sailors. Nossa Senhora da Lapa is a fine 18th-century church, Corinthian in style; São Francisco is a Gothic basilica dating from 1410; Nossa Senhora da Serra do Pilar is a secularized Augustinian convent used as artillery barracks, and marks the spot at which Wellington forced the passage of the Douro in 1809. The exchange (*lonja*) is another secularized convent, decorated with coloured marbles. Parts of the interior are floored and panelled with polished native-coloured woods from Brazil, which are inlaid in elaborate patterns; there is a very handsome staircase, and the fittings of one large room are an excellent modern copy of Moorish ornamentation.

Other noteworthy public buildings are the museum, library, opera-house, bull-ring, hospital and quarantine station. The crystal palace is a large glass and iron structure built for the industrial exhibition of 1865. The English factory, built in 1790, has been converted into a club for the British residents—a large and important community whose members are chiefly connected with the wine and shipping trades. The English club gave its name to the Rua Nova dos Inglezes, one of the busiest streets, which contains many banks, warehouses and steamship offices. The Rua da Alfándega, skirting the right bank of the Douro and passing the custom house (*alfándega*), is of similar character; here may be seen characteristic types of the fishermen and peasants of northern Portugal. The Rua das Flores contains, on its eastern side, the shops of the cloth-dealers; on the west are the jewellers' shops, with a remarkable display of gold and silver filigree-work and enamelled gold. These ornaments are often very artistic, and are largely worn on holidays by women of the poorer classes.

Oporto is chiefly famous for the export of the wine which bears its name. An act passed on Jan. 29, 1906 defined "port" as a wine grown in the Douro district, exported from Oporto, and containing more than 16·5% of alcoholic strength. The vines from which it is made grow in the Paiz do Vinho, a hilly region about 60 m. up the river, and having an area of 27 m. in length by 5 or 6 in breadth. The trade was established in 1678, but the shipments for some years did not exceed 600 pipes (of 115 gallons each). In 1703 the British government concluded the Methuen treaty with Portugal, under which Portuguese wines were admitted on easier terms than French or German, and henceforward "port" began to be drunk (*see* PORTUGAL: *History*). In 1747 the export reached 17,000 pipes. In 1754 the great wine monopoly company of Oporto originated, under which the shipments rose to 33,000 pipes. At the beginning of the 19th century the policy of the government more and more favoured port wine, besides which the vintages from 1802 to 1815 were splendid both in Portugal and in Madeira —that of 1815 has, in fact, never been excelled. For the next few years the grape crop was not at all good, but the 1820 vintage was the most remarkable of any. It was singularly sweet and black, besides being equal in quality to that of 1815. In 1852 the *Oidium* which spread over Europe destroyed many of the Portuguese vineyards. In 1865 *Phylloxera* did much damage, and in 1867 the second monopoly company was abolished. From this time the exports again increased. (*See* WINE.)

A third of the population is engaged in the manufacture of cottons, woollens, leather, silk, gloves, hats, pottery, corks, tobacco, spirits, beer, aerated waters, preserved foods, soap or jewellery. The fisheries—chiefly of hake, bream and sardines—are extensive. Many tourists land at Oporto and visit Braga (*q.v.*), Bussaco (*q.v.*) and other places of interest, on their way to Lisbon. There is also a large tourist traffic from Germany.

The history of Oporto dates from an early period. Before the Roman invasion, under the name of Portus Cale, it was a town on the south bank of the Douro with a good trade; the Alani subsequently founded a city on the north bank, calling it *Castrum Novum*. About A.D. 540 the Visigoths under Leovigild obtained possession, but yielded place in 716 to the Moors. The Christians, however, recaptured Oporto in 997, and it became the capital of the counts of *Portucalia* for part of the period during which the Moors ruled in the southern provinces of Portugal. (*See* PORTUGAL: *History*.) The Moors once more became its masters for a short period, till in 1092 it was brought finally under Christian domination. The citizens rebelled in 1628 against an unpopular tax, in 1661 for a similar reason, in 1757 against the wine monopoly, and in 1808 against the French. The town is renowned in British military annals from the duke of Wellington's passage of the Douro, by which he surprised and put to flight the French army under Marshal Soult, capturing the city on the 12th of May 1809. Oporto sustained a severe siege in 1832–33, being bravely defended against the Miguelites by Dom Pedro with 7,000 soldiers; 16,000 of its inhabitants perished. In the constitutional crises of 1820, 1826, 1836, 1842, 1846–47, 1891 and 1908–10 the action of Oporto, as the capital of northern Portugal, was always of the utmost importance. In 1919 the monarchy was proclaimed at Oporto and lasted for three weeks. In Feb. 1927, having been chosen by disaffected regiments, in touch with political and communist elements, as the scene of their rising, it was bombarded during three days by Government troops and suffered heavily.



OPOSSUM (DIDELPHYS VIRGINIANA), HANGING FROM A TREE WITH YOUNG

OPOSSUM, the name of several American marsupials, also applied in Australia to the phalangers (*q.v.*). True opossums are found almost throughout America (*see* MARSUPIALIA). They form the family *Didelphyidae*, distinguished by the opposable first hind-toe and by the dentition. They are small, nocturnal animals, with long noses, ears and tails, the latter being usually naked and prehensile. The opposable first hind-toe is clawless and the tip is expanded into a flat pad. The other digits all bear claws. Mainly arboreal, they feed on birds, insects and fruit. The best known species of the type-genus is *Didelphys virginiana*, which is very common in the United States. It is nearly the size of a cat, grey in colour, the fur being woolly. When caught, it feigns death (hence the expression "playing 'possum"). The ova of opossums have a thin horny shell, and many more are produced

than can survive. The female produces 6 to 16 young, after a period of gestation of 14 to 17 days. There is no pouch, and the offspring, first clinging to the nipples by their mouths, later hold on to the tail of the mother by their own prehensile tails. In another wide-ranging North American species, *D. marsupialia*, a pouch is present. The young reach this by their own unaided efforts, though born naked, blind and fingerless.

The water-opossum (*Chironectes minimus*) has webbed feet (*see* WATER-OPOSSUM). Numerous other species inhabit various parts of America, being especially numerous in the tropical parts.

OPOSSUM-RAT (*Coenolestes*), a small South American marsupial of great morphological interest, since it is held by some authorities to belong to the polyprotodont division of that class. As the polyprotodonts are otherwise entirely Australian, the presence of a member in South America caused much discussion. Most zoologists now hold, however, that *Coenolestes* is a peculiarly modified diprotodont. (*See* also MARSUPIALIA, ZOOLOGICAL DISTRIBUTION.)

See O. Thomas, *Proc. Zool. Soc. Lond.* (1895).

OPPELN, a town in the Prussian province of Silesia, on the right bank of the Oder, 51 m. S.E. of Breslau, on the railway to Kattowitz, and at the junction of lines to Ratibor. Neisse and Tarnowitz. Pop. (1925) 41,458. Oppeln was a flourishing place at the beginning of the 11th century, and became a town in 1228. It was the capital of the duchy of Oppeln and the residence of the duke from 1163 to 1532, when the ruling family became extinct. Then it passed to Austria, and with the rest of Silesia was ceded to Prussia in 1742. In the partition of Upper Silesia between Germany and Poland in 1921 (*see* SILESIA) Oppeln was retained by Germany. It is the seat of the provincial administration of Upper Silesia, and contains the oldest Christian church in the district, that of St. Adalbert, founded at the close of the 10th century. It has a 15th-century palace on an island in the Oder. The industries of Oppeln include the manufacture of Portland cement, beer, soap, cigars, chemicals, clogs and lime; trade is carried on by rail and river in cattle, grain and the vast mineral output of the district, of which Oppeln is the chief centre. The upper classes speak German, the lower Polish.

OPPENHEIM, a town of Germany, in the republic of Hesse, on the left bank of the Rhine, 20 m. S. of Mainz, on the railway to Worms. Pop. (1925) 3,928. Oppenheim, which occupies the site of the Roman Bauconica, appears in 1226 as a free town of the Empire. It lost its independence in 1375, when it was given in pledge to the elector palatine of the Rhine. The Evangelical church of St. Catherine, a beautiful Gothic edifice of the 13th and 14th centuries, has been recently restored. Industries and commerce are principally concerned with wine.

OPPERT, JULIUS (1825–1905), German Assyriologist, was born at Hamburg, of Jewish parents, on July 9, 1825. He studied at Heidelberg, Bonn and Kiel and afterwards taught German in France. His leisure was given to oriental studies, and in 1852 he joined Fresnel's archaeological expedition to Mesopotamia. He published the results in his *Déchiffrement des inscriptions cunéiformes* (1861). He held posts as professor of Sanskrit in the language school of the National library in Paris (1857), and professor of Assyrian philology and archaeology at the Collège de France (1869). He died in Paris on Aug. 21, 1905. Oppert's chief study was Assyrian and cognate subjects. His works include: *Hist. des empires de Chaldée et d'Assyrie* (1865); *Le peuple et la langue des Mèdes* (1879), and a Sanskrit grammar.

OPPIAN (Gr. Ὀππιανος), the name of the authors of two (or three) didactic poems in Greek hexameters, formerly identified, but now generally regarded as two different persons. (1) Oppian of Corycus (or Anabarzus) in Cilicia, who flourished in the reign of Marcus Aurelius (emperor A.D. 161–180). According to an anonymous biographer, his father was banished to Malta by Verus. Oppian, who had accompanied his father into exile, returned after the death of Verus (169) and went on a visit to Rome. Here he presented his poems to Aurelius and regained the imperial favour for his family. Oppian subsequently returned to his native country, but died of the plague at the age of 30. His poem on fishing (*Halieutica*), of about 3,500 lines, dedicated to Aurelius and his son Commodus, is still extant. (2) Oppian of Apamea (or Pella) in Syria. His extant poem on hunting (*Cynegetica*) is dedicated to the emperor Caracalla, so that it must have been written after 211. It consists of about 2,150 lines, and is divided into four books, the last of which seems incomplete. It is inferior to the *Halieutica*.

A third poem on bird-catching (*Ixeutica*, from ἰξός, bird-lime), also formerly attributed to an Oppian, is lost; a paraphrase in Greek prose by a certain Eutecnius is extant.

The chief modern editions are J. G. Schneider (1776); F. S. Lehrs (1846); U. C. Bussemaker (Scholia, 1849); (*Cynegetica*) P. Boudreaux (1908). The anonymous biography referred to above will be found in A. Westermann's *Biographi Graeci* (1845). On the subject generally *see* A. Martin, *Études sur la vie et les oeuvres d'Oppien de Cilicie* (1863); A. Ausfeld, *De Oppiano et scriptis sub ejus nomine traditis* (1876). There are translations of the *Halieutica*, in English by Diaper and Jones (1722), and in French by E. J. Bourquin (1877).

OPPIUS, GAIUS, an intimate friend of Julius Caesar. He managed the dictator's private affairs during his absence from Rome. According to Suetonius (*Caesar*, 56), many authorities considered Oppius to have written the histories of the Spanish, African and Alexandrian wars which are printed among the works of Caesar. It is now generally held that he may possibly be the author of the last (although the claims of Hirtius are considered stronger), but certainly not of the two first. He also wrote a life of Caesar and the elder Scipio.

For a discussion of the whole question, *see* M. Schanz, *Geschichte der römischen Literatur* (2nd ed., 1898); Teuffel-Schwabe, *Hist. of Roman Literature* (Eng. trans., 1900); *see* also Cicero, *Letters*, ed. Tyrrell and Purser, iv. introd. p. 69.

OPPOSITION, in logic, means the various relations which can exist between judgments or propositions having the same subject and predicate but differing in quality or quantity. *See* LOGIC.

OPTICS. The study of Optics is usually divided into three parts: *Physical Optics*, *Physiological Optics* and *Geometrical Optics*. *Physical Optics* is primarily concerned with the nature and properties of light itself and is treated under LIGHT. *Physiological Optics* deals with the mechanism of vision, and is treated under VISION.

Geometrical Optics, which is the subject of this article, is the name applied to that part of Optics which deals with the properties of optical instruments such as telescopes, microscopes, photographic lenses, spectroscopes and the elementary lenses, mirrors and prisms from which they are constructed. As geometrical methods have been widely employed in inquiries concerning optical instruments, the name is not without historical justification. Nevertheless we shall have occasion to take exception to the validity of these methods in this field. They are in fact only admissible to an extent which deprives the historical theory of much of its utility. A brief account of this theory can, however, hardly be omitted here both on account of its historical importance and because even at the present day the majority of the literature on the subject is still couched in geometrical terms.

The basic conception of geometrical optics in this theory is the ray of light. The fact that light travels in straight paths was well known to the Greek mathematicians and the transition from optics to pure geometry was thus simple. More precisely in geometrical optics we assume that the ray of light continues in the same straight line while it travels in the same homogeneous medium. When it encounters a surface separating this medium from another, for example the surface between air and water, the ray proceeds in another direction from the point in which it meets this surface, and again continues to follow a straight path until another surface is reached. The new path may be in either the original or the new medium. In the former event the ray is said to be reflected, and in the latter refracted, at the surface of separation. We regard the whole continuous path of the light as a single ray, but distinguish the original and final portions as the incident ray and the emergent ray respectively. We may also apply the terms reflected ray or refracted ray as the case may be

to the latter.

The new directions are determined by simple geometrical laws. The law of reflection states (1) the incident ray, the reflected ray, and the normal to the surface at the point of reflection lie in one plane; (2) the incident and reflected rays lie on opposite sides of the normal; (3) the angles made by the incident and reflected rays with the normal are equal. The law of refraction states (1)

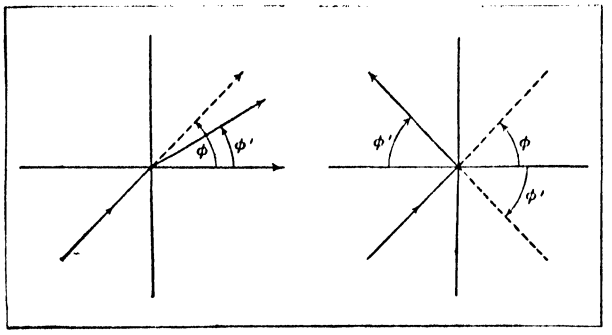


FIG. 1.—ANGULAR-SIGN CONVENTIONS, SHOWING (LEFT) REFRACTION: ANGLES OF INCIDENCE AND REFRACTION BOTH POSITIVE; AND (RIGHT) ANGLE OF INCIDENCE POSITIVE, ANGLE OF REFLECTION NEGATIVE

the incident ray, the refracted ray, and the normal to the surface at the point of refraction lie in the same plane; (2) the incident ray and the refracted ray lie on opposite sides of the normal; (3) the sine of the angle made by the incident ray with the normal bears a constant ratio to the sine of the angle made by the refracted ray with the normal. This ratio depends only on the composition of the two media separated by the surface, and is known as the relative index of refraction.

From a comparison of these two laws it will be seen that the law of reflection may be considered as a special case of the law of refraction, the relative refractive index being equal to either $+1$ or -1. Let us adopt the convention that angles are to be measured by the value of the anti-clockwise rotation needed to reach the ray position from the onward drawn normal. Thus in fig. 1a, the angles of incidence and refraction ϕ and ϕ' are positive, and if μ is the relative refractive index $\sin\phi = \mu\sin\phi'$. When reflection occurs the angle of reflection is opposed in sign to the angle of incidence (*see* fig. 1, right), and μ should therefore receive the value -1. It will be noted also that the reflected ray travels in the opposite direction to that contemplated in the law of refraction. As we shall see later all lengths entering into optical equations are either multiplied or divided by a refractive index and the double reversal of sign frees us from all difficulties regarding the signs of the quantities we employ. We are therefore enabled to dispense with any detailed consideration of reflecting instruments and can proceed to deal with refraction as an inclusive process.

For a reason which will become apparent later it is necessary for the reflecting and refracting surfaces used in optical instruments to approach very closely to ideal geometrical forms. The manufacturing processes by which the necessary degree of perfection can be reached impose severe limitations on the types of surface which may be employed, and in practice any surface but a portion of a sphere —with the plane as a special case—is rarely employed. We will therefore consider the refraction of light at a spherical surface.

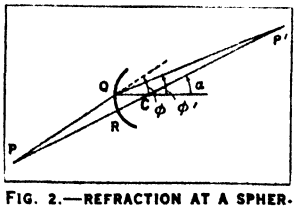


FIG. 2.—REFRACTION AT A SPHERICAL SURFACE

In fig. 2 let a ray passing through the point P be refracted at Q, a point on a spherical surface whose centre is at C. The refracted ray lies in the plane PQC containing the incident ray PQ and the normal QC, and it will therefore in general meet PC at some point P'. Let PC meet the surface in R and make an angle α with QC, and let ϕ and ϕ' be the angles of incidence and refraction. Then from the triangles PQC, $P'QC$

$$\frac{\sin\alpha}{\sin\phi} = \frac{PQ}{PC}, \quad \frac{\sin\alpha}{\sin\phi'} = \frac{QP'}{CP'},$$

and therefore by the law of refraction

$$\mu\frac{PQ}{PC} = \frac{QP'}{CP'}.$$

If now Q is near R, PQ and QP' differ from PR and RP' by small quantities of the second order, and the equation becomes

$$\mu\frac{PC-r}{PC} = \frac{r+CP'}{CP'}$$

or

$$\frac{\mu-1}{r} = \frac{\mu}{PC} + \frac{1}{CP'},$$

where r is the radius of the surface. It follows from this expression that all rays which, before refraction in the neighbourhood of R, pass through P, will afterwards pass through P'. Physically this means that light energy diverging from a particle of matter placed at P will converge to P' or alternatively will diverge in the new medium as though it were liberated at P'. The reunion of the rays at P' is thus of the greatest significance, and P' is called the image of the object P. If P' is so situated that the rays can actually pass through it the image is called real, but if it is so placed that they may merely be regarded as having originated there the image is called virtual. It should be observed that there is no need for the rays to have actually passed through the point P, that is to say we may deal with virtual objects as well as virtual images.

Consider now a succession of spherical surfaces which are all met by rays under the conditions just described. Corresponding to an object point P, real or virtual, the first surface forms an image at a definite point P_1. The point P_1 may be regarded as a source of rays falling upon the second surface, which forms an image P_2 of P_1. Each surface in turn forms a point image of that due to the preceding surfaces, and we conclude that the whole series of surfaces will form at a definite point P' in the final medium, an image, either real or virtual, of an arbitrary point P in the object space. The relation connecting P and P' may be shown to be unique and reversible, so that it is a matter of convention which of the spaces external to the system is regarded as the object space and which as the image space. It will be observed that we have not assumed axial symmetry in the system, so that this conclusion holds whether the centres of curvature of the various refracting surfaces are collinear or not.

Symmetrical Optical Instruments.—The refracting surfaces in a great majority of optical instruments are surfaces of

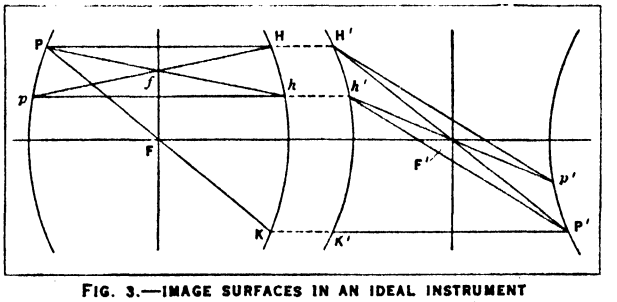


FIG. 3.—IMAGE SURFACES IN AN IDEAL INSTRUMENT
Determination of surfaces in which object and image are equal to one another, and also equal but inverted

revolution with a common axis of symmetry. In consequence of this rotational symmetry the theory of these instruments is particularly simple. Rays which lie initially in a plane containing the axis remain in that plane, and the general one-one correspondence between the points of the two spaces degenerates to a one-one correspondence between points of a plane.

The theory of the symmetrical instrument has been treated very comprehensively by Maxwell and later by Abbe on the assumption that this two dimensional point to point correspondence

holds. From symmetry it is clear that the image of each point on the axis is itself a point on the axis. Thus the axis is a self-conjugate ray for the system, that is to say the axis, regarded as a whole is its own image. Corresponding to the point at infinity on the axis in the object space there corresponds a point F' (*see* fig. 3), usually at a finite distance, in the image space. This is named the second principal focus of the system. Then all rays which in the object space are parallel to the axis will be refracted so as to pass through F' in the image space, and conversely all rays in the image space which pass through F' correspond to rays which are parallel to axis in the object space. Similarly there is a point F on the axis in the object space such that all rays passing through F emerge in the image space as rays parallel to the axis. This point is called the first principal focus of the system. Since the incident portion of any ray refracted parallel to the axis lies in the same axial plane as the emergent portion, the two will meet if produced in some point H. The point thus determined on the incident ray is at the same distance from the axis as the whole of the emergent portion of the ray, and the height of the image of an object extending from H to the axis is equal to the height of the object itself, a fact usually expressed by saying that the transverse magnification is 1. The locus of points H determined in this manner is therefore called the first unit surface. It is to be considered as situated entirely in the object space.

In a similar way by considering the intersections of the incident and emergent portions of rays which pass through F' in the image space we determine the second unit surface situated in the image space. Clearly these two surfaces have rotational symmetry about the axis and are conjugate to one another, that is, the one surface is the image of the other, and any ray striking the first unit surface in the point H will follow a path in the image space passing through H' in the second unit surface where HH' is parallel to the axis. Now let $PHH'F'P'$ and $PFKK'P'$ be two rays meeting in P and P', the former being parallel to the axis in the object space and the latter in the image space. Let these two parallel portions be at equal distances from the axis and on opposite sides of it. The image extending from P' to the axis is of equal height to an object lying between P and the axis, and is inverted. P and P' therefore trace out conjugate surfaces corresponding to the transverse magnification -1. F and F' are the mid-points of PK and $H'P'$ and the new surfaces are therefore precisely equal to the corresponding unit surfaces but face opposite ways. Now let $phh'F'p'$ be another ray parallel to the axis in the object space meeting the unit surfaces in h and h' and the negative unit surfaces in p and p'. From symmetry Ph and pH intersect in a point f situated in the plane through F normal to the axis of the system, and from the congruent triangles $h'F'P'$, $H'F'p'$, $h'P'$ and $H'p'$ are parallel. In other words the normal plane through F is conjugate to the surface at infinity in the image space, and similarly the normal plane through F' is conjugate to the infinitely distant surface in the object space. By taking a pair of rays whose distances from the axis are in any assigned ratio we can construct the conjugate surfaces for this magnification.

It is a simple matter to show that the object space surfaces are all similar and similarly situated about F, and the image space surfaces also similar and similarly situated about F'. Since we have taken the ratio of the distances of corresponding points from the axis as the measure of the magnification, any corresponding secondary elements of length (that is elements normal to the plane through the axis of symmetry) in the image and object surfaces are in this ratio. Now consider two parallel incident rays inclined to the axis, not intersecting it but situated symmetrically with respect to it, the separation between them being small. They determine on every constant magnification object surface a secondary element of unvarying length. In the image space these rays intersect in a point f' in the focal plane through F'. The lengths of the secondary elements intercepted on the constant magnification surfaces in the image space are therefore proportional to the distances of the points of intersection from f'. In other words these surfaces must be similarly situated with respect to any point f' in the focal plane.

It follows that all the constant magnification surfaces are planes normal to the axis, and that the magnification in every such plane is uniform in all directions. All the properties of the system may therefore be related to the points in which these planes meet the axis of symmetry. With the aid of rays passing through F and F' (fig. 4) we readily prove, if U and U' are the

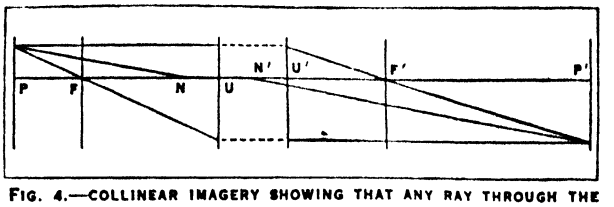


FIG. 4.—COLLINEAR IMAGERY SHOWING THAT ANY RAY THROUGH THE NODAL POINT N EMERGES IN A PARALLEL DIRECTION THROUGH N'

unit points, that is the points in which the unit planes meet the axis, and P and P' are any pair of conjugate axial points

$$\text{transverse magnification} = \frac{FU}{FP} = \frac{P'F'}{U'F'}$$

so that conjugate points are determined by $FP \cdot P'F' = FU \cdot U'F'$. If we draw through f a straight line fN, parallel to the direction of the emergent rays arising from f, to meet the axis in N, we have $FN = U'F'$. The conjugate point N' by the above relation is given by $N'F' = FU$. These points, from the circumstance that the incident and emergent rays through them are parallel to one another, are called the nodal points of the system. FU and $U'F'$ are named the first and second focal lengths of the system. When these two focal lengths are equal the unit points coincide with the nodal points and are frequently called the principal points.

It is easy to show with a system consisting of a single surface that if an object point is moved along the axis, the image moves in the same direction. It follows that this holds also for any compound instrument, and hence FU and $U'F'$ are always measured in the same direction. There are thus only two types of system—positive systems, illustrated in fig. 4, in which the principal foci F and F' are reached by proceeding from U and U' towards the real distant part of the corresponding space (the focal lengths thus being positive), and negative systems in which all these signs are reversed. The unit planes are usually situated close to or between the extreme refracting surfaces of the lens, and in a negative instrument all the real portions of the object space and of the image space are thus on a single side of the respective focal planes. It follows that such a negative system cannot yield a real image of a real object, and since the focal planes separate upright from inverted images, there is no inversion if either object or image is real. With a positive lens we can obtain a real inverted image of a real object, but if there is no inversion either the object or the image or both are virtual.

As we have based this discussion on the general correspondence of object and image points, the conclusions hold whenever the initial assumptions are satisfied irrespective of the way in which the system is constructed. Had we first considered the properties of a single spherical surface and extended the result to a combination of several such surfaces, our conclusions would not necessarily have applied to a system in which aspherical surfaces are employed.

Formulae are frequently used in which measurements are made from the unit points instead of from the principal foci. If we denote the transverse magnification by m, we have

$$\frac{PU}{FU} = 1 - \frac{1}{m}, \quad \frac{U'P'}{U'F'} = 1 - m, \quad \frac{U'P'}{PU} = -m\,\frac{U'F'}{FU}$$

and $\dfrac{FU}{PU} + \dfrac{U'F'}{U'P'} = 1$. When the two focal lengths have the common value f the last two equations become

$$m = -\frac{U'P'}{PU}, \text{ and } \frac{1}{PU} + \frac{1}{U'P'} = \frac{1}{f}.$$

Systems which yield on a uniform scale a plane image of a plane object (and incidentally a plane image of every plane object) are admirably fitted for many practical purposes, for example the photographic reproduction of maps. The scheme we have just described, which is known as collinear imagery, has therefore been widely used as a standard with which the performance of real instruments may be compared. It is of value as an artificial reference frame, rather than as a scheme to which real instruments tend to conform.

The Wave Theory and Lenses.—We will now consider the properties of lenses according to the wave theory of light. The postulates of this theory, which have been justified by the most varied experiments, are that monochromatic light may be regarded as an undulatory disturbance of unvarying period which spreads out in all directions from the source at a uniform speed which depends only on the medium in which it is travelling. In common with other forms of wave motion the disturbance at a given instant at any point may be obtained by replacing the actual wave system by a system of secondary sources of proper intensities and phases distributed over a surface. The statistical distribution of light energy is assumed to be that of the energy distribution of the wave system on the assumption that a long train of waves is involved. On this basis the phenomena observed in the neighbourhood of an optical image—that is the point where the energy of the wave motion has its greatest value through the contributions of the secondary sources arriving in the same phase—have been very satisfactorily accounted for. It is shown in treatises on Physical Optics (*see* LIGHT) that these assumptions involve the propagation of light in straight paths normal to the wavefront (so that the rays of the geometrical theory are to be regarded as normals to the wavefront), and changes in the directions of these paths in agreement with the laws of reflection and refraction provided the relative refractive index is made equal to the ratio of the times taken by light to travel equal distances in the new and old media. It would therefore appear that we should find agreement between the deductions to which we are led by the geometrical and the wave theories. This conclusion however is incorrect. An essential condition in deducing the law of rectilinear propagation is that the wavefront should be of considerable lateral extent. When light approaches a real focus this condition is violated, with the result that the direction of propagation in fact is not constrained to the straight paths assumed in the geometrical theory. It is therefore not surprising to find that while the geometrical theory indicates correctly the positions in which images are formed and the conditions which should be satisfied if an instrument is to yield images of the highest quality, it is misleading in the character of the image it leads us to expect, and the effects to be observed in the neighbourhood of the image. The two theories also differ in the course they would lead us to adopt when any of the conditions corresponding to perfect imagery are not satisfied.

Since the relative refractive index depends only on the relative speed with which light travels in the two media we may, by assigning the value unity arbitrarily as the refractive index of a suitable substance under specified physical conditions, obtain an absolute refractive index for any other substance. As an absolute standard medium empty space is taken, but for practical purposes the refractive index of air at standard temperature and pressure is adopted. We shall hereafter, when we speak of refractive index, imply the absolute refractive index of a substance on one or other of these conventions. We will now show that the two focal lengths of any symmetrical optical system are in the ratio of the refractive indices of the two external media.

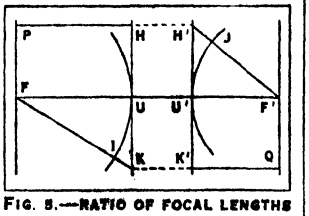


FIG. 5.—RATIO OF FOCAL LENGTHS

Let a plane wave normal to the lens axis in the object space of refractive index μ travel from the position PF, fig. 5, until, after being converted by the instrument into the spherical wave $U'J$, in the image space of refractive index μ', it reaches the principal focus at F'. Let another plane wave in the image space travel in the reverse direction from $F'Q$ to F. As different parts of the same wavefront take equal times to reach the focus, the time taken by the light to travel by the path $PHH'JF'$ is equal to that taken along the axial path $FUU'F'$, and similarly the paths $QK'KIF$ and $F'U'UF$ take equal times. The time taken to traverse the same axial path $FUU'F'$ is independent of the direction, and the times for all these paths are thus equal. Now the times taken along PH and FU are equal, and the times along the equal distances $U'F'$ and JF' in the same medium are equal. It follows that the time taken to travel from U to U' exceeds that between H and H' by the time needed to traverse the distance $H'J$. Similarly the time for the journey UU' exceeds that between K and K' by the time taken to cover the distance IK. Now if H and K are at equal distances y from the axis the time taken to travel between H and H', from the symmetry of the instrument, is equal to that taken between K and K'. It follows that $\mu \cdot IK = \mu' \cdot H'J$, or

$$\mu[\{(FU)^2+y^2\}^{\frac{1}{2}}-FU]=\mu'[\{(U'F')^2+y^2\}^{\frac{1}{2}}-U'F'];$$

that is, if the terms in y^4 and higher powers of y are negligible,

$$\tfrac{1}{2}\mu\,\frac{y^2}{FU}=\tfrac{1}{2}\mu'\,\frac{y^2}{U'F'},$$

and since this holds for finite values of y we must have

$$FU : U'F' = \mu : \mu'.$$

In particular if the two external media are composed of the same kind of matter the two focal lengths are equal to one another.

Let us now consider the possibility, according to the physical criterion of equality of time along the geometrical rays, of collinear imagery. Let $PQRS$ be four object points and $P'Q'R'S'$ their images. Denote by $\{AB'\}$ the distance light would travel in the medium of refractive index unity in the time taken to travel from A through the instrument to B'. Then since with geometrically perfect imagery the time between two conjugate points is equal by all paths,

$$\begin{aligned}
\{PP'\} &= \mu PQ + \{QP'\} = \mu PS + \{SP'\} \\
\{QQ'\} &= \{QR'\} + \mu'R'Q' = \{QP'\} + \mu'P'Q' \\
\{RR'\} &= \mu RS + \{SR'\} = \mu RQ + \{QR'\} \\
\{SS'\} &= \{SP'\} + \mu'P'S' = \{SR'\} + \mu'R'S'
\end{aligned}$$

or $$\mu(PQ+RS-PS-RQ)=\mu'(P'Q'+R'S'-P'S'-R'Q').$$

Now without altering the configuration of the figure $PQRS$ we may, if the focal lengths of the system are finite, make the scale of the figure $P'Q'R'S'$ as large or as small as we like by moving $PQRS$ as near or as far from the lens as we like. In particular we may make each dimension of the figure $P'Q'R'S'$ smaller than any assigned finite small length. This relation cannot therefore hold, and collinear imagery is not possible for a system of finite focal length. In other words it is impossible to construct an optical system having a finite focal length which will refract all rays from any given object point so as to pass through a single image point. Using terms significant in the wave theory, the time taken to travel through the instrument between a point in the object space and a point in the image space cannot be independent of the path followed for an arbitrary choice of the object point. When the focal length is not finite the image is a copy of the object on uniform transverse and longitudinal scales, and collinear imagery is achieved when the two refractive indices are numerically equal and the object and image are congruent figures. The most familiar example is afforded by reflection at a plane mirror, where we suppose the two external refractive indices differ only in sign. (*See* MIRROR.)

The Size of a Point Image: Resolving Power.—The extent of the divergence between the two theories may be illustrated by considering properties of importance to the user of the instrument. First we will consider the size of the image of a point source. Of the spherical wave which spreads out from the source only a portion can enter the instrument, and corresponding to the perfect reunion of the rays in an image point we have an emergent

wave of spherical form. In fig. 6, BAC represents a wave-front filling the aperture BC: the wave is in the form of a portion of a concave sphere of which F is the centre. According to geometrical optics the image is the point F, and is formed by rays filling the cone BFC of which AF is the axis and α is the semi-angle. By the principles of physical optics the disturbances produced by the train of waves are the same as would be produced by a suitable series of disturbances situated in the wave-front BAC. Now any disturbance at A gives rise to a spherical wave with A as centre. If we confine ourselves to a region around F of dimensions small compared with AF we may consider the wave from A to be a plane wave PP' at F. Similarly from B and C we get plane waves QQ' and RR' making angles $\pm\alpha$ with PP'. Now all parts of the wave front BAC are equidistant from F, and the component disturbances at F are therefore all in the same phase—that is to say, all the displacements are in the same direction and reach their maximum values at the same instant.

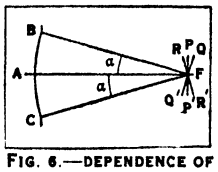


FIG. 6.—DEPENDENCE OF RESOLVING POWER ON APERTURE

The energy of the wave motion is therefore a maximum at F, for there the co-operation is as great as possible. The wave from B will, however, have already passed beyond P, and that from C will not yet have reached P by the time the wave from A has arrived at the position PFP'. To find the disturbance at P we therefore have to take the displacement at B when the wave-front BAC is short of the position shown by the distance PQ, and similarly the displacement at C when this wave-front has advanced beyond the position shown by the distance PR. That is to say the component displacements at P vary in phase, the total range being found by measuring the difference of path, *i.e.*, the length $2PF\sin\alpha$, along the train of waves in the direction of their motion. Now if P is near enough to F the differences of phase are small, and the displacements differ very little from those at F; in other words at points very close to F the light energy is practically the same as at F, so that the image is of finite dimensions, and not a point. As P moves farther away from F the range of phase increases, and at a certain stage we begin to receive contributions from points near B which tend to neutralize those contributed from points near C, so that the light energy as we pass through these positions of P diminishes rapidly. Finally we reach a position of P at which the range of phase is great enough for the various contributions to neutralize one another, or at least to so nearly neutralize one another that our impression on looking at this point is that we have reached or passed the edge of the image.

Since the changes of intensity are due wholly to differences of phase, the image edge will be reached when the difference of path is some constant θ times the wave length λ of the light, *i.e.*,

$$2PF\sin\alpha=\theta\lambda$$

or
$$\text{image diameter}=2PF=\frac{\theta\lambda}{\sin\alpha}=d.$$

If λ_0 is the wave length of the light in the standard medium $\lambda_0=\lambda\mu$, and the last fraction becomes $\theta\lambda_0/\mu\sin\alpha$. As the aperture which limits the light passing through the instrument is reduced, $\sin\alpha$ decreases, and the size of the image increases. If two near object points are to be distinguished on examining them through the instrument their images must be separate, and the resolving power of the instrument, as its capacity for rendering distinct images of near objects is called, is measured by the reciprocal of the image diameter, that is by $\mu\sin\alpha/\theta\lambda_0$. With light of a given wave length the deflominator is invariable, and as $d\mu\sin\alpha$, as we shall see later, is unaltered by refraction, the resolving power of an instrument is measured by $\mu'\sin\alpha'$, where the accented quantities relate to the object space. On account of its importance in microscopy this quantity is known as the numerical aperture of the instrument. The utility of an optical instrument evidently depends upon the variation in path having a small value compared with the wave length of the light used. Since the wave length is very small, a very close approach to the theoretical form, as has already been mentioned, is necessary in the refracting surfaces.

Depth of Focus.—We will now consider according to the two theories how far we may expect to be able to depart along the axis of the instrument from the ideal focus F and still retain a satisfactory image. According to geometrical optics light rays fill the cone BFC, fig. 7, and the image in the plane XY will be a circle of diameter IJ. The image is considered satisfactory if IJ does not exceed a certain diameter, say d, so that the permissible range for G is given by the condition

$$FG=\tfrac{1}{2}d\cot\alpha$$

or very approximately

$$FG=d\cdot\frac{I}{a},$$

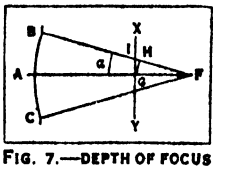


FIG. 7.—DEPTH OF FOCUS

where I is the distance of the image from the principal point and a is the effective diameter of the lens aperture, supposed situated in the unit plane. The important feature of this formula is that the depth of focus is inversely proportional to the first power of the diameter of the aperture.

Let us now consider the same problem from the point of view of the wave-theory. Instead of relying on the geometrician's hypothesis we are able to rest on the well attested fact that an image begins to appear less sharp when the extreme difference between the phases of the component waves at the centre of the image reaches a definite value, that is to say when the path difference at G amounts to $\phi\lambda$ where ϕ is a definite number. This criterion differs from that considered on the geometrical theory less radically than might at first sight appear, for the existence of an appreciable phase difference at the image centre means that in this neighbourhood the light energy is less: but the total light energy of the waves is absorbed wherever the plane may be placed, and energy removed from the central regions must therefore appear in some other place. But to say that an appreciable amount of energy is found farther from the centre is only another way of stating that the image is sensibly enlarged.

Resuming, however, the determination of the range for G, the distance of this point from B differs by an unimportant amount from BH, where GH is perpendicular to BF. Since the extreme paths obviously arise from A at one limit and marginal points such as B at the other, and since all path lengths to F are equal, the extreme path difference is the difference between FG and FH, or $FG(1-\cos\alpha)$ or

$$FG=\frac{\phi\lambda}{1-\cos\alpha}$$

Now $a=2I\sin\alpha$, and therefore approximately

$$FG=8\phi\lambda\left(\frac{I}{a}\right)^2.$$

This formula indicates a law of a quite different type from that derived geometrically, the range varying inversely as the square of the aperture diameter, instead of as the first power.

The Depth of Field.—By reasoning of a character essentially similar to that of the foregoing section we can find expressions for the nearest and greatest distances x and x' at which objects may be situated from the lens for their images to appear sharp on a screen focussed for a distance X. According to the geometrical theory the conditions are

$$\frac{1}{x}-\frac{1}{X}=\frac{1}{X}-\frac{1}{x'}=\frac{d}{Ia},$$

and the conditions derived from a limiting difference of path are

$$\frac{1}{x}-\frac{1}{X}=\frac{1}{X}-\frac{1}{x'}=\frac{8\phi\lambda}{a^2},$$

where the symbols bear the same meanings as in the previous section. Thus assuming the objects are at a considerable distance from the lens, so that I is approximately equal to the focal length of the lens, according to geometrical optics the focal

length of the lens and the aperture are equally important, the range being inversely proportional to both. On the other hand according to the wave theory the focal length has nothing whatever to do with the question, and the range is inversely proportional to the square of the aperture. Both theories, it will be observed, indicate the selection of the same plane for the theoretical focus to secure the utmost sharpness for all objects between two given extreme planes.

It should be unnecessary to point out that the problems on which it has been shown that the two theories differ so widely, are of much practical importance in the use of optical instruments. As an example in photography, when considerable depth of focus is required, the geometrical formula is likely to lead to the use of an unnecessarily small stop, thereby involving not only a longer exposure, but also, through the tendency of a small stop to cause loss of sharpness, a poorer negative.

The Eikonal.—The examples we have just considered show that a complete investigation of the properties of lenses involves the determination of the time taken by light to reach any given point in the neighbourhood of the geometrically determined image, by both stationary and non-stationary routes (that is along "rays" and along other paths), as a preliminary to the calculation of the energy of the wave motion there. The computation of the time by non-stationary routes may be omitted if the surface where the secondary sources are placed is selected in the image space and the times from the source to this surface are determined for stationary routes only. In practice the energy distribution will not be determined in routine calculations, as typical calculations or observations will show the effects caused by departing from strict equality of path by different amounts, for each of the types of variation encountered in well-corrected systems.

All calculations will therefore relate to the geometrical paths, but variation in the lengths of these paths rather than their distances from a mean point in the neighbourhood of an image is to be regarded as the significant factor on which the quality of the image depends. The two sets of magnitudes are not independent, and we proceed to find the connection between them.

Take origins of rectangular co-ordinates in both object and image spaces. Suppose in the first space that a point source of light is situated at (x, y, z) in the object space. Light is radiated from this point in all directions, and some traverses the optical system and finds its way into the image space. Generally the wave-front in the image space will be a curved surface, and the normals or rays at different points of this surface differ in direction. A particular emergent ray may therefore be specified by its direction cosines. Let these be (L', M', N'), and suppose also that (ξ', η', ζ') is a point on this ray. The disturbance has taken a definite time to reach (ξ', η', ζ') from (x, y, z): let the corresponding optical path length, that is, the distance light travels in a standard medium in this time, be denoted by $\mathcal{V}$. Let $\mathcal{V}+\delta\mathcal{V}$ be the path length for a neighbouring ray starting from (x, y, z) and finishing at $(\xi'+\delta\xi', \eta'+\delta\eta', \zeta'+\delta\zeta')$, the final direction being $(L'+\delta L', M'+\delta M', N'+\delta N')$. If μ' is the refractive index of the final medium, the second path exceeds the first by

$$\mu'\{(L'+\delta L')\delta\xi'+(M'+\delta M')\delta\eta'+(N'+\delta N')\delta\zeta'\}$$

since the wave-front, which marks the locus of points optically equidistant from (x, y, z), is normal to the ray. Now suppose that the tangent planes to the wave-fronts at (ξ', η', ζ') and $(\xi'+\delta\xi', \eta'+\delta\eta', \zeta'+\delta\zeta')$ pass through the image space origin. Then

$$L'\xi'+M'\eta'+N'\zeta'=0,$$

$$(L'+\delta L')(\xi'+\delta\xi')+(M'+\delta M')(\eta'+\delta\eta')+(N'+\delta N')(\zeta'+\delta\zeta')=0,$$

and these conditions enable the expression we have found for the path difference to be written

$$-\mu'\{\xi'\delta L'+\eta'\delta M'+\zeta'\delta N'\}=\delta\mathcal{V} \qquad (1).$$

Now L', M', N' are connected by the relation

$$L'^2+M'^2+N'^2=1,$$

and therefore only two of them, say M' and N', may be regarded as independent variables. On eliminating L' (1) becomes

$$-\mu'\Big(\eta'-\frac{M'}{L'}\xi'\Big)\delta M'-\mu'\Big(\zeta'-\frac{N'}{L'}\xi'\Big)\delta N'=\delta\mathcal{V}.$$

Since $\mathcal{V}$ is now regarded as a function of M' and N', for any small variations of M' and N' we shall have

$$\delta\mathcal{V}=\frac{\partial\mathcal{V}}{\partial M'}\delta M'+\frac{\partial\mathcal{V}}{\partial N'}\delta N',$$

and, since M' and N' may be varied independently, we find, by comparing these equations,

$$\mu'\Big(\eta'-\frac{M'}{L'}\xi'\Big)=-\frac{\partial\mathcal{V}}{\partial M'},\quad \mu'\Big(\zeta'-\frac{N'}{L'}\xi'\Big)=-\frac{\partial\mathcal{V}}{\partial N'}.$$

Now $\eta'-\frac{M'}{L'}\xi'$ and $\zeta'-\frac{N'}{L'}\xi'$ are invariants for any given ray, and represent the y' and z' co-ordinates of the intersection of the ray with the plane $x'=0$. If we understand that y' and z' are the co-ordinates of a point in this plane we may write these equations

$$\mu'y'=-\frac{\partial\mathcal{V}}{\partial M'},\quad \mu'z'=-\frac{\partial\mathcal{V}}{\partial N'} \qquad (2)$$

If then we know $\mathcal{V}$ as a function of M' and N', that is to say if we know how the length of the optical path from the source to a plane through the image space origin varies as the direction of this plane alters, we can find where the common normal to this plane and the wave meets an arbitrary fixed plane through the origin.

If, instead of starting with a source of light at a known point of the object space, we had assumed it to be situated in the image space, some of the light diverging from this point would reach the lens and after refraction would emerge into the object space. We could take $\mathcal{V}'$ as a measure of the time taken by the light to reach a plane in the direction (L, M, N) passing through the object space origin, and obtain the equations

$$\mu y=\frac{\partial\mathcal{V}'}{\partial M},\quad \mu z=\frac{\partial\mathcal{V}'}{\partial N} \qquad (3)$$

for the point (y, z) in which the common normal to the wave-front and the plane $L\xi+M\eta+N\zeta=0$ meets the plane $x=0$. The change of sign which will be observed on comparing equations (2) and (3) is due to the assumption that the positive directions of the axes are unaltered, so that a positive displacement of (ξ, η, ζ) corresponds to a decrease in the time $\mathcal{V}'$.

The function $\mathcal{V}$ suffers from the grave disadvantage that it is unsymmetrical, the variables in the object space being point co-ordinates, and in the image space direction cosines. A function which is symmetrical is at once obtained by considering the particular case in which the source of light is at infinity. It is inconvenient to include in the function the infinite term representing the length of the path between the source and a reference position near the lens, so the path is measured from the wave-front which passes through the object space origin. Since all points on the same wave-front are at the same optical distance from the source, $\mathcal{E}$, the new finite path length, which is a function of (M, N, M', N'), differs from $\mathcal{V}$ only by a constant, and, as in the case of $\mathcal{V}$, the equations

$$\mu'y'=-\frac{\partial\mathcal{E}}{\partial M'},\quad \mu'z'=-\frac{\partial\mathcal{E}}{\partial N'} \qquad (4)$$

are satisfied. In a similar way from $\mathcal{V}'$, by placing the source at infinity in the image space in the direction L', M', N', and rejecting the constant infinite part of the path, we obtain a finite function $\mathcal{E}'$ having (M, N, M', N') as its variables and satisfying the equations

$$\mu y=\frac{\partial\mathcal{E}'}{\partial M},\quad \mu z=\frac{\partial\mathcal{E}'}{\partial N} \qquad (5)$$

Now $\mathcal{E}$ and $\mathcal{E}'$ measure the time taken by the light to travel between the same two planes in opposite directions along the stationary path. This stationary path between two planes is unique and independent of the curvature of the wave-front at either

plane. Moreover the speed of light is independent of direction. It follows that $\mathcal{E}$ and $\mathcal{E}'$ are equal, and, since they are expressed in terms of the same variables, they must be identical. This symmetrical function of the direction cosines, which is one of the Characteristic Functions introduced into Optics by Hamilton, will be referred to as the Eikonal, a name proposed by Bruns.

In the application of this function the planes $x=0$ and $x'=0$ will be chosen to coincide with the object and image planes, or at least to be parallel to them. Equations (4) and (5) then show how this function, which itself expresses the length of a path carried through the refracting surfaces, and is thus particularly suitable for investigations according to the wave theory, enables the points in which rays travelling in specified directions meet the object and image surfaces to be found.

Focal Lengths and Principal Foci.—The rays, being the normals to the wave front, are the loci of points for which the path is stationary for slightly displaced routes, and conjugate foci are points of a particular path between which the path length is stationary for larger deviations. In an axially symmetrical system we can see immediately that a pair of such points for a skew ray (that is to say, a ray which does not lie entirely in an axial plane) are the intersections of any axial plane with the incident and emergent rays. By considering a ray in an axial plane as the limiting position of a skew ray, we can extend the definition to all rays. We shall call such conjugate points secondary foci. We proceed to find the positions of the principal secondary foci and the magnitudes of the corresponding focal lengths.

Take the axes of x and x' in coincidence with the axis of symmetry, so that $\mathcal{E}$ may be regarded as a function of three variables only, viz., $\frac{1}{2}\mu^2(M^2+N^2)$, $\mu\mu'(MM'+NN')$ and $\frac{1}{2}\mu'^2(M'^2+N'^2)$. Denoting these by a, b, c respectively, and differentiation by the addition of a suffix, equations (4) give

$$y'+\mu M\mathcal{E}_b+\mu' M'\mathcal{E}_c=z'+\mu N\mathcal{E}_b+\mu' N'\mathcal{E}_c=0 \qquad (5)$$

that is to say, the ray goes through the point $(\rho' L', Y', Z')$ distant ρ' along the ray from the reference plane $x'=0$, where $\rho'=\mu'\mathcal{E}_c$ provided

$$Y'=-\mu M\mathcal{E}_b,\ Z'=-\mu N\mathcal{E}_b \qquad (6)$$

These equations show that at this point the ray goes through a point in the axial plane containing the infinitely distant origin of light (L, M, N). In other words the secondary principal focus lies on the ray at the distance $\mu'\mathcal{E}_c$ beyond its intersection with the reference plane $x'=0$. Similarly the secondary principal focus in the object space lies on the ray at a distance $-\mu\mathcal{E}_a$ from its intersection with the reference plane $x=0$, the measurement being made in the positive direction. By partial analogy with the properties associated with the nodal points of collinear imagery, if f is the object space secondary focal length, the y' and z' co-ordinates of the secondary image of the infinitely distant object (L, M, N) are Mf and Nf respectively. Equations (6) thus give $f=-\mu\mathcal{E}_b$, and similarly the image space secondary focal length is given by $f'=-\mu'\mathcal{E}_b$.

The secondary conjugate points corresponding to the magnification S must satisfy

$$\frac{Y'}{Y}=\frac{Z'}{Z}=s,$$

and if these points are distant ρ' and ρ from the corresponding principal foci, by equations (5) we have

$$\frac{\rho' M'-\mu M\mathcal{E}_b}{\rho M+\mu' M'\mathcal{E}_b}=\frac{\rho' N'-\mu N\mathcal{E}_b}{\rho N+\mu' N'\mathcal{E}_b}=s$$

or

$$\rho=-\frac{\mu\mathcal{E}_b}{s},\ \rho'=\mu'\mathcal{E}_b\cdot s$$

since for a skew ray M/M' and N/N' are not equal. The connection between the principal foci, the focal lengths, a pair of conjugate foci and the magnification for any ray thus correspond exactly to those found for the instrument as a whole in collinear imagery. The fact that this law is followed for lengths measured along the ray itself, and not their projections on the axis, clearly involves the failure of collinear imagery. The constant magnification surfaces in fact tend to be spherical rather than plane.

We will next determine the primary principal foci, which are the points of intersection of successive parallel incident rays lying in the same plane through the axis of the system. Without loss of generality we may suppose $z=z'=N=N'=0$, and the y' co-ordinate of the point in which the ray meets the plane $x'=X'$ is $\frac{M'}{L'}X'-\mu' M'\mathcal{E}_c-\mu M\mathcal{E}_b$. If this point is conjugate to the infinitely distant point (L, M), this value of y' will be unaltered by substituting $\left(L'-\frac{M'}{L'}\delta M',\ M'+\delta M'\right)$ for (L', M'). Since $\delta M'$ is finite, we see that we must travel along the ray from its intersection with the reference plane the distance

$$\frac{X'}{L'}=\mu' L'^2\{\mathcal{E}_c+2a\mathcal{E}_{bb}+2b\mathcal{E}_{bc}+2c\mathcal{E}_{cc}\}$$

to reach the primary principal focus. The corresponding distance for the object space is

$$-\mu L^2\{\mathcal{E}_a+2a\mathcal{E}_{aa}+2b\mathcal{E}_{ab}+2c\mathcal{E}_{bb}\}.$$

To determine the focal lengths we note from (5) that the ray $(M+\delta M,\ M')$ meets the reference plane in the point $y'+\delta y'$ where

$$\delta y'=-\mu\delta M\{\mathcal{E}_b+2a\mathcal{E}_{ab}+b(\mathcal{E}_{bb}+\mathcal{E}_{ac})+2c\mathcal{E}_{bc}\}.$$

Now the separation between these parallel emergent rays is $L'\delta y'$, and the angle between the two incident rays is $\delta M/L$. We define the focal length as the distance at which this separation is subtended by this angle, or

$$F=-\mu LL'\{\mathcal{E}_b+2a\mathcal{E}_{ab}+b(\mathcal{E}_{bb}+\mathcal{E}_{ac})+2c\mathcal{E}_{bc}\},$$

and similarly

$$F'=-\mu' LL'\{\mathcal{E}_b+2a\mathcal{E}_{ab}+b(\mathcal{E}_{bb}+\mathcal{E}_{ac})+2c\mathcal{E}_{bc}\},$$

where F and F' are the first and second primary focal lengths respectively. Substituting these values in generalised variations of (5) we find for points distant ρ and ρ' from the principal primary foci

$$L\delta Y-M\delta X=\rho\frac{\delta M}{L}-F'\frac{\delta M'}{L'},$$

$$L'\delta Y'-M'\delta X'=\rho'\frac{\delta M'}{L'}+F\frac{\delta M}{L},$$

showing that conjugate points for the transverse magnification p are given by $\rho=F/p$, $\rho'=-F'p$, in harmony with the laws found in other cases. Just as we extended the conception of secondary foci from skew rays to rays in an axial plane, we may extend the primary concept to rays in general by basing generalised definitions upon the expressions we have derived.

The Sine Law and the Cosine Law.—The conditions that must be satisfied for an instrument to yield a plane image of a plane object at the constant magnification G may now be investigated. Put

$$a=S^2A-SGB+G^2C,$$
$$b=2SA-(S+G)B+2GC,$$
$$c=A-B+C,$$

so that

$$(S-G)^2A=a-Gb+G^2c,$$
$$(S-G)^2B=2a-(S+G)b+2SGc,$$
$$(S-G)^2C=a-Sb+S^2c.$$

Adopting for the moment the ray conception of imagery,

$$y=\frac{\partial\mathcal{E}}{\mu\partial M}=\mu M\mathcal{E}_a+\mu' M'\mathcal{E}_b=$$
$$\frac{1}{(S-G)^2}\{(\mu M-G\mu' M')(\mathcal{E}_A+\mathcal{E}_B)+(\mu M-S\mu' M')(\mathcal{E}_B+\mathcal{E}_C)\}$$

$$y'=\frac{\partial\mathcal{E}}{\mu'\partial M'}=\frac{1}{(S-G)^2}\{(\mu M-G\mu' M')(G\mathcal{E}_A+S\mathcal{E}_B)$$
$$+(\mu M-S\mu' M)(G\mathcal{E}_B+S\mathcal{E}_C)\}$$

so that

$$y'-Gy=\frac{1}{S-G}\{(\mu M-G\mu'M')\mathcal{E}_B+(\mu M-S\mu'M')\mathcal{E}_C\}$$

and similarly

$$z'-Gz=\frac{1}{S-G}\{(\mu N-G\mu'N')\mathcal{E}_B+(\mu N-S\mu'N')\mathcal{E}_C\}$$

Thus, if the reference points lie in the planes conjugate to one another for magnification G, the presence of terms in B and C with finite coefficients involves displacements of the image points from their desired positions. The condition required is therefore that $\mathcal{E}$ should be a function of A only, that is the direction cosines only occur in the combination

$$(\mu M-G\mu'M')^2+(\mu N-G\mu'N')^2\cdot$$

$\mu M-G\mu'M'$ and $\mu N-G\mu'N'$ must then be constant for all rays through a given object point. These are the generalised sine conditions. When the object point lies on the axis each of these quantities must vanish. In consequence of the axial symmetry only one condition, known as Abbe's sine condition, is in fact involved. If we write $G=\frac{l'}{l}$ where l and l' are conjugate lengths normal to the axis, and ψ and ψ' are the angles made by the ray with the axis, Abbe's condition takes the form $\mu l\sin\psi=\mu' l'\sin\psi'$, a result of which use has already been made in discussing the resolving power of optical instruments.

If (o, y, z) is the point of intersection with the first reference plane of a ray A in the direction (L, M, N), and $(o, y+\delta y, z+\delta z)$ is the point in which a parallel ray B meets the same plane, the change of co-ordinates may be regarded as the result of a displacement through the distance σ in the direction l, m, n if $L\delta y=\sigma(Lm-Ml)$, $L\delta z=\sigma(Ln-Nl)$, which involve

$$L(\delta y\delta M+\delta z\delta N)=\sigma L(l\delta L+m\delta M+n\delta N)-\sigma l(L\delta L+M\delta M+N\delta N)$$

whatever δL, δM, δN may be. If $(L+\delta L, M+\delta M, N+\delta N)$ is a neighbouring direction to (L, M, N) the equation becomes

$$\delta y\delta M+\delta z\delta N=\sigma(l\delta L+m\delta M+n\delta N).$$

Similarly if (o, y', z'), lies on ray A, and a parallel emergent ray C passes through $(o, y'+\delta y', z'+\delta z')$, and the displacement corresponds to a movement through the distance σ' in the direction (l', m', n'), we shall have

$$\delta y'\delta M'+\delta z'\delta N'=\sigma'(l'\delta L'+m'\delta M'+n'\delta N')$$

where $(L'+\delta L', M'+\delta M', N'+\delta N')$ is any direction near that of these two parallel rays. Now if the ray B emerges in the direction $(L'+\delta L', M'+\delta M', N'+\delta N')$ we have

$$\mu\delta y=\mu(y+\delta y-y)=\frac{\partial}{\partial M}(\mathcal{E}_{(B)}-\mathcal{E}_{(A)})=\mathcal{E}_{MM'}\delta M'+\mathcal{E}_{MN'}\delta N'+\cdots.$$

Similarly $\mu\delta z=\mathcal{E}_{NM'}\delta M'+\mathcal{E}_{NN'}\delta N'+\cdots.$

Also if $(L+\delta L, M+\delta M, N+\delta N)$ is the direction of incidence of the ray C,

$$\mu'\delta y'=-\mathcal{E}_{MM'}\delta M-\mathcal{E}_{NM'}\delta N\cdots$$
$$\mu'\delta z'=-\mathcal{E}_{MN'}\delta M-\mathcal{E}_{NN'}\delta N\cdots$$

so that neglecting small quantities of the third order

$$\mu(\delta y\delta M+\delta z\delta N)+\mu'(\delta y'\delta M'+\delta z'\delta N')=0$$

or $$\mu\sigma(l\delta L+m\delta M+n\delta N)+\mu'\sigma'(l'\delta L'+m'\delta M'+n'\delta N')=0,$$

that is $$\mu\sigma(\cos\theta_C-\cos\theta_B)+\mu'\sigma'(\cos\theta_B'-\cos\theta'_C)=0$$
$$\mu\sigma\cos\theta_B-\mu'\sigma'\cos\theta_B'=\mu\sigma\cos\theta_C-\mu'\sigma'\cos\theta_C',$$

where θ and θ' are the angles made by the ray indicated with the directions (l, m, n) and (l', m', n') respectively. If then a small parallel displacement of a collection of incident rays, determined for example by their caustic surface, is to correspond to a parallel displacement of the emergent group, so that the caustic surface of the latter is to be translated without change of shape, the set of rays must all satisfy an equation of the form

$$\mu\cos\theta=p\mu'\cos\theta'+q$$

where p and q are constants, and the displacement in the image space will be p times as great as that in the object space. This cosine law is of wider application than the laws previously given, since no special assumptions, such as that the rays concerned all pass through a given point, have been made. The converse of this law, which has recently been extended in various directions, may also be proved. We can only consider here some specially simple applications.

The law of refraction is obtained by considering rays which pass through a point on the surface, the object and image displacements being necessarily equal. By considering a movement in the plane containing both rays we find, on writing ϕ and ϕ' for the complements of θ and θ', $\mu\sin\varphi=\mu'\sin\varphi'+q$, and q vanishes as φ and φ' vanish together. The analytical form may also be derived at once, for we must have

$$\mu(L\delta x+M\delta y+N\delta z)=\mu'(L'\delta x+M'\delta y+N'\delta z)+q,$$

where δx, δy, δz are the components of the common displacement, so long as $l\delta x+m\delta y+n\delta z=0$ where l, m, n are the direction cosines of the normal to the surface. That is to say $q=0$ and

$$\frac{\mu'L'-\mu L}{l}=\frac{\mu'M'-\mu M}{m}=\frac{\mu'N'-\mu N}{n}$$

is the formula required.

The Abbe Sine Law.—In a system symmetrical about an axis let there be no aberration in the image of a given point on the axis. The condition for the absence of aberrations in the image of a small object normal to the axis through this point is obtained by considering displacements normal to the axis. If ψ and ψ' are the angles made by an incident and the corresponding emergent ray with the axis, the condition is

$$\mu\sin\psi=p\mu'\sin\psi'+\text{constant}$$

where p is the transverse linear magnification. Since the axis itself is both an incident and emergent ray of the group forming the axial image, the constant is zero.

The Sine Law for Axial Displacements (Herschel's Condition).—In the previous system let displacements along the axis be considered. Then the condition that there should be no aberration in the image of a short element of length along the axis is

$$\mu\cos\psi=P\mu'\cos\psi'+\text{constant}.$$

Since $\psi=\psi'=0$ is a member of the group of rays, the constant is equal to $\mu-P\mu'$, and the condition may be written in the form

$$\mu^{\frac{1}{2}}\sin\tfrac{1}{2}\psi=P^{\frac{1}{2}}\mu'^{\frac{1}{2}}\sin\tfrac{1}{2}\psi'$$

which is inconsistent with the Abbe sine law unless $\psi=\pm\psi'$. Both conditions are satisfied by paraxial rays, and therefore $P=p^2\mu'/\mu$. This condition illustrates the proportionality of the longitudinal magnification to the square of the transverse magnification.

The Extended Sine Law.—If there is perfect imagery for the transverse plane for which the magnification is m, the displacement of the object and image point caustics must satisfy the cosine law for displacements in the directions of the y and z axes. Thus in the symmetrical system in which the axes of x and x' coincide with the axis of symmetry, and the axes of y and y' and of z and z' are respectively parallel to one another, the conditions for perfect imagery over the whole plane when there is no aberration on the axis are

$$\mu M-\mu'M'm=q$$
$$\mu N-\mu'N'm=q'$$

where q and q' are functions of y, z, the co-ordinates of the object point from which the rays arise. Symmetry shows that $q=yQ$, $q'=zQ$ where Q is a function of y^2+z^2.

The Construction of the Eikonal.—Before the expressions which have been derived can be applied the eikonal must be constructed. We proceed to show how this may be done.

Suppose that the surface whose homogeneous equation is

$f(a, x, y, z) = 0$ separates media whose refractive indices are μ and μ' respectively. Let the reference planes for the two media both pass through the origin of co-ordinates and have direction cosines (L, M, N) and (L', M', N') respectively. Since for the stationary path the light travels perpendicularly to these planes, the distances of (x, y, z) from these planes for the light are $Lx+My+Nz$ and $L'x+M'y+N'z$ respectively. It readily follows that in the time taken by the light to travel from the plane (L, M, N) to the plane (L', M', N') via the point (x, y, z) the distance travelled in the standard medium is

$$\mathcal{E} = \mu(Lx+My+Nz) - \mu'(L'x+M'y+N'z).$$

If (x, y, z) determines the neighbourhood of the surface for which the time is stationary between the planes, we must have

$$(\mu L-\mu' L')\delta x+(\mu M-\mu' M')\delta y+(\mu N-\mu' N')\delta z = 0$$

for all infinitesimal values of δx, δy, δz which satisfy

$$f_x\delta x+f_y\delta y+f_z\delta z = 0.$$

That is to say we shall have

$$\frac{\mu L-\mu' L'}{f_x} = \frac{\mu M-\mu' M'}{f_y} = \frac{\mu N-\mu' N'}{f_z}$$

and each of these will be equal to

$$\frac{\mu(Lx+My+Nz)-\mu'(L'x+M'y+N'z)}{xf_x+yf_y+zf_z}.$$

Now, since f is homogeneous in a, x, y, z,

$$af_a+xf_x+yf_y+zf_z = 0,$$

and therefore

$$\frac{\mathcal{E}}{af_a} = \frac{\mu' L'-\mu L}{f_x} = \frac{\mu' M'-\mu M}{f_y} = \frac{\mu' N'-\mu N}{f_z}$$

Now f_a, f_x, f_y, f_z are four homogeneous functions of a, x, y, z, between which the three ratios of these variables may be eliminated, giving

$$\phi(f_a, f_x, f_y, f_z) = 0$$

where ϕ is a homogeneous function. It at once follows that $\mathcal{E}$ satisfies the equation

$$\phi(\mathcal{E}/a, \mathfrak{L}, \mathfrak{M}, \mathfrak{N}) = 0$$

where $\mathfrak{L}, \mathfrak{M}, \mathfrak{N}$ denote $\mu' L'-\mu L$, $\mu' M'-\mu M$, $\mu' N'-\mu N$ respectively. This equation expresses $\mathcal{E}$, the stationary path length between the planes (L, M, N) and (L', M', N'), in terms of their direction cosines, so that $\mathcal{E}$ is the eikonal.

Consider refraction at the paraboloid of revolution

$$y^2+z^2-4ax = 0.$$

Here

$$\frac{f_a}{-4x} = \frac{f_x}{-4a} = \frac{f_y}{2y} = \frac{f_z}{2z},$$

so that

$$f_y^2+f_z^2-f_a f_x = 0$$

and

$$\mathcal{E} = a\frac{\mathfrak{M}^2+\mathfrak{N}^2}{\mathfrak{L}}.$$

Again at the spherical surface

$$x^2+y^2+z^2-r^2 = 0$$

we have

$$\frac{f_x}{x} = \frac{f_y}{y} = \frac{f_z}{z} = \frac{f_r}{-r},$$

and therefore

$$f_x^2+f_y^2+f_z^2 = f_r^2$$

or

$$\mathcal{E} = \pm r(\mathfrak{L}^2+\mathfrak{M}^2+\mathfrak{N}^2)^{\frac{1}{2}}.$$

One root corresponds to the part of the surface which is convex, the other to the part which is concave, to the incident light.

By a similar process the equation of the refracting surface may be found when $\mathcal{E}$ is given as a homogeneous function of the first order in $\mathfrak{L}, \mathfrak{M}, \mathfrak{N}$. The equation of the eikonal for the sphere may be written

$$\mathcal{E} = r[\mu'^2+\mu^2-2b-2(\mu^2-2a)^{\frac{1}{2}}(\mu'^2-2c)^{\frac{1}{2}}] = r(\mu'\cos\phi'-\mu\cos\phi)$$

where ϕ and ϕ' are the angles of incidence and refraction. If then we write $\kappa = \dfrac{\mu'\cos\phi'-\mu\cos\phi}{r}$, we have $\mathcal{E} = r^2\kappa$, $\mathcal{E}\mathcal{E}_b = -r^2$ or the secondary focal lengths are μ/κ and μ'/κ respectively, where κ is called the secondary power. The equations

$$\kappa\mathcal{E}_a = \frac{\mu' L'}{\mu L}, \quad \kappa\mathcal{E}_c = \frac{\mu L}{\mu' L'}$$

merely mean that the refracting surface is the unit surface. Again

$$\mathcal{E}_b+2a\mathcal{E}_{ab}+b\mathcal{E}_{bb}+b\mathcal{E}_{ac}+2c\mathcal{E}_{bc} = -\frac{\cos\phi\cos\phi'}{LL'\kappa}$$

so that the primary power is $\kappa\sec\phi\sec\phi'$; also

$$\mathcal{E}_c-L'^2\{\mathcal{E}_c+2a\mathcal{E}_{bb}+2b\mathcal{E}_{bc}+2c\mathcal{E}_{cc}\} = \frac{\sin^2\phi}{\kappa},$$

the quantity on the left when multiplied by μ' being the distance between the primary and secondary principal foci in the image space, that is to say the astigmatism. It is worth noting that at the two principal foci the astigmatism is inversely as the refractive index.

When the incidence is normal both powers become equal to $\dfrac{\mu'-\mu}{r}$, an expression of importance because in a symmetrical instrument incidence is normal for paraxial rays, that is rays which lie close to the axis of symmetry. As the unit in which powers are expressed, the dioptrie or dioptre, the inverse of a metre, is universally employed. Thus a lens of power 5 dioptries (written 5D.) has a focal length of 20 cm. in air.

The Combination of Systems.—Having found the eikonal for the separate surfaces of the instrument it is now necessary to find those for the combination. The process involved may be illustrated by combining two systems. Let O_0, O_1 and O_2 in media of refractive indices μ_0, μ_1 and μ_2 be the reference points on the axis, $\mathcal{E}_1$ the eikonal for the first portion between planes through O_0 and O_1, $\mathcal{E}_2$ that for the second part between planes through O_1 and O_2, and $\mathcal{E}_{12}$ that for the whole. From the definitions of the eikonal it follows that $\mathcal{E}_{12} = \mathcal{E}_1+\mathcal{E}_2$. Moreover

$$-\frac{\partial\mathcal{E}_1}{\partial M_1} = \mu_1 y_1 = \frac{\partial\mathcal{E}_2}{\partial M_1}, \text{ or } \frac{\partial}{\partial M_1}(\mathcal{E}_1+\mathcal{E}_2) = 0$$

with a similar equation involving N_1. These two conditions enable M_1 and N_1 to be eliminated from $\mathcal{E}_1+\mathcal{E}_2$, leaving $\mathcal{E}_{12}$ expressed in terms of the external variables only.

Paraxial Laws.—From the formulae reached in a previous section we see that the refraction of paraxial rays is determined by the part of $\mathcal{E}$ which is linear in a, b and c. Let us put

$$\mathcal{E} = \text{const.}+\alpha a+\beta b+\gamma c+\cdots;$$

then the conditions from which M_1 and N_1 are to be found are

$$\mu_0 M_0\beta_1+\mu_1 M_1\gamma_1+\mu_1 M_1\alpha_2+\mu_2 M_2\beta_2 = 0,$$
$$\mu_0 N_0\beta_1+\mu_1 N_1\gamma_1+\mu_1 N_1\alpha_2+\mu_2 N_2\beta_2 = 0.$$

Squaring and adding we find for the combination

$$\mathcal{E} = \text{constant}+\alpha_1 a-\frac{\beta_1^2 a+\beta_1\beta_2 b+\beta_2^2 c}{\gamma_1+\alpha_2}+\gamma_2 c+\cdots.$$

This expression shows that if we put

$$\alpha = \frac{A}{B}, \ \beta = -\frac{1}{B}, \ \gamma = \frac{C}{B}, \ AC-BD = 1$$

the paraxial constants of the compound instrument are given by the matrix law

$$\begin{pmatrix} A_{12} & D_{12} \\ B_{12} & C_{12} \end{pmatrix} = \begin{pmatrix} A_1 & D_1 \\ B_1 & C_1 \end{pmatrix}\begin{pmatrix} A_2 & D_2 \\ B_2 & C_2 \end{pmatrix},$$

the extension of which to any number of systems is simple. It is an easy matter to show that the equations for the points in which a ray meets the reference planes are given by

$$\begin{pmatrix} A & 1 \\ 1 & C \end{pmatrix}\begin{pmatrix} \mu M & \mu N \\ -\mu' M' & -\mu' N' \end{pmatrix} = B\begin{pmatrix} y & z \\ y' & z' \end{pmatrix},$$

the converse relation by

$$\begin{pmatrix} A & 1 \\ 1 & C \end{pmatrix}\begin{pmatrix} -y' & -z' \\ y & z \end{pmatrix} = D\begin{pmatrix} \mu'M' & \mu'N' \\ \mu M & \mu N \end{pmatrix},$$

and the relation between axial conjugate points by

$$(\mu\ x)\ \begin{pmatrix} A & D \\ B & C \end{pmatrix}\begin{pmatrix} x' \\ -\mu' \end{pmatrix} = 0.$$

If the system consists of a series of spherical refracting surfaces of powers $\kappa_1, \kappa_2, \kappa_3, \cdots$ and separations $\mu_1\tau_1, \mu_2\tau_2, \cdots$ between their vertices, the constants are calculated from the product

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \kappa_1 & 1 \end{pmatrix}\begin{pmatrix} 1 & -\tau_1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \kappa_2 & 1 \end{pmatrix}\begin{pmatrix} 1 & -\tau_2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \kappa_3 & 1 \end{pmatrix}\cdots.$$

where the reference points are at the points of intersection of the axis with the extreme surfaces and, for any surface separating media of refractive indices μ and μ', $\kappa = R(\mu'-\mu)$, R being the curvature of the surface at the vertex, considered positive if its convex side is presented to the incident light. In the special case in which all the refracting surfaces cross the axis at the same point this product reduces to the simple form

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \kappa_1+\kappa_2+\kappa_3+\cdots & 1 \end{pmatrix}.$$

Systems in which the overall axial depth is negligible are termed "thin." They are of much importance in the preliminary development of instruments owing to the simplicity of all formulae relating to thin systems and to the accident that it is nearly always the aim of the designer of optical systems to use no greater amount of glass, quartz or other transparent solid than is necessary.

Chromatic Aberrations.—We have hitherto regarded the refractive index as a property of the medium only. Optical instruments in general are used for the control of light of various wave-lengths, and as the nature of the light is changed the refractive index of the medium alters. It follows that A, B, C, D are liable to vary as the colour of the light changes and the position and size of the image of a given object likewise vary. Most instruments would not be of much value unless these variations could be reduced to very small amounts. We will determine the conditions that must be satisfied for them to be eliminated. We shall assume that the two media external to the system are alike and are the standard medium to which the value unity for the refractive index is conventionally ascribed for all wave-lengths.

The matrix for refraction at a single surface is

$$\begin{pmatrix} 1 & 0 \\ R(\mu'-\mu) & 1 \end{pmatrix},$$

and this may be replaced by the product

$$\begin{pmatrix} 1 & 0 \\ R(1-\mu) & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ R(\mu'-1) & 1 \end{pmatrix}$$

corresponding to refraction from the medium of index μ into the standard medium followed immediately by refraction from the standard medium into that of index μ'. We may therefore consider the system as a combination of a series of bodies, each bounded by two refracting surfaces, immersed in the standard medium. We call each of these elementary bodies a simple lens, and it is convenient to regard such lenses rather than the separate surfaces as the elements from which the instrument is built. The matrix for the instrument now takes the form

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix} = \begin{pmatrix} A_1 & D_1 \\ B_1 & C_1 \end{pmatrix}\begin{pmatrix} 1 & -s_1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} A_2 & D_2 \\ B_2 & C_2 \end{pmatrix}\begin{pmatrix} 1 & -s_2 \\ 0 & 1 \end{pmatrix}\cdots.$$

where s_1, s_2 are separations in the standard medium between the vertices of successive lenses, and thus do not vary as the constitution of the light changes. If in consequence of a change in the wave-length of the light the matrix for a typical lens becomes

$$\begin{pmatrix} A+\delta A & D+\delta D \\ B+\delta B & C+\delta C \end{pmatrix},$$

the changes in the coefficients for the entire instrument to a first approximation will be given by

$$\begin{pmatrix} \delta A & \delta D \\ \delta B & \delta C \end{pmatrix} = \sum(P)\begin{pmatrix} \delta A_k & \delta D_k \\ \delta B_k & \delta C_k \end{pmatrix}(P')$$

where (P) and (P') denote the products of the matrices respectively preceding and following those of the lens κ in the matrix product for the entire system, and the summation extends to all the lenses.

Now $$\begin{pmatrix} A & D \\ B & C \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \frac{C-1}{D} & 1 \end{pmatrix}\begin{pmatrix} 1 & D \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \frac{A-1}{D} & 1 \end{pmatrix},$$

and thus $\frac{C-1}{D} = R(\mu-1)$, $\frac{A-1}{D} = R'(1-\mu)$, $D = -t/\mu$ where R, R', t are the curvatures of the two surfaces and the axial thickness of the single lens. It follows that for light of a different colour for which the refractive index is $\mu+(\mu-1)/\nu$, where ν is a quantity regularly given by glass makers, the increments in A, C, D are given to the first order by

$$\delta\frac{A-1}{D} = \frac{A-1}{D\nu}, \quad \delta\frac{C-1}{D} = \frac{C-1}{D\nu}, \quad \delta D = -D\frac{\mu-1}{\mu\nu},$$

so that $\delta A = \frac{A-1}{\mu\nu}$, $\delta C = \frac{C-1}{\mu\nu}$, $\delta B = \frac{B}{\nu} + \frac{(A-1)(C-1)}{\mu\nu D}$,

that is to say the increment in the matrix is

$$\frac{1}{\nu}\begin{pmatrix} 0 & -D \\ B & 0 \end{pmatrix} + \frac{1}{\mu\nu}\begin{pmatrix} A-1 & D \\ \frac{(A-1)(C-1)}{D} & C-1 \end{pmatrix}.$$

When the thickness of the component is negligible only the first of these matrices is of consequence, and the only alteration is due to a proportional change in B. If all the components are thin lenses in contact, the properties of the system, so far as the paraxial terms are concerned, will be the same for light of the two wave-lengths if $\Sigma\frac{B}{\nu} = 0$. In particular for a system of two thin lenses in contact we have

$$\frac{B_1}{\nu_1} = -\frac{B_2}{\nu_2} = \frac{B_{12}}{\nu_1-\nu_2}$$

as the sole condition for achromatism. In the more general case the expressions most frequently employed are that given for δB and

$$\delta\left(\frac{A}{B}\right) = -\frac{1}{\nu}\left\{A - \frac{(A-1)^2}{\mu DB^2}\right\}, \quad \delta\left(\frac{C}{B}\right) = -\frac{1}{\nu}\left\{C - \frac{(C-1)^2}{\mu DB^2}\right\}.$$

Alternatively we may divide the complete expression into the three parts

$$\frac{1}{\nu}\begin{pmatrix} 0 & -D \\ B & 0 \end{pmatrix} + \frac{1}{\mu\nu}\begin{pmatrix} A & D \\ B & C \end{pmatrix} - \frac{1}{\mu\nu}\begin{pmatrix} 1 & 0 \\ \frac{A+C-2}{D} & 1 \end{pmatrix}$$

where the first indicates a proportional increment in the power of the element and a decrement in its effective thickness, the second a proportional change in all constants of the complete system, and the last the subtraction of the change in these constants which would arise if the separation between the surfaces of the component were annihilated without any change in the curvatures of its surfaces. In actual calculations it is probably more convenient to replace the $-D$ in the first part by 0 and the 0 in the last part by $-t$.

In a large number of instruments having a small field of view the only condition to which close attention is paid is the coincidence of the principal focal planes for different colours corresponding to $\delta\left(\frac{C}{B}\right) = 0$. When the field is large the condition $\delta B = 0$ has to be closely satisfied also. In the older eyepieces consisting of two separated simple thin lenses (those nearest the objective and the eye being respectively named the field lens and the eye lens), no other chromatic condition was imposed on this part of the instrument. This leads to the definite value

$$\left(\frac{\nu_1}{\kappa_1} + \frac{\nu_2}{\kappa_2}\right) \Big/ (\nu_1+\nu_2)$$

for the axial separation of the two lenses, and when both lenses are made from the same kind of glass the old rule that the separation should equal the mean of the focal lengths of the two lenses follows. Modern eyepieces have to cover larger fields than are suited to the older forms, and either the field lens, or the eye lens, or both are compound. Attention to all three conditions is comparatively rare, and is only of importance when good correction is desired in widely separated image planes. If the system is symmetrical end for end, $A=C$, and the three conditions fall to two. Since

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix}\begin{pmatrix} C & \frac{D}{p} \\ pB & A \end{pmatrix}=\begin{pmatrix} AC+pBD & \left(1+\frac{1}{p}\right)AD \\ (1+p)BC & AC+\frac{1}{p}BD \end{pmatrix},$$

a complete system made from two similar components, not necessarily of equal focal length, with corresponding parts next to one another, will be achromatised if A/B and D/C remain unaltered as the colour changes, that is to say the separate components, must be corrected for the position in which light parallel to the axis between the components comes to a focus, and for the image of the centre of symmetry.

The discussion of the conditions which should be satisfied when the rays considered do not lie close to the axis does not differ in any essential feature from that just given.

Aberrations for Homogeneous Radiation.—We have seen earlier that a plane image of a plane object will only be secured when $\mathcal{E}$ is expressible as a function of $(\mu M-G\mu' M')$ and $(\mu N-G\mu' N')$ only, where G is the transverse magnification. In general other terms occur, and the characteristic effects due to them are called aberrations. The quadratic terms in $\mathcal{E}$ may be written in the form

$$-\tfrac{1}{2}[\sigma_0 A^2-2\sigma_1 AB+\sigma_2 B^2+2\left(\sigma_2+\frac{\omega}{\kappa}\right)AC-2\sigma_3 BC+\sigma_4 C^2]$$

where A, B, C denote the quantities previously defined and the σ's are known as the aberrational coefficients; σ_1 is the coefficient for distortion, σ_2 for astigmatism, ω for curvature of the field, σ_3 for coma, and σ_4 for central aberration. Central aberration is so named because the other aberrations disappear on the axis of the system. It must not be supposed that central aberration is not present over the whole field. The significance of these terms will be more fully appreciated if we note that the co-ordinates (Y, Z) of an image point when aberrations are absent are given by

$$Y\kappa=\mu M-G\mu' M',\ Z\kappa=\mu N-G\mu' N'.$$

If then (η, ζ) is the point in which the plane of the stop is met we may substitute

$$A=\frac{(Y^2+Z^2)\kappa^2}{2(S-G)^2},\ B=\frac{(Y\eta+Z\zeta)\kappa^2}{(S-G)^2},\ C=\frac{(\eta^2+\zeta^2)\kappa^2}{2(S-G)^2}$$

in either the expression for $\mathcal{E}$ or in

$$y'-Y=\frac{1}{(S-G)}(Y\mathcal{E}_B+\eta\mathcal{E}_C),\ z'-Z=\frac{1}{S-G}(Z\mathcal{E}_B+\zeta\mathcal{E}_C).$$

From the latter we see that a finite value of σ_1 implies only a fixed displacement of the image point from its ideal position, so that object and image are not geometrically similar; hence the description of this aberration as distortion. At the displaced image point there is no difference of phase. By writing

$$(Y^2+Z^2)\ (\eta^2+\zeta^2)=(Y\eta+Z\zeta)^2+(Y\zeta-Z\eta)^2$$

we see that the terms in B^2 and AC may be analysed into two components, for one of which the point of intersection with the stop lies in the same axial plane as the object point, and for the other in a perpendicular axial plane. It is easy to show that either of these divergences may be removed for a given object point by moving the image plane along the axis. The terms in fact denote that the primary and secondary image surfaces are curved, the curvatures at the axis being $3\kappa^2\sigma_2+\kappa\omega$ and $\kappa^2\sigma_2+\kappa\omega$ respectively. The common part $\kappa\omega$, which depends only on the Airy-Petzval sum, is known technically as the curvature. A finite value of σ_2 implies that the primary and secondary image surfaces differ in curvature, so that σ_2 measures their separation, *i.e.*, the astigmatism. The coma, which has σ_3 for its coefficient, differs from the others in that $y'-Y$ and $z'-Z$ change in sign with η and ζ. The geometrical trace of the rays is therefore unsymmetrical and the phase variation is also unsymmetrical. No change of focus will remove this defect, but the want of symmetry may be removed, for small apertures, by choosing a proper position for the stop. Such a change however also affects the aberrations we have already mentioned. It may easily be shown that the rays from any object point which pass through one half of a circular zone of the stop concentric with the axis, meet the image plane in a complete circle, touching two straight lines, making an angle of 60° with one another, which meet in the image point for light which has passed through the centre of the stop. The primary focus for rays in the axial plane is three times as far as the secondary focus from the ideal image point. The central aberration measured by σ_4 is symmetrical, the rays through concentric circular zones of the stop meeting the image surface in concentric circular zones of radii proportional to the cube of the radii of the former. The aberration implies that each zone has a separate surface on which the image is formed, owing to want of agreement of phase. The primary foci for light from a point on the axis lie on a semi-cubical paraboloid with the axis of the system for its axis of revolution; the axis itself is the locus of the secondary foci. The former are three times as far as the latter from the paraxial image plane. The coefficient σ_0, with a correction added, is the quantity which corresponds to σ_4 when the reference plane is moved to another position. It is interpreted as the central aberration at the middle of the stop.

We can obtain the addition laws very simply for these aberrations by noting that, since all the paraxial terms when eikonals are added are completely accounted for by substituting for the intermediate direction cosines expressions linear in the external direction cosines, we have only to make the same substitutions for A, B, C in these aberrational terms. The expressions obtained in this way are

$$(\sigma_p)_{1,n}=\Sigma(\sigma_p)_\kappa S_\kappa^{4-p} G_\kappa^p,\ (p=0, 1, 2, 3, 4),$$

where the component parts are n in number, of which κ is a typical member, and S_κ, G_κ are the magnifications which the images of the stop and of the object formed by lens κ undergo in the subsequent parts of the system. The quantity $\frac{\omega}{\kappa}$, where κ is the power of the system, is transformed according to the same law as σ_2, and in this case we are led to an expression which is well known on account of its simplicity. This is the so-called Petzval sum

$$(\omega\kappa)_{1,n}=\Sigma(\omega\kappa)_\kappa$$

where $\omega_\kappa=\frac{1}{\mu_\kappa\mu'_\kappa}$. A more correct name would be the Airy sum, using the name of its first discoverer.

If $\mathcal{E}$ and $\mathcal{E}'$ are the eikonals for the same system when the reference points correspond to two different magnifications G and G', we have

$$\mathcal{E}-\frac{\mu^2 L}{\kappa G}-\frac{\mu'^2 L' G}{\kappa}=\mathcal{E}'-\frac{\mu^2 L}{\kappa G'}-\frac{\mu'^2 L' G'}{\kappa},$$

and if A', B', C' are the effective variables in the latter expression corresponding to the A, B, C of the former, we obtain a linear transformation from the one system to the other, and the aberrational coefficients for any positions of the object and stop can be expressed in terms of those for standard positions. By paying special attention to the factor $4AC-B^2$ which can be separated in a large number of terms, we are enabled to classify the aberrations generally by order and by series, the latter classification deriving its importance from the fact that though the conditions for the disappearance of any given aberration depend on the magnification, the disappearance of all the aberrations of a given order and series for a given pair of object and stop positions involves their disappearance for all positions. To this rule there is only one exception—that of the zero series, comprised of terms

which do not contain $4AC-B^2$ as a factor. In the quadratic terms just considered we may write the terms in B^2 and AC in the form

$$-\frac{1}{6}\left(3\sigma_2+\frac{\omega}{\kappa}\right)(B^2+2AC)-\frac{\omega}{6\kappa}(4AC-B^2)$$

showing that the term involving ω belongs to series 1.

It is no less advantageous when considering aberrations than when dealing with the paraxial constants to take the simple lens rather than the single surface as the effective unit. We proceed to find expressions for the aberrational coefficients of a simple thin lens, taking as the standard conditions the stop in the unit surface and the object in the surface for magnification -1. This choice offers many advantages due to symmetry. If object and image space are interchanged the coefficients with an even suffix are unaltered and those with an odd suffix merely changed in sign.

If the origins are taken at the vertex of a single surface system of power κ_1,

$$\mathcal{E}_1=\frac{\mu_1-\mu_0}{2\kappa_1}\left[\frac{\mathcal{M}_1^2+\mathcal{N}_1^2}{\mathcal{L}_1}-\frac{\epsilon_1(\mathcal{M}_1^2+\mathcal{N}_1^2)^2}{2\mathcal{L}_1^3}+\dots\right].$$

Adding a similar expression, the condition, $\frac{\partial}{\partial M_1}(\mathcal{E}_1+\mathcal{E}_2)=0$ gives $\mu_1M_1\kappa=\mu_0M_0\kappa_2+\mu_2M_2\kappa_1$, where $\kappa=\kappa_1+\kappa_2$.

Hence $$\mu_1M_1=\frac{\mu_0M_0+\mu_2M_2}{2}-\frac{\kappa_1-\kappa_2}{\kappa}\left(\frac{\mu_0M_0-\mu_2M_2}{2}\right),$$

$$\frac{\mathcal{M}_1}{\kappa_1}=\frac{\mathcal{M}_2}{\kappa_2}=-\frac{\mu_0M_0-\mu_2M_2}{\kappa}.$$

To secure reference points at the negative unit surfaces we have to add $2(\mu_2^3L_2+\mu_0^3L_0)/\kappa$ to $\mathcal{E}$. Write 1, μ, 1 for μ_0, μ_1, μ_2 and put $\kappa_1-\kappa_2=2(\mu-1)\rho\kappa$ so that $\rho\kappa$ is the common addition made to the curvature of both surfaces to derive its shape from the symmetrical form. Then on expansion we find

$$\mathcal{E}_\kappa=4-4A-2A^2-2B^2-4(1+\omega)AC-8\rho(1+\omega)BC$$
$$-2\left[\frac{1}{(1-\omega)^2}+4\rho^2(1+2\omega)+(\epsilon_1+\epsilon_2-1)\left\{\frac{1}{(\mu-1)^2}+12\rho^2\right\}\right.$$
$$\left.+(\epsilon_1-\epsilon_2)2\rho\left\{\frac{3}{\mu-1}+4\rho^2(\mu-1)\right\}\right]C^2+\dots$$

where $\omega=1/\mu$. If the surfaces are spherical $\epsilon_1=\epsilon_2=\frac{1}{2}$ and the last two terms disappear from the coefficient of C^2. If they are paraboloidal $\epsilon_1=\epsilon_2=0$ and the coefficient of C^2 becomes

$$-2\left[\frac{1+\omega}{1-\omega}-8\rho^2(1-\omega)\right].$$

Since the refracting surfaces are in contact the coefficient of A^2 must correspond to the absence of stop aberration. The absence of a term in AB indicates that there is no distortion. The coefficients which determine the curvature and astigmatism are not under control. The coma may be removed by giving the lens a symmetrical form—that is by making $\rho=0$. The central aberration can then only be controlled by giving the surfaces a suitable shape—viz., by making $\epsilon_1=\epsilon_2=-\frac{1}{2}(\mu^2-1)$. This fixes the eccentricity of the osculating ellipsoids.

Let us write 4β for the coefficient BC and -2γ for that of C^2. Then with the stop magnification S and the object magnification G, after moving the origins and introducing the appropriate changes in A, B, C, we find the following expression, most of the coefficients in which were first obtained by Airy.

$$\mathcal{E}_\kappa=-\frac{(1-G)^2}{G}+\frac{(S-G)^2}{G}A-\frac{(S-G)(S^2-G)}{2G}A^2\dots$$
$$-\tfrac{1}{8}[\gamma-4\mathcal{S}\beta+\mathcal{S}^2(3+2\omega)](1-S)^4A^2$$
$$+\tfrac{1}{2}[\gamma-(3\mathcal{S}+\mathcal{G})\beta+3\mathcal{S}^2+\mathcal{S}(\mathcal{S}+\mathcal{G})\omega](1-S)^3(1-G)AB$$
$$-\tfrac{1}{8}[\gamma-2(\mathcal{S}+\mathcal{G})\beta+\mathcal{S}(\mathcal{S}+2\mathcal{G})$$
$$+\tfrac{1}{2}(\mathcal{S}^2+4\mathcal{S}\mathcal{G}+\mathcal{G}^2)\omega](1-S)^2(1-G)^2(2AC+B^2)$$
$$-\frac{\omega}{12}(S-G)^2(4AC-B^2)$$
$$+\tfrac{1}{2}[\gamma-(\mathcal{S}+3\mathcal{G})\beta+\mathcal{G}(2\mathcal{S}+\mathcal{G})+\mathcal{G}(\mathcal{S}+\mathcal{G})\omega](1-S)(1-G)^2BC$$
$$-\tfrac{1}{8}[\gamma-4\mathcal{G}\beta+\mathcal{G}^2(3+2\omega)](1-G)^4C^2$$

where $\mathcal{S}=\frac{1+S}{1-S}$, $\mathcal{G}=\frac{1+G}{1-G}$ and the terms in the first line correspond to the elimination of aberrations. We may now employ the addition formulae for these aberrational coefficients to obtain corresponding expressions for any number of thin lenses in contact. We then find that ω is the Airy-Petzval sum, and if $\rho\kappa$ is a common curvature addition made to all the surfaces from a standard form the preceding formulae apply without alteration except that β and γ take the forms

$$\beta=\beta_0+2\rho(1+\omega),\quad \gamma=\gamma_0+4\rho^2(1+2\omega).$$

These formulae are particularly advantageous in their application to lenses which are to be cemented together, so that the second surface of one lens has the same curvature as the first surface of the next succeeding lens. For example telescope objectives may be advantageously designed in this way, the conditions to be applied being $\sigma_3=\sigma_4=0$, that is $\beta=(2+\omega)\mathcal{G}$, $\gamma=(5+2\omega)\mathcal{G}^2$, where $\mathcal{G}=1$ for an infinitely distant object. The coma is eliminated by giving a suitable degree of "bending" to the lens as a whole, and the central aberration by the choice of suitable glasses, or by departing from the spherical form for the surfaces, or by distributing the lens powers suitably between three or more components. When there are only two component lenses the ratio of their powers is determined by the condition for the removal of the chromatic aberrations. For more complete information on these developments the reader is referred to numerous papers in the *Transactions of the Optical Society*.

When the lens is no longer thin expressions for the aberrations differing very slightly from those just given may be obtained by the same general procedure. As a rule it is unnecessary to repeat the calculations after such thicknesses as are necessary for the construction of an actual lens have been introduced, as it has been shown that over a wide range of constructions the aberrations of this order introduced by separating the surfaces are automatically compensated in the most advantageous way by the aberrations of the next higher order which become significant at the aperture the thickness is introduced to yield.

Formulae may be obtained for these higher order aberrations in a similar manner; the chief complication is due to the necessity for taking into account in the values of M_1 and N_1 terms depending on the lower order aberrations.

Main Types of Optical Instruments.—Optical instruments tend to assume one of a few forms. Telescopes are systems of very great or even infinite focal length; they may invariably be regarded as a combination of two systems of finite focal length placed with their inner principal focal surfaces nearly or exactly in coincidence. The one part, often of large absolute aperture and long focal length, usually conforms to the thin lens type and is corrected for coma and central aberration. In the other part, the eyepiece, attention is chiefly given to the curvature and astigmatism. Telescopes are essentially instruments for increasing the angle an object appears to subtend at an observer's eye, and in most of them the field of view is small. At the opposite extreme are microscopes, also divisible into objective and eyepiece, but the former is of short focal length and small absolute, but large numerical, aperture. In the higher powers (that is shorter focal lengths) the objectives tend to be very complex. As with telescopes the most important objective corrections are those for colour, central aberration and coma. The eyepiece is of simple construction. Only a small part of an object can be viewed at once. Camera lenses form a class in some respects intermediate between telescopes and microscopes. The field is large and the numerical aperture moderate. In general they are not separable into parts having distinct functions, and all aberrations must be considered. The use of lenses at appreciable axial separations is necessary for the attainment of satisfactory

corrections.

Ray Tracing.—The professional optical designer in evolving complex instruments finds it expedient to use formulae for the aberrational coefficients merely as a general qualitative or roughly quantitative guide to indicate the modifications he should make in a partially developed system to reduce as far as possible the remaining aberrations. The outstanding difficulty in the way of using algebraic expansions for the whole of his work is the uncertain value of the terms of the expansion he must neglect. As he aims at taking into consideration lengths as small as a quarter of a wave length or less, that is to say about one ten-thousandth of a millimetre, it will be appreciated that our knowledge of the higher order aberrations must be thorough before reliance can in general be placed on expansions. The method adopted by the designer is to trace step by step through the system a selected set of rays, and to infer from their positions in the image space the aberrations remaining in the system. For tracing these rays many methods have been devised, of which particulars may be obtained from practical treatises. They are usually entirely trigonometrical, and logarithmic tables are generally employed. The calculations for skew rays are necessarily much more troublesome than those for rays in an axial plane, and in practice skew rays are rarely computed. A method of computing rays in an axial plane, suitable for use with a calculating machine, is as follows.

The incident ray is defined by b, the length of the perpendicular to the ray from the vertex of the surface, and $\sin\psi$, where ψ is the angle between the ray and the axis. The refractive index is denoted by μ, the angle of incidence by ϕ, the curvature of the surface by R, and the separation between the vertices of this and the next surface by t. The same letters, with accents where necessary, are used for the refracted ray, and with the suffix 1 for the following surface.

In the customary methods of calculation ψ_1 is found by the angular relation

$$\psi_1=\psi'=\psi-\phi+\phi'$$

which necessitates references to tables. In the present method the use of these tables is avoided by first finding an approximate value $\sin\theta$ for $\sin\psi'$ given by

$$\sin\theta=\sin\psi-\sin\phi+\sin\phi'.$$

In the absence of aberration this value is correct, and also $b'=b$. In general aberration is present and corrections of aberrational magnitude are required. The working equations are

$$\begin{aligned}
\sin\phi&=\sin\psi+Rb,\\
\sin\phi'&=\sin\phi\times\mu/\mu,\\
\sin\theta&=\sin\psi-\sin\phi+\sin\phi',\\
N&=b(\sin\phi-\sin\phi')(\sin\psi+\sin\phi'),\\
D&=\tfrac{1}{4}\{\sin^2\theta+(\cos\psi+\cos\phi+\cos\psi')^2-1\},\\
b'-b&=N/D,\\
\sin\psi'&=\sin\theta-R(b'-b),\\
b_1&=b'+t\sin\psi_1.
\end{aligned}$$

It is to be noted that $\frac{1}{2}N$ and $\frac{1}{2}N\mu\sin\phi$ are the linear first order coma and spherical aberration respectively for the single refraction, D is the ratio of twice the first order aberration to the total aberration, and

$$\frac{(b'-b)\mu\sin\phi}{\{(1+\cos\psi)(1+\cos\phi)(1+\cos\phi')(1+\cos\psi')\}^{\frac{1}{2}}},$$

which is represented at most refractions with ample accuracy by

$$\tfrac{1}{4}(b'-b)\mu\sin\phi,$$

is the difference in path between the route along the ray and that along the axis from their first to their second crossing point. Brief tables are used for finding D.

Graphical methods of representing the state of correction of the system are widely used. For example the central aberrations may be shown by taking as ordinate the distance from the axis at which a ray crosses the unit surface and as abscissa the distance of its intersection with the axis from a suitable fixed point. The type of curve thus secured is widely used. The paraxial portion of the curve touches the ordinate axis. A more useful curve is obtained by taking the square of the height at which the unit surface is crossed as ordinate. The inclination of this curve to the ordinate axis for rays near the axis depends on the lowest order central aberration, and the curvature gives higher order aberrations. Moreover if we draw through any point X on the abscissa axis a straight line parallel to the ordinate axis, the areas intercepted between this line and the curve measure the differences of path for light passing through the corresponding zones of the unit surface when the image point is at X. By choosing this ordinate so as to cut off alternately equal areas on opposite sides of the curve we can determine the point for which the differences of phase will be least. Corresponding to each geometrical figure a second curve may be drawn with the same ordinates, and the phase at a given image point as abscissa. When only first order aberration is present the geometrical figure is an inclined straight line, the phase curve is a parabola, and the best focus will be at the mid-point of the projection of the straight line on the abscissa axis. This result is at variance with the geometrical prediction that the best position of focus is three times as far from the position where the paraxial rays come to a focus as from the intersection of a marginal ray with the axis.

Aplanatic Surfaces.—Although some lenses designed in the last few years show marked improvements on any that were produced before the World War, no system has yet been evolved which yields over a wide surface an image entirely free from aberration. Points imaged without differences of phase for monorythmic (often called monochromatic) light have long been named aplanatic points. A more restricted interpretation of the term, now universally adopted, was introduced by Abbe, the change involving the absence of aberrations when the object point makes small excursions in a definite surface. Connected aggregates of object and image points each having this property form a pair of aplanatic surfaces. Until recently our knowledge of the conditions under which such perfect imagery is possible were very limited—they amounted to hardly more than the plane mirror reflection, in which the whole object space is imaged without aberration, the aplanatic spheres discovered by Thomas Young for refraction at a sphere, and the trivial case of any single surface at which refraction occurs. A more general result is obtained by noting that if $\mathcal{E}$ is given explicitly as a function of the direction cosines (L, M, N) and (L', M', N'), the points

$$\left(\frac{\partial\mathcal{E}}{\mu\partial L},\ \frac{\partial\mathcal{E}}{\mu\partial M},\ \frac{\partial\mathcal{E}}{\mu\partial N}\right)\text{ and }\left(-\frac{\partial\mathcal{E}}{\mu'\partial L'},\ -\frac{\partial\mathcal{E}}{\mu'\partial M'},\ -\frac{\partial\mathcal{E}}{\mu'\partial N'}\right)$$

are on the incident and emergent rays respectively. Let us now suppose that $\mathcal{E}$ is a homogeneous function of the first order of three variables α, β, γ, each of which is a linear function of the six direction cosines, so that

$$\alpha=\alpha_0+\alpha_1\mu L+\alpha_2\mu M+\alpha_3\mu N-\alpha_4\mu'L'-\alpha_5\mu'M'-\alpha_6\mu'N'$$

where $\alpha_0, \alpha_1, \cdots$ are constants, with corresponding expressions for β and γ. Then

$$x=\alpha_1\mathcal{E}_\alpha+\beta_1\mathcal{E}_\beta+\gamma_1\mathcal{E}_\gamma,\quad x'=\alpha_4\mathcal{E}_\alpha+\beta_4\mathcal{E}_\beta+\gamma_4\mathcal{E}_\gamma$$

with similar equations for y, y' and z, z'. It follows that $\mathcal{E}_\alpha, \mathcal{E}_\beta, \mathcal{E}_\gamma$ can be found in terms of x, y, z, and thus definite values of x', y', z' obtained. That is to say we obtain a one-one correspondence between these points of the object and image spaces. They will be object and image points if the length of the optical path between them is constant. Now this path is

$$\mathcal{E}+\mu'(L'x'+M'y'+N'z')-\mu(Lx+My+Nz)$$

or substituting from the equations for x, y, z, x', y', z' the path length is

$$\mathcal{E}-(\alpha-\alpha_0)\mathcal{E}_\alpha-(\beta-\beta_0)\mathcal{E}_\beta-(\gamma-\gamma_0)\mathcal{E}_\gamma;$$

that is, since $\mathcal{E}$ is homogeneous of the first order in α, β, γ, the path is

$$\alpha_0\mathcal{E}_\alpha+\beta_0\mathcal{E}_\beta+\gamma_0\mathcal{E}_\gamma$$

which depends only on the object point (x, y, z). There is thus no aberration in the image of this point. Moreover the aggregate of these object points forms a surface. For $\mathcal{E}$ satisfies a homogeneous relation of the form $\theta(\mathcal{E}, \alpha, \beta, \gamma)=0$, to which we can add three homogeneous equations

$$\frac{\theta_\alpha}{\mathcal{E}_\alpha}=\frac{\theta_\beta}{\mathcal{E}_\beta}=\frac{\theta_\gamma}{\mathcal{E}_\gamma}=-\epsilon_0.$$

On eliminating the ratios α, β and γ bear to $\mathcal{E}$ between these four equations we obtain a relation of the form $\phi(\mathcal{E}_\alpha, \mathcal{E}_\beta, \mathcal{E}_\gamma)=0$, and if $\mathcal{E}_\alpha, \mathcal{E}_\beta, \mathcal{E}_\gamma$ are replaced by their values in terms of x, y, z and of x', y', z' we obtain the equations of the object and image surfaces. From the linear character of α, β, γ it follows that the image surface can at most be a regular deformation of the object surface.

The converse process of constructing the eikonal which will yield given aplanatic surfaces can be carried out. It is merely a slight generalization of the process by which the eikonal was constructed for a given refracting surface.

In general a given optical system can have only one pair of aplanatic surfaces, for $\mathcal{E}$ can only be expressed in one way as a homogeneous function of the direction cosines. Spherically symmetrical systems are exceptional. For example if

$$\mathcal{E}=(\alpha^2+\beta^2+\gamma^2)^{\frac{1}{2}}$$

where $\alpha=pL+qL'$, $\beta=pM+qM'$, $\gamma=pN+qN'$,

we may, in consequence of the identities

$$L^2+M^2+N^2=1=L'^2+M'^2+N'^2,$$

rewrite the equation in the form $\mathcal{E}=(\alpha'^2+\beta'^2+\gamma'^2)^{\frac{1}{2}}$ where

$$\alpha'=qL+pL',\ \beta'=qM+pM',\ \gamma'=qN+pN'.$$

Corresponding to the first form we have the conjugate surfaces

$$\mu^2(x^2+y^2+z^2)=p^2,\ \mu'^2(x'^2+y'^2+z'^2)=q^2,$$

and corresponding to the second the pair

$$\mu^2(x^2+y^2+z^2)=q^2,\ \mu'^2(x'^2+y'^2+z'^2)=p^2.$$

Thus with a sphere, since its surface is self-conjugate, we may put $p=\mu r$, $q=\mu' r$, and the alternative solution shows that the concentric spheres of radii $r\mu'/\mu$ and $r\mu/\mu'$ are respectively aplanatic conjugate object and image surfaces.

Asymmetrical Systems.—We have discussed at some length the properties of symmetrical lens systems because they form by far the most important section of geometrical optics. The expressions that have been given enable all the ordinary problems to be dealt with—for example the paraxial expressions are sufficiently accurate to determine how large any simple lens must be to pass the rays the instrument should transmit. It is also a simple matter to derive a number of well-known conclusions from the general laws that have been given—for example that the use of an optical instrument will not enable a brighter image of an object subtending an appreciable angle to be formed on the retina of an observer's eye. The reader is not likely to encounter any difficulty arising from the use of prisms inserted for the reflection of light at plane surfaces into the system, for they are equivalent to the insertion of a thick plate of glass with plane parallel faces. Methods of designing prisms to produce desired results cannot be considered in detail here. As a rule a trigonometrical procedure is adopted, but algebraic methods employing matrices appear to offer decided advantages.

There remain systems of much importance without axial symmetry. The theory of such systems, though not difficult, is much more involved than that of axially symmetrical systems. Taking systems in which all the surfaces are met normally by some straight line, and yield symmetrical sections when cut by any plane through this line, which may be called the axis, we find that in place of the second degree matrix for the axially symmetrical system we have to adopt a square matrix of the fourth degree, with sixteen constituent elements. Between these sixteen quantities six independent identities subsist, so that at most there are ten degrees of freedom for paraxial rays. For an account of these quantities, their connections with the positions of the rays and with various expressions giving the lengths of paths through the system, reference should be made to the *Transactions of the Optical Society*. When we proceed to higher order terms representing aberrations the complexity of the theory is enhanced. For example corresponding to the six coefficients for the lowest order monorythmic aberrations in axially symmetric systems we have in these unsymmetrical systems no less than thirty-five coefficients.

Experimental Methods.—The marked changes in the way optical instruments have come to be regarded in recent years is reflected in experimental applications of the theory. A good example is afforded by the use of modified types of Michelson interferometers for the testing of optical instruments. This application of interference is due to F. Twyman. An instrument of this type, equipped for varied work, has been constructed by Messrs. Adam Hilger, Ltd., for the National Physical Laboratory, at Teddington, England. Many other interference methods have recently been described. Space will not permit us to discuss many interesting points which arise in the use of these and other methods of investigating the properties of optical instruments experimentally. (*See* LENS.)

BIBLIOGRAPHY.—Nearly all authorities deal with the geometrical theory only, and some are chiefly of value on account of miscellaneous articles.

See for historical interest mainly: H. Coddington, *Treatise on the Reflexion and Refraction of Light;* W. R. Hamilton, "Theory of Systems of Rays" (4 papers from the *Proceedings of the Royal Irish Academy* which serve as a starting point for modern work); R. Smith, *Compleat System of Opticks.*

More modern works are: S. Czapski and O. Eppenstein, *Grundzüge der Theorie der optischen Instrumente;* H. Geiger and K. Scheel, *Handbuch der Physik; XVIII. H. Konen, Geometrische Optik;* R. T. Glazebrook, *Dictionary of Applied Physics; IV. Optics;* R. S. Heath, *Geometrical Optics;* R. A. Herman, *Geometrical Optics;* M. von Rohr (trans. R. Kanthack), *Formation of Images in Optical Instruments;* J. P. C. Southall, *Principles and Methods of Geometrical Optics;* Steinheil and Voit (trans. J. W. French), *Applied Optics;* G. C. Steward: *The Symmetrical Optical System* (Tract); H. D. Taylor, *A System of Applied Optics.*

For the physical principles involved reference may be made to the optical papers of the late Lord Rayleigh. The writings of A. Gullstrand are important for the optics of spectacle lenses.

Most recent work has been described in journals devoted to optics, of which the chief are the *Transactions of the Optical Society, Revue d'Optique, Journal of the Optical Society of America,* and *Rivista d'Ottica.*

Valuable contributions will also be found in *Zeitschrift für Instrumentenkunde, Die Naturwissenschaften, Phil. Trans., Proceedings of the Physical Society,* and many others. An extensive bibliography is given by Czapski and Eppenstein. (T. SM.)

OPTIMISM, in philosophy, is the theory that the world is the best possible, or that life is worth living (to allude to the popular form of the problem). For a discussion of this question *see* MELIORISM; PESSIMISM; PLATO; LEIBNITZ; HEGEL; also J. Sully, *Pessimism* (1877).

OPTIMUM POPULATION. The origin of this term is not clear. Since the World War it has come into common use to indicate a conception of the relation between population and the produce of industry to which Prof. Edwin Cannan first gave clear expression. The optimum theory of population which is outlined in what follows was not held by Malthus or by the older authors who discussed the population problem. It was their failure to formulate this theory which robs their treatment of the matter of much of its value. This conception which lies at the basis of the position now taken by all authorities may be briefly expressed as follows. At any given time the population which can exist on a given extent of land, consistently with the attainment of the maximum return to industry possible at the time, is definite. In other words, for any given area of land under any given set of circumstances there is an optimum population. If population is at the optimum number the greatest return per head possible under the circumstances will be attained. Departure from the optimum, whether in the direction of deficiency or of excess, will be accom-

panied by a return per head less than the possible return. Departure in the direction of deficiency is called under-population and departure in the direction of excess is called over-population. It is important to realize that no distinction is to be drawn between agriculture and manufacture in relation to this matter. In Prof. Cannan's words "if we start from what I have called the point of maximum return, we can say of manufacture as well as of agriculture that returns diminish as we move in either direction from that point." It is therefore essential from the point of view of economic prosperity that the population of any country should approach as closely as possible to the optimum. Over and under-population alike imply a smaller income per head than could be attained with smaller and larger numbers respectively. Unfortunately attempts to ascertain whether under- or over-population exist meet with the utmost difficulties. Unemployment is not necessarily an indication of over-population and the comparison of figures for the national income over a period of years is an uncertain guide. It is not possible to say whether or not England or the United States are over- or under-populated. It is, however, generally held that parts of India and China are probably over-populated. It is in other words probably true that the inhabitants of these countries would be better off if the population was less dense. (*See* also POPULATION.)

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(A. M. C.-S.)

OPTION, the action of choosing, choice, or the opportunity of choosing. In ecclesiastical law "option" was the right claimed by an archbishop to select one benefice from the diocese of a newly-appointed bishop, the next presentation to which would fall to his, the archbishop's, patronage. This right was abolished in the early 19th century. For the stock exchange "option" see *infra* OPTIONS. "Local option" or "local veto" in politics is the power given to the electorate of a particular district to choose whether licences for the sale of intoxicating liquor shall be granted or not. (*See* LIQUOR LAWS.)

OPTIONS. Option dealing is practised much more extensively on the Continent of Europe than in Great Britain or America, but a fair amount of business of this description is carried out daily on the London and American Stock Exchanges. Option dealing is a complicated matter, and on this account is indulged in more by professional than amateur speculators. As the name implies, an option is a right over certain stocks, commodities or things. It may be the right to buy or the right to sell. In the former case it is termed a "call" option, *i.e.*, the holder of the option has the right to take up the shares or whatever it is; in the case of an option to sell, it is termed a "put" option, the holder having the right to sell the shares to the person with whom he has entered into the bargain constituting the option. It is possible to buy a "put and call" option, which gives the holder the right either to deliver and obtain for payment the stipulated quantity of stock at a date and price arranged when the bargain is entered into, or to call for delivery to him of the same amount of stock at the same price and at the same date.

The first column represents the price to be paid for an option running for one month—or to be more precise, to the last settling day of the month following the conclusion of the bargain; the second column is for an option running yet another month, whilst the third column represents the price asked for a three-months' option. The rules of the Stock Exchange do not permit of dealings in options which run for more than three months. The price stated is for either a call option or a put option, and the double option (put and call) can be purchased for double the price named. The first price in the above list of 1¼ means that for every £1·15·0. paid at the time the bargain was entered into, the Stock Exchange jobber would give the purchaser of a call option the right to buy of him for settlement on July 26 £100 of Great Western Ordinary stock at a given price, regardless of what the actual market quotation might be on that date. This given price would be approximately the price of the day on which the option bargain was entered into, plus perhaps a fractional increase to allow for the fact that by the time the option was exercised the dividend date would be much nearer. The holder of an option, when he comes to exercise it, is entitled to all dividends, bonuses, or subscription rights that may have accrued during the period of his option. In the case of a put option being required, the price would be the same.

The following is part of a typical list as published in the daily press of option prices quoted on the London Stock Exchange.

Call or put of	Settlements			Call or put of	Settlements		
	26th July	30th Aug.	27th Sept.		26th July	30th Aug.	27th Sept.
Home Rails							
Gt. Western	1¾	2¼	2⅝	Burmah	3/6	4/3	5/–
L.M.S.	1¾	2¼	2⅝	Lobitos	3/6	4/3	5/–
L.&N.E. Def.	1	1⅝	1¾	Mex. Eagle	2/6	3/–	3/6
Met. Dist.	1½	1¾	2¼	Ryl. Dutch	1¾	1⅞	2
Sthn. Def.	1⅝	1⅞	1⅞	Shells	3/	3/6	4/–
Foreign Rails				*Rubber*			
B.A.G.S.	1½	2	2½	Ang.-Dutch	1/6	2/–	2/6
Leopold'na	2	2½	3	Ang.-Java	–/6	/7½	/9
Miscellaneous				Lon Asiatic	–/7½	–/9	–/10½
				Malacca	4/–	5/–	6/–
Amer. Cel.	1¾	2⅛	2⅛	Malayalam	1/6	2/–	2/6
Bleachers	2/6	3/–	3/6	Rub. Trust	1/6	2/–	2/6
Brad. Dyers	2/6	3/–	3/6	*Mines*			
B.A.T.	3/6	4/–	4/6				
Brit. Celanese Ord.	⅜	⅜	⅞	African & European	1/4½	1/7½	1/10½
B.S.A.	–/10½	1/1½	1/3	Ang.-Amer.	1/6	1/9	2/–
Cal. Print	1/6	1/10½	2/3	Bw. M'Kub.	–/4½	–/6	–/7½
Coats	3/6	4/–	5/–	Chartered	1/6	1/9	2/–
Courtaulds	3/6	4/6	5/6	Cons. M. Rf.	1/–	1/3	1/6
Fine Cotton	3/3	3/9	4/3	Crown	1/9	2/3	2/9
Forestal Ld.	1/6	2/–	2/6	De Beers Def.	⅛	¼	½
French 5% Loan	1	1¼	1½	Gen. Mng.	1/9	2/3	2/9
Guest Keen	2/–	2/6	3/–	Gold Fields	4/–	5/–	6/–
Imp. Chem. Ord.	2/–	2/6	3/–	Johnnies	1/9	2/3	2/9
				Malyn. Tin	1/6	1/9	2/–
Imp. Tob.	3/–	3/6	4/–	Modder	2/6	3/–	3/6
Kreuger & Toll	1½	2	2½	Mozambique	1/9	2/3	2/9
				Randf. Est.	–/9	–/10½	1/–
Marconi	5/–	5/9	6/6	Rand Mns.	2/6	3/1½	3/6
Swedish Match	1½	2	2½	Rob. Dp. B	1/9	2/3	2/9
Oil				Selukwe	1/6	2/–	2/6
				S.A. Towns	–/10½	1/1½	1/3
Anglo-Persian	3/6	4/3	5/–	T'ngany'ka	3/–	4/–	5/–
Apex (Trin)	2/–	2/6	3/–	Union Crp.	¼	5/16	⅜
				W. Rand	–/10½	1/1½	1/3

Intricacies of Options.—Thus far it might appear as though the complications of option dealing had been exaggerated; but now we approach some of the intricacies of the business. To the uninitiated the purchase of a call option would appear to be a perfectly simple matter. The speculator buys on Jan. 1 an option entitling him to take up at the end of March settlement £10,000 of Great Western Railway Ordinary stock at, say, 100. He waits until the closing days of March and then if the price is 103 he sells in the market £10,000 of stock at that price, calls stock in respect of his option at 100 and delivers it in satisfaction of his sale, netting the difference as profit, less his brokerage charges. If during the period of his option the stock has fallen below par, he simply allows it to lapse, his loss being confined to the cost of the option.

That is how an option transaction appears to the layman. That is not, however, in the least the idea of the average purchaser of an option. What he desires is not to enter into a bet as to what the price will be on a certain date, but to be able to avail himself of market fluctuations during the life of his option. Suppose, in the case named, that a week after the option has been purchased the price rises to 103, the holder of the option cannot demand delivery of the stock before the expiry of the option, and if he sells a week after he has bought a three-months' option, he will be called upon *at the next settlement* to deliver the stock he has sold. That is, however, just the sort of position that the experienced option speculator desires. He sells at 103 for the next account, feeling that he is in the position of a "protected bear." When the settlement arrives he does not deliver, but has the

bargain carried over, and as the stock has risen there will probably be a number of investors for the rise who are desirous of not taking up the stock they have purchased, but wish to carry over their bargains, and have to pay interest for so doing. Our "protected bear," therefore, so far from having to pay for the privilege of not delivering the stock he has sold, receives payment for not doing so. If within the next few days or weeks Great Western Ordinary falls a point or more, he can repurchase the stock he has sold (close his "bear") and is in the position where he started, with part of his option still to run. In a fluctuating market this process might be repeated several times during the course of the option, making it possible for the holder to realize several profits from the variations in price.

All sorts of combinations of this nature are possible with options, and there are a few men in London, almost invariably foreigners, who have the reputation of being exceptionally clever in this class of dealing, and of making large profits out of it. The brokerage on options is exactly the same as if the actual stock were purchased.

Options as described above should not be confused with *Option Certificates* which are quoted in the ordinary sections of the Stock Exchange lists. A company will sometimes issue certificates conferring upon the holder the right to take up shares at a certain price within a certain period, and these option certificates are dealt in just as though they were shares. A case in point is that of Consolidated Diamond Mines of South West Africa which in the year 1925 induced holders of its 8% debenture stock to consent to a reduction in the rate of interest to 6½%, and as compensation gave them option certificates carrying the right up to Oct. 1, 1929 of obtaining at 20 shillings 100 fully-paid £1 shares for each £100 bond. Another instance is that of the Redeemable Securities Investment Trust which, in making an issue in 1928 of 6% preference shares, gave in respect of every two preference shares subscribed, one option entitling the holder to take up an ordinary £1 share at 22s. 6d., such right expiring Dec. 31, 1929. Both these option certificates are quoted on the London Stock Exchange and are dealt in just as though they were shares.

(A. E. Da.)

OPTOPHONE, an instrument invented by E. E. Fournier d'Albe in 1914 which enables the blind to read ordinary letterpress such as printed books or newspapers. The invention thus places within reach of the blind the entire range of world literature, while previously their only means of reading—by raised letter systems—necessitated special books, both bulky and expensive.

The instrument depends for its action upon the chemical element, selenium, the electrical conductivity of which varies greatly in accordance with the amount of light to which it is exposed. Such a light-sensitive selenium bridge is placed between two separate conducting lines of graphite resting on a porcelain tablet and the whole connected in series with an electric battery to a telephone receiver. A beam of light is rendered intermittent by the interposition of a revolving siren disc and is then concentrated into a small bright point on the letter to be read. This is reflected back onto the selenium bridge. As the selenium bridge is exposed to the forms of letters in the line traversed, its changes in conductivity produce a succession of varying notes and chords in the telephone receiver, each letter having its characteristic sound. That is its simple form. Actually in the regular instrument a row of five or six luminous points just filling up the size of the tallest letters to be read is substituted for a single point, and each point is given a different frequency by suitably perforating the disc. A blind reader does not analyze the resulting sounds, but soon comes to recognize the general sound of each letter and in time knows his alphabet of sounds. Later in his practice the succession of sounds which make up certain words becomes familiar. Controlling apparatus to regulate the speed and position of the tracer is designed with a view to ease of manipulation by blind persons. After 1920 developments in amplification enabled the sounds to be made audible to any number in a room if desired, though individual receivers were retained for silent reading. (*See* Selenium Cell.)

OPZOOMER, CORNELIUS WILLIAM (1821–1892), Dutch philosopher, was born in Rotterdam on Sept. 20, 1821. He studied at the University of Leyden, receiving the degree of doctor of law in 1845. In 1846 he was appointed professor of philosophy at the University of Utrecht, which position he held the remainder of his life. His specialty was jurisprudence and many of his numerous writings were in that field, notably *Scheiding van Kerk en Staat* (1875), in which he sustained the primacy of the civil power, and a commentary on the civil code of Holland (11 vols., 1864–87). His greatest influence, however, was in the field of philosophy. He was an empiricist of the positivistic type. His thought can best be traced in such of his writings as *Der Weg de Wetenschap* (1851), *Wetenschap en Wijsbegeerte* (1857), *Het Wezen der Kennis* (1863), *De Waarheid en hare Kenbronnen* (1863), *De Godsdienst* (1864), *Goethe's Godsdienst* (1868), and *Ein Nieuwe Kritick der Wijsbegeerte* (1871). He advocated expulsion of the unscientific from religion, believing that the latter would be left unimpaired, and that it would lead to the reconciliation of religion and science and bring about a new Reformation. Though vigorously opposed at first his views rapidly gained adherents and he became the leader of the liberals and the founder of modern theology in his country. He was also a widely read man of letters, translated the *Antigone* of Sophocles and the *Julius Caesar* of Shakespeare into Dutch, and published (1872) a volume of critical studies on the great English dramatist. He died in Osterbeck on Aug. 23, 1892.

ORACHE or **MOUNTAIN SPINACH,** known botanically as *Atriplex hortensis* (family, Chenopodiaceae), a tall-growing hardy annual, whose leaves, though coarsely flavoured, are very often used as a substitute for spinach, and to correct the acidity of sorrel. The white and the green are the most desirable varieties. The plant should be grown quickly in rich soil. It may be sown in rows 2 ft. apart, and about the same distance in the row, about March, and for succession again in June. If needful, water must be given freely, so as to maintain a rapid growth. A variety, *A. hortensis* var. *rubra,* commonly called red mountain spinach, is a hardy annual 3 to 4 ft. high with fine ornamental foliage.

ORACLE, a special place where a deity is supposed to give a response, by the mouth of an inspired priest, to the enquiries of his votaries, or the actual response. (Lat. *oraculum,* from *orare,* to speak; the corresponding Greek word is *μαντεῖον* or *χρηστήριον.*) (*See* Divination, Magic, Omens.) The whole question of oracles is bound up with that of magic. They are commonly found in the earlier stages of religious culture among different nations. But it is as an ancient Greek institution that they are most interesting historically.

A characteristic feature of Greek religion which distinguishes it from many other systems of advanced cult was the wide prevalence of a ritual of divination and the prominence of certain oracular centres which were supposed to give voice to the will of Providence. In the Greek world the methods of divination were of great variety, but nearly all can be traced among other communities, primitive and advanced, ancient and modern. The most obvious and useful classification of them is that of which Plato was the author, who distinguishes between (*a*) the "sane" form of divination and (*b*) the ecstatic, enthusiastic or "insane" form (Phaedrus p. 244). The first method appears to be cool and scientific, the diviner (*μάντις*) interpreting certain signs according to fixed principles of interpretation. The second is worked by the prophet, shaman or Pythoness, who is possessed and overpowered by the deity, and in temporary frenzy utters mystic speech under divine suggestion. To these we may add a third form (*c*) divination by communion with the spiritual world in dreams or through intercourse with the departed spirit: this resembles class (*a*) in that it does not necessarily involve ecstasy, and class (*b*) in that it assumes immediate *rapport* with some spiritual power.

We may subdivide the methods that fall under class (*a*) according as they deal with the phenomena of the animate or the inanimate world; although this distinction would not be relevant in the period of primitive animistic thought. The Homeric poems attest that auguries from the flight and actions of birds were

commonly observed in the earliest Hellenic period as they occasionally were in the later, but we have little evidence that this method was ever organized as it was at Rome into a regular system of state-divination, still less of state-craft. We can only quote the passage in the *Antigone* where Sophocles describes the method of Teiresias, who keeps an aviary where he studies and interprets the flight and the cries of the birds; it is probable that the poet was aware of some such practice actually in vogue. But normally the Greek augur drew omens from the cries or actions of some bird or beast casually met with (as Hom. *Il.* xiii. 521; Aesch. *Agam.* 109; Serv. Virg. *Aen.* iv. 377; Paus. ii. 19. 3); it is very rare to find such omens habitually consulted in any public system of divination sanctioned by the State. We hear of a shrine of Apollo at Sura in Lycia (Steph. Byz. *s.v.* Σοῦρα; Plutarch, *De sollert. anim.* p. 976 c; Ael. *Nat. anim.* xii. 1) where omens were taken from the movements of the sacred fish that were kept there in a tank; and again of a grove consecrated to this god in Epirus, where tame serpents were kept, and fed by a priestess, who could predict a good or bad harvest according as they ate heartily or came willingly to her or not (Ael. *Nat. anim.* xi. 2).

But the method of animal divination that was most in vogue was the inspection of the inward parts of the victim offered upon the altar, and the interpretation of certain marks found there according to a conventional code. A conspicuous example of an oracle organized on this principle was that of Zeus at Olympia, where soothsayers of the family of the Iamidae prophesied partly by the inspection of entrails, partly by the observation of certain signs in the skin when it was cut or burned (Schol. Pind. *Ol.* 6. 1 1 1). Another less familiar procedure that belongs to this subdivision is that which was known as divination διὰ κληωδόνν, which might sometimes have been the cries of birds, but in an oracle of Hermes at the Achaean city of Pharae were the casual utterances of men. Pausanias (VII. 22. 2) tells us how this was worked. The consultant came in the evening to the statue of Hermes in the market-place that stood by the side of a hearth-altar to which bronze lamps were attached; having kindled the lamps and put a piece of money on the altar, he whispered into the ear of the statue what he wished to know; he then departed, closing his ears with his hands, and whatever human speech he first heard after withdrawing his hands he took for a sign. The same custom seems to have prevailed at Thebes in a shrine of Apollo, and in the Olympian oracle of Zeus (Farnell, *Cults* iv. 221).

Of omens taken from what we call the inanimate world salient examples are those derived from trees and water. Both were in vogue at Dodona, where the ecstatic method of prophecy was never used; we hear of divination there from the bubbling stream, and still more often of the "talking oak"; under its branches may once have slept the Selloi, who interpreted the sounds of the boughs. (Hom. *Il.* xvi. 233, *Od.* xiv. 327; Hesiod, *ap.* Schol. Soph. *Trach.* 1169; Aesch. *Prom. Vinct,* 820). At Corope in Thessaly we hear vaguely of an Apolline divination by means of a branch of the tamarisk tree (Nicander, *Theriaka,* 612, Schol.), and there is a late record that at Daphne near Antioch oracles were obtained by dipping a laurel leaf or branch in a sacred stream (Robertson-Smith *Relig. Sem.* p. 128). We find water divination at Daphne, Taenarum and Patrae. Thunder magic, which was practised in Arcadia, is usually associated with thunder divination; but of this, which was so much in vogue in Etruria (*see* Haruspices) and at Rome, the evidence in Greece is singularly slight. Once a year watchers took their stand on the wall at Athens and waited till they saw the lightning flash from Harma, which was accepted as an auspicious omen for the setting out of the sacred procession to Apollo Pythius at Delphi; and the altar of Zeus Σημαλέος, the sender of omens, on Mount Parnes, may have been a religious observatory of meteorological phenomena (Paus. i. 32. 2). No doubt such a rare and portentous event as the fall of a meteor-stone would be regarded as ominous, and the State would be inclined to consult Delphi or Dodona as to its divine import.

We may conclude the examples of this main department of μαντική by mentioning a method that seems to have been much in vogue in the earlier times, that which was called ἡ διὰ ψήφων μαντική, or divination by the drawing or throwing of lots; these must have been objects, such as small pieces of wood or dice, with certain marks inscribed upon them, drawn casually or thrown down and interpreted according to a certain code. This was practised at Delphi and Dodona by the side of the more solemn procedure; we hear of it also in the oracle of Heracles at Bura in Achaea (Cic. *De div.* i. 76; Suid. *s. v.* πυδώ; Paus. vii. 25. 10). It is this method of "scraping" or "notching" (χράειν) signs on wood that explains probably the origin of the words χρησμός, χοῆσδαι, ἀναιρεῖν for oracular consultation and deliverance. In Italy, oracles by lot (*sortes*) are the only native kind of whose existence we are certain; that of *Fortuna* at Praeneste was the best known.

All these methods are world-wide, and may depend on belief in the *mana* of the bird, spring, lot, etc., or in the controlling influence of a spirit or god. And, again, if we are to understand the most primitive thought, we probably ought to conceive of it as regarding the omen not as a mere sign, but in some confused sense as a cause of that which is to happen. By sympathetic magic the flight of the bird, or the appearance of the entrails, is mysteriously connected, as cause with effect, with the event which is desired or dreaded. When of the three beasts over which three kings swore an oath of alliance, one died prematurely and was supposed thereby to portend the death of one of the kings (Plut. *Vit. Pyrrh.* c. 6), or when in the Lacedaemonian sacrifice the head of the victim mysteriously vanished, and this portended the death of their naval commander (Diod. Sic. xiii. 97), these omens would be merely signs of the future for the comparatively advanced Hellene; but we may discern at the back of this belief one more primitive still, that these things were somehow casually or sympathetically connected with the kindred events that followed.

The other branch of the mantic art, the ecstatic or inspired, has had the greater career among the peoples of the higher religions; it is no doubt of great antiquity, and it is found still existing at a rather low grade of savagery. Therefore it is unsafe to infer from Homer's silence about it that it only became prevalent in Greece in the post-Homeric period. It did not altogether supersede the simpler method of divination by omens; but being far more impressive and awe-inspiring, it was adopted by some of the chief Apolline oracles, though never by Dodona.

The most salient example of it is afforded by Delphi. In the historic period, and perhaps from the earliest times, a woman known as the Pythia was the organ of inspiration, and it was generally believed that she delivered her oracles under the direct afflatus of the god. The divine possession worked like an epileptic seizure, and was exhausting and might be dangerous; nor is there any reason to suppose that it was simulated. This communion with the divinity needed careful preparation. Originally, as it seems, virginity was a condition of the tenure of the office; for the virgin has been often supposed to be the purer vehicle for divine communication; but later the rule was established that a married woman over 50 years of age should be chosen, with the proviso that she should be attired as a maiden. As a preliminary to the divine possession, she appears to have chewed leaves of the sacred laurel, and then to have drunk water from the prophetic stream called Kassotis which flowed underground. But the culminating point of the afflatus was reached when she seated herself upon the tripod; and here, according to the belief of at least the later ages of paganism, she was supposed to be inspired by a mystic vapour that arose from a fissure in the ground. Against the ordinary explanation of this as a real mephitic gas producing convulsions, there seem to be geological and chemical objections (*see* Oppe, "The chasm at Delphi," *Journ. Hell. Stud.*, 1904); nor have the recent French excavations revealed any chasm or gap in the floor of the temple. But the strong testimony of the later writers, especially Plutarch (*De defectu Orac.* c. 43), cannot wholly be set aside; and we can sufficiently reconcile it with the facts if we suppose a small crack in the floor through which a draught of air was felt to ascend. This, combining with the other mantic stimulants used, would be enough to throw a believing medium into the condition, familiar enough nowadays, of a "trance." It is probable that what she uttered were only unintelligible murmurs,

and that these were interpreted into relevance and set in metric or prose sentences by the "prophet" and the "holy ones" or Ὅσιοι as they were called, members of leading Delphic families, who sat round the tripod, who received the questions of the consultant beforehand, probably in writing, and usually had considered the answers that should be given.

Examples of the same enthusiastic method can be found in other oracles of Apollo. At Argos, the prophetess of the Apollo Pythius attained to the divine afflatus by drinking the blood of the lamb that was sacrificed in the night to him (Paus. ii. 24. 1); this is obviously a mantic communion, for the sacrificial victim is full of the spirit of the divinity. And we find the same process at the prophetic shrine of Ge at Aegae in Achaea, where the prophetess drank a draught of bull's blood for the same purpose (Farnell, *op. cit.* iii. 11). In the famous oracle shrines of Apollo across the sea, at Clarus and Branchidae near Miletus (the prophetic fountain at Branchidae is attested by Strabo, p. 814, and in a confused mystic passage of Iamblichus, *De Myst.*, 3, 11), the divination was of the same ecstatic type, but produced by a simple draught of holy water. The Clarian prophet fasted several days and nights in retirement and stimulated his ecstasy by drinking from a subterranean spring which is said by Pliny to have shortened the lives of those who used it (*Nat. Hist.* ii. 232). Then, "on certain fixed nights after many sacrifices had been offered, he delivered his oracles, shrouded from the eyes of the consultants" (Iamb. *loc. cit.*).

The divination by "incubation" was allied to this type, because though lacking the ecstatic character, the consultant received direct communion with the god or departed spirit. He attained it by laying himself down to sleep or to await a vision, usually by night, in some holy place, having prepared himself by a course of ritualistic purification. Such consultation was naturally confined to the underworld divinities or to the departed heroes. It appears to have prevailed at Delphi when Ge gave oracles there before the coming of Apollo, and among the heroes Amphiaraus, Calchas and Trophonius are recorded to have communicated with their worshippers in this fashion. And it was by incubation that the sick and diseased who repaired to the temple of Epidaurus received prescriptions from Asclepius.

Turning now to the history of oracles in Greece, we know that the leading one, Delphi, was a seat of prophecy from the earliest days of Greek tradition. Ge, Themis and perhaps Poseidon had given oracles here before Apollo. But it is clear that he had won it in the days before Homer, who attests the prestige and wealth of his Pythian shrine; and it seems clear that before the Dorian conquest of the Peloponnese a Dryopian migration had already carried the cult of Apollo Pythius to Asine in Argolis. Also the constitution of the Amphictyones, "the dwellers around the temple," reflects the early age when the tribe rather than the city was the political unit, and the Dorians were a small tribe of north Greece. The original function of these Amphictyones was to preserve the sanctity and property of the temple; but this common interest early developed a certain rule of intertribal morality. By the formula of the Amphictyonic oath preserved by Aeschines, which may be of great antiquity, the members bound themselves "not to destroy any city of the league, not to cut any one of them off from spring-water, either in war or peace, and to war against any who violated these rules." We discern here that Greek religion offered the ideal of a federal national union that Greek politics refused to realize.

The next stage in the history of the oracle is presented by the legend of the Dorian migration. For we have no right to reject the strong tradition of the Delphic encouragement of this movement, which well accounts for the devotion shown by Sparta to the Pythian god from the earliest days; and accounts also for the higher position that Delphi occupied at the time when Greek history is supposed to begin.

We have next to consider a valuable record that belongs to the end of the 8th century or beginning of the 7th, the Homeric hymn to Apollo, which describes the coming of the Dolphin-god Δελφίνιος to Pytho, and the organization of the oracle by Cretan ministers. Of this Cretan settlement at Delphi there is no other literary evidence, and the Ὅσιοι who administered the oracle in the historic period claimed to be of aboriginal descent. Yet recent excavation has proved a connection between Crete and Delphi in the Minoan period; and there is reason to believe that in the 8th century some ritual of purification, momentous for the religious career of the oracle, was brought from Crete to Delphi, and that the adoption of this latter name for the place which had formerly been called Πυθώ synchronized with the coming of Apollo Delphinius.

The influence of Delphi was great in various ways. We may first consider its political influence upon the other states. The practice of a community consulting an oracle on important occasions undoubtedly puts a powerful weapon into the hands of the priesthood, and might lead to something like a theocracy. And there are one or two ominous hints in the *Odyssey* that the ruler of the oracle might overthrow the ruler of the land. Yet owing to the healthy temperament of the early Greek, the civic character of the priesthood, the strength of the autonomous feeling, Greece might flock to Delphi without exposing itself to the perils of sacerdotal control. The Delphic priesthood, content with their rich revenues, were probably never tempted to enter upon schemes of far-reaching political ambition, nor were they in any way fitted to be the leaders of a national policy. Once only, when the Spartan State applied to Delphi to sanction their attack on Arcadia, did the oracle speak as if, like the older papacy, it claimed to dispose of territory (Herod. i. 66)—"Thou askest of me Arcadia; I will not give it thee." But here the oracle is on the side of righteousness, and it is the Spartan that is the aggressor. In the various oracles that have come down to us, many of which must have been genuine and preserved in the archives of the State that received them, we cannot discover any marked political policy consistently pursued by the "holy ones" of Delphi. As conservative aristocrats they would probably dislike tyranny; their action against the Peisistratidae was interested, but one oracle contains a spirited rebuke to Cleisthenes, while one or two others, perhaps not genuine, express the spirit of temperate constitutionalism. As exponents of an Amphictyonic system they would be sufficiently sensitive of the moral conscience of Greece to utter nothing in flagrant violation of the "ius gentium." In one department of politics, the legislative sphere, it has been supposed that the influence of Delphi was direct and inspiring. Plato and later writers imagined that the Pythia had dictated the Lycurgan system, and even modern scholars like Bergk have regarded the ῥήτραι of Sparta as of Delphic origin. But a severer criticism dispels these suppositions. The Delphic priesthood had neither the capacity nor probably the desire to undertake so delicate a task as the drafting of a code. They might make now and again a general suggestion when consulted, and, availing themselves of their unique opportunities of collecting foreign intelligence, they might often recommend a skilful legislator or arbitrator to a state that consulted them at a time of intestine trouble. Finally, a legislator with a code would be well advised, especially at Sparta, in endeavouring to obtain the sanction and the blessing of the Delphic god, that he might appear before his own people as one possessed of a religious mandate. In this sense we can understand the stories about Lycurgus.

There is only one department of the secular history of Greece where Delphi played a predominant and most effective part, the colonial department. The great colonial expansion of Greece, which has left so deep an imprint on the culture of Europe, was in part inspired and directed by the oracle. For the proof of this we have not only the evidence of the χρησμοί preserved by Herodotus and others, such as those concerning the foundation of Cyrene, but also the worship of Apollo Ἀρχηγέτης, "the Founder," prevalent in Sicily and Magna Graecia, and the early custom of the sending of tithes or thanksgiving offerings by the flourishing western states to the oracle that had encouraged their settlements.

Apollo was already a god of ways, Ἀγυιεύς, who led the migration of tribes before he came to Delphi. And those legends are of some value that explain the prehistoric origin of cities such as Magnesia on the Maeander, the Dryopian Asine in the Peloponn-

nese, as due to the colonization of temple-slaves, acquired by the Pythian god as the tithe of conquests, and planted out by him in distant settlements. The success of the oracle in this activity led at last to the establishment of the rule that Herodotus declares to be almost universal in Greece, namely, that no leader of a colony would start without consulting Delphi. Doubtless in many cases the priesthood only gave encouragement to a preconceived project. But they were in a unique position for giving direct advice also, and they appear to have used their opportunities with great intelligence.

Their influence on the state cults can be briefly indicated, for it was not by any means far-reaching. They could have felt conscious of no mission to preach Apollo, for his cult was an ancient heritage of the Hellenic stocks. Only the narrower duty devolved upon them of impressing upon the consultants the religious obligation of sending tithes or other offerings. Nevertheless their opportunity of directing the religious ritual and organization of the public worships was great; for Plato's view (Rep. 427A) that all questions of detail in religion should be left to the decision of the god "who sits on the *omphalos*" was on the whole in accord with the usual practice of Greece. Such consultations would occur when the State was in some trouble, which would be likely to be imputed to some neglect of religion, and the question to the oracle would commonly be put in this way—"to what god or goddess or hero shall we sacrifice?" The oracle would then be inclined to suggest the name of some divine personage hitherto neglected, or of one whose rites had fallen in decay. Again, Apollo would know the wishes of the other divinities, who were not in the habit of directly communicating with their worshippers; therefore questions about the sacred land of the goddesses at Eleusis would be naturally referred to him. From both these points of view we can understand why Delphi appears to have encouraged the tendency towards hero-worship which was becoming rife in Greece from the 7th century onwards. But the only high cult for which we can discover a definite enthusiasm in the Delphic priesthood was that of Dionysus. And his position at Delphi, where he became the brother-deity of Apollo, sufficiently explains this.

As regards the development of religious morality in Greece, we must reckon seriously with the part played by the oracle. The larger number of deliverances that have come down to us bearing on this point are probably spurious, in the sense that the Pythia did not actually utter them, but they have a certain value as showing the ideas entertained by the cultivated Hellene concerning the oracular god. On the whole, we discern that the moral influence of Delphi was beneficent and on the side of righteousness. It did nothing, indeed, to abolish, it may even have encouraged at times, the barbarous practice of human sacrifice, which was becoming abhorrent to the Greek of the 6th and 5th centuries; but a conservative priesthood is always liable to lag behind the moral progress of an age in respect of certain rites, and in other respects it appears that the "Holy Ones" of Delphi kept well abreast of the Hellenic advance in ethical thought. An oracle attributed to the Pythoness by Theopompus (Porph. *De abstinentia*, 2, 16 and 17) expresses the idea contained in the story of "the widow's mite," that the deity prefers the humble offering of the righteous poor to the costly and pompous sacrifice of the rich. Another, of which the authenticity is vouched for by Herodotus (vi. 86), denounces the contemplated perjury and fraud of a certain Glaucus, and declares to the terrified sinner that to tempt God was no less a sin than to commit the actual crime. A later *χρησμός*, for which Plutarch (*De Pyth. Or.*, p. 404 B) is the authority, embodies the charitable conception of forgiveness for venial faults committed under excessive stress of temptation: "God pardons what man's nature is too weak to resist." And in one most important branch of morality, with which progressive ancient law was intimately concerned, namely, the concept of the sin of homicide, we have reason for believing that the Apolline oracle played a leading part. Perhaps so early as the 8th century, it came to lay stress on the impurity of bloodshed and to organize and impose a ritual of purification; and thus to assist the development and the clearer definition of the concept of murder as a sin and the growth of a theory of equity which recognizes extenuating or justifying circumstances (Farnell, *Cults*, iv. 300). Gradually, as Greek ethics escaped the bondage of ritual and evolved the idea of spiritual purity of conscience, this found eloquent expression in the utterances imputed to the Pythia (Ael. *Var. Hist.* iii. 44; Anth. Pal. xiv. 71 and 74). Many of these are no doubt literary fictions; but even these are of value as showing the popular view about the oracular god, whose temple and tripod were regarded as the shrine and organ of the best wisdom and morality of Greece. The downfall of Greek liberty before Macedon destroyed the political influence of the Delphic oracle; but for some centuries after it still retained a certain value for the individual as a counsellor and director of private conscience. But in the latter days of paganism it was eclipsed by the oracles of Claros and Branchidae.

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(X.; H. J. R.)

ORADEA MARE, a town of western Rumania, capital of the department of Bihor. Pop. (1928) 49,200, mainly Magyar. It is situated in a plain on both banks of the river Crisul Repede, and is the seat of a Roman Catholic and of a Greek Uniate Bishopric (founded 1776). Among its principal buildings are the St Ladislaus parish church, built in 1723, which contains the remains of the king St. Ladislaus (d. 1095), the Roman Catholic cathedral, built in 1752–1779, the Greek cathedral, the large rococo palace of the Roman Catholic bishop, built in 1778, and the archaeological and historical museum. There is a law academy, a seminary for priests, a modern school, a Roman Catholic and a Calvinistic gymnasium, a commercial academy, a training school for teachers and a secondary school for girls. Oradea Mare is an important railway junction; it possesses extensive manufactures of pottery and large distilleries, and carries on a brisk trade in agricultural produce, cattle, horses, fruit and wine.

Oradea Mare is a very old town; its bishopric was founded by St. Ladislaus in 1080. The town was destroyed by the Tatars in 1241. Peace was concluded here on Feb. 24, 1538 between Ferdinand I. of Austria and his rival John Zápolya, voivode of Transylvania. In 1556 it passed to Transylvania, but afterwards reverted to Austria. In 1598 the Turks besieged the fortress unsuccessfully, but took it in 1660 and held it till 1692. After the World War it was ceded by Hungary to Rumania.

ORAN, a city of Algeria, capital of the department and military division of the same name. It stands at the head of the Gulf of Oran, on the Mediterranean, in 35° 44′ N., 0° 41′ W. The city is 261 m. by rail W.S.W. of Algiers, 220 m. E. of Gibraltar and 130 m. S. of Cartagena, Spain. It is built on the steep slopes of the Jebel Murjajo, which rises to a height of 1,900 feet. The city was originally cut in two by the ravine of Wad Rehhi, now for the most part covered by boulevards and buildings. West of the ravine lies the old port, and above this rises what was the Spanish town, with the ancient citadel looking down on it; but few traces of Spanish occupation remain. The modern quarter rises, like an amphitheatre, to the east of the ravine, and is extending more and more to the north-east and to the south-east upon the plateau of Karquenta, where the centre of the town now lies; a ring of populous suburbs, Montplaisant, Gambetta, Saint-Eugène, Eckmühl, encircle it from north-east to south-west. The Place d'Armes, built on the plateau above the ravine, is the centre of the modern quarter. It contains a fine column commemorative of the battle of Sidi Brahim (1845), between the French and Abd-el-Kader. The Château Neuf, built in 1563 by the Spaniards, is surrounded by the beautiful Promenade de L'etang, which overlooks the port. Formerly the seat of the beys of Oran, it is occupied by the general in command of the military division, and also serves as barracks. The *kasbah* (citadel), or Château Vieux

used for military purposes, lies south-west of the Château Neuf. It was partly destroyed by the earthquake of Oct. 8 and 9, 1790. On the hills behind the kasbah are Fort St. Grégoire and Fort Santa Cruz, crowning, at a height of 1,312 ft., the summit of the Aidur. The Grand Mosque (in rue Philippe) was erected at the end of the 18th century to commemorate the expulsion of the Spaniards, and with money paid as ransom for Christian slaves.

Oran is the seat of a large trade. There is regular communication with Marseille, Cette, Barcelona, Valencia, Cartagena, Malaga, Gibraltar and the various ports on the Barbary coast. The harbour is sheltered by a large jetty stretching from west to east, parallel to the shore and more than 1,200 metres long. The different basins which it protects include the old harbour (1868), the Aucour basin (1876), the Morocco basin (1914), and the Poincaré basin (1928). The surface of water is 40 hectares, the length of the quays 2,097 metres, the extent of the platforms 160,000 sq. metres; a dock railway station has been built on the south quay. Oran is the terminus of the wide gauge railway lines from Algiers and from Ujda via Tlemçen and Sidi-bel-Abbes, and of the narrow gauge line from Colomb-Bechar-Kenadsa, which penetrates 771 km. towards the south. The construction of the broad gauge railway from Ujda to Fez, that of the lines penetrating eastern Morocco, eventually that of the Trans-Saharan railway, is destined to increase still more the importance of the port, the growth of which has been extremely rapid. Gross tonnage reaches 16 million tons, the tonnage of goods 2,462,000 tons (imports 1,382,000, exports 1,080,000).

The total population of Oran is 150,301, the municipal population 145,183, of whom 24,615 are natives and 120,568 Europeans (81,405 French).

See Augustin Bernard, "Oran, port du Maroc et du Sahara" (*Bull. Soc. Géogr. Oran*, 1928).

History.—Andalusian Arabs settled here in the beginning of the 10th century and gave Oran its name. Rapidly rising into importance as a seaport, Oran was taken and retaken, pillaged and rebuilt, by the various conquerors of northern Africa. In the latter half of the 15th century it became subject to the sultans of Tlemçen, and reached the height of its prosperity. Active commerce was maintained with the Venetians, the Pisans, the Genoese, the Marseillais and the Catalans, who imported the produce of their looms, glass-wares, tin-wares, and iron, and received in return ivory, ostrich feathers, gold-dust, tanned hides, grain, and negro slaves. Admirable woollen cloth and splendid arms were manufactured. The magnificence of its mosques and other public buildings, the number of its schools, and the extent of its warehouses shed lustre on the city; but luxury began to undermine its prosperity and its ruin was hastened by the conduct of the Muslim refugees from Spain, under whose influence the legitimate trade of the town gave place to piracy, Mers-el-Kebir becoming the stronghold of the pirates.

Animated by the enthusiasm of Cardinal Ximenes, the Spaniards determined to put a stop to these expeditions. Mers-el-Kebir fell into their hands on Oct. 23, 1505, and Oran in May 1509. The latter victory, obtained with but trifling loss, was stained by the massacre of a third of the Mohammedan population. From 6,000 to 8,000 prisoners, 60 cannon, engines of war and a considerable booty fell into the hands of the conquerors. Cardinal Ximenes introduced the Inquisition, etc., and also restored and extended the fortifications. Oran became the penal settlement of Spain, but neither the convicts nor the noblemen in disgrace who were also banished thither seem to have been under rigorous surveillance. The bey of Mascara seized Oran in 1708. The Spaniards recovered it in 1732, but found the maintenance of the place a burden rather than a benefit, the neighbouring tribes having ceased to deal with the Christians. The earthquake of 1790 furnished an excuse for withdrawing their forces. Commencing by 22 separate shocks at brief intervals, the oscillations continued from Oct. 8 to Nov. 22. Houses and fortifications were overthrown and a third of the garrison and a great number of the inhabitants perished. Famine and sickness had begun to aggravate the situation when the bey of Mascara appeared before the town with 30,000 men. By prodigies of energy the Spanish commander held out till Aug. 1791, when, the Spanish Government having made terms with the bey of Algiers, he was allowed to set sail for Spain with his guns and ammunition. The bey Mohammed took possession of Oran in March 1792 and made it his residence instead of Mascara. On the fall of Algiers the bey (Hassan) placed himself under the protection of the conquerors and shortly afterwards removed to the Levant. The French army entered the city on Jan. 4, 1831, and took formal possession on Aug. 17.

See M. D. Stott, *The Real Algeria* (1914).

ORANGE, HOUSE OF. The small principality of Orange, a district now included in the French department of Vaucluse, traces back its history as an independent sovereignty to the time of Charlemagne. William, surnamed *le Cornet*, who lived towards the end of the 8th century, is said to have been the first prince of Orange, but the succession is only certainly known after the time of Gerald Adhemar (*fl.* 1086). In 1174 the principality passed by marriage to Bertrand de Baux, and there were nine princes of this line. By the marriage of John of Châlons with Marie de Baux, the house of Châlons succeeded to the sovereignty in 1393. The princes of Orange-Châlons were (1) John I., 1393–1418, (2) Louis I., 1418–1463, (3) William VIII., 1463–1475, (4) John II., 1475–1502, (5) Philibert, 1502–1530. Philibert was a great warrior and statesman, who was held in great esteem by the emperor Charles V. For his services in his campaigns the emperor gave him considerable possessions in the Netherlands in 1522, and Francis I. of France, who had occupied Orange, was compelled, when a prisoner in Madrid, to restore it to him. Philibert had no children, and he was succeeded by his nephew Réné of Nassau-Châlons, son of Philibert's sister Claudia and Henry, count of Nassau, the confidential friend and counsellor of Charles V. He too died without an heir in 1544 at the siege of St. Dizier, having devised all his titles and possessions to his first cousin William, the eldest son of William, count of Nassau-Dillenburg, who was the younger brother of Réné's father, and had inherited the German possessions of the family.

William of Orange-Nassau was but 11 years old when he succeeded to the principality. He was brought up at the court of Charles V. and became famous in history as William the Silent (*q.v.*), the founder of the Dutch Republic. On his assassination in 1584 he was succeeded by his eldest son Philip William, who had been kidnapped by Philip II. of Spain in his boyhood and brought up at Madrid. This prince never married, and on his death in 1618 his next brother, Maurice (*q.v.*), stadtholder in the United Netherlands and one of the greatest generals of his time, became prince of Orange. Maurice died in 1625, also unmarried. Frederick Henry, the son of Louise de Coligny, William's fourth wife, born just before his father's murder, now succeeded to the princedom of Orange and to all his brothers' dignities, posts and property in the Netherlands. Frederick Henry was both a great general and statesman. His only son, William II. (*q.v.*), was married in 1641 to Mary, princess royal of England, he being fifteen and the princess nine years old at that date, and he succeeded to the title of prince of Orange on his father's death in 1647. At the very outset of a promising career he suddenly succumbed to an attack of smallpox on Nov. 6, 1650, his son William III. (*q.v.*) being born a week after his father's death.

A revolution now took place in the system of government in the United Provinces, and the offices of stadtholder and captain- and admiral-general, held by four successive princes of Orange, were abolished. However, the counter revolution of 1672 called William III. to the head of affairs. At this time Louis XIV. conquered the principality of Orange and the territory was incorporated in France, the title alone being recognized by the treaty of Ryswick. For William III.'s accession to the throne of England, *see* ENGLAND: *History*. He left no children, and a dispute arose among various claimants to the title of prince of Orange. The king of Prussia claimed it as the descendant of the eldest daughter of Frederick Henry; John William Friso of Nassau-Dietz claimed it as the descendant of John, the brother of William the Silent, and also of the second daughter of Frederick Henry. The result was that at the Peace of Utrecht in 1713, the king of Prussia aban-

doned the principality to the king of France in exchange for compensation elsewhere, and John William Friso gained the barren title and became William IV., prince of Orange. His sons William V. and William VI. succeeded him. William VI. in 1815 became William I., king of the Netherlands (*q.v.*).

See Bastet, *Histoire de la ville et de la principauté d'Orange* (Orange, 1856). (G. E.)

ORANGE, a town of France, 18 m. N. of Avignon on the P.L.M. railway. Pop. (1926), 6,828. Orange (*Arausio*), capital of the Cavari, was in 105 B.C. the scene of the defeat of a Roman army by the Cimbri and Teutones. It became after Caesar an important Roman colony. Its ramparts and fine buildings were partly destroyed by the Alamanni and Visigoths, and partly ruined by the erections of the middle ages. Orange was included in the kingdom of Austrasia, fell into the hands of the Saracens and was recovered by Charlemagne. It became the seat of an independent countship in the 11th century. The town had a university from the 14th century till the Revolution. Orange stands at some distance from the left bank of the Rhone, in the midst of meadows, orchards and mulberry plantations, watered by the Meyne, and overlooked by Mont Ventoux, 22 m. to the east.

Orange has famous Roman remains. The triumphal arch ranks third in size and importance among those still extant in Europe; 72 ft. in height, 69 ft. in width, and 26 ft. in depth, it is composed of three arches supported by Corinthian columns. On three sides its sculptured decorations are well preserved. The arch seems to have been set up in honour of Tiberius, perhaps to commemorate his victory over the Gallic chieftain Sacrovir in A.D. 21. It was used as a donjon in the middle ages. The theatre, dating from the time of the emperor Hadrian and built against a hill on the summit of which a colossal figure of the Virgin stands, has a façade 121 ft. high, 340 ft. long and 13 ft. thick, which is pierced by three square gates surmounted by a range of blind arches and a double row of projecting corbels, with holes in which the poles of the awning were placed. Of the seats for the spectators, only the lower tiers remain. It was used as an out-work to the fortress built on the hill by Maurice of Nassau in 1622, and destroyed fifty years later by order of Louis XIV., who in 1660 captured the town. At the beginning of the 19th century it was filled with hovels and stables; the building has been cleared and restored, and now serves as a national theatre. Near the theatre traces have been found of a hippodrome; and there are statues, bas-reliefs and ruins of an amphitheatre. Notre Dame, the old cathedral, originally built by the prefect of Gaul, was ruined by the barbarians, rebuilt in the 11th and 12th centuries, and damaged by the Protestants.

There are manufactories of footwear, brooms, jewellery and beet-sugar. The town deals largely in fruit, and millet-stalks for brooms, as well as in wool, silk, honey and truffles.

ORANGE, a city of Orange county, California, U.S.A., 30 m. S.E. of Los Angeles and 14 m. from the Pacific ocean; served by the Pacific Electric, the Santa Fe and the Southern Pacific railways. Pop. 4,884 in 1920 (88% native white); estimated locally at 9,000 in 1928. It is surrounded by orange, lemon and walnut groves. Beans, peppers and dairy products are other important agricultural products of the county, and its oil-fields had an output valued at $50,000,000 in 1927. The county's citrus crops in 1927 were valued at $27,000,000. Fruit-packing is one of the principal industries of the city. The manufactures include copper wire, twine and cordage, hosiery, machinery and gold-leaf.

ORANGE, a town of Franklin county, Mass., U.S.A., on Miller's river and the Boston and Maine railroad, 35 m. N.W. of Worcester. Pop. (1920) 5,393 (86% native white). It has numerous and varied manufacturing industries. The district of Orange was formed in 1783 from parts of Athol, Royalston and Warwick, and certain common lands, and in 1810 it was made a town.

ORANGE, a city of Essex county, New Jersey, U.S.A., 12 m. W. of New York city, 4 m. W. of Newark; served by the Erie and the Lackawanna railways, interurban trolleys and motor-bus lines. Pop. (1920), 33,268 (21% foreign-born white and 11% negro); 1928 local estimate, 37,000. The city covers 2·2 sq.m. at the base of the first Watchung mountain, in the heart of the great suburban residential community known as "the Oranges," completely surrounded by East, South and West Orange. There are some 60 manufacturing establishments in the city, with an output in 1925 valued at $9,319,962. The assessed valuation of property for 1927 was $41,717,116. Since 1914 the city has had a commission form of government. Settlement began here soon after the founding of Newark in 1666, and the region was generally called Newark Mountain. In 1718 the people of "the mountain" severed connections with the church at Newark and formed an independent congregation. The neighbourhood was referred to as Orange Dale in 1782 and two years later "Orange" was in use. The township of Orange was set off from Newark and incorporated in 1806. It was incorporated as a town in 1860; the other "Oranges" were set off from it in 1861, 1862 and 1863; and in 1872 it was chartered as a city.

ORANGE, a city on the eastern boundary of Texas, U.S.A., at the head of navigation on the Sabine river; the county seat of Orange county. It is on Federal highway 90; has an airport of 200 ac. and a 30-ft. harbour, with a deep-water channel to the Gulf of Mexico; and is served by the Missouri Pacific and the Southern Pacific railways. The population was 9,212 in 1920 (27% negroes) and was estimated locally at 15,500 in 1928. The city is built around a deep hairpin bend in the river. It is surrounded by six gas and oil fields, huge forests of pine and cypress, and a cultivated district devoted chiefly to truck farming, poultry, and figs. The commerce of the port amounted to 729,543 tons in 1925, valued at $16,702,845, of which 36% represented foreign trade, largely exports of timber and lumber. The rapidly developing manufacturing industries include saw and shingle mills, a rice mill, cotton gins, an oil refinery, shipyards, wrapping-paper and paper-bag factories, creosoting and fabricating steel plants and canneries. The city was founded as a trading post about 1800; and began on its present expansion with the completion of harbour improvements in 1914 and the discovery of oil in 1920.

ORANGE, the longest river of South Africa, almost traversing the continent from ocean to ocean. It rises in Basutoland, less than 200 m. from the Indian ocean, and flows west, with wide sweeps south and north, to the Atlantic. It drains, with its tributaries, an area estimated at over 400,000 sq.m., passing through more than twelve degrees of longitude or 750 m. in a straight line from source to mouth. The valley of the river exceeds 1,000 m., and the stream has a length of not less than 1,300 m. Its headstreams are in the highest part of the Drakensberg range, the principal source, the Sinqu, rising, at an elevation of more than 10,000 ft., on the Mont aux Sources in 28° 48′ E., 28° 50′ S.

Rising on the inner slopes of the hills these rivulets all join the Sinqu, which receives from the north several streams which rise in the Maluti Mountains. Of these the largest are the Semene and Sinqunyane (little Sinqu) and the best known the Maletsunyane, by reason of its magnificent waterfall—an unbroken leap of 630 ft. Increased by the perennial waters of these numerous torrents the Sinqu makes its way S.W. across the upland valleys between the Maluti and Drakensberg ranges. After a course of some 200 m., the Sinqu, already known as the Orange, receives the Makhaleng, or Kornet Spruit (90 m.), which rises in Machacha Mountain. The Orange here enters the great inner plateau of South Africa, which at Aliwal North, the first town of any size on the banks of the river, 80 m. below the Kornet Spruit confluence, has an elevation of 4,300 feet. Forty miles lower down the Orange is joined by the first of its large tributaries the Caledon (230 m.), which, rising on the western side of the Mont aux Sources, flows, first west and then south, through a broad and fertile valley. At the confluence the united stream has a width of 350 yards. Thirty miles lower down the Orange reaches, in 25° 40′ E., its southernmost point—30° 40′ S., approaching within 20 m. of the Zuurberg range. In this part of its course the river receives from the south the streams, often intermittent, which rise on the northern slopes of the Stormberg, Zuurberg and Sneeuwberg ranges. Of these the chief are the Kraai, which joins the Orange near Aliwal North, the Stormberg and the Zeekoe (Sea Cow), the last named having a length of 120 miles.

From its most southern point the Orange turns sharply N.W. for

200 m., when having reached 29° 3′ S., 23° 36′ E. it is joined by its second great affluent, the Vaal (*q.v.*). Here it bends south again, and with many a zigzag continues its general westerly direction, crossing the arid plains of Bechuana, Bushman and Namaqualands. Flowing between steep banks, considerably below the general level of the country, here about 3,000 ft., it receives, between the Vaal confluence and the Atlantic, a distance of more than 400 m. in a direct line, no perennial tributary but on the contrary loses a great deal of its water by evaporation. In this region, nevertheless, skeleton river systems cover the country north and south. These usually dry sandy beds, which on many maps appear rivers of imposing length, for a few hours or days following rare but violent thunder-storms, are deep and turbulent streams.

In 28° 35′ S., 20° 20′ E., are the great waterfalls of the Orange, where in cataracts, and cascades the river drops 400 ft. in 16 miles. The Aughrabies or Hundred falls, as they are called, are divided by ledges, reefs and islets, the last named often assuming fantastic shapes. Below the falls the river rushes through a rocky gorge, and openings in the cliffs to the water are rare. These openings are usually the sandy beds of dried-up or intermittent affluents, such as the Bak, Ham, Houm, Aub (or Great Fish) rivers of Great Namaqualand. Crossing the narrow coastal plain the river, with a south-westerly sweep, enters the ocean by a single mouth, studded with small islands, in 28° 37′ S., 16° 30′ E. A large sand bar obstructs the entrance to the river, which is not quite 1 m. wide. The river when in flood, at which time it has a depth of 40 ft., scours a channel through the bar, but the Orange is at all times inaccessible to sea-going vessels. Above the bar it is navigable by small vessels for 30 or 40 miles.

Captain Henry Hop first crossed the Orange in September 1761, but shortly afterwards returned. In 1777 Captain (afterwards Colonel) R. J. Gordon, a Dutch officer of Scottish extraction, who commanded the garrison at Cape Town, reached the river in its middle course and named it the Orange in honor of the Prince of Orange. Next year Lieut. W. Paterson, an English traveller, reached the river in its lower course, and in 1779 Paterson and Gordon journeyed along the west coast of the colony and explored the mouth of the river. F. Le Vaillant also visited the Orange near its mouth in 1784. Mission stations north of the Orange were established a few days later, and in 1813 the Rev. John Campbell, after visiting Griqualand West for the London Missionary Society, traced the Harts River, and from its junction with the Vaal followed the latter stream to its confluence with the Orange, journeying thence by the banks of the Orange as far as Pella, in Little Namaqualand, discovering the great falls. These falls were in 1885 visited and described by G. A. Farini, from whom they received the name of the Hundred Falls. The source of the Orange was first reached by the French Protestant missionaries T. Arbousset and F. Daumas in 1836.

The story of Hop's expedition is told in the *Nouvelle description du Cap de Bonne Espérance* (Amsterdam, 1778). Lieut. Paterson gave his experiences in *A Narrative of Four Journeys into the Country of the Hottentots and Caffraria in the Years 1777–1778–1779* (London, 1789). *See* also Campbell's *Travels in South Africa* (London, 1815), Arbousset and Daumas' *Relation d'un voyage d'exploration au nord-est de la colonie du Cap de Bonne Espérance en 1836* (Paris, 1842), and Farini's *Through the Kalahari Desert* (London, 1886).

ORANGE. The plant that produces the familiar fruit of commerce is closely allied to the citron, lemon and lime; all the cultivated forms of the genus *Citrus* (family Rutaceae) are nearly related. The numerous kinds of orange chiefly differing in the external shape, size and flavour of the fruit may all probably be traced to two well-marked species—the sweet or China orange, *Citrus sinensis*, and the sour Seville orange or bigarade, *Citrus Aurantium*.

The Sour, Seville or Bigarade Orange, C. Aurantium, *C. Aurantium*, is a rather small tree, rarely exceeding 30 ft. in height. The green shoots bear sharp axillary spines, and alternate evergreen oblong leaves, pointed at the extremity, and with the margins entire or very slightly serrated; they are of a bright glossy green tint, the stalks distinctly winged and, as in the other species, articulated with the leaf. The fragrant white flowers appear in the spring months, and the fruit, usually round or spheroidal, does not perfectly ripen until the following spring, so that flowers and both green and mature fruit are often found on the plant at the same time. The bitter aromatic rind of the bigarade is rough, and dotted closely over with concave oil-cells; the pulp is acid and more or less bitter in flavour.

The Sweet or common China Orange (*C. sinensis*) including the Malta or Portugal orange, has the petioles less distinctly winged, and the leaves more ovate in shape, but chiefly differs in the fruit, the pulp of which is agreeably acidulous and sweet, the rind comparatively smooth, and the oil-cells convex. The ordinary round shape of the sweet orange fruit is varied greatly in certain varieties, in some being greatly elongated, in others much flattened; while several kinds have a conical protuberance at the apex, others are deeply ribbed or furrowed, and a few are distinctly "horned" or lobed, by the partial separation of the carpels. The two species of orange reproduce themselves true to species by seed; and, where hybridizing is prevented, the seedlings of the sweet and bitter orange retain respectively the more distinctive features of the parent plant.

History.—Though now the most widely cultivated of *Citrus* fruits and grown in most of the warmer parts of the world, and apparently in many completely naturalized, the diffusion of the orange has taken place in comparatively recent historical periods. To ancient Mediterranean agriculture it was unknown; and, though the later Greeks and Romans were familiar with the citron as an exotic fruit, their "Median apple" appears to have been the only form of the citrine genus with which they were acquainted. The careful researches of Gallesio have proved that India was the country from which the orange spread to western Asia and eventually to Europe. Oranges are at present found apparently wild in the jungles along the lower mountain slopes of Sylhet, Kumaon, Sikkim and other parts of northern India, and, according to Royle, even in the Nīlgiri hills; the plants are generally thorny, and present the other characters of the bitter variety, but occasionally wild oranges occur with sweet fruit; it is, however, doubtful whether either sub-species is really indigenous to Hindustan, and De Candolle is probably correct in regarding south China and the Indo-Chinese peninsula as the original home of the orange. Cultivated from a remote period in south-eastern Asia, it was carried to south-western Asia by the Arabs, probably before the 9th century, towards the close of which the bitter orange seems to have been well known to that people; though, according to Mas'ūdī, it was not cultivated in Arabia itself until the beginning of the 10th century, when it was first planted in 'Omān, and afterwards carried to Mesopotamia and Syria. It spread ultimately, through the agency of the same race, to Africa and Spain, and perhaps to Sicily, following everywhere the tide of Mohammedan conquest and civilization. In the 12th century the sour orange or bigarade was abundantly cultivated in all the Levant countries, and the returning soldiers of the Cross brought it from Palestine to Italy and Provence.

No allusion to the sweet orange occurs in contemporary literature at this early date, and its introduction to Europe took place at a considerably later period, though the exact time is unknown. It was commonly cultivated in Italy early in the 16th century, and seems to have been known there previously to the expedition of Da Gama (1497), as a Florentine narrator of that voyage appears to have been familiar with the fruit. The importation of this tree into Europe is usually attributed to the Portuguese who first circumnavigated Africa and found the way to India and China although Gallesio suspects that Genoese merchants of the 15th century, who must have found it growing abundantly then in the Levant, may have introduced it.

The prevailing European names applied to the orange are sufficient evidence of its origin and of the line taken in its migration westward. The Sanskrit designation *nagrungo*, becoming *narungee* in Hindustani, and corrupted by the Arabs into *nāranj* (Spanish *naranja*), passed by easy transitions into the Italian *arancia* (Latinized *aurantium*), the Romance *arangi*, and the later Provençal *orange*. The true Chinese sweet orange, however, was undoubtedly brought by the Portuguese navigators direct from the East both to their own country and to the Azores, where now

it grows luxuriantly. Throughout China and in Japan the orange has been grown from very ancient times, and it was found diffused widely when the East Indian archipelago was first visited by Europeans. In more recent days its cultivation has extended over most of the warmer regions of the globe, the tree growing freely and producing fruit abundantly wherever the temperature is sufficiently high, and enough moisture can be supplied to the roots; where night-frosts occur in winter or spring the culture becomes more difficult and the crop precarious.

Cultivation.—The orange flourishes in any moderately fertile soil, if it is well drained and sufficiently moist; but a rather stiff loam or calcareous marl, intermingled with some vegetable humus, is usually considered most favourable to its growth. Grafting or budding on stocks raised from the seed of some vigorous variety of sour or sweet orange, trifoliate orange or the so-called rough lemon is the plan usually adopted by the cultivator. The seeds, carefully selected, are sown in well-prepared ground, and the seedlings removed to a nursery-bed in the fourth or fifth year, and, sometimes after a second transplantation, grafted in the seventh or eighth year with the desired variety. When the grafts have acquired sufficient vigour, the trees are placed in rows in the permanent orangery. Propagation by marcottage or air-layers is occasionally adopted; cuttings do not readily root, and multiplication directly by seed is always doubtful in result, on account of the lack of uniformity among the seedlings. The distance left between the trees in the permanent plantation or grove varies according to the size of the plants and subsequent culture adopted. The ground is kept well stirred between the trunks, and the roots manured with well-rotted dung, guano or other highly nitrogenous matter; shallow pits are sometimes formed above the roots for the reception of liquid or other manures; in dry climates water must be abundantly and frequently supplied. Between the rows melons, pumpkins and other annual vegetables are frequently raised. In garden culture in southern Europe the orange is sometimes trained as an espalier, and with careful attention yields fruit in great profusion when thus grown. In favourable seasons the oranges are produced in great abundance, from 400 to 1,000 being commonly borne on a single plant in full bearing, while on large trees the latter number is often vastly exceeded. The trees will continue to bear abundantly from 50 to 80 years, or even more; and some old orange trees, whose age must be reckoned by centuries, still produce a crop; these very ancient trees, are, however, generally of the sour or Seville orange. Oranges intended for export to colder climates are gathered long before the deep tint that indicates maturity is attained, the fruit ripening rapidly after picking; but the delicious taste of the China orange maturing on the tree is seldom thus acquired. Carefully gathered, the oranges are packed in boxes, each orange being wrapped in paper, or with dry maize husks or leaves placed between them. The immense quantities of this valuable fruit imported into Britain are derived from various sources, the Azores ("St. Michael's" oranges), Sicily, Portugal, Spain and other Mediterranean countries, Jamaica, the Bahamas, Florida and California, South Africa and Australia. In Florida the sour orange has grown, from an unknown period, in a wild condition, and some of the earlier botanical explorers regarded it as an indigenous tree; but it was undoubtedly brought by the Spanish colonists to the West Indies, and was probably soon afterwards transplanted to Florida; its chief use in America is for stocks on which to graft sweet orange and other species of *Citrus*.

There are numerous varieties of the sweet orange. Maltese or blood oranges are characterized by the deep-red tint of the pulp, and comprise some of the best varieties. Gallesio refers to the blood orange as cultivated extensively in Malta and Provence; they are largely grown in the Mediterranean region in the present day, and have been introduced into America. The Washington or Bahia Navel and other so-called navel oranges have a navel-like mark on the apex of the fruit due to the production of an incipient second whorl of carpels forming a more or less abortive small orange under the skin of the main one. Baptiste Ferrari, a Jesuit monk, in his work *Hesperides, sive de malorum aureorum cultura et usus libri quatuor*, published at Rome in 1646, figures and describes such an orange.

Citrus nobilis is the king orange, of which *c. nobilis* var *deliciosa* is the mandarin or tangerine orange. It is remarkable for its flattened spheroidal fruit, the rind of which readily separates with the slightest pressure; the pulp has a peculiarly luscious flavour when ripe. The small tangerine orange, valued for its fine colour and fragrance, is a variety of loose-skinned orange now grown rather extensively in Florida and California. The Bergamot orange (*Citrus Bergamia*) largely grown in Southern Italy and Sicily, yields the perfume. It is probably of hybrid origin.

Another loose-skinned orange, the Satsuma, introduced into the United States many years ago, is cultivated on a fairly large scale in the region bordering on the Gulf of Mexico in western Florida, southern Alabama, southern Mississippi and southern Louisiana. The Satsuma is the chief variety grown in Japan and is the earliest citrous fruit grown in the United States, ripening from the first of October to the first of December.

The fruit is a very wholesome article of diet, abounding in citric acid, and, like the lemon and lime, possessing a high vitamin content.

Diseases.—Several are caused by fungi, others by insects. Of the fungus diseases that known as root-rot in Florida and *mal-di-gomma* in Italy is very widely distributed. It occurs on the lower part of the trunk and the main roots of the tree, and is indicated by exudation of gum on the bark covering the diseased spot. The diseased patches spread into the wood, killing the tissues, which emit a foetid odour; the general appearance of the tree is unhealthy, the leaves become yellow and the twigs and young branches die. A fungus (*Phytophthora terrestris*) is found associated with the disease, which is also fostered by faulty drainage, a shaded condition of the soil, the use of rank manures and other conditions. For treatment, the diseased patches should be cut away and the wound treated with an antiseptic. A very similar disease, brown-rot gummosis, occurs in California; it is caused by *Pythiacystis citrophthora*, and is treated in much the same way. The sour orange resists both root-rot and gummosis and is in consequence largely used as root stock both in Florida and California.

Decay of oranges in transit often causes serious losses; this has been shown to be due to *Penicillium*, the germinating of which spores penetrate the skin of damaged fruits. Careful picking, handling and packing have much reduced the amount of loss from this cause. Another fungus disease, scab, has been very injurious to the lemon and sour orange and grapefruit in Florida. It is caused by *Cladosporium citri* which forms small warts on the leaves and fruits; spraying with a weak solution of Bordeaux mixture or with ammoniacal solution of copper carbonate is recommended. Citrus canker, a bacterial disease caused by *Phytomonas citri*, formerly caused much loss in Florida and nearby states. It has been eradicated at a cost of many millions of dollars. The sooty mould of the orange, which forms a black incrustation on the leaves and also the fruit, probably occurs wherever the orange is cultivated. It is caused by species of *Meliola;* in Europe and the United States by *M. Penzigii*. The fruit is often rendered unsaleable and the plant is also injured as the leaves are unable properly to perform their functions. The fungus is not a parasite, but lives apparently upon the honey dew secreted by aphides, etc., and is therefore dependent on the presence of these insects. Spraying with resin-wash is an effective preventive, as it destroys the insects. The diseases of citrus fruits have been very thoroughly studied during recent years. (*See* Fawcett's *Citrus Diseases.*)

Several insect enemies attack the plant, of which the scale insect *Aspidiotus* is the most injurious in Europe and the Azores. In Florida another species, *Mytilaspis citricola* (purple scale), sometimes disfigures the fruit to such an extent as to make it unfit for market. Several species of *Aleyrodes* are insect pests on leaves of the orange; *A. citri*, the white orange fly of Florida, is described as the most injurious of the insect pests of the crop in Florida at the present time; *A. Howardi* is a very serious pest in Cuba. Cold weather in winter has sometimes proved destructive in Provence, and many plantations were destroyed by the hard frosts of 1780 and 1820.

The Sour Orange.—The sour orange is chiefly cultivated for the

aromatic qualities of the rind. Planted years ago in Andalusia by the Moorish conquerors, it is still extensively grown in southern Spain—deriving its common English name "Seville" orange from the abundant groves that still exist around that city, though the plant is now largely cultivated elsewhere. The fruit is imported into Great Britain in large quantities for the manufacture of orange marmalade, which is prepared from the pulp and rind, usually more or less mingled with the pulp of the sweet orange. In medicine the fresh peel is largely employed as an aromatic tonic, and often, in tincture and syrup and "orange wine," as a mere vehicle to disguise the flavour of more nauseous remedies. The chief constituents are three glucosides, hesperidin, isohesperidin and aurantiamarin, the latter being the bitter principle; and an oil which mainly consists of a terpene known as limonene. The essential oil of the rind is collected for the use of the perfumer, being obtained either by the pressure of the fresh peel against a piece of sponge, or by the process known as *écuelle*, in which the skin of the ripe fruit is scraped against a series of points or ridges arranged upon the surface of a peculiarly-shaped dish or broad funnel, when the oil flows freely from the broken cells. Another fragrant oil, called in France *essence de petit grain*, is procured by the distillation of the leaves, from which also an aromatic water is prepared. The flowers of the bitter orange yield, when distilled with water, the "oil of Neroli" of the druggist and perfumer, and likewise the fragrant liquid known as "orange-flower water," which is a saturated solution of the volatile oil of the fresh flowers. The candied peel is much in request by cook and confectioner; the fragrant liqueur sold as "curaçoa" derives its aromatic flavour from the rind of the bitter orange.

Orange trees occasionally acquire a considerable diameter; the trunk of one near Nice, still standing in 1789, was so large that two men could scarcely surround it with their arms; the tree was killed by the intense cold of the winter of that year. The wood of the orange is of a fine yellow tint, and, being hard and close-grained, is valued by the turner and the cabinetmaker for the manufacture of small articles; it takes a good polish.

Although the bitter "Poma de Orenge" were brought in small quantities from Spain to England as early as the year 1290, no attempt appears to have been made to cultivate the tree in Britain until about 1595, when some plants were introduced by the Carews of Beddington in Surrey, and placed in their garden, where, trained against a wall, and sheltered in winter, they remained until destroyed by the great frost of 1739–1740. In the 18th century the tree became a favourite object of conservatory growth; in the open air, planted against a wall and covered with mats in winter, it has often stood the cold of many seasons in the southern counties, in such situations the trees occasionally bearing abundant fruit.

The orange has been usually cultivated in England for the beauty of the plant and the fragrance of its blossoms, rather than for the purpose of affording a supply of edible fruit. The latter can, however, be easily grown in a hot-house, some of the fruits thus grown, especially those of the pretty little Tangerine variety, being superior in quality to the imported fruit.

Production and Consumption of Oranges.—Oranges are produced and consumed in enormous quantities in the United States. According to Wellman and Braun, the average production during the five-year period 1923–27 inclusive was 31,756,000 boxes (of 72 to 80 lb. net weight), of which amount California produced 67%, Florida 32%, other States about 1 per cent. Exports of oranges from the U.S. amounted to an average of 2,597,000 boxes, or 8·2% of the total production, while imports (mostly from Porto Rico) averaged only 397,000 boxes, or only 1·2% of the total domestic production.

The average carload shipments of oranges in the U.S. for the five-year period 1923–27 was 70,534 cars, an amount exceeded only by apples, about 110,000 cars, and bananas, 111,414 cars. The next largest fruit shipments were of peaches 32,252 cars.

The value of the orange crop of the United States in 1928, as estimated by the Crop-Reporting Board of the U.S. Department of Agriculture was $130,500,000. This value was exceeded by only one other fruit crop, apples, the crop of which for 1928 was worth $185,125,000. Among all farm crops produced in the United States in 1928 oranges ranked eleventh in value.

The estimated annual production (in 70 lb. boxes) of the other chief orange producing countries is as follows: Spain 33,898,000 boxes (1927), Italy 9,168,000 (1925), Japan 9,802,000 (1926), Palestine 2,429,000 (1926), Australia 2,098,000 (1925), Algeria 2,236,000 (1923). The production in China is large but figures are not available.

Great Britain probably ranks next to the United States in the consumption of oranges, her annual imports for the five-year period 1922–26, inclusive, averaged 12,105,000 boxes of 70 lb. each.

For further details, *see* G. Gallesio, *Traite du Citrus* (Paris, 1811), for early history; A. Risso and A. Poiteau, *Histoire et culture des Oranges, 2nd edition* (Paris, 1872); A. de Candolle, *Origin of Cultivated Plants* (1881); F. Engler and A. Prantl, *Die natürlichen Pflanzenfamilien* (Leipzig, 1897) H. Hume, *The Cultivation of Citrus Fruits* (1926); W. W. Robins, *Botany of Crop Plants* (1924); Walter T. Swingle the article "Citrus," in L. H. Bailey, *The Standard Cyclopedia of Horticulture* (1914); Howard S. Fawcett, *Citrus Diseases and their Control* (1926); James B. McNair "Citrus Products," *Field Mus. of Nat. Hist. Pub.* 238, Botanical Ser. vol. vi., no. 1. (Chicago, 1926); H. R. Wellman and E. W. Braun "Oranges," *Calif. Agric. Exp. Sta.* (Berkeley, 1928).

ORANGE, COUNCILS OF: *see* COUNCILS OF ORANGE.

ORANGEBURG, a city of South Carolina, U.S.A., the county seat of Orangeburg county; on the North Edisto river and Federal highway 21, at an altitude of 259 ft., 48 m. S.E. of Columbia. It is served by the Atlantic Coast Line and the Southern railways. Pop. 7,290 in 1920 (45% negroes); estimated locally at 10,000 in 1928. It is the financial, commercial and industrial centre of a rich section of the Atlantic Coastal plain, and is the seat of the State Agricultural and Mechanical college for negroes (1896). Cotton, grain, live stock, poultry, tobacco and pecans are leading products of the county; and the city has lumber mills, veneer plants, cotton mills and various other manufacturing industries. It operates under a commission form of government. In 1704 a trader and trapper built his cabin here, and in 1735 a colony of Germans and Swiss established a settlement, naming it in honour of William, Prince of Orange. The town was incorporated in 1851, and was chartered as a city in 1883.

ORANGE FREE STATE, an inland province of the Union of South Africa. It is divided from Natal by the Drakenberg, from Basutoland by the Caledon river, from the Transvaal by the Vaal river and from the Cape of Good Hope by the Orange river, and in the west by a line drawn across the veld from the Orange to the Vaal. It lies between 26° 30′ and 30° 40′ S. and between 24° 10′ and 29° 40′ E. Its area is 49,647 sq. miles.

The country forms part of the inner plateau of South Africa, and most of it lies between 4,000 and 5,000 ft. above sea level. From the mountainous, eastern districts it slopes gradually westward, no natural boundary marking its western frontier. The aspect of the country is that of vast, undulating, treeless plains, with a certain number of willows and thorn trees along the streams. The latter were formerly more widely spread, but have nearly all been cut down for fuel. The Australian black wattle, gums and the pepper tree have been successfully introduced and are grown along the streets of the towns, and in plantations on farms, especially in the eastern districts, to provide shelter, poles and firewood. The general level of the surface is broken by low ridges, and isolated table mountains, the latter attaining considerable elevation above the plain. They are particularly numerous and well developed in the east, and are due to the outcrop of beds of sandstones and dolerites. The rivers, except the Orange, Vaal and Caledon, are dry or nearly dry, for three or four months during the dry winter season, but after rain even the small spruits may become raging torrents. (For geology, climate, flora and fauna, *see* SOUTH AFRICA, UNION OF.)

Population.—In 1926 the white population numbered 202,985. The corresponding figures are not available (1929) for the non-European elements, but in 1921 their numbers amounted to 421,306 natives, 395 Asiatics and 17,898 mixed and others. The largest element among the natives is probably the Basuto, who are largely represented in the districts of Harrismith, Bethlehem, Ficksburg

and Ladybrand. A considerable number of Barolong live in the districts of Thaba'nchu and Bloemfontein, and the Amazulu are well represented chiefly in the north-eastern area, adjoining Zululand. Other tribes include Fingoes, Ama-xosa, etc. The population of the country as a whole, which amounts to 9·08% of the Union, and which has an average density of 12·67 per sq. m., is concentrated in the eastern and better-watered districts.

Towns.—These call for little comment. They are mostly small administrative and provisioning centres for their surrounding districts. Only eight have a white population exceeding 2,000 and of these Bloemfontein, the capital, Kroonstad, Ladybrand and Ficksburg have been described in separate articles. Harrismith and Bethlehem are prosperous centres for the north-eastern districts. The former, situated at the foot of the Plattberg, was formerly a military station and is a recognized resort for sufferers from chest diseases. Parys (whites [1926], 2,656; total [1921], 3,653) is situated on the Vaal river, and is developing as a pleasure resort. Jam making and fruit preserving are carried on and the town has spinning and weaving schools.

Agriculture and Pastoralism.—The Orange Free State is a healthy stock country. It is little affected by horse sickness and the number of horses in 1926 was 265,748. These probably include many ponies kept by natives. Cattle number 1,955,772 and are most numerous in the eastern districts, especially about Ficksburg. Sheep, totalling over 10,000,000, are most abundant in the Rouxville, Wepener and Smithfield districts, while goats, which exceed 160,000, are either kept largely by natives, or concentrated in the dry south-western area about Philippolis. Among the chief crops, maize takes first place, the districts of Heilbron and Frankfurt forming part of the South African maize belt (*q.v.*). Toward the west the area sown with maize varies greatly from year to year, according to the incidence of the rains. The most fertile part of the country lies in the valley of the Caledon river. Here a considerable quantity of wheat is grown, especially in the districts of Ladybrand, Ficksburg, Bethlehem and Rouxville. The same districts and Harrismith also produce oat-hay. Here, too, there has been a considerable recent development of apple and plum orchards, the apples being among the best grown in South Africa. Potatoes, tobacco, pumpkins, etc., are also grown.

Diamonds and Other Mining Industries.—In the Orange Free State the occurrences of diamonds appear to cluster about Boshof, Koffiefontein, Jagersfontein, Kroonstad and Theunissen. The production in 1926 was valued at £976,204. The chief mines are at Jagersfontein, which, however, are closed down (1928). The alluvial diamonds, found in the gravels of the Vaal and some of its tributary streams, are of great purity. Coal approaching a million tons was produced in 1926. The chief producers are the Cornelia colliery on the Vaal river, opposite to Vereeniging, and the Clydesdale, about 15 m. to the south. The coal is not of the best quality. Flour-milling is carried on at a number of local centres. Salt making is also carried on. The source of supply is the heavily saline waters of certain "pans" in the western districts, evaporated from shallow basins, in most cases by solar heat.

Education, other than higher education, is controlled by the provincial education department, subject to the sanction of the provincial administration. At the head of the department is the director. It has powers to establish and maintain primary, secondary and certain special schools, and to make grants in aid of private schools which comply with certain conditions and attain a satisfactory standard. There is a normal training college in Bloemfontein. The province is divided into 57 school districts, in each of which is an advisory board, consisting of elected members, and having certain powers of supervision. In 1926 there were in the province 858 State and State-aided schools, attended by 44,866 scholars. There were also 201 schools for natives, two for other non-Europeans, and one training school. (R. U. S.)

HISTORY

The country north of the Orange river was first visited by Europeans towards the close of the 18th century. At that time it was somewhat thinly peopled, mainly by tribes of the Bechuana division of the Bantus. Early in the 19th century Griquas established themselves north of the Orange. Between 1817 and 1831 the country was devastated by the chief Mosilikatze and his Zulus. Up to this time the few white men who had crossed the Orange had been chiefly hunters or missionaries. In 1834 Dutch farmers from Cape Colony seeking pasture for their flocks settled in the country. They were followed in 1836 by the first parties of the Great Trek. These emigrants left Cape Colony from various motives, but all were animated by the desire to escape from British sovereignty. (*See* SOUTH AFRICA, UNION OF; and CAPE COLONY.) The leader of the first large party of emigrants was A. H. Potgieter, who concluded an agreement with Makwana, the chief of the Bataung tribe of Bechuanas, ceding to the farmers the country between the Vet and Vaal rivers. The emigrants soon came into collision with Mosilikatze, who in Nov. 1837 was decisively defeated by the Boers and thereupon fled northward. In the meantime another party of emigrants had settled at Thaba'nchu, where the Wesleyans had a mission station for the Barolong. The emigrants were treated with great kindness by Moroko, the chief of that tribe, and with the Barolong the Boers maintained uniformly friendly relations. In Dec. 1836 the emigrants beyond the Orange drew up in general assembly an elementary republican form of government. After the defeat of Mosilikatze the town of Winburg (so named by the Boers in commemoration of their victory) was founded, a *volksraad* elected, and Piet Retief, one of the ablest of the *voortrekkers*, chosen "governor and commandant-general." The emigrants already numbered some 500 men, besides women and children and many coloured servants. Dissensions speedily arose among the emigrants, whose numbers were constantly added to, and Retief, Potgieter and other leaders crossed the Drakensberg and entered Natal. Those that remained were divided into several parties intensely jealous of one another.

Meanwhile a new power had arisen in the mountainous region of the Upper Orange and in the valley of the Caledon. There a Bechuana chief named Moshesh had welded together a number of scattered and broken clans and had formed of them the Basuto nation. The Basuto were a menace to the white farmers, and the farmers were equally a menace to the Basuto. At that time the British Government was not prepared to exercise effective control over the emigrant farmers, but on the advice of Dr. John Philip, the superintendent of the London Missionary society's stations in South Africa, a treaty was concluded in 1843 with Moshesh, placing him under British protection. A similar treaty was made with the Griqua chief, Adam Kok III. (*See* BASUTOLAND and GRIQUALAND.) By these treaties, which recognized native sovereignty over large areas on which Boer farmers were settled, it was sought to keep a check on the emigrants and to protect both the natives and Cape Colony. Their effect was to precipitate collisions between all three parties. Trouble first arose between the Boers and the Griquas in the Philippolis district. British troops were moved up to support the Griquas, and after a skirmish at Zwartkopjes (May 2, 1845), a new arrangement was made between Kok and Sir Peregrine Maitland, then governor of Cape Colony, virtually placing the administration of his territory in the hands of a British resident, a post filled in 1846 by Capt. (afterwards Major) H. D. Warden. The place chosen by Warden as the seat of his court was known as Bloemfontein, and it subsequently became the capital of the whole country.

First Annexation by Great Britain.—The *volksraad* at Winburg during this period continued to claim jurisdiction over the Boers living between the Orange and the Vaal and the relations between the Boers and the British were in a continual state of tension. Sir Harry Smith became governor of the Cape at the end of 1847. He recognized the failure of the attempt to govern on the lines of the treaties with the Griquas and Basutos, and on Feb. 3, 1848, he issued a proclamation declaring British sovereignty over the country between the Orange and the Vaal eastward to the Drakensberg. The justness of Sir Harry Smith's measures and his popularity among the Boers gained for his policy considerable support, but the Republican Party, at whose head was Andries Pretorius (*q.v.*), did not submit without a struggle. They were, however, defeated by Sir Harry Smith in an engagement at Boomplaats (Aug. 29, 1848). Thereupon Pretorius, with those

most bitterly opposed to British rule, retreated across the Vaal.

Warden remained British resident until July 1852. A nominated legislative council was created, a high court established and other steps taken for the orderly government of the country, which was officially styled the Orange River Sovereignty. In Oct. 1849 Moshesh was induced to sign a new arrangement considerably curtailing the boundaries of Basutoland. The frontier towards the Sovereignty was thereafter known as the Warden line. The British resident had, however, no force sufficient to maintain his authority, and Moshesh and all the neighbouring clans became involved in hostilities with one another and with the whites. In 1851 Moshesh joined the Republican party in the Sovereignty in an invitation to Pretorius to recross the Vaal. The intervention of Pretorius resulted in the Sand River Convention of 1852, which acknowledged the independence of the Transvaal but left the status of the Sovereignty untouched.

The British Government, which had reluctantly agreed to the annexation of the country, had, however, already repented its decision and had resolved to abandon the sovereignty. A meeting of representatives of all European inhabitants of the sovereignty, elected on manhood suffrage, held at Bloemfontein in June 1852, nevertheless declared in favour of the retention of British rule. But the cabinet in London adhered to the determination to withdraw from the Sovereignty. Sir George Russell Clerk was sent out in 1853 as special commissioner "for the settling and adjusting of the affairs" of the Sovereignty. At that time there were some 15,000 whites in the country, among them numbers of farmers and tradesmen of British (chiefly Scottish) blood.

Independence Forced on the Boers.—The majority of the whites still wished for British rule provided that it was effective and the country guarded against its enemies, but Sir George Clerk announced that, as the elected delegates were unwilling to form an independent government, he would enter into negotiations with other persons. While the elected delegates sent two members to England to try to induce the Government to alter their decision Sir George Clerk came to terms with a committee formed by the Republican party and presided over by J. H. Hoffman.

A royal proclamation had already (Jan. 30, 1854) "abandoned and renounced all dominion" in the sovereignty. A convention recognizing the independence of the country was signed at Bloemfontein on Feb. 23 by Sir George Clerk and the Republican committee, and on March 11, 1854, the Boer Government assumed office and the Republican flag was hoisted. Five days later the representatives of the elected delegates had an interview in London with the colonial secretary, the duke of Newcastle, who informed them that it was impossible for England to supply troops to constantly advancing outposts, "especially as Cape Town and the port of Table bay were all she really required in South Africa." In withdrawing from the Sovereignty the British Government declared that it had "no alliance with any native chief or tribes to the northward of the Orange river with the exception of the Griqua chief Captain Adam Kok." Kok was not formidable in a military sense and in 1861 he sold his sovereign rights to the Free State for £4,000 and removed with his followers to the district now known as Griqualand East.

Constitution of the Republic.—On the abandonment of British rule representatives of the people were elected and met at Bloemfontein on March 28, 1854, and between that date and April 18 were engaged in framing a constitution. The country was declared a republic and named the Orange Free State. All persons of European blood possessing a six months' residential qualification were to be granted full burgher rights. The sole legislative authority was vested in a single popularly elected chamber styled the *volksraad*. Executive authority was entrusted to a president elected by the burghers from a list submitted by the *volksraad*. The president was to be assisted by an executive council, was to hold office for five years and was eligible for re-election. The constitution was subsequently modified but remained of a liberal character. A residence of five years in the country was required before aliens could become naturalized. The franchise was confined to European adult males; the grant of the suffrage to natives was never considered. It may be added here that subsequently the Free State prohibited the entry into its territory of Asiatics, so that it was never troubled with an Indian question. The first president was J. H. Hoffman, but he was accused of being too complaisant towards Moshesh and resigned, being succeeded in 1855 by J. N. Boshof, one of the *voortrekkers*, who had previously taken an active part in the affairs of Natal.

Distracted among themselves, with the formidable Basuto power on their southern and eastern flank, the troubles of the infant state were speedily added to by the action of the Transvaal Boers. Marthinius Pretorius, who had succeeded to his father's position as commandant-general of Potchefstroom, wished to bring about a confederation between the two Boer States. As peaceful overtures failed Pretorius, aided by Paul Kruger, made a raid in 1857 into the Free State territory. They found, however, little support; Kruger came into Boshof's camp with a flag of truce; and on June 2, 1857, a treaty of peace was signed, each State acknowledging the absolute independence of the other. This experience did not, however, heal the party strife within the Free State. The difficulties of the State were so great that the *volksraad* in Dec. 1858 passed a resolution in favour of confederation with Cape Colony. This proposition received the strong support of Sir George Grey, then governor of Cape Colony, but his view did not commend itself to the British Government and was not adopted. In the same year the disputes between the Basutos and the Boers culminated in open war. As the contest went against them the Free State appealed to Sir George Grey, who induced Moshesh, for a time, to come to terms. President Boshof now gave up the struggle of attempting to rule the country and in Feb. 1859 retired to Natal. His old opponent Marthinius Pretorius was elected president in his stead. Though unable to effect a durable peace with the Basutos, or to realize his ambition for the creation of one powerful Boer republic, Pretorius saw the Free State begin to grow in strength. The fertile district of Bethulie as well as Adam Kok's territory was acquired, and there was a considerable increase in the white population. The burghers generally, however, had not learned the need of discipline, of confidence in their elected rulers, or that to carry on a government taxes must be levied. Wearied like Boshof of a thankless task, and more interested in affairs in the Transvaal than in those of the Free State, Pretorius resigned the presidency in 1863, and after an interval of seven months Mr. (afterwards Sir) John Henry Brand (*q.v.*), an advocate at the Cape bar, was elected president.

Brand's Rule.—President Brand took office in Feb. 1864. His selection proved a turning-point in the history of the country, which, under his beneficent and tactful guidance, became peaceful and prosperous and, in some respects, a model state. But before peace could be established an end had to be made of the difficulties with the Basutos. At length, in 1867 the burghers gained a decisive victory, every stronghold in Basutoland save Thaba Bosigo being stormed. Moshesh now turned to the British at the Cape for preservation and in 1868 he and his country were taken under British protection. Thus the 30 years' strife between the Basutos and the Boers came to an end. The Boers reaped the reward of victory. By the treaty of Aliwal North (Feb. 12, 1869), the country lying to the north of the Orange river and west of the Caledon, formerly a part of Basutoland, was ceded to the Free State. This country, some 100m. long and nearly 30m. wide, lies at an altitude of nearly 6,000ft. and forms one of the richest corn-growing districts in South Africa.

The Basutoland difficulties were no sooner arranged than the Free Staters found themselves confronted with a serious difficulty on their western border. In the years 1870–71 a large number of diggers had settled on the diamond fields near the junction of the Vaal and Orange rivers, which were situated in part on land claimed by the Griqua chief Nicholas Waterboer and by the Free State. The Free State established a temporary government over the diamond fields, but the administration of this body was satisfactory neither to the Free State nor to the diggers. At this juncture Waterboer offered to place the territory under the administration of Queen Victoria. The offer was accepted, and on Oct. 27, 1871, the district, together with some adjacent territory to which the Transvaal had laid claim, was proclaimed, under the

name of Griqualand West, British territory. When the British annexation took place a party in the *volksraad* wished to go to war with Britain, but the wiser counsels of President Brand prevailed. The matter involved no little irritation between the parties concerned until July 1876. It was then disposed of by the 4th Earl of Carnarvon, at that time secretary of State for the colonies, who granted to the Free State £90,000 "in full satisfaction of all claims which it considers it may possess to Griqualand West." One thing at least is certain with regard to the diamond fields—they were the means of restoring the credit and prosperity of the Free State. Moreover, it is doubtful if the Free State could at that time have controlled the diggers. The probability is that the alternative to British sovereignty was an independent diamond field republic. At this time, largely owing to the exhausting struggle with the Basutos, the Free State had drifted into financial straits. A paper currency had been instituted, and the notes—currently known as "bluebacks"—soon dropped to less than half their nominal value. Commerce was largely carried on by barter, and many cases of bankruptcy occurred. But the influx of British and other immigrants to the diamond fields, in the early '70s, restored public credit and individual prosperity to the Free State Boers. The diamond fields offered a ready market for stock and other agricultural produce. "Bluebacks" recovered par value, and were called in and redeemed by the Government.

Relations with the Transvaal.—From 1870 until the time when it became involved in the second struggle between Great Britain and the Transvaal the story of the Free State was one of steady, quiet progress, marked by cordial relations with its neighbours. The State has been described as for 30 years a farmers' and transport riders' paradise. At the time of the first annexation of the Transvaal, Brand and the *volksraad* declined the invitation of Lord Carnarvon to federate with the other South African communities and when the Transvaalers rose against the British in 1880 they had the sympathy of the Free Staters. Indeed, many burghers joined the Transvaal forces in the Majuba campaign and it was due to the tact and statesmanship of Brand that a dangerous situation was prevented from developing. The danger passed and the Free State showed considerable ability in adapting itself to the change, political and economic, which, a few years later, following the discovery of the Rand gold mines, came over the whole of South Africa. Paul Kruger, instead of imitating the liberal policy of the Free State, sought to meet the problem presented by the large *uitlander* population on the Rand by reliance on foreign (*i.e.*, not British) Powers and by an alliance with the Free State. In Oct. 1887 Kruger visited Bloemfontein and tried to induce Brand to enter into an offensive and defensive alliance with the Transvaal "against the common enemy." Brand declined to be drawn into such an engagement. He refused to recognize the British as enemies—indeed, though opposed to federation, he was equally opposed to racial rivalries. He was for full co-operation with the other South African communities, and a few months later arranged with the Cape and Natal for a conference on customs and railway questions. That was in Jan. 1888; in the June following Brand died. He was one of the most upright and enlightened rulers South Africa had known, and he earned the title of peacemaker. The conference he had planned was held in 1889 and resulted in a customs union between Cape Colony and the Free State, while the Cape Government obtained permission to extend the Port Elizabeth railway to Bloemfontein. This agreement was displeasing to the Transvaal, for the ultimate objective of the railway was the Rand, and Kruger had determined that the Rand's outlet to the sea should be through the Portuguese port of Lourenço Marques (Delagoa Bay).

In Brand's successor to the presidency—F. W. Reitz—the Transvaal found an ally. At one time an advocate at the Cape and since 1874 chief justice of the Free State, Reitz had been in 1881—at the time of Majuba—a leading organizer in the State of the Afrikander Bond (*q.v.*), at that time a bitterly anti-British organization. Reitz was elected president in Jan. 1889; two months later he made a treaty of alliance with Kruger. The alliance looked to a contingency which, however, did not arise during Reitz's presidency and meanwhile the Free State continued to prosper. From its geographical position it reaped the benefit without incurring the anxieties consequent on the settlement of a large *uitlander* population on the Rand. The Jameson raid, Dec. 1895, re-awakened anti-British feeling in the Free State. Reitz had resigned the presidency a month before the raid and at the election in Feb. 1896 Judge M. T. Steyn, a strong nationalist, was elected president, receiving 41 votes against 19 cast for (Sir) John G. Fraser. Fraser was the most prominent of the burghers of Scots descent, of whom there were a considerable number in the State, and he represented Brand's policy. Many burghers supported Fraser in opposition to entangling engagements with the Transvaal; nevertheless, Steyn, though protesting against many of the manifestations of Krugerism, concluded a new defensive and offensive alliance with Kruger in March 1896.

The South African War and After.—In the four years which followed, the Free State revised its constitution, the period of residence to obtain naturalization being reduced (Dec. 1897) from five to three years; entered (1898) into a new customs union with the Cape and Natal and in other ways tried to live up to its reputation as a model community. It was alarmed at the developments of the *uitlander* troubles in the Transvaal and tried to get Kruger to enact reforms; its ex-president, Reitz, had become State secretary in the Transvaal. Bloemfontein was chosen as the place for the Milner-Kruger conference which met in June, 1899, when Steyn urged Kruger to grant the five-year franchise to the *uitlander* (and thus avoid war) and Kruger retorted by asking Steyn "not to play the tame elephant to get him into the English kraal." But when the war came in the October following, the Free State was solidly by the side of the Transvaal. A resolution had been passed by the *volksraad* on Sept. 27 declaring that the State would observe its obligations to the Transvaal whatever happened. It would probably have sided with its sister Boer republic in any case, alliance or no alliance, for racial ties were strong. The offer of the British Government to respect the independence of the Orange Free State if it remained neutral had no response; and, as is common in these cases, the bitterness against Great Britain—with whom it had no cause of quarrel—was greater in the Free State than in the Transvaal. The events of the war are told elsewhere. (*See* SOUTH AFRICAN WAR and SOUTH AFRICA, UNION OF.)

Orange River Colony.—Bloemfontein was occupied by the British under Lord Roberts on March 13, 1900; and on May 28 following the Free State was annexed to the British dominions under the title of Orange River Colony. For nearly two years longer the burghers kept the field under Christian de Wet (*q.v.*), and other leaders, but by the articles of peace signed on May 31, 1902, British sovereignty was acknowledged. A civil administration of the colony was established early in 1901 and in June 1902 a nominated legislative council was set up of which Sir John Fraser and a number of other prominent ex-burghers became unofficial members. In every direction vigorous and successful efforts were made to repair the ravages of the war. Over £4,000,000 was spent by the British Government in the colony on these objects. At the same time efforts were made—with no great measure of success—to strengthen the British element in the country by means of land settlements. Special attention was also devoted to the development of the resources of the country and the education system was reorganized and greatly improved.

Responsible Government.—Having recovered from the worst effects of the war the Boers, both in the Transvaal and Orange Colony, began in 1904 to make organized efforts to regain their political ascendancy. This agitation, as far as the Orange River Colony was concerned, coincided with the return to South Africa of ex-President Steyn. Steyn had gone to Europe at the close of the war and did not take the oath of allegiance to the British Crown until the autumn of 1904. A congress of ex-burghers was held at Brandfort in Dec. 1904, when among other resolutions passed was one demanding the grant of self-government to the colony. This was followed in July 1905 by a conference at Bloemfontein, when it was resolved to form a national union. This organization, the *Oranjie Unie*, was formally constituted in May 1906.

A counter-organization was formed by ex-burghers who had

whole-heartedly accepted the new order of things. They took the title of the Constitutional party, and Sir John Fraser was chosen as chairman. In Bloemfontein the Constitutionalists had a strong following; elsewhere their supporters were numerically weak. The programmes of the two parties were very similar, the real difference between them being the attitude with which they regarded the British. While the ideal of the *Unie* was an Afrikander state, the Constitutionalists desired the equality of both white races.

The advent of a Liberal administration under Sir Henry Campbell-Bannerman in Great Britain in Dec. 1905 completely altered the political situation in the late Boer States. The previous (Conservative) Government had in March 1905 made public a form of representative government, intended to lead up to self-government for the Transvaal, and had intimated that a similar constitution would be subsequently conferred on the Orange Colony. The Campbell-Bannerman administration decided to do without this intermediary step in both colonies. It was not, however, until July 1, 1907, that the letters-patent conferring self-government on the colony were promulgated, the election for the legislative assembly taking place in November following. They resulted in the return of 29 members of the *Oranjie Unie,* five Constitutionalists and four Independents. The Constitutionalists won four of the five seats allotted to Bloemfontein, Sir John Fraser being among those returned. A ministry, which included Generals J. B. M. Hertzog and Christian de Wet, was formed by Abraham Fischer, one of the leading members of the old *volksraad.* Steyn's ill-health prevented his taking office, but he wielded almost as much power as when he had been president of the country.

Union of South Africa.—The responsible government entered upon its task in favourable conditions. The seven years of Crown colony administration had achieved remarkable results. Materially the country had been restored to a sound state with every prospect of a prosperous future, and steady progress was made under responsible government, but political developments were rapid, and less than three years after Fischer took office the Orange River Colony, as such, had ceased to exist.

The colony took part in May 1908 in an inter-State conference which determined to renew the existing customs convention and to make no alteration in railway rates. These decisions were the result of an agreement to bring before the parliaments of the various colonies a resolution advocating the closer union of the South African States and the appointment of delegates to a national convention to frame a draft constitution. In this convention Steyn took a leading and conciliatory part, and subsequently the Orange River Colony legislature agreed to the terms drawn up by the convention for the unification of the four self-governing colonies. Under the imperial act by which unification was established (May 31, 1910) the colony entered the Union under the style of the Orange Free State Province. (For the union movement *see* SOUTH AFRICA, UNION OF.) Fischer and Hertzog became members of the first Union ministry, while Dr. A. E. W. Ramsbottom, formerly colonial treasurer, became the first administrator of the Free State as a province of the Union.

Education Controversy.—During the period in which the province had been a self-governing colony much bitterness had been caused by the educational policy pursued by Hertzog, who was attorney-general and minister of education. From the date of the passing of an education act in the middle of 1908 until the absorption of the colony into the Union, Hertzog so administered its provisions regarding the media of instruction as to compel every European child to receive instruction in every subject, partly in the medium of Dutch. This policy of compulsory bilingualism was persisted in despite the vehement protests of the English-speaking community, and of the desire of many Dutch burghers that the medium of instruction for their children should be English. Failing to obtain redress, the English-speaking section of the community proceeded to open separate schools. It was not until 1912 that through the intervention of the Union parliament the dispute was settled by the provision that in the lower standards the medium of instruction should be the "home language" of the pupil. As to the Boer section, the *taal,* renamed *Afrikaans,* was by ordinance passed in 1920 recognized as a medium of instruction instead of Netherlands Dutch; the Free State Province being the first to adopt officially South African Dutch.

The province followed Hertzog when he parted from Botha on the racial issue and it became the stronghold of the Dutch Nationalists. With the exception of one of the Bloemfontein divisions they had a majority in every parliamentary constituency in the province. Up to his death in 1916 Steyn's influence with the Dutch section of the people continued powerful. In the crisis caused by the World War Steyn, supported by Hertzog, opposed operations against the Germans in South-West Africa. There followed the rebellion of de Wet, who drew his chief strength from the Free State. On Steyn's death Hertzog became the undisputed leader of the Dutch Nationalists and after the general election of 1924 he was chosen as prime minister of the Union. In internal affairs the province has been governed on progressive lines. Its interests remain predominantly agricultural.

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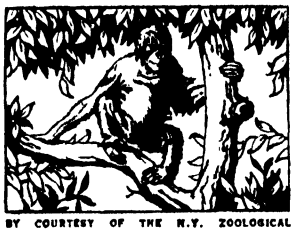
ORANGEMEN, members of the Orange Society, an association of Irish Protestants, originating and chiefly flourishing in Ulster, but with ramifications in other parts of the United Kingdom, and in the British colonies. Orangemen derive their name from King William III. (Prince of Orange). They are enrolled in lodges in the ordinary form of a secret society. Their toasts, about which there is no concealment, indicate the spirit of the Orangemen. The commonest form is "the glorious, pious and immortal memory of the great and good King William, who saved us from popery, slavery, knavery, brass money and wooden shoes," with grotesque or truculent additions according to the orator's taste. The brass money refers to James II.'s finance, and the wooden shoes to his French allies. The final words are often "a fig for the bishop of Cork," in allusion to Dr. Peter Browne, who, in 1715, wrote cogently against the practice of toasting the dead. Orangeism is essentially political. Its original object was the maintenance of Protestant ascendancy, and that spirit still survives. The orange flowers of the *Lilium bulbiferum* are worn in Ulster on July 1 and 12, the anniversaries of the Boyne and Aughrim. Another great day is Nov. 5, when William III. landed in Torbay.

ORANG-UTAN ("man of the woods"), the giant red manlike ape of Borneo and Sumatra (*Simia satyrus*). The reddish colour of the long, coarse hair distinguishes the omias, as the Dyaks call it, from African apes; the arms are such that the animal in the upright posture can rest on its bent knuckles. In some races, in the old males, which may stand 5½ft. high, there is a large expansion of the cheeks, due to growth of fibrous tissue and producing a broad and flattened type of face. Another peculiarity of the males is the presence of a huge throat-sac on the front of the throat and chest, which may extend even to the armpits; although present in females, it does not reach nearly the same dimensions in that sex. More than half a dozen separate races of orang-utan are recognized in Borneo where the red ape inhabits the swampy forest-tract at the foot of the mountains. These apes are comparatively slow and deliberate in their movements; they construct platforms of boughs in the trees, which are used as sleeping-places, and apparently occupied for several nights in succession. Durian, the tough spiny hide of which is torn open with their strong fingers, forms their chief food. They also consume the mangustin and other fruits. (*See* PRIMATES.)



BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

ORANG-UTAN (SIMIA SATYRUS)
A giant red ape of Borneo and Sumatra

ORANIENBAUM, a town of Russia in the Leningrad Area, in 59° 54′ N., 29° 48′ E., lying 100 ft. above the sea on the south coast of the Gulf of Finland, opposite Kronstadt. Pop.

(1926) 7,061. It was formerly a summer residence of the imperial family. The site was given to Menshikov in 1714 by Peter the Great, and the palace he erected still stands. Confiscated in 1727, it became an imperial residence. In 1743 the empress Elizabeth presented Oranienbaum to the future Tsar Peter III., who built there a castle, now destroyed, for his Holstein soldiers. The palace became a hospital during the 1914–18 war, and is now a rest home for workers. A school of forestry was established in one of the wings in 1918. A railway has been built since the revolution to link the town with the fort of Krasnaya Gorka, which guards the entrance to Kronstadt bay. There are flour-mills and brick works and the saw-milling industry is important.

ORAON, an aboriginal tribe of the Chota Nāgpur plateau, India, also known as Dhāngars. They call themselves *Kurukh*, but being divided into various groups are apt to be designated by group-names (*e.g.* Modi, "navvy," Kisān, "cultivator"), when they emigrate. A short, sturdy race of Dravidian type, they are in demand as labourers. As Oraon mothers shape their babies' heads their dolichocephaly may be to some extent artificial. The village organization is advanced. Their speech is akin to Kanarese. Their religion is a mixture of nature-worship and magic, thinly overlaid with Hinduism, Dharmes being the supreme god. In recent years a religious movement, influenced by Christianity as well as by Brahmanism, known as the Tana Bhagat movement and manifesting itself in ghost-hunting and the addition of German Bāba to the pantheon, caused some excitement in 1915. It had begun with a crusade against belief in ghosts and was largely a revolt against social degradation and economic depression.

Sarat Chandra Roy, *The Oraons of Chota Nagpur Ranchi* (1915), gives full history and valuable information; *Man in India* I. (1921).

ORATORIO, the name given to a form of religious music with chorus, solo voices and orchestra, independent of, or at least separable from the liturgy, and on a larger scale than the cantata (*q.v.*). Its history is involved in that of opera (*see* ARIA and OPERA), but its antecedents are more definite. The term is almost certainly (but *see* Schütz's "stilo Oratorio" on p. 844) derived from the fact that St. Filippo Neri's Oratory was the place for which Animuccia's settings of the *Laudi Spirituali* were written; and the custom of interspersing these hymns among liturgical or other forms of the recitation of a Biblical story is one of several origins of modern oratorio. A more ancient source is the use of incidental music in miracle plays and in such dramatic processions as the 12th century *Prose de l'Âne,* which on Jan. 1, celebrated at Beauvais the Flight into Egypt. But the most ancient origin of all is the Roman Catholic rite of reciting, during Holy Week, the story of the Passion according to the Four Gospels, assigning the words of the Evangelist to a tenor, distributing all *ipsissima verba* among appropriate voices, and giving the *responsa turbae,* or utterances of the whole body of disciples (*e.g.,* "Lord, is it I?") and of crowds, to a chorus. The only portion of this scheme that concerned composers was the *responsa turbae,* to which it was permitted to add polyphonic settings of the Seven Last Words of the eucharistic utterances of the Saviour. The narrative and the parts of single speakers were sung in the Gregorian tones appointed in the liturgy. Thus the settings of the Passion by Victoria and Soriano represent a perfect solution of the art-problem of oratorio. "Very tame Jews" is Mendelssohn's comment on the 16th century settings of "Crucify Him"; and it has been argued that Soriano's and Victoria's aim was not to imitate the infuriated Jews, but to express the contrition of devout Christians telling the story. On the other hand, ancient tradition ordained a noisy scraping of feet on the stone floor to indicate the departure from the place of the judgment seat! And so we owe the central forms of Bach's Lutheran Passion-oratorios to the Roman Catholic ritual for Holy Week.

With the monodic revolution at the outset of the 17th century the history of oratorio as an art-form wholly controlled by composers begins. There is nothing but its religious subject to distinguish the first oratorio, Emilio del Cavaliere's *Rappresentazione di anima e di corpo* from the first opera, Peri's *Euridice,* both produced in 1600. Differentiation was brought about primarily by the fact that oratorios without stage-presentation gave opportunity for a revival of choral music. And oratorios on the stage discouraged, by reason of their sacred subjects, whatever vestiges of dramatic realism could survive the ascendancy of the aria (*q.v.*). For lesser composers than Bach and Handel this ubiquitous form represented almost the only possibility of keeping music alive, or at least embalmed, until the advent of the dramatic and sonata styles. The efforts of Carissimi (d. 1674) in oratorio clearly show how limited a divergence from the method of opera was possible when music was first emancipated from the stage. Yet his art shows the corruption of Church music by a secular style rather than the rise of Biblical music-drama to the dignity of Church music. Normal Italian oratorio remains indistinguishable from serious Italian opera as late as *La Batulia liberata,* which Mozart wrote at the age of 15. Handel's *La Resurrezzione* and *Il Trionfo del Tempo* contain many pieces simultaneously used in his operas, and they contain no chorus beyond a perfunctory operatic final tune. *Il Trionfo del Tempo* was a typical morality play, and it became a masque, like *Acis and Galatea* and *Semele,* when Handel at the close of his life adapted it to an English translation with several choral and solo interpolations from other works. Yet between these two versions of the same work lies half the history of classical oratorio. The rest lies in the German Passion-oratorios that culminate in Bach; after which the greatest music avoids every form of oratorio until the two main streams, sadly silted up, and never afterwards quite pure, unite in Mendelssohn.

Luther was so musical that while the German Reformation was far from conservative of ancient liturgy, it retained almost everything which makes for musical coherence in a Church service; unlike the English Church, which with all its insistence on historic continuity, so rearranged the liturgy that no possible music for an English Church service can ever form a coherent whole. The four *Passions* and the *Historia der Auferstehung Christi* of H. Schütz (who was born in 1585, exactly a century before Bach) are as truly the descendants of Victoria's Passions as they are the ancestors of Bach's. They are Protestant in their use of the vulgar tongue, and narrative and dialogue are set to free composition instead of Gregorian chant, although written in Gregorian notation. The *Marcus Passion* is in a weaker and more modern style and stereotyped in its recitative. It may be spurious. But in the other Passions, and most of all in the *Auferstehung,* the recitative is a unique and wonderful language. It may have been accompanied by the organ, though the Passions contain no hint of accompaniment at all. In the *Auferstehung* the Evangelist is accompanied by four viole da gamba in preference to the organ. The players are requested to "execute appropriate runs or passages" during the sustained chords. A final non-scriptural short chorus on a chorale-tune is Schütz's only foreshadowing of the contemplative and hymnal element of later Passion oratorios.

The *Auferstehung,* the richest and most advanced of all Schütz's works, has one strange convention, in that single persons, other than the Evangelist, are frequently represented by more than one voice. If this were confined to the part of the Saviour, it would have shown a reverent avoidance of impersonation, as in Roman Catholic polyphonic settings of the Seven Words. But Schütz writes thus only in *Die Auferstehung* and there on no particular plan. While the three holy women and the two angels in the scene at the tomb are represented naturally by three and two imitative voices, Mary Magdalene is elsewhere always represented by two sopranos.

Shortly before Bach, Passion oratorios were represented by several remarkable works of art, most notably by R. Keiser (1673–1739). Chorale-tunes, mostly in plain harmony, were freely interspersed in order that the congregation might take part in what was, after all, a church service for Holy Week. The meditations of Christendom on each incident of the story were expressed in accompanied recitatives (*arioso*) leading to arias or choruses, and the scriptural narrative was sung to dramatic recitative and ejaculatory chorus on the ancient Roman plan. On slightly different lines was Graun's beautiful *Tod Jesu,* which was famous when the contemporary works of Bach were ignored.

The difference between Bach's Passions and all others is simply the measure of his greatness. Where his chorus represents the

whole body of Christendom it has as peculiar an epic power as it is dramatic where it represents tersely the *responsa turbae* of the narrative.

In the Matthew Passion the part of Christ has a special accompaniment of sustained strings, generally at a high pitch, though deepening at the most solemn moments. And at the words "Eli, Eli, lama sabacthani" this musical halo has vanished. In power of declamation Bach was anticipated by Keiser; but no one approached him in sustained inspiration and architectonic greatness. The forms of Passion music may be found in many of Bach's Church cantatas; a favourite type being the *Dialogue*; as, for instance, a dispute between a fearing and a trusting soul with, perhaps, the voice of the Saviour heard from a distance; or a dialogue between Christ and the Church, on the lines of the Song of Solomon. The Christmas Oratorio, a set of six Church cantatas for performance on separate days, treats the Bible story in the same way as the Passions, with a larger proportion of non-dramatic numbers. Many of the single Church cantatas are called oratorios, a term which by Bach's time seems definitely to have implied dialogue, possibly on the strength of a false etymology. Thus Schütz inscribes a monodic sacred piece "in stilo Oratorio," meaning "in the style of recitative." The further history of oratorio radiates from the heterogeneous works of Handel.

There are various types and several mixtures of style in Handelian oratorio. The German forms of Passion music evidently interested Handel, and it was after he came to England, and before his first English oratorio, that he set to music the famous poetic version of the Passion by Brockes, which had been adopted by all the German composers of the time, and which, with very necessary improvements of taste, was largely drawn upon by Bach for the text of his Johannes-Passion. Handel's Brockes Passion does not appear ever to have been performed, though Bach found access to it and made a careful copy; so Handel must have composed it for his own edification. He soon discovered that many kinds of oratorio were possible. The emancipation from the stage admitted of subjects ranging from semi-dramatic histories, like those of *Saul, Esther* and *Belshazzar,* to cosmic schemes expressed entirely in the words of the Bible, such as *Israel in Egypt* and *The Messiah.* Between these types there is every gradation of form and subject; besides an abrupt contrast of literary merit between the mutilated Milton of *Samson* and the amazing absurdities of *Susannah.*

The very name of Handel's first English oratorio, *Esther,* and the facts of its primary purpose as a masque and the origin of its libretto in Racine, show the transition from the stage to the Church; and, on the other hand, Haman's lamentation on his downfall is scandalously adapted from the most sacred part of the Brockes Passion.

We may roughly distinguish three main types of Handelian oratorio, not always maintained singly in whole works, but always available as methods. First, there is the operatic method, in which the arias and recitatives are the utterances of characters in the story, while the chorus is a crowd of Israelites, Babylonians or Romans (*e.g., Athalia, Belshazzar, Saul,* etc.). The second method retains the dramatic rôles both in solos and in choruses, but (as, for instance, in "Envy, eldest born of Hell," in *Saul*) also uses the chorus as the voice of universal Christendom. Handel's audience demanded plenty of arias, most of which are accounted for by futile, when not apocryphal, love affairs. The haughty Merab and the gentle Michal are characterized with fatal ease, and make parts of *Saul* almost as impossible as most of *Susannah.* The third Handelian method is a series of choruses and numbers on a subject altogether beyond the scope of drama, as, for instance, the greater part of *Solomon* and, in the case of *The Messiah* and *Israel in Egypt,* treated entirely in the words of Scripture, and those not in narrative but in prophecy and psalm.

After Bach and Handel, oratorio fell upon evil days. The rise of the sonata style, which brought life to opera, was bad for oratorio; since not only did it accentuate the fashionable dislike of that polyphony which is essential even to mere euphony in choral writing, but its dramatic power became more and more disturbing to the epic treatment that oratorio naturally demands.

Philip Emanuel Bach's oratorios, though cloying in their softness and sweetness, achieved a true balance of style in the earlier days of the conflict; indeed, a judicious selection from *Die Israeliten in Wüste* (1769) would perhaps bear revival almost as well as Haydn's *Tobias* (1774).

The Creation (*Die Schöpfung*) and *The Seasons* (*Die Jahreszeiten*) will always convey to unspoilt music-lovers the profound message of the veteran Haydn, who could not help "worshipping God with a cheerful heart." This spirit was well known to Bach, the composer of *"Mein glaübiges Herze,"* and it is compatible with the romantic sound-pictures and Handelian sublimity of the opening Representation of Chaos and the great chord of C major at the words "and there was light." The childlike gaiety of much of the rest ought not to blind us to its fundamental greatness, which brings the naïvely realistic birds and beasts of *The Creation* into line with even the wine-chorus in the mainly secular *Seasons,* and removes Haydn from the influence of the vile taste which henceforth pervaded oratorios, until Mendelssohn effected a partial improvement. Haydn strenuously resisted the persuasion to undertake *The Seasons* which had a close connection with Thomson's poem, as *The Creation* had a distant connection with *Paradise Lost.* He thought the whole scheme "Philistine" (his own word) and, both before he yielded to persuasion and after he had finished the work, said all the hard things about it that have ever been said since.

Roman Catholic oratorio was under the disadvantage that it was not permitted to take Biblical texts except in the Latin language. Jomelli's *Passione* for once had the benefit of a meditative text with some distinction of style; and in closing the first part with a dominant seventh on the word *"pensaci"* he achieved a stroke of genius which at the present day would still startle the listener and leave his mind in the desired frame of meditative astonishment.

But words fail to characterize the libretto of Beethoven's unfortunate *Christus am Oelberge* (*c.* 1800). The texts of Lutheran church-music had often been grotesque and even disgusting; but their barbarity was pathetic in comparison with the sleek vulgarity of a libretto in which not only is the agony of the garden of Gethsemane represented by an aria (as in Handel's lamentation of Haman), but Christ sings a brilliant duet with the ministering angel. In after years Beethoven had not a good word for this work, which, nevertheless, contains some beautiful music exquisitely scored. And justice demands praise for the idea of making a Hallelujah chorus conclude the work as soon as the betrayal of Christ has been accomplished, thus compensating for the irreverent opening by avoiding all temptation to treat the rest of the passion-story with the same crassness. A well-meant effort was made to provide the *Mount of Olives* with an inoffensive subject in English, but the stupidity of *Engerdi: or David in the Wilderness* passes belief.

Schubert's interesting fragment *Lazarus* is strangely prophetic of Wagnerian continuity and has a morbid beauty that transcends its sickly text. There are signs that the despair of the Sadducee was going to be treated with some power. The result might have been a masterpiece; but fate ruled that the next advance should again be Protestant.

Bach's Passions were rediscovered by the boy Mendelssohn after a century of ignorance of their very existence; and in *St. Paul* (*Paulus*) and *Elijah* (*Elias*) rose upon the early middle 19th century like the sunrise of a new Handel.

To-day *St. Paul* has almost sunk below the horizon; and *Elijah,* which still shares with *The Messiah* the Christmas repertoire of every British urban choral society, is in many points an easy target for criticism. Yet the ascendancy of Mendelssohn is the one redeeming feature in the history of oratorio during the first three quarters of the 19th century. Let us admit the defects of *Elijah;* the all too lifelike tiresomeness of the widow (achieved after strenuous revision), the parochial softness of the double quartet, the Jewishness of the Jews (but is this a defect?), and the snorts of the trombones whose third summons causes the Almighty to capitulate: when all these unconscious profanities are discounted, there remains a vivid and coherent oratorio that, musically and

dramatically, towers above later works by many accomplished composers who despise it. (*See* MENDELSSOHN.)

Spohr is the only contemporary of Mendelssohn whose sacred music is still known. So tremendous a subject as that of *The Last Judgment* ought, indeed, to be treated with reserve; but the softness and slowness which pervades nine-tenths of Spohr's work is not reserve but self-indulgence. Spohr has moments of vision; but an almost random glance at the pages of *St. Paul* shows that even in eclipse Mendelssohn has characterization, movement and the capacity for thrilling dramatic moments.

In England, the influence of Mendelssohn completed the devastation begun by our inveterate habit of praising the inspired literary skill of the sacred narrative, as a preface to our restatement of it in 40 times as many words of our own. Deans and chapters listened in graceful official pride and imperfectly secret glee to the strains in which the cathedral organist celebrated with equal realism the destruction of Sennacherib's hosts and his own octuply-contrapuntal doctorate of music. Before 1880 our composers had, as Dr. Walker says, "set with almost complete indiscrimination well-nigh every word of the Bible." Had they confined themselves to the second chapter of Ezra they would have escaped dangers of unconscious humour that lurk in the opportunities for "naturalness" in declaiming the dialogues and illustrating the wonders of scriptural narrative.

Neither Sterndale Bennet nor Macfarren improved matters; but Parry and Stanford, towards the end of the century, completely changed the situation. Stanford's *Eden* has a libretto by Robert Bridges. The disgruntled professional librettists, who were also musical critics, had the effrontery to say that this magnificent poem would be the better for extensive cuts. The real truth is that Stanford's music, especially in its orchestral introduction, is diffuse. But it has many beautiful features, and achieves a coherent scheme on exactly such lines of Wagnerian continuity as can be applied to oratorio. Parry preferred to be his own librettist, and by this means he achieved more significant results. The lapses of the amateur poet are less distressing than the *clichés* of the ordinary professional librettist; and the works of Parry and Stanford permanently raised English oratorio from squalor and made it once more an art-form which educated people could enjoy. Some of Parry's architectonic and dramatic ideas will never lose the power to thrill, if only the works as wholes can live in spite of a certain dryness of melody and heaviness of texture. For example, the exploit of Judith is shown with a total avoidance of the cheap and salacious opportunity for a scene between her and Holofernes. Instead, we listen to the watchmen anxiously making their circuit of the city walls in darkness. The music of their march is at a low pitch. It is reaching a normal close when, high above the tonic chord, the cry of Judith bids the watchmen open the gates to her. If this moment cannot thrill, there is no meaning in art. In *King Saul* Parry made a significant discovery as to the emancipation of dramatic oratorio from the stage conditions of time and space. The Witch of Endor prophesies the battle of Gilboa. Her tale becomes real in the telling and is immediately followed by the final dirge.

As with opera, so, but more easily, with oratorio, the method of Wagnerian continuity at last enabled composers to take extant poems and set them to music in their entirety. Thus the fragrant mysticism of Roman Catholic oratorio, dimly adumbrated in Schubert's *Lazarus*, at last came to fruition in Elgar's wonderful setting of Newman's *Dream of Gerontius*, while the old miracle play *Everyman* was very successfully composed by Walford Davies. In his later works, *The Apostles* and *The Kingdom*, Elgar pursues a comprehensive religious design on texts arranged by himself. Oratorio on the basis of Wagnerian continuity and *Leit-motif* is unquestionably a living art-form. Its greatest difficulty is its fatal facility. The oratorio-composer is lost who omits to transcend the limits of the stage; yet when these are transcended only the stedfastness of genius can prevent the composer from sinking to the fashion-storming eclecticism of Honegger's *Le Roi David* which, with the aid of a reciter to read the Bible, takes up the arts of all periods from Handel to 1927 and drops each of them before anything like an art-problem arises.

Why not follow more often the method of *The Messiah* and of *Israel in Egypt;* and deal with religious subjects in terms of prophecy and psalm? Brahms's *Deutsches Requiem* is really an oratorio; and since its production (all but one later movement) in 1866 it continues year by year to tower over all other choral music since Beethoven's Mass in D. Form, disciplined form, is not the only thing needed to save future oratorios from the limbo of vanity; but it is their first need. (D. F. T.)

ORATORY, the art of speaking eloquently or in accordance with the rules of rhetoric (*q.v.*).

ORATORY OF ST. PHILIP NERI, CONGREGATION OF THE, or ORATORIANS, a religious order consisting of a number of independent houses, first organized in 1575 by the Florentine priest, Philip Neri (*see* NERI, PHILIP.)

ORBIGNY, ALCIDE DESSALINES D' (1802–1857), French palaeontologist, was born at Couërzon, Loire Inférieure, on Sept. 6, 1802, and was educated at La Rochelle. His first appointment was as travelling naturalist for the Museum of Natural History at Paris. He went in 1826 to South America, and gathered much information on the natural history and ethnology, embodying the results in his great work *Voyage dans l'Amérique Méridionale* (1839–1842). Then, in 1840 he began to publish his *Paléontologie Française, ou description des fossiles de la France*, a monumental work, accompanied by figures of the species. Eight volumes were published by him dealing with Jurassic and Cretaceous invertebrata, and since his death many later volumes have been issued. In 1853 he was appointed professor of palaeontology at the Museum of Natural History in Paris, but died on June 30, 1857, at Pierresitte, near St. Denis.

His works include *Cours élémentaire de paléontologie et de géologie stratigraphiques* (3 vols., 1849–52), and *Prodrome de paléontologie stratigraphique* (3 vols., 1850–52).

ORBIT, in astronomy, is the path of a heavenly body revolving around an attracting centre (from Lat. *orbita*, a track, *orbis*, a wheel); in particular, it denotes the path of a planet or comet around the sun, or of a satellite around its controlling planet.

Kepler's Laws.—In 1609 Johann Kepler announced two laws of planetary motion, and by 1619 he added a third. Kepler's first law is as follows:—A planet moves around the sun in an elliptic orbit, the sun being situated in one focus of the ellipse. If the straight line joining any two points S and T is produced equal distances beyond S and T to A and B, and if P is any point such that the sum of the distances P S and P T is equal to the distance A B, then the aggregate of all such points as P is the curve known as the ellipse. The points S and T are the foci. The curve passes through A and B and A B is called the major axis of the ellipse. If C is the mid-point of A B, the ratio

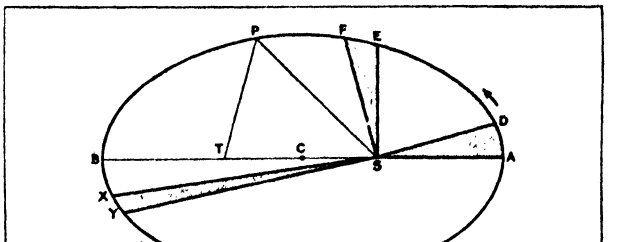


FIG. 1.—DIAGRAM ILLUSTRATING KEPLER'S LAWS OF PLANETARY MOTION

of the length of C S to the length of C A is called the eccentricity. The ellipse then is specified by means of (i) the semi-major axis and (ii) the eccentricity. If the eccentricity happens to be zero, the two foci must coincide at the centre C and the resulting curve is simply a circle; if the eccentricity is precisely unity, then the curve is known as a parabola. Kepler's first law simply states that if the sun is supposed situated at the focus S, the planet's path around the sun—in other words, its orbit—is an ellipse such as is represented in the diagram above. The time required for a complete revolution in the ellipse is the planet's

revolution period; for example, the earth's period of revolution is a little over 365 days; Mercury describes its orbit in 88 days, and Neptune requires 165 years. At A—the point of the ellipse nearest S—the planet is said to be in *perihelion*, and when it reaches B, the most remote point of the ellipse from S, it is said to be in *aphelion*.

Kepler's second law states that the straight line joining the sun to the planet (the radius vector) sweeps out equal areas in equal times. In the preceding figure let D be the position of the planet in its elliptic orbit a month after it reached perihelion (A); similarly let E F be two positions of the planet separated by an interval of a month; the pair of points X, Y are defined in the same way. The shaded area S D A, for example, is the area swept out by the radius vector in one month and by the second law the three shaded areas are equal. Now it is clear from the figure that the arc A D is greater than the arc X Y, for the areas S D A and S X Y are equal and S A and S D are less than S X and S Y; consequently, the velocity of the planet in its orbit must be greater between A and D than between X and Y. More definitely, the velocity of the planet is greatest at perihelion, decreasing gradually until aphelion is reached and thereafter increasing to a maximum again at perihelion.

The figure also shows that the angles described in equal intervals of time by the radius vector vary throughout the orbit; for example the angle D S A is clearly greater than the angle X S Y. The angular velocity is greatest at perihelion and least at aphelion. In one complete revolution around the sun, the radius vector sweeps out 360° and as the period of revolution is accurately known, the average angular velocity is easily deduced. This is known as the "mean motion" and is expressed as so many degrees (or seconds of arc) per day.

Kepler's third law is a relation connecting the semi-major axes of the several planets with their periods of revolution. In Kepler's time, the mean distance of any one planet from the sun was not known in miles but it was known fairly accurately in terms of the earth's mean distance from the sun regarded as the unit of the distance; in other words, the planetary system had been fairly correctly mapped out but the scale of the map was lacking. Also, the periods of the several planets were known with considerable accuracy. The third law expressed in words is: the cube of the semi-major axis of any planetary orbit divided by the square of the period of revolution is the same whatever planet is considered. If the year is regarded as the unit of time and the earth's mean distance from the sun as the unit of distance (this is known as the astronomical unit of distance) the quotient above for the earth is plainly unity and consequently by the third law the cube of the semi-major axis of any other planet (expressed in terms of the astronomical unit) must be equal to the square of the planet's period (expressed in years).

The Orbit in Space.—We have seen that the elliptic orbit of a planet is specified by the eccentricity and the semi-major axis. To apply Kepler's first and second laws to predict the positions of the planet in its orbit at any time it is necessary to know in addition the time when it occupied any definite position in the orbit or the time when it passed through perihelion. The eccentricity, the length of the semi-major axis and the time of perihelion passage constitute three elements of the planet's orbit.

The planetary motions do not all take place in the same plane and consequently the plane of the orbit of a particular planet must be specified with reference to some fundamental plane: the plane chosen is that of the earth's orbit and is called the plane of the ecliptic. Imagine a sphere drawn with the sun at the centre. The plane of the earth's orbit will cut the sphere in a circle (the ecliptic) and the orbital plane of any other planet will cut the sphere in another circle inclined at some definite angle to the plane of the ecliptic. The two circles intersect at two points N and M—called the Nodes. Let V denote a definite reference point on the ecliptic—the direction S V may be thought of as the direction of a particular star as seen from the sun. The point V is known as the "vernal equinox" or "First point of Aries"; it is not necessary here to specify it more particularly. The plane of the planet's orbit is completely specified—with reference to the ecliptic and the point V—by (i) the inclination of the planet's plane to the plane of the ecliptic and (ii) the position of the node N with respect to the point V. The latter is evidently given by the angle subtended at the sun by the radii S V and S N, and this angle is known as the longitude of the node. One thing more requires to be done and that is to specify the orientation of the orbital ellipse in its plane; this is accomplished by specifying the direction of perihelion—in the figure this is indicated by the direction S A. The sum of the angles subtended at S by the arcs V N and N A is called the longitude of perihelion. It should be noticed that there is an ambiguity as to the meaning of the expression "longitude of the node" for there are two nodes N and M. If the upper hemisphere in the figure contains the north pole of the heavens, the radius vector of the earth's orbit moves in the direction S V towards S N as indicated by the arrow; and if the radius vector of the planet moves in the direction S N towards S A, as indicated by the arrow, then N is called the ascending node and M the descending node and (ii) above more precisely should be "the longitude of the ascending node." The ambiguity consequently disappears.

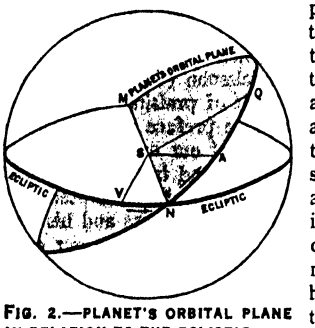


FIG. 2.—PLANET'S ORBITAL PLANE IN RELATION TO THE ECLIPTIC

To summarize; a planet's orbit in space is completely specified by the six elements: (i) the semi-major axis, (ii) the eccentricity, (iii) the time of perihelion passage, (iv) the longitude of the ascending node, (v) the longitude of perihelion, (vi) the inclination of the orbital plane to the plane of the ecliptic.

When the six elements of a planet's orbit are known the position of the planet (the effects of the attractions of the other planets not being taken into account) with reference to the sun and the fundamental plane (the ecliptic) can be calculated for any future date by principles essentially contained in Kepler's laws. The earth's orbit also being known, the position of the planet in the heavens, as seen from the earth, can then be deduced.

The Orbit from Observations.—The reverse problem is to determine the elements of the orbit from actual observations of position made from the earth. When a minor planet or comet is discovered it is important to determine the six elements of its orbit which hold the new body in the secure grasp of mathematical analysis, thus enabling the astronomer to follow subsequently its wanderings even without the aid of observational appliances. A single complete observation of a planet consists in determining its right ascension and declination; three such complete observations at intervals, say, of a month are sufficient to allow the calculation of the six orbital elements.

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(W. M. S.)

ORCAGNA (*c.* 1308–*c.* 1368), Italian painter, sculptor, worker in mosaic and architect, whose full name was ANDREA DI CIONE, called ARCAGNUOLO, was the son of a Florentine goldsmith, Maestro Cione, said to have been one of the principal artists who worked on the magnificent silver frontal of the high altar of San Giovanni, the Florentine Baptistery. The result of Orcagna's early training in the use of the precious metals may be traced in the extreme delicacy and refined detail of his principal works in sculpture. His brothers, Lionardo or Nardo, the eldest, a painter; Matteo, a sculptor and mosaicist, and Jacopo, also a painter, were often associated with Orcagna in his varied labours.

From the time of Giotto to the end of the 14th century Orcagna stands pre-eminent among the many excellent artists of that time.

1. *Orcagna as a Painter.*—He was admitted to the guild of the Medici and Speziali, where his name first occurs in the documents of 1344. His chief works in fresco were at Florence, in the church of Sta. Maria Novella. He covered the walls of the retro-choir

with scenes from the life of the Virgin. These, unfortunately, were much injured by damp very soon after their completion, and towards the end of the following century were replaced by other frescoes of the same subjects by Ghirlandaio, who, according to Vasari, made much use of Orcagna's motives and invention. Vasari says that Orcagna also painted the Strozzi chapel in the same church in company with his brother. But Ghiberti attributes these works to his brother Nardo alone. These frescoes still exist though much restored; modern criticism is inclined to attribute them to Nardo. The finest composition is that on the west wall, unbroken by any window. It represents paradise, with Christ and the Virgin enthroned in majesty among rows of brilliantly coloured cherubim and seraphim tinged with rainbow-like rays of light. Here Andrea Orcagna may have had a share in the execution.

In 1357 Orcagna painted one of his finest panel pictures, as a retable for the altar of the same chapel, where it still remains. In the centre is Christ in majesty between kneeling figures of St. Peter and St. Thomas Aquinas, attended by angel musicians; on each side are standing figures of three other saints. It is painted with extreme miniature-like delicacy, and is on the whole very well preserved. This retable is signed, "An. dni. mcclvii. Andreas Cionis de Florentia me pinxit." It is the only certified painting by Orcagna in existence. According to Vasari, he also painted some very fine frescoes in Sta. Croce. Of these only a small fragment remains. Orcagna's figures are plastically conceived, and clearly defined by a firmly drawn contour. They stand out against the background like statues.

2. *Orcagna as a Sculptor and Architect.*—Orcagna was admitted as a member of the Sculptors' Gild in 1352. His name occurs in the roll as "Andreas Cionis vocatus Arcagnolus, pictor." According to Vasari, Orcagna worked under Andrea Pisano as a pupil in sculpture. His style, however, constitutes an advance on Andrea's art and prepares the way for the coming Renaissance. In 1359 he completed the great marble tabernacle for the chapel of Or San Michele. This, in its combined splendour of architectural design, sculptured reliefs and statuettes, and mosaic enrichments, is one of the most important and beautiful works of art which even rich Italy possesses.

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ORCHARDSON, SIR WILLIAM QUILLER (1832–1910), British painter, was born in Edinburgh on March 27, 1832. At 13½ he went to the Trustees' academy. At 20, Orchardson had mastered the essentials of his art, and for seven years after this he worked in Edinburgh, devoting himself partially to "black and white." In 1862 he came to London, and established himself in 37, Fitzroy square, where his friend John Pettie joined him.

The English public was not immediately attracted by Orchardson's work, which was too quiet to compel attention at the Royal Academy, and Pettie, Orchardson's junior by seven years, at first outshone him. Orchardson confined himself to the simplest themes and designs and the most reticent schemes of colour. In 1865 Pettie married, and the Fitzroy square *ménage* was broken up. Orchardson married Miss Helen Moxon in 1873. In 1868 he was elected A.R.A. and in 1877 R.A. He died on April 13, 1910.

Orchardson's first great success was gained in 1881, when he exhibited "On Board the 'Bellerophon'" (now at the Tate gallery) at the Royal Academy, and for the next ten or twelve years his exhibits enjoyed unfailing popularity. "The Voltaire" (1883) (now in the Kunsthalle, Hamburg) is perhaps his finest composition. The "Mariage de convenance" (1884) and "A Tender Chord" (1886) were two of his most famous paintings, and about this time he exhibited a series of period pictures.

Among his portraits are "Master Baby," "The Provost of Aberdeen" and "Sir Walter Gilbey, Bart." Other paintings are "After" (sequel to "Mariage de convenance"), and "The Young Duke."

ORCHESTRA. In ancient Greece the *ὀρχήστρα* was the space between the auditorium and the proscenium or stage, in which were stationed the chorus and the instrumentalists. In its modern acceptation the word means either that portion of a theatre or concert-hall provided for the accommodation of the instrumentalists or the body of instrumentalists itself; by extension in the U.S.A. it means the main floor of the theatre.

The modern orchestra is composed of (1) a basis of strings—first and second violins, violas, violoncellos and double basses; (2) flutes, sometimes including a piccolo; (3) the reed contingent, consisting of two complete families, (*a*) the oboes with their tenors and basses (the cor anglais, the fagotto or bassoon and the contrafagotto or double bassoon), (*b*) the clarinets with their tenor and basses (the basset horn and the bass and pedal clarinets), with the addition sometimes of saxophones; (4) the brass wind, consisting of the horns, a group sometimes completed by the tenor and tenor-bass Wagner tubas, the trumpet or cornet, the trombones (tenor, bass and contrabass), the tubas (tenor, bass and contrabass); (5) a harp or harps; (6) the percussion instruments, including the kettledrums, bells, Glockenspiel, cymbals, triangle, etc.; to which are sometimes added a celesta and a pianoforte, to say nothing of such "extras" as the rattle employed by Richard Strauss in *Till Eulenspiegel*, the wind machine required by the same composer in *Don Quixote*, the iron chains introduced by Schönberg in his *Gurrelieder*, and so on.

Although most of the instruments from the older civilizations of Egypt, Chaldea, Persia, Phoenicia and of the Semitic races were known to the ancient Greeks, they did not share in any way their neighbours' love of orchestral effects, obtained by combining harps, lyres, guitars, tanburs, flutes, trumpets, bagpipes, cymbals, drums, etc., playing in unison or in octaves. The Greeks only cultivated to any extent the various kinds of citharas, lyres and auloi, and these were seldom used in concert. To the predilection of the Romans for wind instruments of all kinds we owe nearly all the wind instruments of the modern orchestra, each of which had its prototype among the instruments of the Roman empire: the flute, oboe and clarinet, in the tibia; the trombone and trumpet in the buccina; the tubas in the tuba; and the French horn in the cornu and buccina.

The 4th century A.D. witnessed the downfall of the Roman drama and the debasement of instrumental music, which was placed under a ban by the Church. During the convulsions which the migrations of Goths, Vandals and Huns caused in Europe after the fall of Rome instrumental music was preserved from absolute extinction by wandering actors and musicians.

The earliest instrumental compositions extant are certain 15th century dances and pieces in contrapuntal style preserved in the libraries of Berlin and Munich. The late development of notation, which long remained exclusively in the hands of monks and troubadours, personally more concerned with vocal than with instrumental music, ensured the preservation of the former, while the latter was left unrecorded. But indications are not wanting of an independent energy and vitality which must surely have existed in unrecorded mediaeval instrumental music, since there is such evidence of this in the instruments themselves. It is, for example, significant of the attitude of the 10th century instrumentalists towards musical progress that they at once assimilated Hucbald's innovation of the *organum*, a parallel succession of fourths and fifths, accompanied sometimes by the octave, for two or three voices respectively, and that they produced in the same century the *organistrum*, named after Hucbald's *organum*.

At the time of the revival of the drama with music, afterwards modified and known as opera, at the end of the 16th century, there was as yet no orchestra in our sense of the word, but merely an abundance of instruments used in concert for special effects, without balance or grouping; small positive organs, regals, harpsichords, lutes, theorbos, archlutes, chittarone (bass and contrabass lutes), guitars, viols, lyras *da braccio* and *da gamba*, psalteries, citterns, harps, flutes, recorders, cornets, trumpets and trombones, drums and cymbals.

Monteverde was the first to see that a preponderance of strings is necessary to ensure a proper balance of tone. With the perfected models of the Cremona violins at his disposal, a quartet of strings was established and all other stringed instruments not played with the bow were ejected from the orchestra, with the exception of the harp. Under the influence of Monteverde and his

successors, Cavalli and Cesti, the orchestra won for itself a separate existence with music and laws of its own. As instruments were improved, new ones introduced, and old ones abandoned instrumentation became a new and favourite study in Italy and in Germany, and musicians began to find out the capabilities of the various families of instruments and their individual value.

At first the orchestra was an aristocratic luxury, performing privately at the courts of the princes and nobles of Italy; but in the 17th century performances were given in theatres, and Germany eagerly followed. Dresden, Munich and Hamburg successively built opera houses, while in England opera flourished under Purcell, and in France under Lully, who, with the collaboration of Molière, also greatly raised the status of the entertainments known as *ballets*, interspersed with instrumental and vocal music.

The revival of the drama seems to have exhausted the enthusiasm of Italy for instrumental music and the field of action was shifted to Germany, where the perfecting of the orchestra was continued. Most German princes had at the beginning of the 18th century good private orchestras or *Kapelle*, and they always endeavoured to secure the services of the best available instrumentalists. Kaiser, Telemann, Graun, Mattheson and Handel contributed greatly to the development of German opera and of the orchestra in Hamburg during the first quarter of the century. Bach, Gluck and Mozart, the reformers of opera; Haydn, the father of the modern orchestra and the first to treat it independently as a power opposed to the solo and chorus, by scoring for the instruments in well-defined groups; Beethoven, who individualized the instruments, writing solo passages for them; Weber, who brought the horn and clarinet into prominence; Schubert, who inaugurated the conversations between members of the wood wind—all left their mark on the orchestra, leading the way up to Wagner, Strauss and their successors.

ORCHESTRATION: *see* INSTRUMENTATION.

ORCHESTRION, a name applied to three different kinds of musical instruments: (1) a chamber organ, designed by Abt Vogler at the end of the 18th century; (2) a pianoforte with organ pipes attached, invented by T. A. Kunz of Prague in 1791; (3) a mechanical wind orchestra, automatically played by means of revolving cylinders, invented in 1851 by F. T. Kaufmann of Dresden.

ORCHHA (also called *Tehri* or *Tikamgarh*), an Indian state in the Bundelkhand agency of Central India. It is the oldest and highest in rank of all the Bundela principalities, and was the only one not held in subjection by the peshwa. Area, 2,080 sq.m., pop. (1921) 284,948. The maharaja, Sir Pratap Singh, G.S.C.I. (born in 1854, succeeded in 1874), took a great personal interest in the development of his state, and bears the hereditary title of "First of the Princes of Bundelkhand." The state exports grain, *ghi*, and cotton cloth, but trade suffers from imperfect communications. The town of Orchha, the former capital, is on the river Betwa, not far from Jhansi. It possesses an imposing fort, dating mainly from the early 17th century, with two magnificent palaces —the Rajmandir, a massive square erection of which the exterior is almost absolutely plain, and the Jahangirmahal, a singularly beautiful specimen of Hindu domestic architecture. Elsewhere about the town are fine temples and tombs, among which may be noticed the Chaturbhuj temple on its vast platform of stone. The town of Tehri or Tikamgarh, where the chief now resides, is about 40 m. S. of Orchha; pop. (1921) 14,096. The maharaja has a salute of 15 guns, with 2 added as a personal distinction.

ORCHIDS, the name given to members of the orchid family (Orchidaceae), one of the most numerous and interesting groups of flowering plants, usually with beautiful and often with exceedingly handsome and highly fragrant flowers. Orchids are found in moist climates very widely throughout the world, except in the polar regions, but they occur in by far their greatest diversity and abundance in humid tropical forests. The orchids are all perennial herbs and are comprised in two groups: (1) terrestrial orchids, which grow in the ground, and (2) epiphytic orchids, epiphytes, which grow perched upon trees, found in the tropics where they form an important feature of the vegetation. Most orchids of the temperate zone are terrestrial.

Floral Structure.—The flowers of orchids, though extremely diverse within certain limits, are all formed upon one common plan, which is only a modification of that observable in such flowers as those of the narcissus. Such flowers consist essentially in the presence of a six-parted perianth, the three outer segments of which correspond to a calyx, the three inner ones to a corolla. These segments spring from the top of the ovary which is inferior instead of superior as in the lily. Within the perianth, and springing from its sides, or apparently from the top of the ovary, are six stamens whose anthers contain powdery pollen-grains. These stamens encircle a style which is the upward continuation of the ovary, and which shows at its free end traces of the three originally separate but now blended carpels of which the ovary consists.

An orchid flower has an inferior ovary, but with the ovules on the walls of the cavity (not in its axis or centre), a six-parted perianth, a stamen or stamens and stigmas. The main distinguishing features consist in the fact that one of the inner pieces of the perianth becomes in course of its growth much larger than the rest, and usually different in colour, texture and form. So different is it that it receives a distinct name, that of the "lip" or "labellum." In place of the six stamens we commonly find but one (two in *Cypripedium*), and that one is raised together with the stigmatic surfaces on an elongation of the floral axis known as the "column." Moreover, the pollen, instead of consisting of separate cells or grains, consists of cells aggregated into "pollen-masses," the number varying in different genera, but very generally two, four or eight. In *Cypripedium* all three stigmas are functional, but in most orchids only the lateral pair form receptive surfaces, the third being sterile and forming the rostellum which plays an important part in the process of pollination, often forming a peculiar pouch-like process in which the viscid disk of the pollen-masses is concealed.

It would appear, then, that the orchid flower differs from the more general monocotyledonous type in the irregularity of the perianth, in the suppression of five out of six stamens, and in the union of the one stamen and the stigmas. In addition to these modifications, which are common to nearly all orchids, there are others generally but not so universally met with; among them is the displacement of the flower arising from the twisting of the inferior ovary, in consequence of which the flower is so completely turned round that the "lip," which originates in that part of the flower, conventionally called posterior, or that nearest to the supporting stem, becomes in course of growth turned to the anterior part of the flower nearest to the bract. Other common modifications arise from the union of certain parts of the perianth to each other, and from the varied and often very remarkable outgrowths from the lip. These modifications are associated with the structure and habits of insects and their visits to the flowers.

Cross-Fertilization by Insects.—In the common orchids of British meadows, *Orchis maculata*, *O. mascula* (Shakespeare's long purples), etc., the general structure of the flower is as described. In addition there is in this particular genus, as indeed in many others, a long tubular spur or horn projecting downwards from the back of the lip, whose office it is to secrete and store a honeyed juice; the forepart of the lip forms an expanded plate, usually larger and more brightly coloured than the other parts of the flower, and with hairs or ridges and spots of various kinds according to the species. The remaining parts of the perianth are much smaller, and commonly are so arranged as to form a hood overarching the "column." This column stands up from the base of the flower, almost at right angles to the lip, and it bears at the top an anther, in the two hollow lobes of which are concealed the two pollen-masses, each with its caudicle terminating below in a roundish gland, concealed at first in the pouch-like rostellum at the front of the column. Below the anther the surface of the column in front is hollowed out into a greenish depression covered with viscid fluid—this is the two united stigmas.

In the process of pollination a bee alights on the lip. There, guided by the hairs or ridges, it is led to the orifice of the spur with its store of honeyed juice. The position of this orifice, as we have seen, is at the base of the lip and of the column, so that the in-



PAINTED FOR THE ENCYCLOPÆDIA BRITANNICA BY ISABEL COOPER AFTER SPECIMENS GROWN BY JOSEPH MANDA

EIGHT VARIETIES OF CULTIVATED ORCHIDS

The orchid family, one of the most interesting groups of flowering plants, comprises upwards of 7,000 species, found most abundantly in the Tropics. Several hundred species are grown in greenhouses; from these, gardeners have developed many varieties and an immense number of hybrid forms

1. Thwaites' Dendrobium (*Dendrobium Thwaitesiae*). 2. Venus Dendrobium (*D. Falconeri* x *nobile*). 3. Moth orchid (*Phalaeopsis Luedemanniana*) 4. Alexander's Cymbidium (*Cymbidium Alexanderi*). 5. Argus lady slipper (*Cypripedium Argus*). 6. Sanders' lady slipper (*Cypripedium insigne Sanderae*). 7. Queen Cattleya (*Cattleya Dowiana aurea*). 8. Triana Cattleya (*Cattleya Trianae*)

sect, if of sufficient size, while bending its head to insert the proboscis into the spur, almost of necessity displaces the pollen-masses. Liberated from the anthers, these adhere to the head or back of the insect by means of the sticky gland at the bottom of the caudicle. Having sipped the nectar the insect withdraws, taking the pollen-masses with it, and visits another flower. The two anther-cases in an orchis are erect and nearly parallel the one to the other; the pollen-masses within them are of course in the like position. Immediately, however, the pollen-masses are removed, movements take place at the base of the caudicle so as to effect the bending of this stalk, bringing the pollen-mass in a more or less horizontal position, or, as in the case of *O. pyramidalis*, the two pollen-masses originally placed parallel diverge from the base like the letter V. The movements of the pollen-masses may readily be seen with the naked eye by thrusting the point of a needle into the base of the anther, when the disks adhere to the needle as they would do to the antenna of an insect, and may be withdrawn. Sometimes the lip is mobile and even sensitive to touch, as are also certain processes of the column. In such cases the contact of an insect or other body with those processes is sufficient to liberate the pollen often with elastic force, even when the anther itself is not touched.

In other orchids movements take place in different ways and in other directions. The object of these movements will be appreciated when it is remembered that, if the pollen-masses retained the original direction they had in the anther in which they were formed, they would, when transported by the insect to another flower, merely come in contact with the anther of that flower, where of course they would be of no use; but, owing to the divergences and flexions above alluded to, the pollen-masses come to be so placed that, when transplanted to another flower of the same species, they come in contact with the stigma and so effect the pollination of that flower. The adaptions of orchid flowers to fertilization by insects are exceedingly numerous and in many cases are remarkably complicated.

Propagation and Growth.—The fruit of orchids is a capsule which usually splits by three lengthwise slits, forming valves that remain united above and below. The seeds, minute and innumerable, are well-adapted to wind-dissemination. In many species the seeds lose their viability after a few months, and often are slow and difficult to germinate after planting, some requiring from three months to two years. The roots of terrestrial orchids are often bulbous and still more frequently more or less tuberous, the tubers being partly radical and partly budlike, so that propagation of new individuals by division from the parent takes place. Often there is a marked alternation in the production of vegetation and flowering shoots; sometimes the flowering shoots are not produced for several years in succession. This accounts for the profusion with which various orchids are found in flower in some seasons and for their scarcity in others.

Tropical orchids are mostly epiphytal—that is, they grow upon trees without deriving nourishment from them. They are frequently provided with "pseudo-bulbs," large solid swellings of the stem, in the tissues of which water and nutritive materials are stored. They derive this moisture from the air by means of aerial roots, developed from the stem and bearing an outer spongy structure, or *velamen*, consisting of empty cells kept open by spiral thickenings in the wall; this sponge-like tissue absorbs dew and rain and passes it on to the internal tissues.

Classification.—In number of species the orchid family is exceeded by only two or three other families of flowering plants. Conservatively stated, it contains at least 7,500 species comprised in 450 genera; some authorities place the number of species as high as 15,000.

The family is divided into two main groups based on the number of the stamens and stigmas. The first Pleonandrae, has two or rarely three fertile stamens and three functional stigmas. It contains two small genera of tropical Asia and Africa with almost regular flowers, and the large genus *Cypripedium* containing about 30 species in the north-temperate zone and tropical Asia and America. In *Cypripedium* two stamens are present, one on each side of the column instead of one only at the top, as in the group Monandrae, to which belong the remaining genera in which also only two stigmas are fertile.

The Monandrae have been subdivided into 20 tribes, the characters of which are based on the structure of the anther and pollinia, the nature of the inflorescence, whether terminal or lateral, the vernation of the leaf and the presence or absence of a joint between blade and sheath, and the nature of the stem. The most important are the following:

Ophrydeae, terrestrial orchids, mainly north temperate, including the British genera *Orchis*, *Aceras*, *Ophrys*, *Herminium*, *Gymnadenia* and *Habenaria*.

Neottieae, also terrestrial, contains 13 more or less widely distributed tropical or subtropical subtribes, one, *Cephalanthereae*, which includes the British genera *Cephalanthera* and *Epipactis*, is chiefly north temperate. The British genera *Spiranthes*, *Listera* and *Neottia* are also included in this tribe, as is also *Vanilla*, the elongated stem of which climbs by means of tendril-like aerial roots.

Coelogyneae, mostly epiphytes, and inhabitants of tropical Asia. A single internode of each shoot is swollen to form a pseudobulb.

Liparideae, terrestrial, two, *Malaxis* and *Corallorhiza*, are British and North American. *Liparis* is a large genus widely distributed in the tropics.

Pleurothallidieae, natives of tropical America, one of which, *Pleurothallis*, contains about 500 species. *Masdevallia* is common in cultivation and has often brilliant scarlet, crimson or orange flowers.

Laelieae, natives of the warmer parts of America, including three of those best known in cultivation, *Epidendrum*, *Cattleya* and *Laelia*.

Phajeae, chiefly tropical Asiatic, some—*Phajus* and *Calanthe*—spreading northwards into China and Japan.

Cyrtopodieae, tropical, but extending into north temperate Asia and South Africa; *Eulophia* and *Lissochilus* are important African genera.

Cataseteae, with tropical American genera, two of which, *Cataselum* and *Cycnoches*, have di- or tri-morphic flowers.

Dendrobieae, in the warmer parts of the Old World; the chief genus is *Dendrobium*, with 750 species, often with showy flowers.

Cymbidieae, in the tropics of the Old World. The leaves are generally long and narrow. *Cymbidium* is well known in cultivation.

Oncidieae, in the warmer parts of America. *Odontoglossum* and *Oncidium* include some of the best-known cultivated orchids.

Sarcantheae, in the tropics. *Vanda* (Asia) and *Angraecum* (Africa and Madagascar) are known in cultivation. The flower of *Angraecum sesquipedale* has a spur 18 in. in length.

British Orchids.—The family is well represented in Great Britain by nearly 40 species representative of 18 genera; among these are several species of *Orchis*, *Gymnadenia* (fragrant orchis), *Habenaria* (butterfly and frog orchis), *Aceras* (man orchis), *Herminium* (musk orchis), *Ophrys* (bee, spider and fly orchis), *Epipactis* (helleborine), *Cephalanthera*, *Neottia* (bird's-nest orchis), one of the few saprophytic genera, which have no green leaves, but derive their nourishment from decaying organic matter in the soil, *Listera* (tway blade), *Spiranthes* (lady's tresses), *Malaxis* (bog-orchis), *Liparis* (fen-orchis), *Corallorhiza* (coral root), also a saprophyte, and *Cypripedium* (lady's slipper), represented by a single species now very rare in limestone districts in the north of England.

North American Orchids.—In North America north of Mexico about 140 species of orchids are found, representing some 40 genera (*see* O. Ames, *An Enumeration of the Orchids of the United States and Canada*, 1925). Many are widely distributed across the continent, some extending to Alaska and even to Greenland, but they occur most numerously in the eastern and especially the south-eastern States. The generic groups having the largest number of species are the rein-orchises (*Habenaria*), 32 species; lady's-tresses (*Spiranthes*), 15 species; lady's-slippers (*Cypripedium*), 10 species; and boy-orchises (*Malaxis*), 8 species. The tropical epiphytes are represented by *Epidendrum*, 9 species, and *Oncidium*, 4 species, found in Florida. Among the many attractive

orchids native to the eastern States and Provinces are the showy lady's-slipper (*C. reginae*), the yellow lady's-slipper (*C. parviflorum*), the moccasin-flower (*C. acaule*); the showy orchis (*Orchis spectabilis*), the round-leaved rein-orchis (*Habenaria rotundifolia*), the white-fringed rein-orchis (*H. blephariglottis*), the yellow-fringed rein-orchis (*H. ciliaris*), the purple-fringed rein-orchis (*H. psychodes*), the rose-pogonia or snake-mouth (*Pogonia ophioglossoides*), the dragon's-mouth (*Arethusa bulbosa*) and the grass-pink (*Limnodorum tuberosum*).

In the Rocky Mountain region and adjacent plains some 40 species of orchids occur; fully half of these are found also in the eastern States and a dozen or more extend northward to Alaska. Among them are the mountain lady's-slipper (*Cypripedium montanum*), the oval-leaved rein-orchis (*Hobenaria Menziesii*), and the round-leaved orchis (*Orchis rotundifolia*), which ranges northward to the Yukon and to Greenland. About 35 species of orchids occur in the Pacific States; among these are the California lady's-slipper (*Cypripedium californicum*), the Sierra rein-orchis (*Habenaria leucostachys*), the giant helleborine (*Epipactis gigantea*) and the rare phantom orchis (*Cephalanthera Austinae*).

Cultivation.—The only orchid of substantial economic importance, furnishing a staple article of extensive use is vanilla (*q.v.*). But the number of tropical orchids grown in greenhouses in Europe and North America for the flower markets, and as objects of horticultural and scientific interest is immense. More than 3,000 species, many of them epiphytes, are in cultivation, as well as many thousand hybrid forms derived from them. Among the genera thus represented in orchid culture are *Cattleya, Cordula, Dendrobium, Epidendrum, Laelium, Odontoglossum,* and *Phalaenopsis.* Propagation of these cultivated forms is by division, cuttings and growth from seed. Many terrestrial orchids practically defy all efforts at cultivation, due to lack of knowledge regarding soil conditions, to saprophytic habits, and to their growth in association with special fungi (*see* MYCORRHIZA).

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ORCHOMENUS (on coins and inscriptions, *Erchomenos*), the name borne by two cities of ancient Greece.

1. A Boeotian city, between the Cephissus river and its tributary, the Melas, on a long, narrow hill projecting south from Mt. Acontium, on every side admirably situated to be the stronghold of an early kingdom. The acropolis is situated at the north end of the ridge.

In prehistoric times Orchomenus is revealed alike by archaeological finds and by legends, as one of the most prosperous towns of Greece, once a continental and a maritime power. It controlled the greater part of Boeotia, especially the fertile lowlands of Lake Copaïs, upon the drainage of which its early kings bestowed great care. Its original inhabitants, the Minyae, were a seafaring people, and Orchomenus remained a member of the Calaurian League of naval States till historical times. Then, however, Orchomenus no longer figures as a great commercial State, and its political supremacy in Boeotia has passed to the people of Thebes. Nevertheless, it long exercised some overlordship over towns of northern Boeotia, and an independent policy within the Boeotian League. In 447 it was the headquarters of the oligarchic exiles who freed Boeotia from Athenian control. In the 4th century Orchomenus was actuated throughout by an anti-Theban policy, partly a recrudescence of old rivalry, but chiefly inspired by aversion to the new democracy at Thebes. In the Corinthian war the city supported Lysander and Agesilaus in their attacks upon Thebes, and Orchomenus again sided with the Spartans in 379. After the battle of Leuctra the Thebans, first, on Epaminondas's advice, readmitted it into the Boeotian League, but in 368 destroyed the town. By 353 it had been rebuilt, probably by the Phocians, as a bulwark against Thebes. After the subjection of the Phocians in 346 it was again razed by the Thebans, but was restored by Philip of Macedon as a check upon Thebes (338). In 85 B.C. Orchomenus provided the battle-field on which the Roman general Sulla destroyed an army of Mithridates VI. of Pontus. But its later history is obscure, and its decadence is attested by the encroachments of Lake Copaïs. Since mediaeval times the site has been occupied by a village named Skripou. Since 1867 drainage operations have been resumed, and an English company has reclaimed much fertile land. The so-called "treasury of Minyas," outside the ancient city at Mycenae (*see* MYCENAE), is almost exactly the same size as the "treasury of Atreus." The admiration of Pausanias is justified by the beautiful ornamentation of the roof of the inner chamber brought to light by Schliemann. Excavation by Doctors Furtwängler and Bulle revealed three prehistoric settlements, superposed. The first represents the Neolithic "painted-ware" culture of Thessaly and other parts of north-east Greece; in the second, oval huts replace the earlier round ones, and dull smeared pottery ("Urfirniss") the painted ware; the third has rectangular houses and characteristic grey "Minyan" pottery, finely modelled but without ornament. All these cultures precede the "Late Minoan" occupation, to which the great "Treasury" tomb belongs.

The worship of the Charites (*see* GRACES) was the great cult of Orchomenus, and the site of the temple is now occupied by a chapel of the Virgin (Κοίμησις τῆς Παναγίας). The Charites were worshipped under the form of rude stones, which had fallen from heaven during the reign of Eteocles; and it was not till the time of Pausanias that statues of the goddesses were placed in the temple. Near this was another temple, dedicated to Dionysus, in whose festival, the *Agrionia* (*q.v.*), are apparent the traces of early human sacrifice.

2. An Arcadian city north of Mantineia and west of Stymphalus. Its district was mountainous, but had two valleys—the northern containing a lake drained by a *katavothron;* the southern below the city, separated from Mantineia by the ridge Anchisia. The old city, in a strong situation, was a ruin in Strabo's time. Till the late 7th century the kings of Orchomenus held some sort of sovereignty over all Arcadia. In the 5th century it was overshadowed by Mantineia, and in 418 B.C. Orchomenus fell for a time into its power; in 370 it held aloof from the new Arcadian League which Mantineia was organizing. About this time it also lost some possessions on the east to the new Arcadian capital, Megalopolis. In the 3rd century it belonged in turn to the Aetolian League, to the Lacedaemonians, and, since 222, to the Achaean League. Its history after it passed under the Roman rule is quite obscure.

ORCINOL, a homologne of resorcinol (*q.v.*), found in many lichens, e.g., *Rocella tinctoria, Lecanora,* and formed by fusing extract of aloes with caustic potash. It is 3:5-dihydroxy-1-methylbenzene ($C_6H_3(CH_3)(OH)_2$). It may be synthesized from toluene; or from acetonedicarboxylic ester by condensation with the aid of sodium. It crystallizes in colourless prisms with one molecule of water, which redden on exposure. Ferric chloride gives a bluish-violet coloration with the aqueous solution. Unlike resorcinol it does not give a fluorescein with phthalic anhydride. Oxidation of the ammoniacal solution gives *orcein,* $C_{28}H_{24}N_2O_7$, the chief constituent of the natural dye archil (*q.v.*). Homopyrocatechol is an isomeride (CH_3:OH:OH = 1:3:4), found as its methyl ether (creosol) in beech-wood tar.

ORDEAL, a term of varying meaning but bearing the special sense of the mediaeval Lat. *Dei iudicium,* a miraculous decision as to the truth of an accusation or claim. The ordeal in principle, and often in the very forms used, belongs to ancient culture. Some ordeals, which possibly represent early stages of the practice, are simply magical, being processes of divination turned to legal purpose. Thus in Burma suits are sometimes still determined by plaintiff and defendant being each furnished with a candle, equal in size and both lighted at once—he whose candle outlasts the other being adjudged to have won his cause (Shway Yoe, *The*

Burman, ii. 254). In Borneo, the two parties are represented by two shell-fish on a plate, which are irritated by pouring on some lime-juice, and the one first moving settles the guilt or innocence (as has been before arranged) of its owner (St. John, *Forests of the Far East*, i. 89). The administration of ordeals has been much in the hands of priests, the intervention of a deity being invoked and assumed to take place even when the process is in its nature one of symbolic magic. The ordeal is related to divination (*q.v.*). *Coscinomancy* (the use of a sieve for divination) served anciently to discover a thief when, with prayer to the gods for direction, the names of the suspected persons were called over it (Potter, *Greek Antiquities*, i. 352). When a suspended hatchet was used in the same way to turn to the guilty, the process was called *axinomancy*. The sieve-ordeal is mentioned in Hudibras (ii. 3):

> . . . th' oracle of sieve and shears
> That turns as certain as the spheres.

In the modern Christian form of the key and bible, a psalter or bible is suspended by a key tied in at Psalm l. 18: "When thou sawest a thief, then thou consentedst with him"; the bow of the key being balanced on the fingers, and the names of those suspected being called over, he or she at whose name the book turns or falls is the culprit (*see* Brand, *Popular Antiquities*).

One form of divination passing into ordeals is the appeal to the corpse itself for discovery of its murderer. Thus the natives of Australia will ask the dead man carried on his bier of boughs, who bewitched him; if he has died by witchcraft he will make the bier move round, and if the sorcerer who killed him be present a bough will touch him (Eyre, *Australia*, ii. 344). Among the negroes of Ashanti, the corpse causes its bearers to dash against the guilty party (R. S. Rattray, *Religion and Art in Ashanti* [1927] p. 167, *see* also B. Malinowski, *Crime and Custom in Savage Society*, H. V. Russell, *Tribes and Castes of the Central Provinces*, [1916] iii. p. 90). The well-known ordeal of the bier in Europe in the middle ages seems founded on a different principle, the imagination that a sympathetic action of the blood causes it to flow at the touch or neighbourhood of the murderer. Apparently the liquefaction of the blood which in certain cases takes place after death may have furnished the ground for this belief. On Teutonic ground, this ordeal appears in the *Nibelungenlied*, where the murdered Siegfried is laid on his bier, and Hagen is called on to prove his innocence by going to the corpse, but at his approach the dead chief's wounds bleed afresh. In Shakespeare (*Rich. III.*, act i, sc. 2):

> O gentlemen, see, see! dead Henry's wounds
> Open their congeal'd mouths, and bleed afresh!

Certain ordeals are closely related to oaths, so that the two shade into one another. Let the curse which is to fall on the oath-breaker take effect at once, it then becomes a sign condemning the swearer—in fact, an ordeal. Thus the drinking of water on which a curse or magical penalty has been laid is a mere oath so long as the time of fulfilment is unfixed (*see* OATH). But it becomes an ordeal when, as in Brahmanic India, the accused drinks three handfuls of water in which a sacred image has been dipped; if he is innocent nothing happens, but if he is guilty sickness or misfortune will fall on him within one to three weeks (for accounts of these and other Hindu ordeals *see* Ali Ibrahim Khan in *Asiatic Researches*, i. 389, and Stenzler's summary in *Z. D. M. G.*, vol. ix.). Numbers v. describes the mode of administering to a woman charged with unfaithfulness the bitter water mixed with the dust of the tabernacle floor, with the curse laid on it to cause her belly to swell and her thigh to fall if guilty. The term "bitter" is applied to the water before it has been cursed, which suggests that it already contained some drug, as in the poison-water ordeal still in constant use over a great part of Africa. The result of the ordeal depends partly on the patient's constitution, but more on the sorcerer who can prepare the proper dose to prove either guilt or innocence, and thereby acquires boundless influence. The poison-ordeal is also known to Brahmanic law, decoction of aconite root being one of the poisons given, and the accused if not sickening being declared free (Stenzler, *l.c.*). Theoretically connected with the ordeal by cursed drink is that by cursed food. The ordeal by bread and cheese, practised in Alexandria about the 2nd century, was practically the same as that known to English law five to ten centuries later as the *corsnaed* or "trial slice" of consecrated bread and cheese which was administered from the altar, with the curse that if the accused were guilty God would send the angel Gabriel to stop his throat, that he might not be able to swallow that bread and cheese. In fact, if guilty and not a hardened offender he was apt to fail, dry-mouthed and choking through terror, to get it down.

The passing through the fire is described in the Hindu codes of Yâjnavalkya and others, and in the *Râmâyana* the virtuous Sitâ thus proves her innocence to her jealous husband Râma (Stenzler, p. 669; Pictet, *Origines Indo-Européennes*, part ii. p. 457). In European law and chronicle, Richardis, wife of Charles the Fat, proves her innocence by going into a fire clothed in a waxed shift, and is unhurt by the fire (Grimm, *Deutsche Rechtsalterthümer*, p. 912). Yet more minutely prescribed in the Hindu ordeal-books is the rite of carrying the glowing hot iron seven steps, into the seven or nine circles traced on the ground, the examination of the hands to see if they show traces of burning, and the binding them up in leaves. In a Scandinavian law it is prescribed that the red-hot iron shall be carried nine steps (Grimm, *op. cit.*, p. 918). In Anglo-Saxon laws the iron to be carried was at first only one pound weight, but Athelstan's law (in *Ancient Laws and Institutes of England*, iv. 6) increased it to three pounds. Another form well known in old Germany and England was the walking barefoot over glowing ploughshares, generally nine. The law-codes of the early middle ages show this as an ordinary criminal procedure (*see* the two works last referred to). Queen Emma, mother of Edward the Confessor, accused of familiarity with Alwyn bishop of Winchester, triumphantly purged herself and him by the help of St. Swithin—each of the two thus acquitted giving nine manors to the church of Winchester, in memory of the nine ploughshares, and the king being corrected with stripes (John Bromton, *see* Freeman's *Norm. Conq.*, vol. ii. App.). To dip the hand in boiling water or oil or melted lead and take out a stone or ring is another ordeal of this class. Some of these fiery trials are still in use, in regions of Africa or further Asia—the negro plunging his arm into the caldron of boiling oil, the Burman doing feats with melted lead, while the Bedouin will settle a conflict of evidence by the opposing witnesses licking a glowing hot iron spoon (Kennett, *Arabian justice*). This latter feat may be done with safety, provided the iron be clean and thoroughly white hot, while if only red-hot it would touch and burn the tongue. Probably the administerers of the ordeal know this, and the possibility of dipping the hand in melted metal; and there are stories of arts of protecting the skin (*see* the recipe in Albertus Magnus, *De Mirabilibus*), though it is not known what can be really done beyond making it horny like a smith's, which would serve as a defence in stepping on hot coals, but not in serious trials like that of carrying a heavy red-hot iron. The fire-ordeals are still performed by mountebanks. Fire walking is still practised by Hindus and was performed in Natal in the autumn of 1925. The Hindu code of Manu (viii. 115) avers that "He whom the flame does not burn, whom the water does not cast up, or whom no harm soon befalls, is to be taken as truthful in his oath." This water-ordeal is well known in Europe, where the accused is thrown bound into the water, which receives him if innocent, but rejects him if guilty. The directions given by Archbishop Hincmar in the 9th century provide that he who is let down into the water for trial is to be fastened by a rope, that he may not be in danger if the water receives him as innocent, but may be pulled out. In the later middle ages this ordeal by "swimming" or "fleeting" became the most approved means of trying a suspected witch: she was stripped naked and cross bound, the right thumb to the left toe, and the left thumb to the right toe. In this state she was cast into a pond or river, in which it was thought impossible for her to sink (Brand iii. 21). Cases of "ducking" witches which used to occur in England were remains of the ancient ordeal.

When in the warfare of Greeks and Trojans, of Jews and Philistines, of Vandals and Alamans, heroes come out from the two sides and their combat decides the victory, then we have the ordeal by battle. A passage from old German law shows the single

combat accepted as a regular legal procedure: "If there be dispute concerning fields, vineyards, or money, that they avoid perjury let two be chosen to fight, and decide the cause by duel" (Grimm, *Rechtsaltert.*, p. 928). In England, after the Conquest, trial by combat superseded other legal ordeals, which were abolished in the time of Henry III. A lord often sent his man in his stead to such combats, and priests and women were ordinarily represented by champions. The wager of battle died out so quietly in England without being legally abolished that in the court of king's bench in 1818 it was claimed by a person charged with murder, which led to its formal abolition (*Ashford* v. *Thornton* in Barnewall and Alderson 457; *see* details in H. C. Lea, *Superstition and Force*, ii.). A distinct connection may, however, be traced between the legal duel and the illegal private duel. (*See* DUEL.)

(E. B. T.; X.)

ORDER, a row or series, hence grade, class or rank, sequence or orderly arrangement (Lat. *ordo*, rank, arrangement). For its various meanings *see* MINISTRY, THE CHRISTIAN; MONASTICISM; KNIGHTHOOD AND CHIVALRY; ORDER IN COUNCIL; BILL OF EXCHANGE.

For technical mathematical uses of "order" *see* NUMBER; CURVE; SURFACE; DIFFERENTIAL EQUATION.

ORDER, (1.) in classic architecture, a column or pilaster, with its base, shaft and capital, and the entablature (*q.v.*) above it (sometimes called epistyle), consisting of architrave, frieze and cornice, considered as a single architectural feature; the "orders" are systematized classifications of five different types, Tuscan, Doric, Ionic, Corinthian and Composite. (2.) In mediaeval architecture, in an arched door or other opening, where the opening is larger on the outer face of a thick wall than on the inner face, one of the breaks in the steps in the thickness of the wall, consisting of an arch above and a pier on each side, by which the transition from larger exterior to smaller interior opening is effected.

Classic Orders.—Greek architecture had developed three easily recognizable classes of order which had been adopted by the Romans, with modifications, by the middle of the 1st century, B.C. It was natural, therefore, that Vitruvius, in his remarkable treatise on architecture (last quarter of 1st century, B.C.) should have attempted to give rules for the construction of these three orders. Moreover, as the Etruscan architects had developed a simple order of their own, using a wooden entablature, he added a section dealing with that. With the republication of Vitruvius in the second half of the 15th century, he was at once hailed as the authority on all things architectural, and architectural writers of the later Italian Renaissance attempted to imitate him by giving ideal rules for the orders, which should be efforts to reconcile the standards of Vitruvius with the many varying examples of Roman work that they knew. They added as a fifth order the Composite type of capital. The two most famous of these Renaissance compilations, those of Vignola (Giacomo Barocchio, or Barozzi), published in 1563, and Palladio (1570), exerted a tremendous influence over 17th and 18th century architecture throughout Europe, and gave rise to the idea that these compilations were not merely statements of average usage, but rules to be absolutely followed, an idea contradicted by the architectural work of the two authors themselves. Lacking knowledge of Greek remains, and of the structural systems and details of Etruscan temples, the Tuscan order, which they described, is merely a simplified Roman Doric. Their passion for regularization showed also in the fact that they specify a definite pedestal and even a definite baluster as a part of each order. Various 18th century and modern architectural writers have attempted to simplify the order descriptions of Vignola and Palladio, and have thus perpetuated the Renaissance myth of the immutability of the orders. In general, Vignola's work was followed in France and Palladio's in England. The orders, as thus systematized, are as follows:—

Tuscan.—This is the simplest of the orders. It is characterized by a column seven diameters high, the capital and base each occupying one-half the diameter in height. The base consists of a plain, square plinth (*q.v.*) with a large torus (*q.v.*) and a fillet above. The capital has an astragal (*q.v.*) at the top of the shaft, a necking (*q.v.*), which is merely a short continuation of the line of the column, and above that an echinus (*q.v.*) consisting of a simple ovolo (*q.v.*) or quarter round with a fillet below it, and carrying a simple, square abacus (*q.v.*). The entablature, as in all the orders, is supposed to be one-quarter of the height of the column, and consists of a plain architrave (*q.v.*), or lower member, with a simple square projection or taenia (*q.v.*) at the top, a plain frieze, or central member, and a cornice with a single moulding as a bed-mould (*q.v.*), an undecorated corona (*q.v.*) or projecting rectangular portion, and a cymatium (*q.v.*) or crowning moulding that is an ovolo.

Doric.—The column is eight diameters high, and carries 20 flutes, separated by arrises (*q.v.*) or sharp edges. The base has two toruses, the lower one larger than the upper, and the capital is given a projecting moulding at the top of the echinus and additional fillets or an astragal below the ovolo. The necking is ornamented with eight rosettes. The architrave in the entablature is sometimes given two faces, the upper one projecting slightly, being wider than the lower. The taenia is decorated with a moulding and beneath each triglyph (*q.v.*) of the frieze, a small block called a regula (*q.v.*), with six guttae, or small conical forms on its under side. The frieze is ornamented by triglyphs, or vertical projections decorated with a series of vertical grooves. Between each two triglyphs is a square metope (*q.v.*), a plain surface carrying sculpture; a triglyph is arranged over the centre of each column. Two forms of cornice are described; the denticular, in which the chief feature of the bed-mould is a row of dentils or little projecting blocks, and the mutular, in which the under side of the corona is decorated with projecting blocks, one over each triglyph. In both cases guttae are used on the soffit or under side of the cornice. In the denticular cornice they ornament square panels over each triglyph; in the mutular, the under side of the projecting blocks or mutules. The cymatium consists either of a cavetto or a cyma recta, a moulding of double curvature, the convex portion below and concave portion above.

Ionic.—The column is nine diameters high. The base is of the type known as an Attic base (*q.v.*) with a plinth carrying two toruses, separated by a scotia or hollow moulding. The capital is characterized by the volutes (*q.v.*) or spiral scrolls that are the ends of a band (usually consisting of a hollow portion called a canalis, and a raised fillet) represented as passing horizontally across the top of the echinus, and winding up on either side in a volute or helix. The capital is thus rectangular, and the volutes of the two faces of the capital are connected by a generally cylindrical form known as a cushion. This sometimes takes the form of two vases, end to end, and is sometimes decorated with leaves. The echinus, of ovolo profile, is carved with the egg and dart (*q.v.*), and where, as it follows the curve of the column, it disappears behind the rolls of the volutes, a little half anthemion (*q.v.*) or radiating petalled form hides the intersection. The entablature has an architrave decorated with either two or three bands, each wider and projecting farther than the one below it, and a taenia ornamented with mouldings. The frieze is plain, and the cornice has a bed-mould of three parts—a dentil band separating two mouldings, the lower one a cyma reversa, the upper one an ovolo. The cymatium is a cyma recta with a smaller cyma reversa below it.

Corinthian.—The column is ten diameters in height, and the base resembles the Attic base of the Ionic order, with the exception that in the centre of the scotia there is a third, small torus, with fillets above and below. The capital is much deeper than in the Doric and Ionic orders, and consists of a generally bell-shaped core, carrying a moulded abacus whose sides are concave, so that the corners project. At the bottom of the bell of the capital is an astragal, and the surface of the bell is surrounded by a characteristic decoration of acanthus leaves and scrolls. The lower two-thirds has 16 acanthus leaves in two rows of eight each, the centres of the upper leaves being placed between the joints of the lower leaves. Between the leaves of the upper row are cup-shaped leaf ornaments known as cauliculi (*q.v.*), which grow on stalks, and out of each cauliculus grow two stalks, one large and one small, so arranged that the voluted ends of the two adjacent large scrolls meet under each projecting corner of the abacus,

while the two adjacent smaller stalks come together under the centre of each concave abacus space; above their juncture is a large rosette. The architrave of the entablature, like that of the Ionic, has three bands and a moulded taenia, but additional richness is given by tiny mouldings between the bands. The frieze is plain, though sometimes pulvinated, or given a profile of convex curve. The cornice resembles that of the Ionic order with the addition of the band of modillions (*q.v.*). These are small scrolled brackets under the soffit of the corona, and are usually decorated on the sides with S-scrolls and on the bottom and front face with acanthus leaves. They are crowned by a little cyma reversa moulding. The soffit of the corona is panelled between the modillions, and in each panel there is a rosette.

Composite.—This is, in reality, merely a varied form of the Corinthian order and, like it, the column is fluted and ten diameters high. A special base is given to it by doubling the small torus in the centre of the scotia between the two large toruses. The capital, its main distinguishing feature, consists of a bell surrounded with 16 acanthus leaves, in two rows, arranged similarly to those of the Corinthian capital. But above them, instead of the scrolls and cauliculi, there are volutes, like those of the Ionic order, except that they are on the four sides of the capital and brought out at an angle at the corners. In the bed-mould of the cornice, large rectangular blocks take the place of the modillions, and in some codifications a part of the bed-mould as well.

Scamozzi Ionic.—In addition to the five orders listed above, certain authorities have given a variant of the Ionic order, known as the Scamozzi Ionic after the Italian architect (Vincenzo Scamozzi, 1552–1616), who first codified it. Its chief difference from the ordinary Ionic order is in the fact that its capital is four-sided, the volutes occurring on all four faces, and at the corners brought out in an angle, so that the abacus above is concave-sided, like the Corinthian. Moreover, the bands forming the volutes are not connected on each face by a horizontal line, but curve over and down into the top of the echinus; in the empty space thus left in the centre of each face there is a rosette. At times garlands connect the centres of the volutes.

Purpose.—The object of each codification of the orders is to furnish exact proportionate dimensions for every small feature, so that given the diameter of the column, the entire order may be constructed mechanically. The rules of all these attempted codifications vary slightly. The orders shown on the plate are constructed from the simplified scheme devised by the late William R. Ware, 1832–1915 (*The American Vignola*, 1910).

Origins.—The origin of the earliest of the orders, the *Doric*, was, at least partially, in wooden construction and seems to be a purely Dorian, or at least Hellenic, development, as far as the entablature is concerned. The question of the column is, however, more complex. In the Aegean culture, columns were common and their capitals consisted of a square abacus with a convex echinus below. The resemblance of this type, shown not only in wall paintings, but also in certain remains of the stair hall of the palace at Cnossus (*c.* 1500 B.C.), the column on the Lion Gate and those of the tholos of Atreus, both at Mycenae (both *c.* 1200 B.C.) to primitive Greek Doric capitals, is too close to be mere coincidence. On the other hand, Aegean columns universally tapered downward, were principally of wood and sometimes extremely slender in proportion, those at the tholos of Atreus being almost 11 diameters high, while those of the primitive Doric have an extreme taper upward and are short and stumpy. Moreover, the Aegean entablature, as shown in wall paintings, is entirely different from the Greek Doric, its chief features being round, projecting beam ends, close together, supported on a simple girder. The Greek Doric entablature has forms which seem to indicate a wooden origin, but one based on a different system of construction from that employed by the Aegean peoples. The architrave represents the original wooden beam running from post to post; the taenia, a board above this, to give a perfect bearing for the cross beams. The triglyphs are the ends of these cross beams, held in place by pegs through the taenia board, represented by the guttae. The metopes are merely closing boards between the beams. The mutules, or sloping blocks on the under side of the projecting cornice corona, represent the under sides of slanting roof rafters, supported on a timber or plate, above the cross beams, and perhaps decorated on the under side by flat boards or wooden pegs whose heads become the guttae in the stone version.

It is known that the primitive temple of Hera, at Olympia, had, originally, wooden posts, which were replaced from time to time during historic times, as they rotted, by stone columns. Nevertheless, the extreme taper and squat proportions of early Doric columns seem to demand an origin of masonry, and especially a masonry made of small stones. The origin would thus appear to be triple; the shaft, from early rubble construction; the capital borrowed and adapted from Aegean sources; while the entablature is an interpretation in stone of traditional Dorian wood construction. The earliest example known of the Greek Doric order is that of the temple at Corinth, probably dedicated to Apollo, which must be as early as the 6th century, and may go back to the 7th. Other early examples exist at Segesta, Selinus, Girgenti and Paestum, which are all of uncertain date, but undoubtedly prior to the Persian wars. Two of those at Selinus may go back to the 7th century B.C. The latest ancient example is that of the Agora gate at Athens (12 B.C.–A.D. 2). During these 700 years the basic elements of the Doric order did not change; the development, which was great, was only in the gradual refinement of every feature, and a continual experimentation in the exact treatment of each form, to give the desired result. Columns became taller and more slender, and the entasis (*q.v.*), or curved taper, more and more delicate. The ovolo of the echinus changed from the obese projections of Corinth and Paestum to the extremely refined and subtle curves of the Periclean period. The entablature, which in early examples had been almost half the height of the column, was gradually reduced in size, till in the Parthenon it is approximately one-fifth. The Greek Doric order was probably, in all cases, richly decorated in colour, so that its present appearance of austerity and over-restraint is illusory.

The *Roman Doric* order has plainly a double origin. The differences between it and the Greek Doric are not due entirely to Roman inability to appreciate the subtleties of Greek work, but merely to the fact that the Etruscans, and perhaps the north Italians, generally, had, at a very early period, developed a column and entablature of their own, with a long, slender, wooden column, having an ovolo echinus similar to the Aegean, and an entablature of wood, sometimes decorated with terra-cotta appliqués. It is this Etruscan column and entablature which Vitruvius endeavoured to describe, and which was misunderstood by the Renaissance, so that the name Tuscan came to be applied to a simplified Doric. It was also the origin of the unfluted, Roman Doric column, with its simple, quarter round echinus. To this the Romans applied an entablature embodying certain Greek features. In Roman architecture, the use of the Doric was reserved for small scale columns, as in many of the house courtyards at Pompeii (the forum colonnade at Pompeii was originally Greek), and to engaged or attached columns between arches. When used on a larger scale it was frequently much modified. Thus, in the temple of Hercules at Cori (attributed to Sulla, *c.* 80 B.C.), a base has been added, consisting of a single torus, but without a plinth. The entablature is extremely delicate in proportion, and the capital profile approximates that of the Greek Doric. A triglyph occurs on the corner, as in Greek work. In the theatre of Marcellus, at Rome (completed 13 B.C.), there is no base, and in the Colosseum (A.D. 80) there are no triglyphs. The Renaissance codifiers, however, took these two as the most typical, and their order is a sort of average between them. Another Doric order, coming originally from Albano, has no base except a fillet with apophyge, and the mouldings of the capital are richly carved. Other Roman Doric orders of extreme richness, in which the echinus of the capital is formed by a cyma recta instead of an ovolo are those from a temple on the Aventine, probably of the 2nd century A.D., and one from the baths of Diocletian (A.D. 305).

The *Ionic* order had manifestly an Asiatic origin. Its capital is a development from stele (*q.v.*) capitals of Phoenicia and the eastern end of the Mediterranean, which were themselves based

originally on the tri-lobed lotus. A famous example of the primitive type was found at Neiandreia, and another in Messa, in Lesbos. Excavations on the Acropolis at Athens, and elsewhere, have revealed many examples of the intermediate stages between the flaring volutes and awkward proportions of the early type and the refined perfection of the developed Ionic of the temple of Nike Apteros (probably between 440 and 410 B.C.), or the Erechtheum (407 B.C.). The characteristic features of the Greek Ionic order as found in Greece itself are the bold size and exquisite curvature of the volutes, the remarkable perfection of carved ornament that decorates the whole, and the variety of the types of base found.

The treatment of the order at the corners of a portico was difficult. The corner capital was formed with volutes on two adjacent, rather than two opposite, faces; where they met, the volutes were curved out at an angle together under the corner of the entablature. This created a new difficulty on the opposite corner, inside the colonnade, as it brought two half volutes together in an awkward way. It was this difficulty that led to a development of a variation of the Ionic capital with four faces the same and angle volutes. The most beautiful Greek example is that of the temple of Apollo at Bassae, designed by Ictinus, the architect of the Parthenon (probably *c.* 425 B.C.). In this the columns of the interior of the cella are connected by short walls to the exterior wall, and evidently, in order to have them present the same decorative face toward the entrance as toward the narrow nave between them, Ictinus adopted a four-sided Ionic capital.

A much more virile Ionic at enormous scale was developed in the great Hellenistic temples of the Asia Minor coast, such as those at Miletus and Priene. The archaic temple at Ephesus had set the style as early as the 6th century B.C., and its rebuilding, shortly after 350 B.C., by Dinocrates, while keeping certain of the more archaic features, such as the sculptured drums of the lower portions of the columns, was in the complete new Hellenistic Ionic style. The characteristics of this are: (1) a capital with volutes relatively smaller than in Athenian examples; (2) a cornice whose most striking feature was the very large dentils of the bed-mould, so large and so widely spaced, in fact, that in appearance they became almost separate brackets.

The *Roman Ionic* was based more on the Asia Minor than on the Attic types. Its details, throughout, were heavier than the usual Greek type. This heaviness appears even in the temple of Fortuna Virilis, which is not only the earliest purely Roman Ionic order, but also probably the earliest building in Rome in a good state of preservation to-day. It is variously attributed to the beginning of the 2nd and the beginning of the 1st century B.C. In general, the three chief differences between the Greek and Roman Ionic orders are: (1) the band connecting the volutes is perfectly horizontal, both at top and bottom, in Roman examples, and without the central dip of most Greek capitals; (2) the relative height and importance of the bed-mould of the cornice is much greater in the usual Roman examples. This is true, even in the most delicate and the most Greek of the monumental Roman orders—that of the theatre of Marcellus; (3) the base of the Roman order has, almost always, a square plinth as its lowest member. An exceptional type of Roman Ionic order is that of the temple of Saturn, on the Roman forum, the ancient treasury of Rome, whose ugly heaviness is characteristic of its date, after the great fire of A.D. 283.

Whatever the date of the original invention of the *Corinthian* order, it did not come into general use until the middle of the 4th century B.C. The capital perhaps owes its bell shape to Greek travellers' memories of the campaniform capitals of Egypt. But the Greek expression of this form is characteristically gracious. (For the charming Greek myth of its creation, *see* Vitruvius, Bk. IV.) Certainly the simplest form of the capital, in which a bell, decorated with flat and delicately pointed leaves, close together, has its lower portion surrounded by eight boldly curving acanthus leaves, suggests a basket around the bottom of which an acanthus plant has grown, as the myth states. The most famous example of this simple type decorated the "Tower of the Winds," at Athens, originally built in the 1st century B.C. to contain a water clock. The more complicated type, which is well represented by the exquisite capital of the tholos at Epidorus (middle 4th century B.C.), had two rows of leaves below and corner and central scrolls above. An even simpler form of the same type of capital, found alone in the ruins of the temple at Bassae, may be as early as the temple itself. The most popularly known example of the Greek Corinthian order, is that of the little choragic monument of Lysicrates, at Athens (335 B.C.).

The extremely lavish capital is, however, exceptional in many ways, and its silhouette unpleasantly broken. The existing columns and capitals of the great temple of Zeus at Athens were originally considered to be duplicates of the capital that Sulla took to Rome, and which served as a model for early Roman Corinthian. It is now known that the present remains are of the time of Hadrian. The order is, therefore, Roman, and not Greek. The Greeks never developed a separate entablature for the Corinthian order, using, instead, one of purely Ionic type; that of the tholos at Epidaurus owes its peculiar flat cornice to the fact that it was an interior order, rather than to any attempt to develop special entablature forms to crown the Corinthian capital.

Roman tradition found the origin of the *Roman Corinthian* order in a capital of the Athenian temple of Zeus, which Sulla brought with him to Rome. Long before that date, however, the Etruscans had been using forms Corinthianesque in type, and Pompeii also shows capitals which approach the Corinthian. In any case, the use of the Corinthian order on a monumental scale, as the Roman order *par excellence,* was well established by the time of Augustus, and the temple of Mars Ultor, dedicated in 2 B.C. as part of the forum of Augustus, and the portico of Octavia, of approximately the same date, both have completely developed magnificent Corinthian orders. It is noteworthy that in these the modillion (*q.v.*) had already reached a complete form. New light on the origin of this new feature which transformed the Ionic entablature into the Corinthian and which is the great Roman contribution to the development of the orders, is furnished by fragments of the order of the basilica Aemilia (dedicated 29 B.C.). These fragments are of the typically pure Augustan type, and therefore, probably due to this date and not to any of the succeeding rebuildings, and indicate a cornice with modillions which are deeper at the outer end than at the inner; that is, they slope down like the Doric mutules. Their outer ends are, however, scrolled.

The Roman Corinthian order is found in infinite variations. In certain small examples in tombs, gateways and the like, its proportions are thick and stumpy, as in the triumphal gateway at Saintes, of the time of Tiberius. In other cases it is extremely slender, as in the arch of Augustus at Susa. At times there are no modillions in the cornice, as in the temple of Antoninus and Faustina, at Rome (A.D. 141), and in the great temple of Venus, at Rome (A.D. 135), rebuilt by Maxentius (after 307). The modillions are replaced by the square, projecting blocks adopted by the Renaissance for the Composite order. Moreover, many types of capital exist. In some the two rows of leaves are at approximately equal height and kept tight to the bell, so that the effect is very vertical. In others, the lower row of leaves is made tall, so that the projecting leaf ends of both rows are close together and project markedly, giving almost the effect of a wreath around the capital. In other smaller examples, such as many at Pompeii, the ornament is hardly more than a frosting of the stucco surface of the bell. In the colonnade of the temple of Apollo, at Pompeii (rebuilt *c.* A.D. 63), a Doric entablature is supported by Corinthianesque columns. In some examples, rampant animals take the place of the corner volutes, as in the order of the temple of Concord, at Rome (A.D. 10) and in the capitals of the Roman gateway at Eleusis, in Greece (1st century A.D.). Another type, common in pilasters, substitutes for the cauliculi, with their double scrolls, an S-scroll at each side, turned in to the centre below and out to the corners above. This type gave rise to many 15th century early Renaissance capitals.

The most characteristic examples of the best type of the Roman Corinthian order are those of the round temple of Vesta,

at Tivoli (probably Augustan); the portico of the Pantheon, perhaps from the original building by Agrippa (27 B.C.); the interior of the Pantheon (A.D. 115–125); the portico of Octavia; the temple of Castor and Pollux on the forum (either of the rebuilding under Tiberius A.D. 6, or of the time of Hadrian), which is remarkable for the decoration of the middle band of the architrave and for the large, interlacing, central volutes of the capital; and that of the temple of Jupiter at Baalbek in Syria (time of Hadrian). An interesting order in brick and terra-cotta, evidently never stuccoed, is a doorway from an ancient Roman police station in Rome (early 3rd century); a more elaborate type of cut brick Corinthian with octagonal columns recessed into the wall is in the tomb of Annia Regilla (late 2nd century).

The *Roman Composite* order was actually only one of many variations of the Corinthian, and its erection into another order is a purely Renaissance idea. Vitruvius makes no mention of it and the earliest example known is one from a small garden pavilion in a house court recently (1928) excavated in Pompeii; an early monumental type is that of the arch of Titus, at Rome (completed A.D. 81), in which the exquisite composite capitals carry a normal Corinthian entablature. The bold richness of this type of capital was particularly popular during the later empire and the most magnificent example, remarkably delicate in execution for its late date, is one in the baths of Caracalla (211–216).

Renaissance.—During the middle and late 15th century in Italy and the early 16th century in France, the early Renaissance architects developed modified Corinthianesque orders of the most exquisite delicacy, in connection with doors, tombs and the like. The most characteristic feature of these orders is the general use of S-scrolls instead of volutes and cauliculi, and the use frequently of only small leaves beneath them at the corners of pilaster capitals. In the working out of the details of capitals of this type, the personalities of such sensitive designers as the Della Robbias, Desiderio da Settignano (1428–64) and Mino da Fiesoli (1431–84) achieved some of their most characteristic and delicate expression. At times dolphins, birds and even cherubs' heads replaced the scrolls under the cornice of the capital. The entablatures of these orders are almost always without modillions, but characterized by a jewel-like delicacy in the carving of the ornamented mouldings. In the arrangement of this there is the greatest variety. During the high and late Renaissance the orders tend to become more normal, but little strict archaeology is found and much individuality of design is still present. The work of B. Peruzzi (1481–1537), of D. Bramante (1444–1514), of Vignola and of Palladio is particularly noteworthy. Typically Renaissance variations are rusticated orders like those in the gates of Verona by San Michele (1530) and the banded columns developed by Philibert Delorme for the Tuileries in Paris (1564), and followed in the Grande Gallerie (1578) and twisted columns like those of Bernini's baldacchino in S. Peter's at Rome (1633).

During the Baroque period, especially in Spain, all kinds of forms were used which approximate the orders, but are so broken up and contorted, and so varied in detail, that they can be assigned to no definite classification.

The 20th century has seen a reaction against the archaeological correctness of orders of the revival period. Orders, where occurring, are treated with the utmost freedom, and those styles seem most popular in which a like freedom prevailed, such as the late Georgian style of the Adam brothers, and American colonial, with its slimness and attenuation. In so-called modernist work, the order tends to pass from use as a superfluous ornament. In exceptional cases, however, especially in Scandinavia, extremely free and modified orders are still used, as in the concert hall at Stockholm, by Ivar Tengbom, and in America in portions of the interior of the Nebraska State capitol by B. G. Goodhue and the Goodhue associates, still (1928) under construction. (*See*, also GREEK ARCHITECTURE; RENAISSANCE ARCHITECTURE; ROMAN ARCHITECTURE.)

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(T. F. H.)

ORDERIC VITALIS (1075–*c.* 1142), the chronicler, was the son of a French priest, Odeler of Orleans, who had entered the service of Roger Montgomery, earl of Shrewsbury, and had received from his patron a chapel in that city. Orderic was sent at the age of five to learn his letters from an English priest, Siward by name, who kept a school in the church of SS. Peter and Paul at Shrewsbury. When eleven years old he was entered as a novice in the Norman monastery of St. Evroul en Ouche. Orderic did not know a word of French when he reached Normandy; his book, though written many years later, shows that he never lost his English cast of mind or his love of England. His superiors rechristened him Vitalis, after a member of the legendary Theban legion. But in the title of his Ecclesiastical History he prefixes the old to the new name and proudly adds the epithet *Angligena*. He became a deacon in 1093, a priest in 1107. He left his cloister on several occasions, and speaks of having visited Croyland, Worcester, Cambrai (1105) and Cluny (1132). For many years he appears to have spent his summers in the scriptorium. His superiors (at some time between 1099 and 1122) ordered him to write the history of St. Evroul. The work grew under his hands until it became a general history of his own age. St. Evroul was a house of wealth and distinction. War-worn knights chose it as a resting-place of their last years. It entertained visitors from southern Italy, where it had planted colonies of monks, and from England, where it had extensive possessions.

Thus Orderic, though he witnessed no great events, was often well informed about them. His narrative gives us much invaluable information for which we should search the more methodical chroniclers in vain. He throws a flood of light upon the manners and ideas of his own age; he sometimes comments with surprising shrewdness upon the broader aspects and tendencies of history. His narrative breaks off in the middle of 1141, though he added some finishing touches in 1142.

The *Historia ecclesiastica* falls into three sections. (1) Bks. i., ii., which are historically valueless, give the history of Christianity from the birth of Christ. After 855 this becomes a bare catalogue of popes, ending with the name of Innocent I. These books were added, as an afterthought, to the original scheme; they were composed in the years 1136–1141. (2) Bks. iii.–vi. form a history of St. Evroul, the original nucleus of the work. Planned before 1122, they were mainly composed in the years 1123–1131. The fourth and fifth books contain long digressions on the deeds of William the Conqueror in Normandy and England. Before 1067 these are of little value, being chiefly derived from two extant sources, William of Jumièges' *Historia Normannorum* and William of Poitiers' *Gesta Guilelmi*. For the years 1067–1071 Orderic follows the last portion of the *Gesta Guilelmi;* hence this is of the first importance. From 1071 he begins to be an independent authority. But his notices of political events in this part of his work are far less copious than in (3) Bks. vii.–xiii., where ecclesiastical affairs are relegated to the background. In this section, after sketching the history of France under the Carolingians and early Capets, Orderic takes up the events of his own times, starting from about 1082. He has much to say concerning the empire, the papacy, the Normans in Italy and Apulia, the First Crusade (for which he follows Fulcher of Chartres and Baudri of Bourgueil). But his chief interest is in the histories of Duke Robert of Normandy, William Rufus and Henry I. He continues his work, in the form of annals, up to the defeat of Stephen at Lincoln in 1141.

The *Historica ecclesiastica* was edited by Duchesne in his *Historiae Normannorum scriptores* (Paris, 1619). This is the edition cited by Freeman and in many standard works. It is, however, inferior to that of A. le Prévost in five vols. (*Soc. de l'histoire de France*, Paris, 1838–55). The fifth volume contains excellent critical studies by M. Leopold Delisle, and is admirably indexed. Migne's edition (*Patrologia latina*, clxxxviii.) is merely a reprint of Duchesne. There is a French translation (by L. Dubois) in Guizot's *Collection des mémoires relatifs à l'histoire de France* (Paris, 1825–1827); and one in English by T. Forester in Bohn's Antiquarian Library (4 vols., 1853–56). In addition to the *Historia* there exists, in the library at Rouen, a manuscript edition of William of Jumièges' *Historia*

Normannorum which Leopold Delisle assigns to Orderic. (*See* this critic's *Lettre à M. Jules Lair* [1873].) (H. W. C. D.; X.)

ORDER IN COUNCIL, in Great Britain, an order issued by the sovereign on the advice of the privy council, or more usually on the advice of a few selected members thereof. It is the modern equivalent of the mediaeval ordinance and of the proclamation so frequently used by the Tudor and Stuart sovereigns. In practice it is only issued on the advice of ministers of the Crown, who are, of course, responsible to parliament for their action in the matter. Orders in council were first issued during the 18th century, and their legality has sometimes been called in question. Consequently in several cases parliament has subsequently passed acts of indemnity to protect the persons responsible for issuing them, and incidentally to assert its own authority. At the present time the principle seems generally accepted that orders in council may be issued on the strength of the royal prerogative, but they must not seriously alter the law of the land.

The most celebrated instance of the use of orders in council was in 1807 when Great Britain was at war with France. Orders in council are used to regulate the matters which need immediate attention on the death of one sovereign and the accession of another.

In addition to these and other orders issued by the sovereign by virtue of his prerogative, there is another class of orders in council, *viz.*, those issued by the authority of an Act of parliament, many of which provide thus for carrying out their provisions. At the present day orders in council are extensively used by the various administrative departments of the government, who act on the strength of powers conferred upon them by some Act of parliament. They are largely used for regulating the details of local government and matters concerning the navy and the army, while a new bishopric is sometimes founded by an order in council. They are also employed to regulate the affairs of the crown colonies, and the lord-lieutenant of Ireland, the viceroy of India, the governor-general of Canada, and other representatives of the sovereign may issue orders in council under certain conditions.

In times of emergency the use of orders in council is indispensable to the executive. The Regulation of the Forces Act 1871 empowers the government in a time of emergency to take possession of the railway system by the issue of such an order; and during the World War the use of orders in council was frequent.

ORDERS OF KNIGHTHOOD: *see* KNIGHTHOOD AND CHIVALRY.

ORDINANCE, in mediaeval England, a form of legislation. The ordinance differed from the statute because it did not require the sanction of parliament, but was issued by the sovereign by virtue of the royal prerogative, although, especially during the reign of Edward I., the king often obtained the assent of his council to his ordinances. Legislation by ordinance was common during the reigns of Henry III. and Edward I. when laws were issued by the king in council or enacted in parliament indifferently. Both were regarded as equally binding. In 1389 the Commons presented a petition to King Richard II. asking that no ordinance should be made contrary to the common law, or the ancient customs of the land, or the statutes ordained by parliament. For this and other reasons this form of legislation fell gradually into disuse, becoming obsolete in the 15th century. The modern equivalent of the ordinance is the order in council, but in the crown colonies legislation is both by orders in council and by local ordinance issued by the governor with the assent of his council (*q.v.*).

In the 17th century the use of the word ordinance was revived, and was applied to some of the measures passed by the Long Parliament, among them the famous Self-denying Ordinance of 1645.

ORDINANCE or **ORDONNANCE,** in architecture, a composition of some particular order or style; not restricted to columnar composition, the term applies to any kind of design which is subjected to conventional rules for its arrangement.

ORDINARY, in canon law, the name commonly employed to designate a superior ecclesiastic exercising "ordinary" jurisdiction (*iurisdictionem ordinariam*), *i.e.*, in accordance with the normal organization of the Church. It is usually applied to the bishop of a diocese and to those who exercise jurisdiction in the name of the bishop or by delegation of his functions. In English law, however, the term ordinary is now confined to the bishop and the chancellor of his court. The pope is the *ordinarius* of the whole Roman Catholic Church, and is sometimes described as *ordinarius ordinariorum.* Similarly in the Church of England the king is legally the supreme ordinary, as the source of jurisdiction.

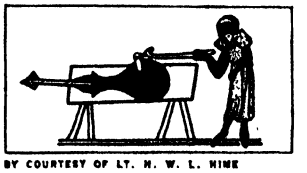
In England the only instance of the term ordinary being employed in its civil application was that of the office of judge ordinary created by the Divorce Act of 1857, a title which was, however, only in existence for about 18 years owing to the incorporation of the divorce court with the high court of justice by the Judicature Act, 1875. But in Scotland the ordinary judges of the inner and outer houses are called lords ordinary, the junior lord ordinary of the outer house acts as lord ordinary of the bills, the second junior as lord ordinary on teinds, the third junior as lord ordinary on exchequer causes. In the United States the ordinary possesses, in the States where such an officer exists, powers vested in him by the constitution and acts of the legislature identical with those usually vested in the courts of probate. In South Carolina he was a judicial officer, but the office no longer exists, as South Carolina has now a probate court.

ORDINATE: *see* CO-ORDINATES.

ORDNANCE, a general term for great guns for military and naval purposes, as opposed to "small arms" and their equipment; hence the term also includes miscellaneous stores under the control of the ordnance department as organized. In England the Master-General of the Ordnance, from Henry VIII.'s time, was head of a board, partly military, partly civil, which managed all affairs concerning the artillery, engineers and matériel of the army; this was abolished in 1855, its duties being distributed. The making of surveys and maps (*see* MAP) was, for instance, handed over eventually (1889) to the Board of Agriculture, though the term "ordnance survey" still shows the origin.

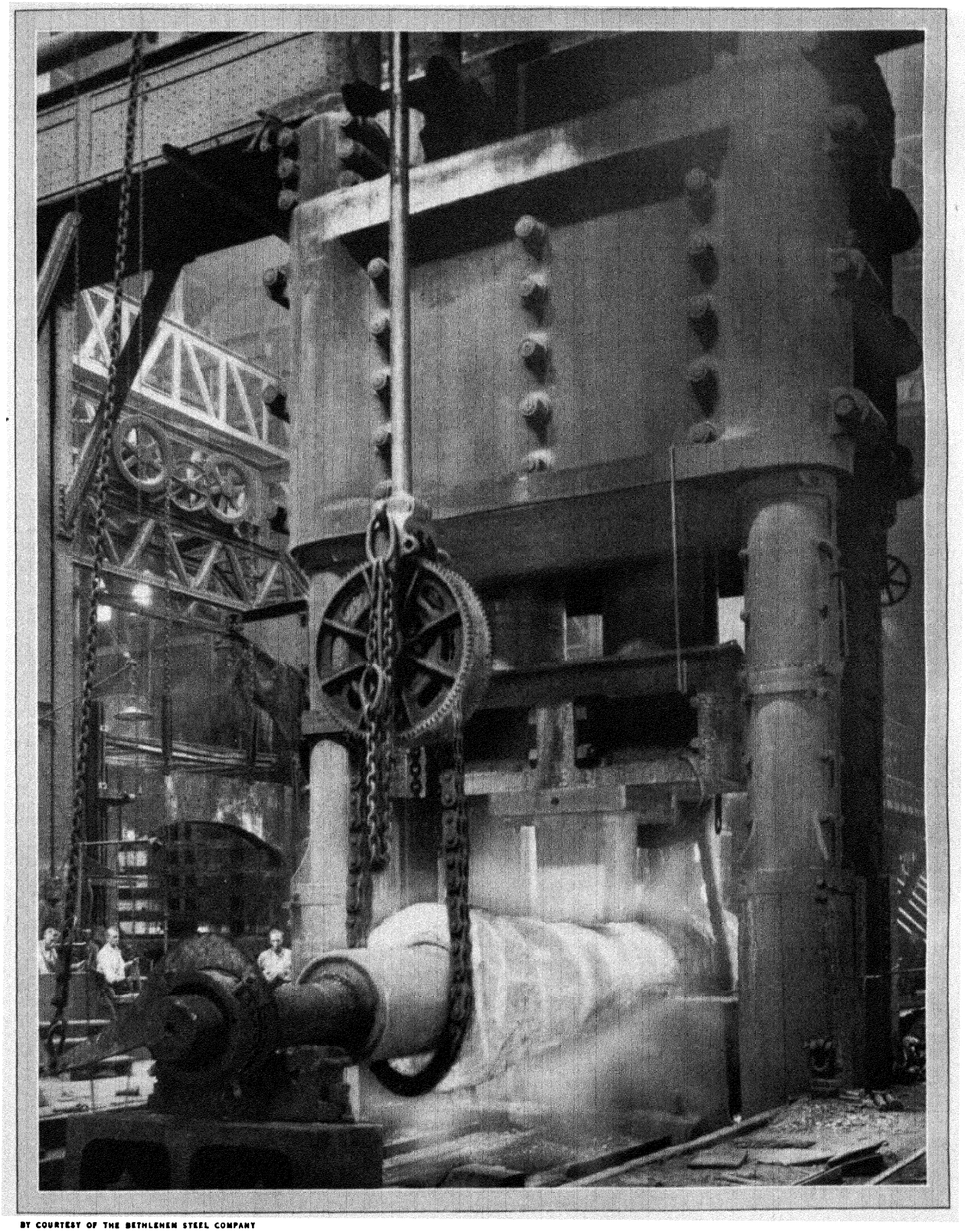
HISTORY

The invention of guns may be said to date from the first quarter of the 14th century. At this period gunpowder (*q.v.*), which had been known as an explosive for at least sixty years, appears to have been first used as a propellent. Although incendiary compounds and fire-projecting machines were known to the Greeks, Arabs and Chinese in very early times and were used on the sailing-galleys of Constantine Pogonatus in the year 673 for the destruction of enemy vessels, there is no good evidence that any explosive resembling gunpowder was discovered before the 13th century. Roger Bacon refers, in 1249, to such an explosive and may even have been its discoverer. Nothing is known of the man who first applied gunpowder to the projection of missiles for military purposes and the ascription of the invention of cannon to a German monk, Berthold Schwartz, has with good reason been discredited by reliable historians. The cannon was probably evolved at the beginning of the 14th century from some such engine as the *madfaa* referred to in an anonymous Arabic manuscript of that period. This *madfaa* seems to have been a small wooden mortar-like instrument on the muzzle end of which a ball rested like an egg in an egg-cup until projected by the firing of the charge. Another primitive machine, from which an arrow-like bolt was shot, is illustrated in the Millemete ms. (1327). The bottle shape of this suggests the name "pot de fer" found in early records. (*See* fig. 1.) It is natural to suppose an evolution by which the narrow neck of this weapon was enlarged until the bottle became a straight tube and the arrow bolt was replaced by a ball. All the early guns were very small and were made of iron or cast bronze; they fired iron or lead balls and there is evidence of their general use in western Europe from about 1325 onwards. They are reported to have been used at a siege of Metz in 1324 and iron balls and metal cannon are mentioned in a Florentine document of 1326. John Barbour, writing in 1375, refers to the "crakys of war" used by Edward III. in



BY COURTESY OF LT. H. W. L. HIME

FIG. 1.—EARLY TYPE OF CANNON, IN 1313

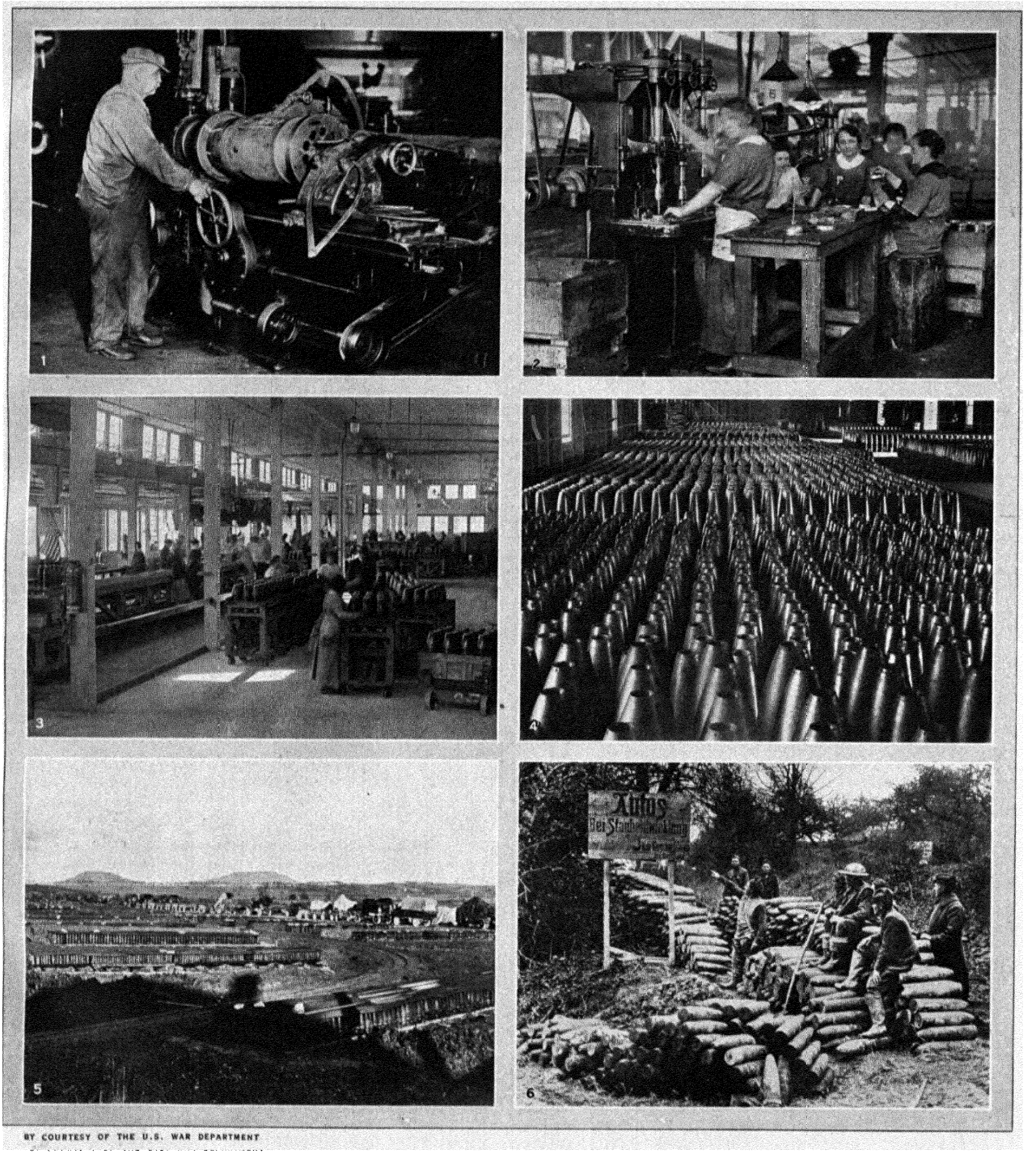


BY COURTESY OF THE BETHLEHEM STEEL COMPANY

GUN FORGING

Forging a large gun jacket in a 14,000-ton hydraulic forging press. Under the intense pressure, the white-hot metal is squeezed into the required shape and size, following which it is heat-treated to obtain the desired physical properties

ORDNANCE



BY COURTESY OF THE U.S. WAR DEPARTMENT

SHELL MANUFACTURING AND STORING

1. Turning the outside of large-calibre shell on metal finishing lathe
2. Drilling base plugs for shells
3. Inspecting finished shell
4. Finished shell in storage without fuses
5. Ammunition dump behind a theatre of operation
6. Ammunition dump for brigade near line of action

*

his Scottish campaign of 1327. The same king provided himself with cannon when he invaded France in 1346. Guns were carried in an English ship, the "Christopher of the Tower," as early as 1338 and a "pot de fer" is recorded to have been in one of the French vessels which attacked Southampton in that year. Guns were used in the English fleet at the battle of Sluys in 1340 and in a sea-fight between the Moors of Tunis and the Moorish King of Seville in 1350. The history of guns falls naturally into three epochs; the first being the smooth-bore era, from the 14th century to about 1845; the second, the evolutionary era from about 1845 to 1885; the third, the high velocity smokeless powder era from about 1885 onwards.

THE FIRST EPOCH (EARLY 14TH CENTURY TO 1845)

This period is marked by the use of smooth-bore weapons of low striking velocity. It is notable for the small progress made in five centuries of considerable warfare, beginning with the Hundred Years' War. Wrought iron pieces came largely into use in the latter part of the 14th century, owing, no doubt, to the difficulty of obtaining sufficiently sound metal castings for the bigger guns and to the high cost of copper. These guns were constructed of rods or bars which were beaten and welded together lengthwise and reinforced by iron rings clamped round the outside of the gun. This radically unsound form of construction survived during the 15th century notwithstanding many accidents, the most notable of which caused the death of King James II. of Scotland in 1460.

Stone balls came into general use for the larger pieces during the 14th century; such balls were cheaper than those of lead or iron and, being relatively much lighter, were better suited to the feeble guns of the period as these increased in size. Before the middle of the 15th century guns had developed from small weapons firing a 1 lb. or 2 lb. pellet to large "bombards" capable of throwing balls of 300, 400 and even 700 lb. weight. One of the most famous of these, Dulle Griete, the giant bombard of Ghent with a 25-inch calibre, was built as early as 1382. (*See* fig. 2.) Exceptionally large bombards were used by the Turks at the siege of Constantinople in 1453. The Turkish bombards were of cast bronze, but wrought iron construction was more general and is exemplified by Mons Meg, a 15th century gun now at Edinburgh Castle. It is noteworthy that many early guns were loaded from the breech end by a detachable chamber. (*See* fig. 3.) Another interesting feature of primitive gunnery was the common use of the *ribauld* or *ribauldequin* between 1350 and 1400. This was the prototype of the *mitrailleuse* and consisted of a number of small iron gun tubes clamped together in a bundle and fired in quick succession from the breech end, the whole being mounted on a wheeled carriage.

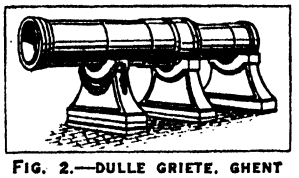


FIG. 2.—DULLE GRIETE, GHENT

The art of casting improved in the latter part of the 15th century, though not introduced into England until 1521, and the large cast bronze guns of that time were often beautifully ornamented with renaissance workmanship. Cast iron shot came into use at the end of the 15th century and by the end of the 16th century stone shot only survived for use in *petrieros, slyngs, fowlers, murtherers* and other relics of the preceding period. As cast iron shot displaced stone, its greater efficiency as a projectile tended to encourage the manufacture of a smaller and stronger type of gun and medium calibre muzzle-loading pieces, made first of forged iron and later of cast iron, came into use. These and cast brass weapons were developed steadily for field and naval service, whereas hitherto siege purposes had been the predominant consideration. It was not until the 17th century that cast iron muzzle-loading guns came into general use and they then continued as the principal weapons ashore and afloat until the end of the epoch. The improvement in the composition and strength of gunpowder after the introduction of "corned" gunpowder about 1450 had long made these stronger weapons a requirement. The use of cast steel was tried during the 16th and 17th centuries, but was generally found objectionable and finally abandoned, the metallurgical ignorance of the time making it impossible to obtain sound castings.

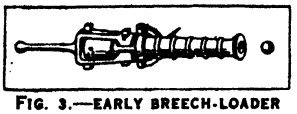


FIG. 3.—EARLY BREECH-LOADER

Principal Guns of the 16th Century Compiled from What Appear to Be the Most Trustworthy Ancient Authorities§

Name of piece	Calibre	Length*	Weight of gun	Weight of shot	Charge of powder	Later designation
	Ins.	Ft. In.	Lb.	Lb.	Lb.	
Cannon Royal	8·54	8 6	8,000	74	30	..
Cannon	8·0	..	6,000	60	27	..
Cannon Serpentine	7·0	..	5,500	42	25	..
Bastard Cannon	7·0	..	4,500	42	20	42 pounder
Demi-cannon	6·4	11 0	4,000	32	18	32 ,,
Cannon Pedro, or Petro†	6·0	..	3,800	26	14	24 ,,
Culverin**	5·2	10 11	4,840	18	12	18 ,,
Basilisk	5·0	..	4,000	14	9	12 ,,
Demi-culverin	4·0	..	3,400	8	6	9 ,,
Culverin Bastard	4·56	8 6	3,000	11	5·7	..
Saker‡	3·65	6 11	1,400	6	4	6 pounder
Minion	3·5	6 6	1,050	5·2	3	..
Falcon	2·5	6 0	680	2	1·2	..
Falconet¶	2·0	3 9	500	1	·4	..
Serpentine	1·5	..	400	·5	·3	..
Rabinet or Robinet	1·0	..	300	·3	·18	..

§*See* Sir W. Monson's "Tracts" in Churchill's *Voyages*, iii.; *"Archaeologia,"* vi. 189, xi. 170, xiii. 27, etc. Tartaglia's *"Three Books of Colloquies,"* translated by Lucar (London, 1588); and S.P.Dom. Eliz. ccxlii. 64. Hardly any two of these agree.

*Monson puts the length of the guns mentioned by him at 8 ft. 6 in.; but specimens still extant, dating from about his time, indicate that this was not always correct.

†"Cannon Pedro" was the English form of *"canon pierrier,"* and means a gun primarily intended for throwing stone shot.

**I.e. couleuvrine—serpent. Compare Basilisk.

‡Named after the Saker hawk. Compare Falcon.

¶In the grounds of the Seigneurie, Sark, is a well-preserved brass gun, apparently a falconet, 57 inches in length, and 1¾ inches in calibre, bearing the following inscription:—*"Don de sa Majesté la Royne Elizabeth au Seigneur de Sarcq,* A.D. *1572."*

The above table, taken from *The Royal Navy, A History* by Laird Clowes, vol. i., p. 410, shows the guns mounted in ships during Queen Elizabeth's reign. A column has been added to this table, indicating the weapons in general use in the 17th and 18th centuries, with the classification in terms of the projectile's weight, which was carried out under Cromwell's government when a greater uniformity in the size of shot and in the clearance between the shot and the bore (windage) was demanded.

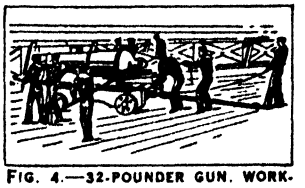
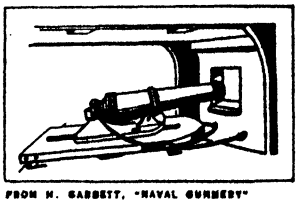


FIG. 4.—32-POUNDER GUN, WORKING WITH REDUCED CREW OF NINE MEN



FROM H. GARBETT, "NAVAL GUNNERY"

FIG. 5.—32-POUNDER CARRONADE

In the middle of the 18th century progress was made in ordnance by boring from a solid casting instead of relying on hollow casting; this resulted in greater uniformity of bore. Also a more scientific attitude to ballistics (*q.v.*) was adopted. This attitude was mainly due to Benjamin Robins, inventor of the ballistic pendulum, who in 1742 published an important work, *The New Principles of Gunnery*. A result of his research and

experiments was the introduction in 1779 of *carronades*. These were light short weapons of various calibres from 6 to 68 pounders in which windage was greatly reduced. A contrast between this weapon on its ship's mounting and a gun of the same calibre on a truck carriage is shown in figs. 4 and 5. More attention was also paid to the shape and weight of guns in relation to the stresses to be borne and less to external ornament. Trunnions were placed near the axis of the gun instead of below it, thus lessening the stresses on the carriage.

Hollow shot filled with explosive or incendiary mixtures were used from mortars in the middle of the 16th century, but explosive shell did not come into general use for guns until early in the 19th century. Their advent sounded the death knell of the wooden warship and soon became an incentive to the development of steel through the impetus given to the production of protective armour. The 65 cwt. 8 in. shell gun was introduced into the British Navy after 1838 and took the place of the 32 pounder as the lower deck armament in line of battle ships and the main deck armament of frigates. The gun was 9 ft. long and fired a 56 lb. shell. It formed the principal armament of H.M.S. "Marlborough" as late as 1860.

THE SECOND EPOCH (1845–1885)

This may be described as the "evolutionary era." It is notable for the great advance made in a short period through the introduction of rifling for cannon and of a "built-up" construction involving shrinkage, resulting in medium velocity weapons firing elongated projectiles of considerable penetrative power. This epoch embraced the Russian, American Civil and Franco-Prussian Wars. These contributed to the remarkable developments in ordnance, revived the armament firms of Europe that had gone into obscurity since the Napoleonic Wars, particularly Krupp (Germany) and Schneider (France), and brought others into being, notably Armstrong Whitworth (Britain). The progress in mechanics and engineering of this industrial era, which included the introduction of the Bessemer and Siemens open-hearth method of making steel, was reflected in the advance in gun mechanisms, in recoil appliances and in the application of power to the working of guns. The inventive genius of the time was particularly exemplified by the production of machine guns and automatic guns.

Introduction of Rifling.—The introduction of rifling owes much to Benjamin Robins who, in 1747, wrote: "Whatever state shall thoroughly comprehend the nature and advantage of rifled barrel pieces and . . . shall introduce into their armies their general use . . . will by this means acquire a superiority which will almost equal any thing that has been done at any time by the particular excellence of any one kind of arms."

Rifling, by imparting a spin to the projectile as it travels along the spiral grooves in the bore, permits of the use of an elongated projectile and ensures its flight point first, which greatly increases accuracy. The longer projectile being heavier than round shot has a greater striking energy for the same muzzle velocity. The shape of the head can be designed to reduce air resistance, thereby increasing range. Though Robins was probably the first to give reasons based on sound principles why rifling was desirable, the fact that it was helpful in external ballistics had been appreciated since the early 16th century and a barrel exists at Woolwich, dated 1542, which is rifled with six fine spiral grooves. Straight grooving was applied to firearms (muskets) as early as 1480 and this practice of grooving the bore of a musket without any twist was extensively used during the 16th century. Probably rifling evolved from the early observation of the action of the feathers on an arrow and from the practical experience of cutting channels in a musket, originally to reduce fouling, being found beneficial to the weapon's accuracy. Towards the end of the 18th century the importance of rifled small arms and their necessity had been appreciated. The War of Independence contributed to this result; the Americans early realised the value of the rifled musket. Elongated bullets, however, did not begin to replace spherical until 1828. It was not until a hundred years after Robins' experiments that any attempt to rifle guns was successful. In 1846 a Sardinian officer, Major Cavalli, and a Swedish officer, Baron Wahrendorff, both independently produced breech-loading rifled iron guns. The Cavalli gun had two grooves cut separately along the bore on opposite diameters, in which two projections, ½-inch deep, on the 69 lb. cylindro-conical projectile, engaged. Promising results were obtained with both guns, though they were of a somewhat weak construction.

About the same time Charles Lancaster endeavoured to rotate projectiles by giving the gun an elliptical bore of small eccentricity, the spiral increased gradually towards the muzzle, and rotation was effected through rifling "surfaces" instead of by grooves. Guns rifled on this principle were used in gunboats during the Crimean War, but were not a success. An improved form of this principle of rifling was adopted by Joseph Whitworth a few years later. The advantages of an elongated rotating projectile both in range and penetrative properties were now thoroughly established. The muzzle velocity of guns during the last 100 years of the 1st epoch compared favourably with that of the earlier rifled guns; the elongated projectiles of the latter however lost their velocity slowly whereas the smooth bore round shot lost velocity so rapidly that at 2,000 yards' range the striking velocity has only about one third of the muzzle velocity.

Introduction of Shrinkage Construction.—The idea of reinforcing cast iron or bronze guns to reduce the number of accidents with cast pieces had been under investigation from time to time. In 1833 a gun was produced by M. Thiery (France), by whom the virtue of shrinking on hoops was to some extent appreciated. The interior of the gun was made of cast iron, and this was encased in a longitudinal armature of wrought iron bars, which were further reinforced by wrought iron hoops shrunk on.

In 1855 W. G. Armstrong (afterwards Lord Armstrong, *q.v.*) designed a rifled breech-loading gun embodying so many considerable improvements as to be in effect revolutionary. The main feature of the construction was the introduction of hoops and tubes formed by wrought iron bars, which were coiled hot on a mandril and welded into a closed helix, the fibre of the wrought iron running in the direction most suitable for circumferential strength. Longitudinal strength was obtained by a forged hollow breech piece. These helical cylinders were shrunk over a steel tube or liner in the original Armstrong gun. In later construction the steel tube was replaced by a wrought iron helical tube (*see* fig. 6). The gun was rifled with a large number of grooves and fired lead-coated projectiles, thus eliminating windage; breech-loading was effected by a powerful screw holding a sliding vent-piece tightly against the face of the breech.

Various types of guns, having a built-up form of construction involving shrunk hoops, were produced about the same period as the Armstrong gun, notably Chambers gun (United States, 1849); Treadwell gun (United States, 1855); Blakely gun (Britain, 1855); Parrot gun (United States, 1861). Many rival claims to originality were made after the success of the Armstrong gun, but its superiority was due more to the manner in which the difficulties of manufacture were overcome than to the introduction of new principles. In Britain the gun which competed most successfully with the Armstrong gun was that produced by Whitworth. This distinguished engineer had already become prominent for improvements effected by him in the Enfield rifle. He designed a steel gun of a hoop form of construction which was principally remarkable for the accuracy of its manufacture. Reliance was not

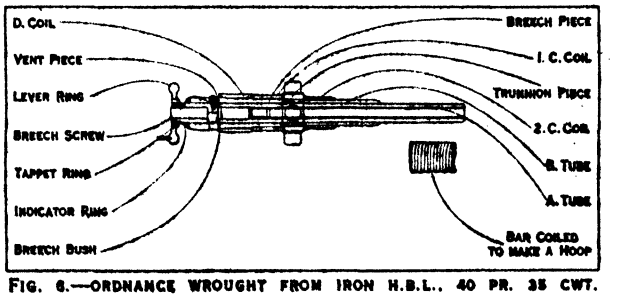


FIG. 6.—ORDNANCE WROUGHT FROM IRON H.B.L., 40 PR. 35 CWT. MARK I



BY COURTESY OF THE U.S. WAR DEPARTMENT

FIRING GUNS IN ACTION

1. A 75-mm. Field Artillery gun and crew in action
2. A 75-mm. gun ammunition cart showing sleeves for the projectiles
3. French gun, medium calibre, Mobile Artillery
4. 37-mm. infantry gun and crew in action
5. 4-in. Stokes projector for chemical shells used in trench firing
6. 155-mm. howitzer gun and crew in action

ORDNANCE



BY COURTESY OF (2, 3) THE U.S. WAR DEPARTMENT; PHOTOGRAPHS, (1, 4) UNDERWOOD AND UNDERWOOD

ANTI-AIRCRAFT AND DISAPPEARING GUNS

1. Battery of 3-in. anti-aircraft guns and their crews. The crew has only to load the gun and pull the firing lanyard. A remote control elevates and points the battery from a central point miles away by means of a newly developed torque amplifier
2. A 7-in. naval gun in mobile carriage
3. A 12-in. disappearing coast defense gun, having a range of over 12 miles
4. Projectile mounted on a shot truck ready for loading into a 12-in. coast defense gun
5, 6. Loading a 12-in. coast defense gun

placed on heat shrinkage, but the tension and compression effect was produced by building the members under hydraulic pressure, forcing a slightly larger tube into a cylinder. The improvement in technique of construction owes much to the methods adopted and great accuracy of workmanship insisted on by this scientific engineer, who was also a pioneer in the heat treatment of steel forgings which was later to play such an important part in the strength of guns. Oil-hardening of steel tubes and subsequent tempering came into practice about 1863.

Another gun of this period (1855–63) which calls for mention is the Krupp steel breech-loading monobloc gun which owed its strength to the good quality crucible steel used. A feature of this gun was the breech mechanism which proved more efficient and safer than that introduced by Armstrong. Its general principles have survived in the modern quick-firing Krupp guns of built-up

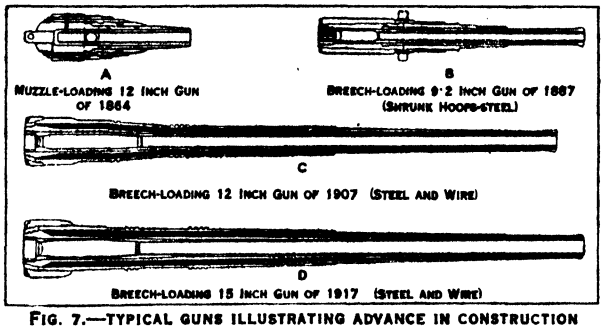


FIG. 7.—TYPICAL GUNS ILLUSTRATING ADVANCE IN CONSTRUCTION

hoop construction. The British guns of the period 1855–63 were mainly rifled breech-loading guns, designated R.B.L., but in 1864 after repeated experiments and in view of failures and accidents due to defects in breech mechanism, Great Britain reverted to muzzle-loading guns. These were rifled and designated R.M.L. (*See* fig. 7, A.) Many smooth-bore guns were converted on Sir William Palliser's system by enlarging the bore of the cast iron gun and inserting a rifled barrel of coiled wrought iron. Having reverted to a muzzle-loading policy, Great Britain adhered to it for several years longer than the other great powers, thus falling behind them in efficiency of armament. But in 1880, after a serious accident caused by the inadvertent double-loading of one of H.M.S. "Thunderer's" guns in the previous year, the adoption of an improved system of breech-loading was decided on. Towards the end of the epoch, the advantage of steel as a material for guns was more clearly appreciated as the former difficulties in forging large masses were overcome. Steel hoops were preferred to either steel or wrought iron coils and by 1885 steel tubes were replacing hoops in British construction.

Recoil Appliances.—During this epoch the progress in recoil appliances was remarkable. With the increased power of guns and the greater recoil energy involved by the use of rifling and low windage projectiles it became essential to devise means of limiting the recoil, especially in ships' guns. This had to be done by more effective methods than those hitherto used of surface friction, skids, inclined planes or rope breechings. The "compressor," which now replaced these, consisted of friction plates capable of being set up or released as necessary for firing or subsequent running out. Before the end of the epoch recoil cylinders were introduced in the mounting. In these the recoil is overcome through the resistance offered by a liquid contained in the cylinder to the passage of a piston attached to the gun. The liquid passes through a hole or port in the piston head, the size of the port being controlled by a valve key fitted to the cylinder. The recoil pressure can thus be suitably regulated.

Machine Guns.—Before the end of the epoch the energy of recoil had been applied, in particular by the inventive genius of Hiram Maxim, to automatic guns, *i.e.*, guns in which some of the recoil energy was employed in the work of reloading the gun. After the introduction of the French *mitrailleuse* in 1870, other inventors of the time, notably Gatling, Gardner and Nordenfeldt, had produced machine-guns of increasing effectiveness.

THE THIRD EPOCH (1885 TO THE PRESENT DAY)

This period may be distinguished as the steel era of high velocity guns. The epoch begins with the advent of smokeless propellents (cordite, *q.v.*). The much greater gas yield efficiency of these permitted of lighter charges or higher velocities and required longer and stronger guns for the suitable combustion of the slower burning high pressure powders. (The 68-pounder

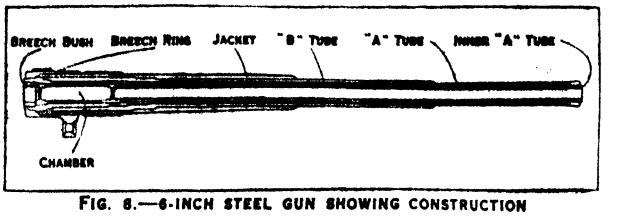


FIG. 8.—6-INCH STEEL GUN SHOWING CONSTRUCTION

was fired with 18 lb. of gun powder and gave a muzzle velocity of 1,100 f.s., whereas the 100 lb. projectile fired with 14½ lb. of cordite had a muzzle velocity of 2,630 f.s.) By 1890 nitro cellulose and nitro-glycerine powders (so-called, but in the usual form cords or small cylinders) had generally replaced gunpowder in the ordnance of all first class powers. The ordnance developments of this epoch are as remarkable as those of the preceding one, but the advances have been due to the great progress in metallurgical knowledge and practice, in engineering science, and in the technique of construction, rather than to radical innovations such as those for which the previous epoch was conspicuous. This era is notable for the steady advance in the power of guns through the increase in calibre and hence in the weight of the projectile, and increase in muzzle velocity; also for the development in automatic machine guns and semi-automatic quick-firing guns.

Q.F. and B.L. Guns.—The quick-firing (Q.F.) gun is distinguished from the breech-loading (B.L.) gun by the method adopted for obturation or sealing the gases at the breech end. In a B.L. gun this is effected by some feature of the breech mechanism, such as a pad or ring which expands against a seating in the bore of the gun under the pressure of firing. The charge being in a bag such guns are called "bag guns" in U.S.A. In the Q.F. gun obturation is effected, as in a rifle and shot gun, by the expansion of the metal cartridge case which contains the propellent. Such guns are called "case guns" in the U.S.A. If the projectile is attached to the cartridge case, forming one loading unit, the ammunition is called "fixed" to distinguish it from the "separate" type.

All Steel or Wire Construction.—Between 1885 and 1890 "all steel" rifled B.L. and Q.F. guns of considerable length came into general use. They were of built-up construction, steel tubes and hoops being shrunk on at suitably calculated shrinkages. (*See* fig. 8.) Since 1890, wire wound guns (*see* fig. 9) have come into use in many countries, particularly Great Britain, Italy and Japan.

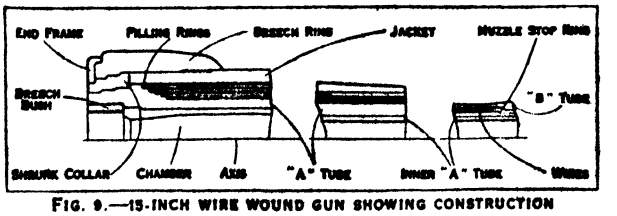
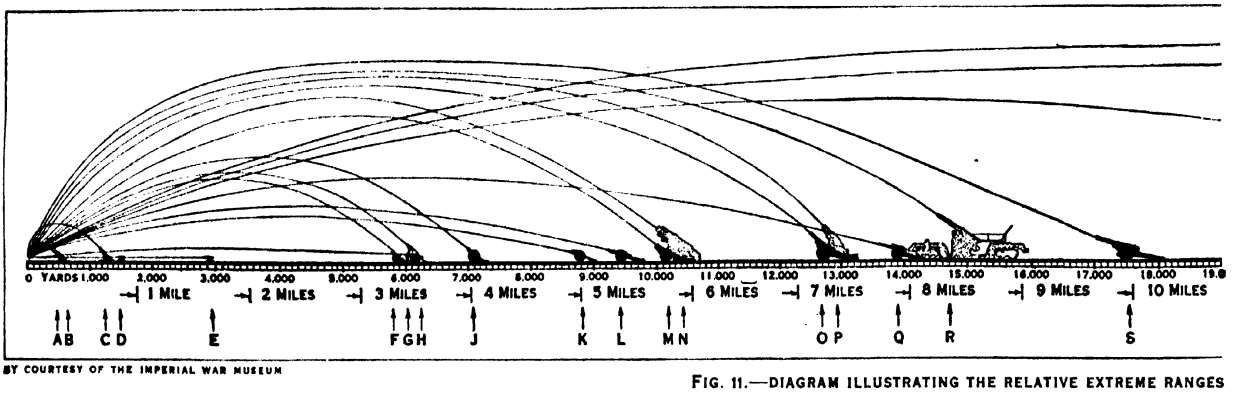


FIG. 9.—15-INCH WIRE WOUND GUN SHOWING CONSTRUCTION

Various systems of wire construction had already been put forward during the preceding epoch.

It is noteworthy that Germany adhered throughout to an "all steel" construction and preferred a Q.F. mechanism for all natures of guns. In the Krupp gun of medium and heavy calibre a hoop form of construction is used in preference to tubes. Since the World War an "all steel" construction for medium calibre guns is more general in view of the greatly improved properties of high grade alloy steels. For smaller guns a monobloc form of construction is sometimes preferred, owing to the success of a



BY COURTESY OF THE IMPERIAL WAR MUSEUM

FIG. 11.—DIAGRAM ILLUSTRATING THE RELATIVE EXTREME RANGES

(A) 3-in. Stokes Mortar, (B) 2-in Trench Mortar, (C) 9.45-in. Trench Mortar, (D) Machine Gun (effective range), (E) Machine Gun (distant range), (F) 3.7-in. Mountain Howitzer, (G) 6-in. 30 cwt. Howitzer, (H) 2.75-in. Mountain Gun, (J) 4.5-in. Howitzer, (K) 13-Pndr, (L) 18-Pndr (Mark IV.),

cold forging (auto-frettage) process which results in an economical and rapid production of light guns capable of sustaining high pressures. The post-war progress in ordnance has been marked by greater efficiency and simplicity in both the design of the gun and in the mechanism.

GUN CONSTRUCTION

In the early days of ordnance, gunnery was in the realm of the magic arts. It was not until the sixteenth century that it was treated in a scientific spirit by Niccolo Tartaglia. Later Benjamin Robins advanced the study, but results of his research and experiment were not fully applied until the evolutionary epoch, when gunnery passed into the realm of science.

DESIGN CONSIDERATIONS

During the twentieth century much attention has been devoted not only to the structure of the gun, but to its interior design to obtain improved ballistics, so that higher efficiency and greater accuracy might be achieved. The nature and form of rifling, the size and form of chamber, the character (particularly in regard to regularity in combustion and freedom from age deterioration), weight and form (size) of the propellent are matters for research and experiment in which progress still continues to be made. Four important general requirements of a gun are (1) high muzzle velocity; (2) accuracy; (3) good life; (4) rapidity of fire. The relative importance of these depends on the special conditions for which the gun is required. All affect the prospects of hard and frequent hitting which are the main desiderata.

High Muzzle Velocity.—This depends on the pressure developed during the projectile's passage down the bore and the distance through which this pressure acts, and the frictional resistance encountered by the projectile. Limitations in maximum pressure are decided by the strength of the steel of which the gun is constructed, and to some extent by the pressure that can be withstood by the weakest type of shell that the gun is required to fire, such as large capacity high explosive shell. In modern guns this maximum pressure rarely exceeds 22 tons per square inch. Limitations are imposed on the length of the gun by the circumstances of its use, such as considerations of weight and the stresses produced on the mounting or structure which carries it; by requirements in regard to the position of the centre of gravity; and by the amount of deflection or gravitational droop which is permissible in the unsupported chase of the gun. Modern guns are generally between 45 and 55 calibres in length, that is, the length of the bore and chamber of a 50 calibre 6-inch gun is 25 feet. (In some countries the overall length of the gun is referred to.)

Accuracy.—This depends upon the uniformity of pressure and of friction for successive rounds and on the stiffness of the gun structure. Both pressure and friction are affected by the wear which they occasion in the bore and chamber. The wear increases the size of the chamber by allowing the projectile to seat further forward and affects the frictional resistance to the driving band of the projectile and possibly the efficiency of the gas seal. Uniformity of pressure is also affected by the suitability of the size of chamber and charge used.

Good Life.—This depends on a slow rate of erosion in relation to rounds fired. As the time down the bore is a fraction of a second the actual working life of a heavy gun that could fire 300 rounds is only a few seconds. Erosion is principally "wear" which is a washing away of the surface of the bore, particularly at the commencement of the rifling, by the high temperature and velocity of the gases. This temperature and velocity depend for a given propellent on the rate of combustion, which again is decided by the size of chamber and the weight and form of the charge. The rate of erosion is also affected by the friction of the projectile, which depends on the nature of rifling, type of driving band, and efficiency of centring and seating the projectile and of sealing the gases. Bad sealing results in "scoring."

Rapidity of Fire.—This depends on the efficiency of the mechanism for operating the breech and for absorbing the recoil and replacing the gun in the firing position, and on the loading arrangements. It is of importance that the gun should be kept as cool as possible under rapid fire conditions, particularly in view of the exposure of the charge in the chamber during loading, which also necessitates provision for extinguishing all smouldering residue.

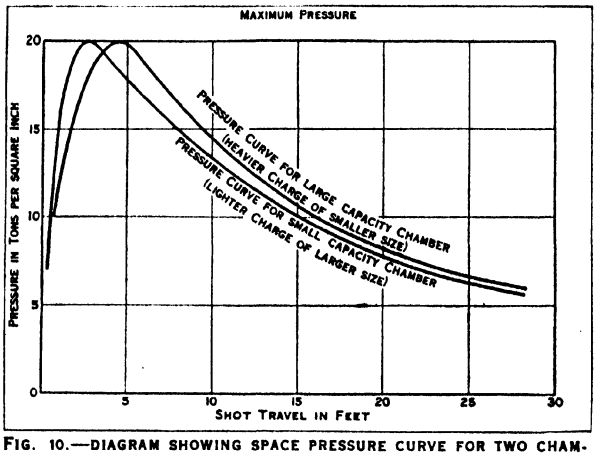
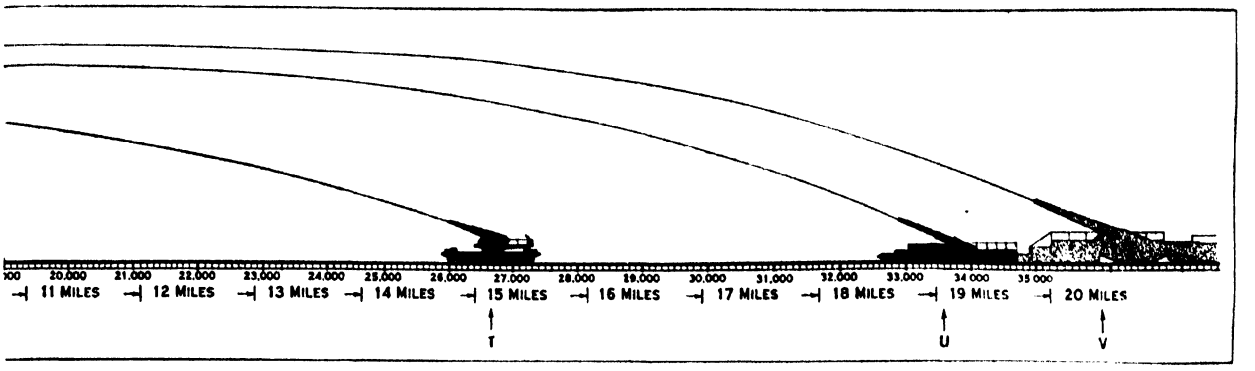


FIG. 10.—DIAGRAM SHOWING SPACE PRESSURE CURVE FOR TWO CHAMBERS OF DIFFERENT SIZE, GIVING SAME MUZZLE VELOCITY

Size of Chamber.—The designer being given a required muzzle velocity and length of gun and a limiting maximum pressure, is confronted with the problem of deciding the most suitable size of chamber. A gun may be viewed as a single stroke internal combustion engine, the piston of which, represented by the projectile, is blown through the open end of the cylinder at each stroke, after being rotated by the rifled walls of the cylinder. The latter engage in the copper driving band, which also serves as a piston packing ring and seals the gases. The same muzzle velocity and maximum pressure can be obtained in the same length of



OF THE BRITISH PIECES OF ORDNANCE USED IN THE WORLD WAR

(M) 6-in. 26 cwt. Howitzer, (N) 15-in. Howitzer, (O) 8-in. (Mark VII.) Howitzer, (P) 9.2-in. (Mark II.) Howitzer, (Q) 60-Pndr (Mark I.), (R) 12-in. (Mark V.) Howitzer, (S) 6-in. (Mark XIX.) Gun, (T) 9.2-in. (Mark X.) Gun, (U) 12-in. Gun (Mark IX.), (V) 14-in. Gun (Mark III.)

gun by chambers of different capacity, provided suitable variations are made in the weight and form of the charge. Different sizes of chambers are favoured by different nations; the point is important as it has a direct bearing on the accuracy or regularity of the gun. By means of internal ballistic calculations based on theory and supported by data obtained from experiments with gases in closed vessels, pressure curves can be produced for different sizes of chamber and weight and form of charge. The form of charge or size of the elements of which it is composed, affects through the surface exposed, the rate of burning.

In the diagram (fig. 10) the pressure developed along the bore is given for two different chambers with charges adjusted to give the same maximum pressure and muzzle velocity. In the case of the smaller chamber, the weight of charge is less, but it occupies a relatively larger volume of its chamber and this increase in the "density of loading" results in a more rapid rate of combustion through the greater confinement of the gases. This is modified to some extent by the lighter charge being composed of individual cords or elements of larger size, thereby exposing less surface to the igniting gases and tending to reduce the rate of burning. Features of importance in these pressure curves are the position of maximum pressure in the bore and the extent of the muzzle pressure. Both these features affect the position of the gun's centre of gravity as the pressure curve is reflected in the thickness of the gun walls. At first sight it would appear that all the advantages are with the lighter charge giving the lower forward pressure, which reduces the muzzle vibration and, in combination with the earlier maximum pressure, brings the centre of gravity towards the breech end, but consideration must be given to the effects on the muzzle velocity of usage and of small variations incidental to the gun, the charge and the projectile. The smaller chambered gun is naturally more sensitive to such changes and its regularity in muzzle velocity may be inferior. The life of such a gun may be shorter through loss in accuracy, though the measured wear or enlargement of bore be less than with the larger chambered gun.

The regularity in the muzzle velocity from round to round is an important characteristic of a gun and generally defines the minimum size of chamber and weight of charge. The "form" of the chamber as opposed to its capacity is to some extent influenced (particularly at the forward end) by the type of driving band fitted to the projectiles, and this also affects the character of the rifling. The form of chamber and shot seating is responsible for the centring of the projectile and its initial steadiness which are of importance as affecting both accuracy and wear. Generally modern gun chambers are of medium capacity obtained by length rather than width and with small changes in section.

FUNDAMENTAL PRINCIPLES

During the evolutionary epoch the value of shrinking tubes or hoops over each other to obtain increased circumferential strength in a gun had gradually emerged and been confirmed by experience. It was appreciated that in a monobloc gun such as the cast-iron gun of the early 19th century there was a limit to the increase of circumferential strength obtained by increasing the thickness of the material (this limit is practically reached when the thickness of the gun walls equals the radius of the bore). Towards the end of the first epoch, Thomas Barlow had shown that the stresses produced by pressure in a cylinder are greatest on the interior surface and diminish in a ratio affected by the square of the distance from the centre to the exterior. Thus, as the thickness of a cylinder increases, the value of the material towards the exterior rapidly diminishes.

Basic Law.—It was further realised that the bore of the gun must not be permanently expanded on firing, in other words, that *the gun must work elastically* and in no circumstances must any of the material be permanently strained (stressed beyond its elastic limit). This is the basic law of gun construction. Steel has a certain elastic range, depending on its quality, both under tension and under compression stress. Thus if it is put in a state of compression it will have an increased elastic range for subsequent tension stresses. The principle of initial tension or compression is the principle of making use of the compressive as well as the extensive elasticity of material such as steel. Initial compression is generally obtained by shrinking one tube on another. This produces compressive stresses in the inner tube at the expense of tension stresses in the outer. The theoretically ideal gun would be one in which the circumferential stresses produced on firing were uniform throughout the thickness of the walls. Such a gun would be in initial tension on the exterior gradually passing to compression in the interior, and on firing, all parts of the gun would be equally stressed circumferentially. This ideal effect can be partially achieved by shrinking a series of thin tubes or hoops over each other.

Wire Winding.—The effect can be more nearly reached through a definite section of the gun by winding wire at varying tensions for successive layers. It can be still more completely achieved in a monobloc steel gun by the cold forging process, sometimes known as "auto-frettage."

Auto-frettage.—This process takes advantage of Barlow's law and by the application of fluid pressure to the bore of the gun or tube permanent expansion is produced through overstraining the inner layers of the material. The pressure is so controlled, however, as not to overstrain the outer layers which remain stressed within the elastic limit. After removal of the pressure the inner layers do not return to their original form, and the outer layers therefore remain in a state of tension and act compressively on the inner. This condition is stabilised by "ageing" the metal by suitable mild heat treatment.

THEORY OF GUN CONSTRUCTION

The important effect already noted is that the shrinkage pressure produces circumferential compression on the inside tube at the expense of circumferential tension in the outside tube. This opposes the radial pressure and circumferential tension which result from radial powder pressure in the bore of the gun.

Circumferential Strength.—A theory of gun construction, which is based on Barlow's law and has stood the test of

experience, is known as Lamé's theory. It relates the radial powder and shrinkage pressures to the induced tensions and compressions with respect to the internal and external radii of the tubes concerned. This relation is known as the gunmaker's formula, and it enables the designer to calculate pressures, tensions or compressions in any position in the walls of the gun both when the gun is in repose, and only affected by shrinkages, and also when it is firing and affected by both shrinkages and powder bore pressures. A design can thus be produced giving the necessary thickness of tubes and degree of shrinkage estimated as of suitable circumferential strength not only to resist fracture longitudinally, but to avoid straining any of the material beyond the elastic limit. Several theories of construction are followed, but in all certain assumptions are made, particularly in regard to the mutual effects of stresses in different directions. To cover any inaccuracies in calculation due to these and to ensure a margin of security in the use of the gun, a suitable safety factor is allowed. The gun is generally designed to stand pressures ranging from twice the normal pressure experienced at the muzzle end to one and a half times at the breech end.

Longitudinal Strength.—Provision must also be made for suitable longitudinal strength in the gun to meet the stresses produced by the pressure of gases on the face of the breech block and on the base of the projectile, forces which stress the material in a direction tending to produce circumferential rupture. Minor longitudinal stresses are also brought into play by the resisting action of the recoil brake. The maximum bore pressure is considered fully effective on the breech surface exposed and it is necessary to distribute the stresses as far as possible to the other members of the gun. This is done in an all-steel gun with a screw breech mechanism through the medium of a screwed breech bush in which the threads of the breech screw engage, while in a gun with a sliding breech mechanism the direct thrust brought on the surface of the sliding block is transmitted to the breech ring and so to the other hoops or tubes which are connected longitudinally by means of shoulders. In a wired gun, the arrangement at the breech end must be such as to connect the tubes inside the wire with those outside, since the wire itself is incapable of contributing in any way to the longitudinal strength of the gun.

Girder Strength.—In addition to the longitudinal and circumferential strength, the gun is required to have a certain degree of girder strength so that the gravitational deflection is kept as small as possible. The gun resting in its mounting may be regarded as a beam supported at a certain distance from one end and its girder strength depends on the rigidity with which the various parts are connected. In a wired gun the wire makes no contribution to this strength, which is therefore dependent upon the tubes and the means taken to connect them rigidly in place.

MANUFACTURE

The design of a post-World War all-steel British gun is shown in fig. 9. This gun is fitted with an inner "A" tube or liner so that when the rifling is considerably worn the gun may be economically repaired by introducing a new liner in place of the old one. (This arrangement is very general but not universal as some guns, usually those of small calibre, have no liners and are repaired by replacing the entire "A" tube.) The liners are usually tapered on the exterior and are driven in to the tapered bore of the outer "A" tube by hydraulic pressure or other suitable means so that when in place there is a certain shrinkage pressure operating. In medium calibre guns, since the World War, "loose" liners have also been tried, *i.e.*, liners with a small clearance or air space. Such liners are necessarily of high quality steel with a large elastic range so that when they temporarily expand on firing they receive support from the walls of the gun before they have been strained beyond their elastic limit. The material of the liner contracts to its original dimensions after firing and is easily removable. The liner is keyed at the ends to prevent rotation under the action of the projectile and is shouldered at the rear end to prevent forward movement. Such a system of ready repair has obvious advantages in connection with guns which wear out rapidly or which, like anti-aircraft guns, are subject to very considerable use in a short space of time. The repair is of such a simple nature that it can be effected without dismounting the gun. The "B" tube, the jacket and the breech ring are built by shrinkage, which is effected by machining the internal diameter of the tube to be built to a smaller diameter than the surface on which it is built. The difference in diameters must be such as will give the required compression and must permit of sufficient expansion for building at a temperature below that which could affect the temper of the material. Sudden changes in the section of tubes are avoided to obviate longitudinal weakness and to prevent difficulties in building through the thinner section of the tube cooling more rapidly than the thicker and possibly seizing before properly in place. In all guns the aim is to relieve from all longitudinal stress the metal which bears the brunt of the circumferential stress. Consequently, the breech bush is free from the liner and attached to the "A" tube.

Material.—All gun body members are made of steel (*q.v.*) of a specified chemical composition and physical properties. The more important tubes are usually of a high grade alloy steel, the essential physical property being a high yield point to give a good elastic range. The British specification requires the steel to be made by the acid open-hearth process to ensure the pure quality of the ingredients. The steel is cast as an ingot which in the case of large forgings may weigh 100 tons or more. There is a large discard from the top and a small discard from the bottom of the ingot and the core is removed by trepanning before or after shaping up the ingot into a billet.

Forging.—The material is then forged under a hydraulic press on a water-cooled mandrel in a series of heats to draw it into a tube of the required dimensions. In this forging operation the length may be increased five times and the diameter halved. The forging, after straightening and rough machining, is normalized or annealed in a furnace to remove the forging stresses. Oil hardening is then carried out by heating the forging to a suitable degree and immersing it in oil, after which it is tempered as necessary and the required properties are tested mechanically by breaking and bending test pieces taken from the two ends of the tube.

Building and Wiring.—The tubes are machined to the finished dimensions for building, the exterior of an inner tube being turned to conform to the measurements given by the bored interior of the corresponding outer tube, allowing for the design shrinkages. The outer tube is heated sufficiently to obtain the necessary clearance by expansion and is then lowered over the inner tube or gun which is placed vertically in a pit for this purpose and kept cool by water running through the bore. As soon as the outer tube is properly in place, that is, the rear or building shoulder is in contact, it is rapidly cooled from this shoulder which is near the breech end by the application of water. This cooling requires careful control to prevent the tube seizing at any forward position. The forward portion is kept heated by gas rings, which are gradually withdrawn as the cooling proceeds, and the water moves up the exterior of the tube, thus ensuring that the tube is held or drawn towards the breech end throughout the shrinking operation. In the case of a wire wound gun, after insertion of the liner or inner "A" tube, which is slightly conical and a driven fit, the rear end of the "A" tube is threaded inside to take the breech bush (*see* fig. 9). A stepped collar is shrunk over the rear end of the "A" tube. This reinforces the breech bush and forms the connecting link between the "A" tube and jacket through the medium of the breech ring so that the longitudinal stresses can be suitably distributed. The muzzle stop ring is shrunk over the muzzle of the "A" tube. This ring forms the front support for the wire which is wound over the "A" tube. The wire consists of a steel ribbon $\frac{1}{4}$ in. wide and ·06 in. thick. The breaking strength of this material is over 100 tons per square inch and all the wire used is, previous to winding, subjected to a very severe load to ensure that it is perfectly sound. The fact that wire can be so tested throughout is a great merit of this form of construction. It is wound on the gun in a continuous length, the number of turns varying in the case of a 15 in. gun from 20 at the muzzle end to 79 at the breech. Approximately 22 tons of

wire, about 186 miles in length, are required for such a gun. The winding tension is such as to produce the required design tension after completing the winding operation, allowance being made for the effects of subsequent layers of wire on those already wound. This tension is controlled during winding by a readily adjustable friction brake. On completion of the wiring, the external layer of wire is turned with a fine cut to obtain a good building surface for the 'B" tube and jacket which are shrunk on. The breech ring is finally screwed and shrunk on. The exterior of the gun is finish machined and the bore and chamber are bored and lapped to size.

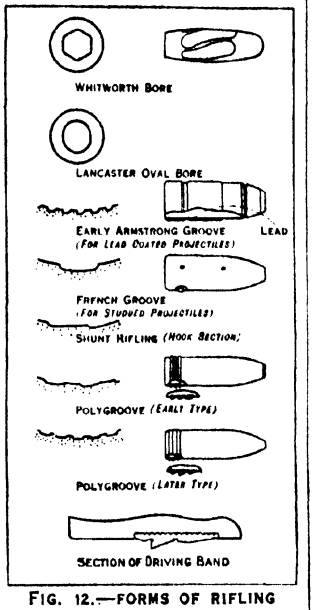


FIG. 12.—FORMS OF RIFLING

Rifling.—The gun is then rifled: the spiral grooves are cut by a special machine, several grooves being cut at the same time, to the required depth and form. The number of grooves, their depth and general form and the relative width of the groove and land (intervening bore surface) vary considerably in different guns. The general form of groove is one of plain section in which the width of "land" is approximately half the width of the groove (*see* fig. 12 which contrasts different and earlier types of rifling). The twist of rifling is generally uniform, one turn occurring in a length of 30 calibres, but increasing twist is also used and a combination of increasing and uniform twist. A typical modern form of driving band is also illustrated. It has three functions to perform:—(1) To rotate the projectile. (2) To act as a gas seal and so prevent the bore of the gun being scored or guttered by gas escaping over the projectile, which would result in irregularity in the muzzle velocity. (3) To hold the projectile at any elevation after loading so that it does not slip back into the chamber, and to ensure that a certain pressure is generated before the projectile starts to travel.

The copper of the driving band is engraved and pressed by the lands into the grooves as the projectile proceeds. To avoid copper deposition in the bore, which would reduce its diameter and affect the form of grooves, tinfoil is combined with the propellent.

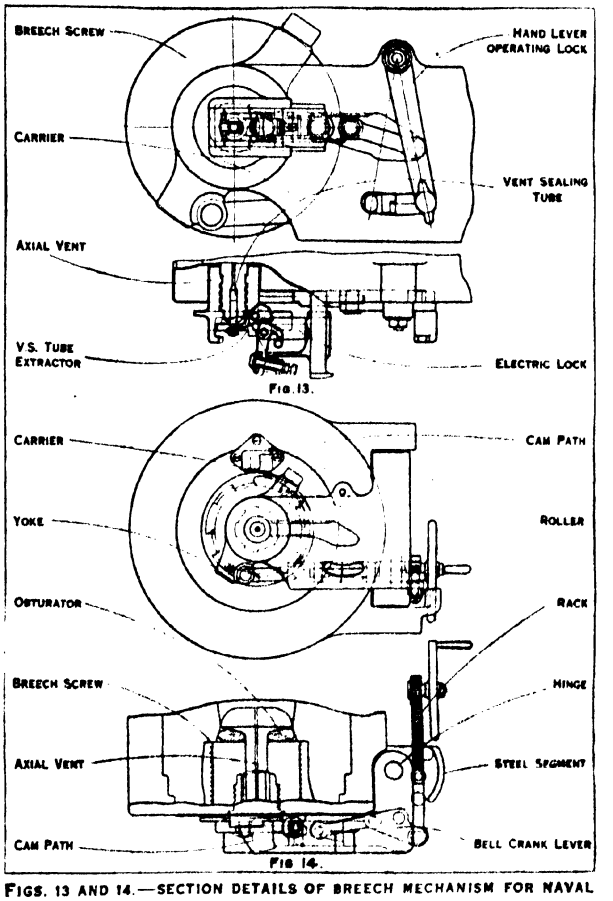
BREECH MECHANISM

A breech mechanism is a mechanical device for closing the rear end of the chamber of a gun. It includes the mechanism for firing the gun, and safety arrangements for preventing the gun from being fired before the breech is fully locked. It also embraces the necessary operating gear which may be "hand" or "power." If the latter, "hand" alternative is generally provided which can be readily connected or clutched in. The chief requirement is safety, with ease and rapidity of operation. Two main types of mechanism prevail:—(1) The "screw plug" with interrupted threads, held in a carrier hinged to the gun, so that the action is a swinging and rotating one. This "swinging" type may be used for both B.L. and Q.F. guns. (2) The vertical or horizontal sliding wedge shaped block, travelling in a mortice across the rear face of the gun. This "sliding" type is only suitable for a Q.F. gun. Other types are:—The sliding and rotary combination, the rotating eccentric block and the sliding bolt. Certain automatic and machine guns employ a "breech action" in which the operations of opening, extracting, reloading and closing are effected by the recoil and counter-recoil motion augmented by springs.

B.L. Mechanism.—For B.L. guns (in which the charge is bagged) the breech screw is fitted with an obturator for sealing the escape of gas to the rear. It requires a channel or vent to convey the flash from the tube to the charge to fire the gun.

The illustrations (figs. 13 and 14) of an Asbury "hand" and "power" mechanism show an example of a modern screw plug type. The screw is of the Welin form, an arrangement in which the surface is divided circumferentially into a number of segments of different radii. The number of plain segments is less than half the total number, thus giving an increased bearing surface compared with a plain cylindrical screw with interrupted threads. The Welin compared with the cylindrical screw allows of equal strength with a reduced length and weight of screw. The reduced length enables the screw to be swung into the breech opening instead of having to be first swung and then entered in a separate movement. Direct swing entry can also be obtained by a breech screw in which the rear portion is cylindrical and the front conical.

Obturation.—The obturator, fitted at the front end of the block and carried on the vent axial bolt, known as the De Bange system, comprises a plastic gas check pad between two steel discs. The pad is statically compressed in manufacture, which gives it semi-elastic properties. It readily conforms to any irregularities in the coned annular seating at the rear end of the gun chamber. The obturator is seated on the closing of the breech with a moderate initial pressure which can be adjusted by discs



FIGS. 13 AND 14.—SECTION DETAILS OF BREECH MECHANISM FOR NAVAL ORDNANCE PIECE

behind the pad and which is obtained by the forward movement of the screw on turning. Its gas-sealing efficiency is due to the heavy firing pressure which tends to reduce the thickness of the pad and increase its diameter. The sealing action may therefore be described as due to *compression* as opposed to the sealing action of the metal case in a Q.F. gun which is due to *expansion*. Features of this mechanism are:—(a) The single motion action. The one direction movement of the rack (operated by "hand" or "power") performs both the swinging and rotation required. The system of levers for revolving the breech screw are locked

during the swinging operation and do not come into action until the mechanism has swung clear of the steel segment shown in fig. 15. (b) The momentum of swinging is converted into momentum of rotation through roller on the screw engaging with a cam path on the face of the gun, thereby preventing rebound effects.

Q.F. Mechanism.—In Q.F. guns (in which the charge is in a metal case) the sealing is effected by the expansion of the case

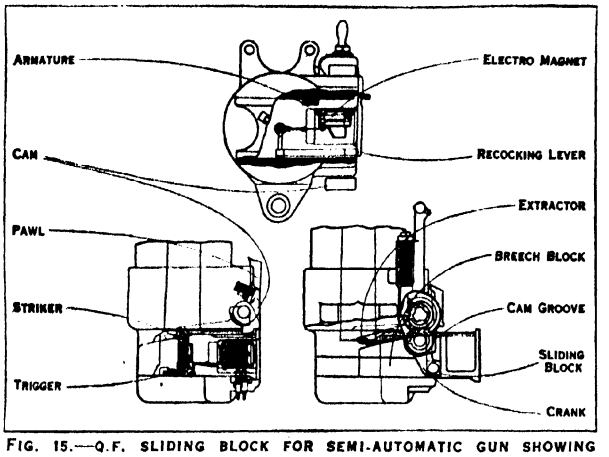


FIG. 15.—Q.F. SLIDING BLOCK FOR SEMI-AUTOMATIC GUN SHOWING ELECTRIC RELEASE OF PERCUSSION FIRING GEAR

and is thus independent of the breech mechanism, which in such circumstances includes extractors for withdrawing the case during the operation of opening the breech.

Sliding Q.F. Mechanism.—The illustrations give an idea of the sliding mechanism used for semi-automatic Q.F. guns of medium calibre. The block which contains the firing mechanism is worked in a wedge-shaped mortice in the breech ring either by hand or automatically. The automatic action of opening the breech and ejecting the case is effected as the gun runs out by a pawl fitted to the mounting engaging a cam connected to the breech block. When rotation has been given to the cam sufficient to open the breech block to the full extent the pawl is thrown off. The opening movement of the block operates extractors which withdraw and eject the empty cartridge case. The extractors hold the block open until the rim of the live cartridge case trips them on reloading, thereby freeing the block which closes under the action of a spring.

Firing Mechanism.—In Q.F. guns the electric or percussion tube or primer is carried in the cartridge case and the breech mechanism is consequently simplified in so far as it is not required to provide for loading the tube. If an electric tube is used, contact is made with the head of the tube when the breech is fully closed and the gun is fired by the completion of an electric circuit, the current heating a platinum silver bridge within the tube and so igniting the surrounding composition, the flash thereby passing to the propellent. If a percussion tube is used, the firing is effected by a blow from the percussion striker exploding the cap in the tube. The striker may be a simple spring action firing pin cocked either by hand or automatically during the opening of the breech mechanism, and released by a trigger action. Percussion strikers may also be released electrically by means of an electro-magnet or solenoid, the movement of the armature operating the trigger, as in the illustration. In the case of B.L. mechanism, arrangement must be made for loading the tube which is inserted in the rear end of the vent axial. A novel method of ignition was adopted in the case of the long range German gun used for bombarding Paris during the World War. By surrounding the rear portion of the charge with gas, more efficient initiation of combustion was obtained.

Safety Arrangements.—In all firing arrangements safety features are introduced designed to prevent the gun from being fired before the breech is closed, and to ensure that the first action of opening the breech prevents the gun from being fired. A very general method of effecting this is to leave a small idle movement in the breech mechanism operating gear (which also operates the firing mechanism). This movement is used to break or to make contact between the lock and the tube when firing electrically or to lock or unlock the percussion striker. The idle movement may perform another useful safety service in locking the breech mechanism gear thus making it impossible for the breech block to be forced open by the firing pressures.

(J. G. M. Mc.H.)

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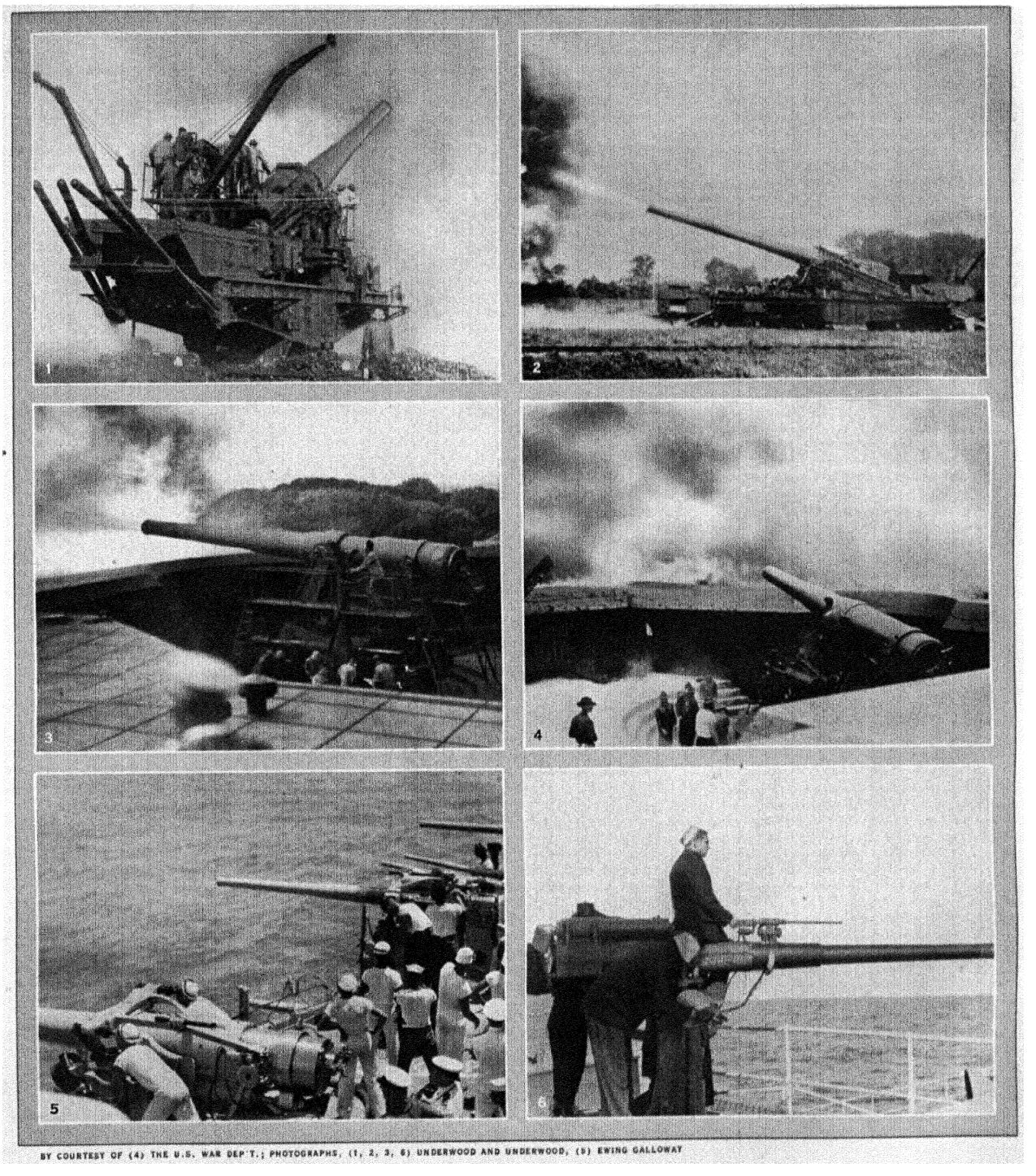
MILITARY

Artillery (*q.v.*) as employed in land warfare has such a great variety of tasks to perform, that a modern army must necessarily be provided with many different types of artillery weapons. The calibre of these weapons ordinarily varies from about 3″ to 15″, although calibres outside these limits may be used for special purposes. The pieces themselves may be guns, howitzers or mortars, the name depending mainly on the length, and they are identical with naval ordnance (*q.v.*) as regards design, construction, and general characteristics, though mortars are generally of simplified construction.

General Requirements of a Land Service Artillery Equipment.—An equipment must in the first place provide a stable support for the gun for firing, and secondly, where mobility is required, it must act also as a support for travelling. In addition to these fundamental requirements means must be provided to enable the gun to move laterally, so that it can be readily aligned in any required direction ("Traverse"); to move vertically, so that the elevation required for any particular range may be obtained ("Elevation"); and to move axially when it recoils ("Recoil").

The Structure of a Land Service Equipment.—It is very convenient to consider an artillery equipment as consisting of a *basic structure* and a *superstructure.* The former is the support and the latter provides the necessary gears and instruments which enable the gunner to aim and fire his gun rapidly, accurately and easily. In general, the superstructure provides for traverse, elevation and recoil, and also carries the sights. It consists principally

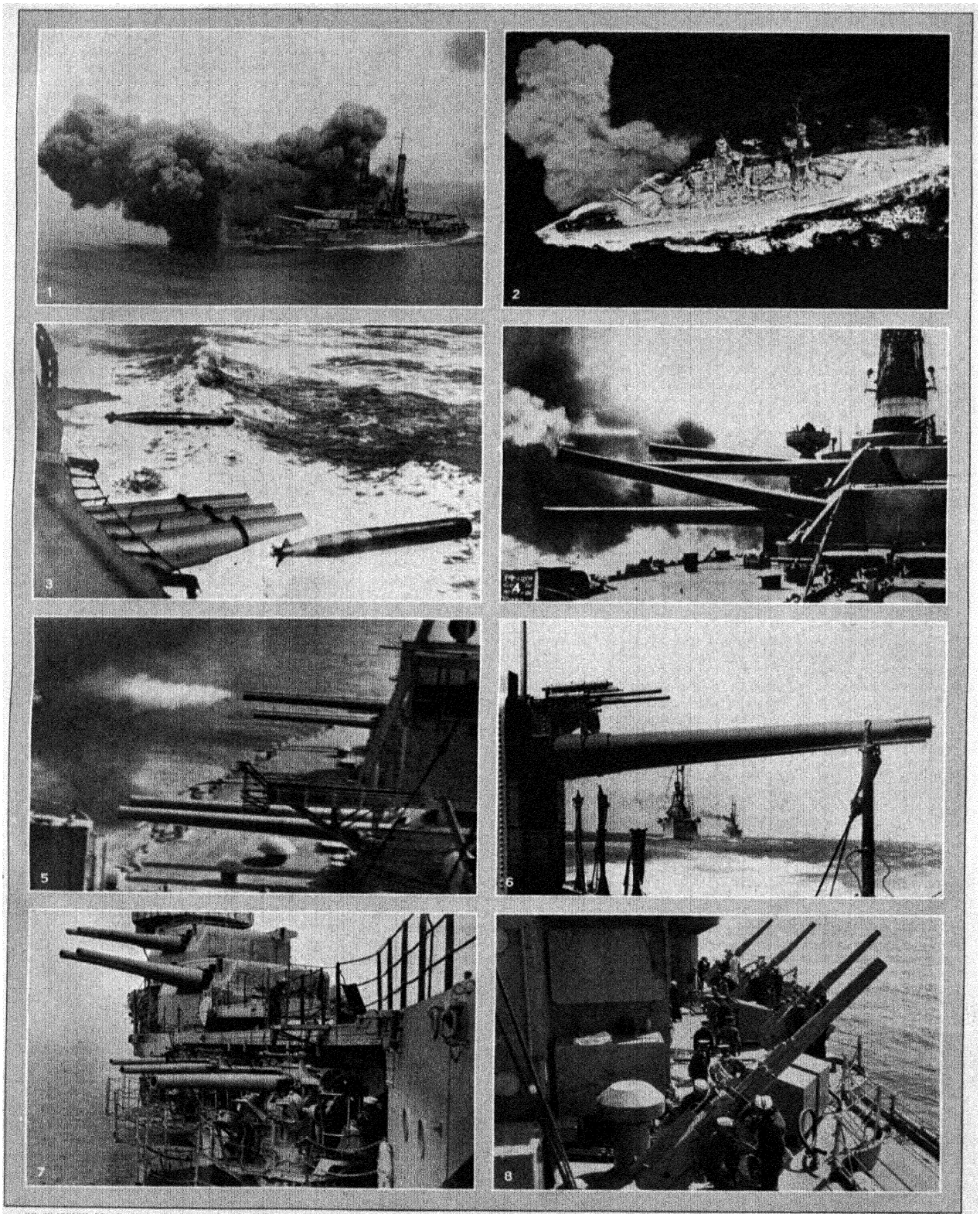


BY COURTESY OF (4) THE U.S. WAR DEP'T.; PHOTOGRAPHS, (1, 2, 3, 6) UNDERWOOD AND UNDERWOOD, (5) EWING GALLOWAY

UNITED STATES COAST DEFENCE ORDNANCE

1. A 14-in. mobile coast defence rifle mounted on a railway carriage. The big gun has an effective range of 27 miles
2. A 14-in. railway mounted coast artillery gun, having an effective range of more than 75 miles
3. Firing one of the 12-in. guns, which guard the mouth of the Columbia River, at Fort Stevens
4. A 12-in. coast defence gun of the disappearing type, shown recoiling after firing
5. Midshipmen of the U.S.S. "Nevada" at the 5-in. guns used for torpedo boat defence
6. Coast guardsmen placing a 5-in. gun in range on the U.S. coast guard "Modoc"

ORDNANCE



BY COURTESY OF (3, 4) THE U.S. NAVY DEPARTMENT; PHOTOGRAPHS, (1, 2, 5, 6, 7, 8) UNDERWOOD AND UNDERWOOD

AMERICAN NAVAL ORDNANCE

1. U.S.S. "New Mexico" firing a broadside during naval manoeuvres
2. Forward turret guns of U.S.S. "West Virginia," firing
3. Releasing torpedoes from a U.S. battleship in practice
4. Fourteen-inch guns on an American warship
5. U.S.S. "Texas" firing 5-in. and 14-in. guns
6. Close-up of a U.S. Navy 8-in. gun
7. Anti-aircraft guns and the forward 8-in. gun turrets on a U.S. warship
8. Anti-aircraft battery of the U.S.S. "West Virginia" just before a salvo

of two components called the *carriage body* and the *cradle*.

The carriage body is pivoted to the basic structure so that it can turn in a plane more or less horizontal, and so enable the gun to be traversed to the right or left. It is anchored to the basic structure so that it cannot lift when the gun is fired. The cradle, which houses the recoil system, supports the gun on slides so that the latter may recoil and be returned to the firing position under the control of the recoil system. Small guns are provided with guide-ribs which engage the cradle guide-ways: in larger guns the guide-ribs are separate in the form of a slipper or sleigh to which the gun is secured, as in naval practice. The cradle is provided with trunnions which rest in bearings in the carriage body, so forming the horizontal axis about which the cradle, and so the gun, is elevated.

Traversing and Elevating Gears.—Except in the case of the fixed armament of a fortress, and certain other very special circumstances, power is neither available nor necessary for traversing and elevating land service equipments, and some form of hand operated gear is employed.

Where traverse is limited to a few degrees, as is usual in the case of the wheeled carriage, the traversing gear is generally of a simple nut and screw type, but where more traverse is obtainable, spur gearing in conjunction with a toothed arc is frequently used. The traversing gear is fitted between the carriage body and the basic structure, so that the necessary movement of the former is obtained. The elevating gear is placed between the cradle and carriage body and is generally of the arc and spur pinion type.

In all these gears, some form of self-locking device is necessary, so that there shall be no tendency for the gun to traverse or elevate of its own accord when fired.

The Recoil System.—The recoil system performs two functions: firstly it acts as a brake during recoil, bringing the recoiling gun to rest by absorbing the energy of recoil, and secondly, it returns the gun to the firing position after recoil has ceased. The braking action is supplied by an hydraulic buffer, and the gun is returned to the firing position by the "recuperator," in which either springs or air are compressed during recoil. At the end of recoil, the springs or air expand, so that the gun is forced back to the firing position. The compression of the springs or air in the recuperator assists the buffer in checking recoil.

The recuperator must initially be in a state of compression to prevent the gun slipping back in the cradle when elevated; and its action, moreover, must be controlled, otherwise the speed at which the gun is forced forwards would continually increase, and the gun would finally reach the firing position with such violence as to cause damage to the equipment. Although with pneumatic recuperators it is possible to embody a throttling device to control the action to a certain extent, the control is mainly provided by the buffer.

Many different buffer systems are in use on modern equipments: some are more suitable for short than for long recoil, and, generally speaking, these are the less complicated varieties. One designer or armament firm may favour one particular type of buffer while another will adopt some other system as standard. The chief merit of the *spring recuperator* lies in its simplicity, but the great overall length required prohibits its use on a modern long recoil carriage unless a telescopic system is employed: this, however, has inherent disadvantages and such systems do not work satisfactorily. Spring recuperators to-day are mainly confined to light short recoil equipments such as anti-aircraft guns, light coast artillery, and tank mountings. *Pneumatic recuperators* are complicated owing to the difficulty of preventing the escape of air at the high working pressures required; and for this reason a liquid system is always introduced, for liquid can be sealed satisfactorily at much higher pressures than air. The liquid may be included as an entirely separate sealing system, or it may be arranged so that the air is compressed through the medium of the liquid. In this case the recuperator is referred to as a "Hydro-pneumatic" system. This latter type is convenient for a long recoil carriage as it can more easily be arranged in a confined space than the pneumatic type. The latter type, however, does not suffer from aeration of the liquid, which always causes erratic action.

Although the buffer and recuperator are usually entirely separate systems, designs exist in which they are combined. The well known French 75 mm. field carriage uses such a system, which is said to be very satisfactory. It is generally accepted that a combined system is more complicated, more expensive and more difficult to maintain in the field than separate systems.

Buffers of modern design are generally fitted with reservoirs which may feed the system either by gravity or pressure, in order that the buffer may be kept full of liquid. A partially empty buffer will cause erratic and violent action both during recoil and recuperation. Liquids used in recoil systems vary, but that most generally adopted is a high grade mineral oil of low viscosity. Pneumatic recuperators are generally charged with air, but nitrogen has been successfully used in France. The great disadvantage of using air is that its moisture content is sufficient to cause serious corrosion of cylinders and piston rods, from which leakage ensues.

The Position of the Cradle Trunnions.—If the cradle trunnions are situated near the centre of gravity of the elevating parts, natural balance will be obtained, but as the gun is elevated the breech will approach the ground. Where long recoil is employed, as in the case of a mobile carriage, it will be necessary to shorten recoil at the higher elevations and this is done automatically by a device called the "Cut-off gear" which regulates the action of the buffer in the required manner: recoil is then said to be "controlled." Alternatively, the trunnions may be placed so near to the breech that the latter will not sensibly approach the ground when the gun is elevated. Thus, with "rear trunnions" a constant long recoil is possible, but the elevating parts must be artificially balanced by a spring or pneumatic equilibrator. Centre trunnions combined with a cut-off gear are standard in the British service, while rear trunnions are common in other countries.

Shields.—These are provided for light field equipments and for coast artillery, but not usually elsewhere. In the former case, the shield is of light steel plate and is designed to give protection from rifle and machine gun fire. Pieces of a heavier nature normally operate out of effective range of these weapons; their shields would therefore be required to afford protection from shell fire, and the weight involved would be excessive.

Coast artillery equipments, since considerations of weight do not arise, are very heavily armoured, the shield providing front, side and overhead protection.

Sights.—Sighting systems, for field, coast, and anti-aircraft artillery have necessarily developed on distinct lines. With field artillery, except in open warfare, the target is seldom visible from the gun: guns are then laid from some visible aiming point, and laying is said to be "indirect." The target will not, in general, be at the same height above mean sea level as the gun, so that with indirect laying allowance must be made for "angle of sight." Most field artillery targets are stationary except when the battle is moving—when fleeting opportunities are presented.

Two systems of sighting are used for field equipments: the "rocking bar" system and the "independent line of sight." The former has the disadvantage that every alteration in the elevation of the gun throws the sight off the target or aiming point and the layer has to relay every time this happens, corrections to range being constantly required during a shoot. With the independent line of sight changes in gun elevation are not imparted to the sight, so that the service of the gun may be more rapid than with rocking bar sights. A much more complicated elevating gear is, however, necessary. With each of these systems the sight is fitted with holders for a telescope for laying direct, and with a carrier for a prismatic sight for indirect laying.

Coast artillery is chiefly intended for anti-ship work, though guns may be specially sited for repelling land attacks. Their targets, therefore, are generally moving, and, except when obscured by fog or smoke screens, are visible. Laying then is normally direct, and neglecting the effect of tide and curvature of the earth's surface, the gun is always at the same height above the target. On this important fact is based the principle of the

automatic sight, which is fitted to most coast artillery equipments. The cradle and sight are mechanically connected in such a way that the layer has only to elevate the gun until the sight is aligned on the water line of the target: the gun is then layed at the required elevation. This sight loses its accuracy rapidly as the range increases until a range called the "auto-sight limit" is reached, when the sight can no longer be used. The greater the height at which the gun is sited, the longer will be the auto-sight limit. In addition to the automatic sight most coast artillery equipments are fitted with a rocking bar sight.

The anti-aircraft problem is to hit a very rapidly moving target, the course, height and speed of which may be continuously changing. Since alterations to line and range during a shoot will be large, and since rapid service is essential, the independent line of sight is ideal for anti-aircraft artillery, provided it is independent both for line and elevation. Sights on these lines have been designed and are in use, but they involve great complications in the traversing and elevating arrangements. Otherwise, the rocking bar system is used, two sights being fitted, one on each side of the mounting. The sights are cross-connected, one layer laying for line, the other for elevation.

All equipments are provided with some form of range or elevation indicator, which is set at the elevation ordered to the gun. Many modern range indicators are fitted with adjustable readers and specially engraved scales so that the errors in shooting due to wear of the gun may be counteracted without the necessity of calculating and applying a special correction.

Most modern sighting systems embody means for correcting certain other errors in shooting. Thus, a sufficiently accurate correction for "drift," which is the lateral deviation of the projectile due to the spin imparted to it by the rifling of the gun, is obtained by tilting the sight so that the line of sight is deflected in the required direction as the gun is elevated. A correction for the error in line caused by the wheels of a field carriage being on unlevel ground is obtained by providing means for cross-levelling the sight. Automatic sights embody arrangements which give compensation for the error in range due to the rise and fall of tide, and to atmospheric conditions which affect the shooting: a device is also usually fitted which corrects the error in range due to want of level in the mounting.

Sights of modern artillery equipments are invariably fitted to a non-recoiling portion of the carriage, so that the layer need not stand clear at each round and time is saved. In order to improve and maintain accuracy, special attention is given to providing means for taking up wear and play in sighting mechanisms, and the readers, scales, etc., are adjustable.

CLASSIFICATION OF EQUIPMENTS

Land Service Artillery falls conveniently into three categories, viz., (*a*) mobile equipments, (*b*) semi-mobile equipments and (*c*) fixed mountings. These three classes differ radically from one another as regards their basic structure, and also among themselves as regards size and weight.

Mobile Equipments.—Light, horse, field, medium and certain heavy artillery equipments are included in this category. They possess considerable tactical mobility, particularly as regards the lighter natures. The gun carriage is a two-wheeled vehicle and forms the travelling and firing support for the gun.

The basic structure comprises the trail, axletree and wheels, and when in action the end of the trail, which is provided with a spade, rests on the ground. At the first round, the spade digs itself in and prevents the carriage recoiling on its wheels. For travelling the trail is hooked to another two-wheeled vehicle called the limber, which is fitted either with a pole for horse draught, or with an engine draught connector. The combined gun carriage and limber thus form a four-wheeled vehicle having sufficient flexibility to negotiate rough ground. The balance of the equipment when limbered up and the distribution of the weight between gun carriage and limber wheels are matters of importance, and, in view of this, guns of some medium equipments are drawn to the rear for travelling, the breech resting on the rear part of the trail. Field artillery limbers carry a certain amount of ammunition.

A fore-carriage is sometimes used in place of a limber for tractor drawn medium artillery: its steering gear, which is similar to that of a motor car, is connected direct to the tractor, and its wheels are of small diameter.

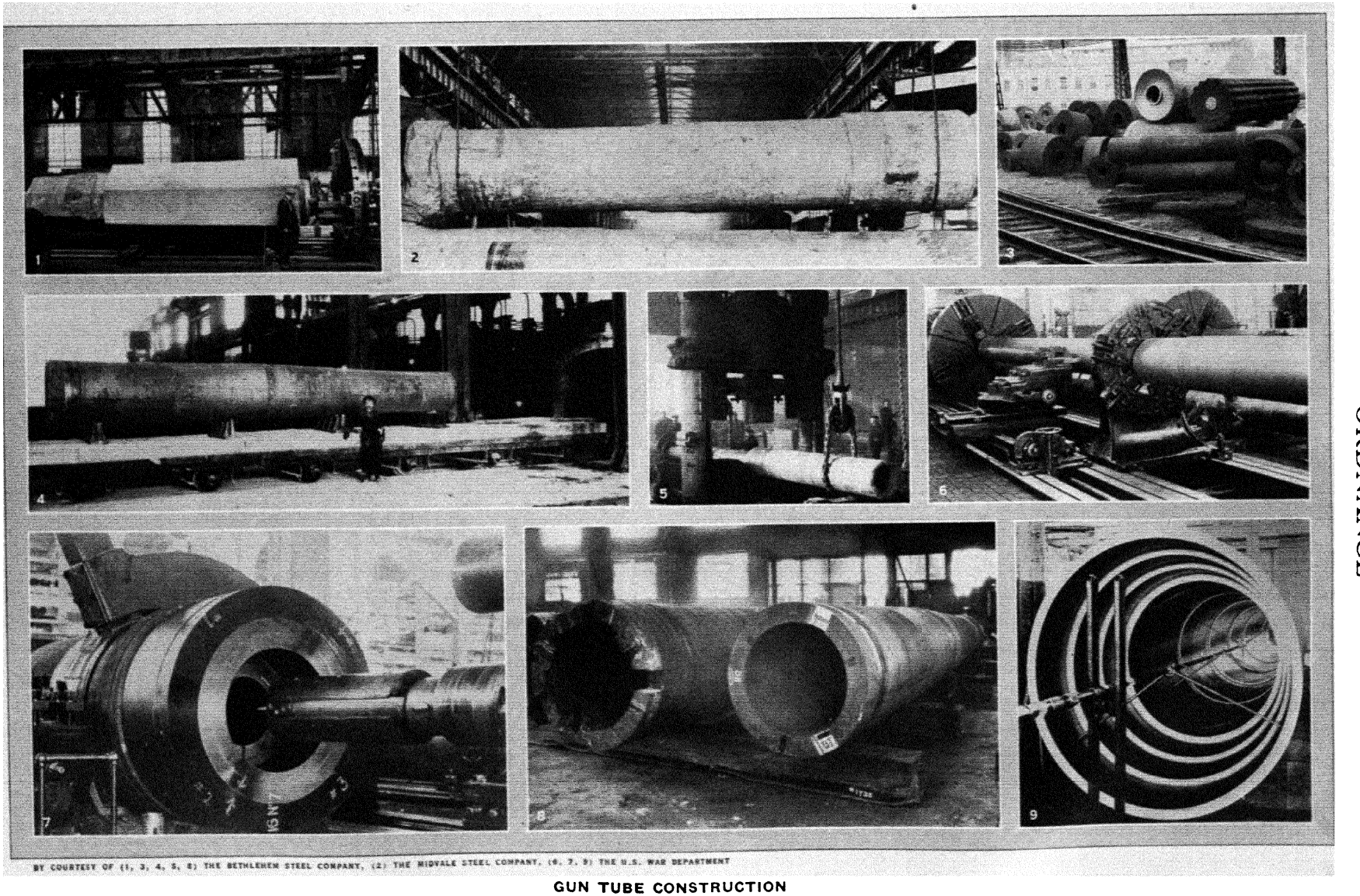
Stability of the Mobile Carriage in Relation to Mobility.—From the firing point of view the stability is essential for accurate shooting. This demands as much weight as possible on the ground, a low centre of gravity, and a long trail—factors which combine to counteract the tendency for the carriage to overturn to the rear when the gun is fired. A field artillery equipment is, however, restricted as regards weight according to the capacity of a team of six light draught horses; moreover, from the point of view of mobility, the wheels should be of large diameter to give easy draught, and the trail should be short so that the carriage may be manoeuvred easily in a confined space. Although a cranked axletree enables a low centre of gravity to be obtained with large wheels it is evident that the factors upon which stability largely depends are in direct contrast to those which secure mobility, so that the designer of a mobile carriage must effect the best compromise possible, having due regard to particular requirements of each case. This problem applies also to the heavier natures, for even where mechanical transport is used axle loads must be reasonably limited and the equipment must not be too heavy to be man-handled for short distances.

The Mobile Carriage.—The most usual type of mobile carriage in use to-day is one in which the trail is of the "box" pattern, a space being formed between its two side members into which the gun may recoil at high elevations. The carriage body is pivoted to the trail near the axletree, and is capable of being traversed 4° to the right or left by the traversing gear. The cradle supports the gun on slides and rests in trunnion bearings in the carriage body. It is in the form of a trough in which is housed the recoil system, secured to the gun at the breech end.

Some designers, notably Schneider of France, favour what is known as "Cross-axle Traverse" for field carriages. The carriage body is dispensed with and trunnion bearings are fitted in the sides of the trail, which are curved upwards in front for this purpose. The traversing gear causes the trail to slide to the right or left along the axletree, the point of the spade becoming the centre of the traversing circle. The amount of traverse obtainable depends on the length of the axletree which is limited by the overall width of the carriage, and is generally about 4° each way. When traverse in excess of that provided on the carriage itself is required, the spade must be dug out and the trail carried round until the gun is roughly aligned in the required direction. Such a procedure is too slow where moving targets such as tanks or armoured cars are being engaged, and this has led to the introduction of the "split trail," this being made up of two single trails connected to the axletree by ball and socket joints, so that when they are opened out, the spades may adapt themselves to uneven ground. For travelling, the legs are locked together, and one of them carries an eye for the limber hook. Owing to the loose joints between the axletree and trail legs, the carriage body obtains no support from the trail. A somewhat complicated connection between carriage body, axletree and trail legs is therefore essential. With this type of trail about 50° of traverse is obtainable without moving the trail legs.

Wheels.—These are still generally built of wood, except for the heavier natures when steel is used. Steel wheels are frequently of built up construction and resemble the familiar road locomotive wheel, though other types are sometimes employed. The wooden wheel suffers from the disadvantage that even when thoroughly well seasoned materials are used, it is seriously affected by climatic changes, and since the World War considerable attention has been given to the possibility of replacing the wooden wheel by one of steel or aluminium alloy. An important advantage of the wooden wheel is the ease with which it can be repaired in the field. Wheels are usually dished to give strength to withstand lateral stresses when travelling. They must also be sufficiently robust to withstand the shock when the gun is fired.

Problems Due to Mechanical Draught.—The introduction of mechanical draught for artillery has made possible great increase



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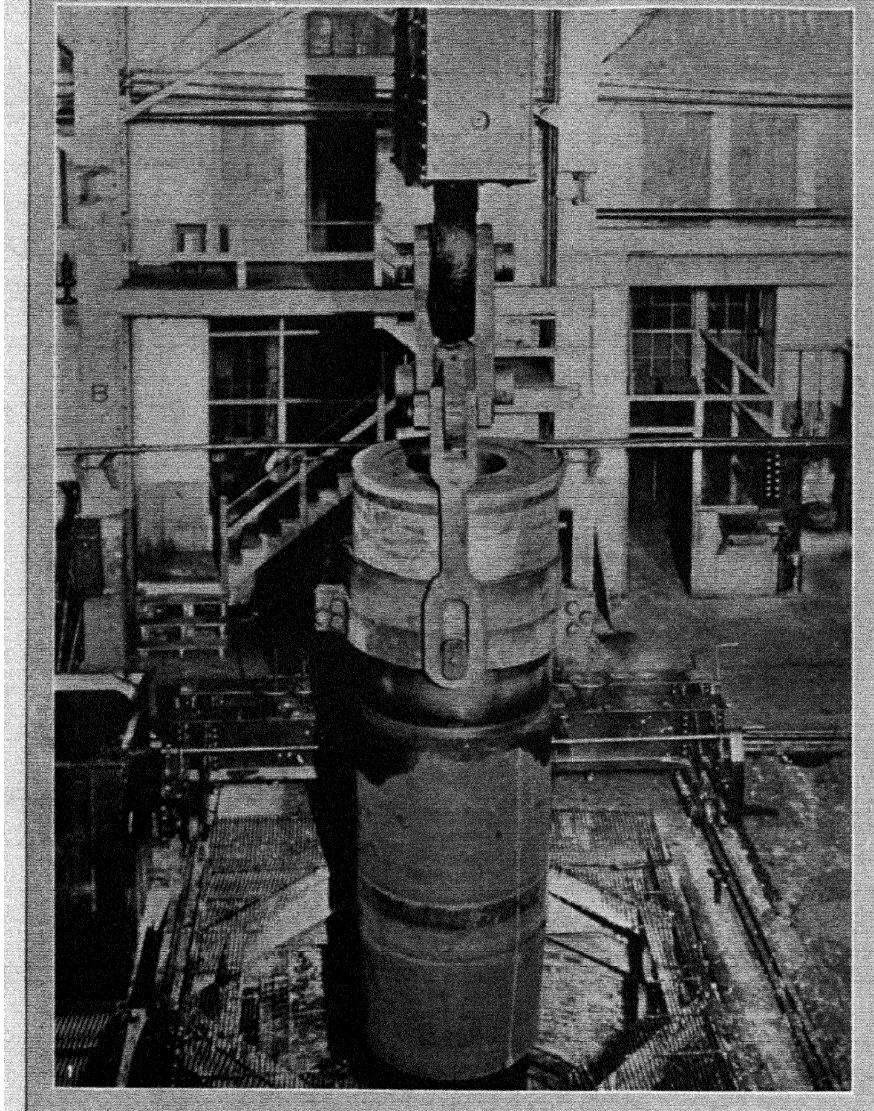
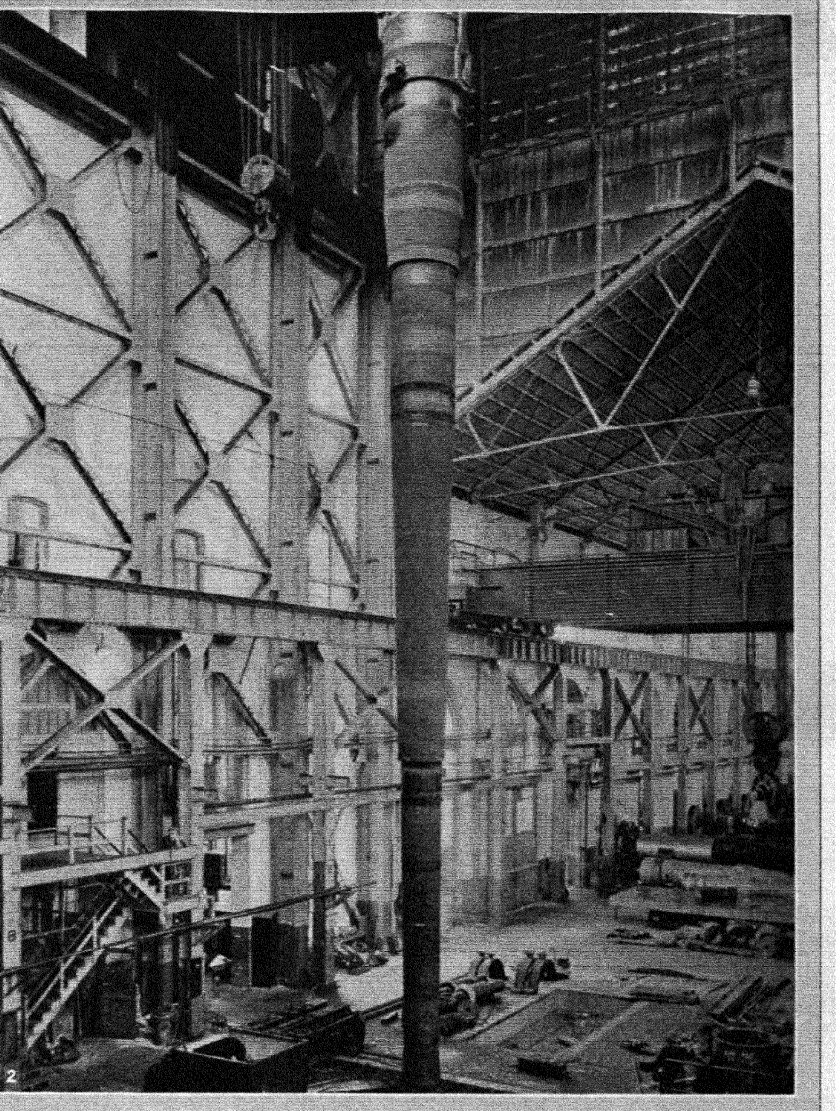
GUN TUBE CONSTRUCTION

1. Corrugated ingot for 16-in. tube
2. Finishing forging of jacket
3. Ingots for brush blocks, breech bushings and locking rings
4. Rough machined hoop forging on car preparatory to being placed in annealing furnace
5. Gun press; gun under press being forged on mandril
6. Battery of engine lathes cutting tube to proper diameter and putting finishing on tube
7. Boring the powder pit with pack-bit
8. Hoop forging indicating locations for physical test specimens on breech end
9. Star gauging for accuracy of boring





BY COURTESY OF THE U.S. WAR DEPARTMENT

FITTING GUN JACKETS

1. 16-in. gun jacket being lowered into a pit and heated to be expanded to fit gun

2. 16-in. gun being taken out of the pit where jacket has been cooled by water and allowed to shrink, making a tight fit

in speed, particularly in the case of the heavier natures. This in turn has set up excessive strains in the carriage, and with a view to reducing the effect thereof numerous experiments with rubber tyres have been carried out both in Europe and the United States. In order to improve matters still further, considerable attention has recently been given to the question of mounting mobile equipments on springs. Schneider have lately produced a light field equipment in which springs are embodied in the naves of the wheels.

Brakes.—These are an essential feature of mobile artillery equipments both from the firing and travelling aspects. They are applied in action to prevent the carriage running forward on its wheels when the gun is running out to the firing position after recoil. The tyre brake is the normal type in use to-day, but some form of rim or hub brake will be necessitated by the introduction of rubber tyres. Brakes are usually cross-connected and equalized, and in many cases may be operated from either in front or in rear of the axletree. Those of light field equipments are often provided with a rapid acting device for use when firing; this is a particularly desirable feature where cross-axle traverse is employed as the brake must be released on each occasion the gun is traversed.

Pack Artillery.—Equipments for use in mountainous country, or where roads are non-existent are designed to be dismounted for transport, their components being carried by pack mules. When in action, the equipment resembles a mobile carriage of conventional form except that small wheels may be used as it is not intended for draught.

The special requirements of a pack equipment are:—(*a*) it must be capable of being assembled or packed very rapidly; (*b*) loads must not be bulky or unwieldly; (*c*) the weight of each load including saddle should be within the limit which the pack animal can carry without undue fatigue.

In order to keep within the load limit, the guns of pack equipments are generally transported in two parts, which, when assembled, are secured by a nut on the interrupted screw principle. The gun is secured to a slipper which slides on the cradle; this obviates the provision of guide ribs on the gun, which would make it an awkward load to pack.

Semi-mobile Equipments.—This category embraces equipments which, by reason of their size and consequent weight, possess little tactical mobility. It comprises two classes, viz., equipments for artillery designed to travel (*a*) by road, and (*b*) by rail.

Road Mountings.—In order to keep each axle load within the recognized limit of roughly five tons, equipments whose total weight would exceed ten tons when limbered up are designed to travel on more than two pairs of wheels. A departure from the conventional form of the mobile carriage is thus necessitated, and the various components of the carriage travel as separate loads. Such a carriage, therefore, does not fire from its wheels and this involves the operation of mounting and dismounting the equipment whenever a new position is taken up.

The basic structure consists of some form of temporary anchorage of wood and steel beams, usually called the holdfast or platform, to which a firing bed is secured. The ground must be prepared for the holdfast, which is prevented from lifting in front when the gun is fired by a mass of earth contained in a steel box or sand-bags, and by pickets driven into the ground. The firing bed contains a pivot in front and at the rear a cross-member carries a toothed arc by means of which about 60° of traverse is obtained by the carriage body. The pivot and the arc both contain roller bearings on which the carriage body is supported so that easy traverse is ensured. The carriage body is comparatively larger than that of an ordinary field carriage, but in other respects the superstructure is of normal design.

The number of loads in which the equipment travels depends on its total weight. Lifting screws and jacks are provided for mounting and dismounting the various loads. Large numbers of these equipments were used by the belligerents of 1914–18, British examples being the 9·2″, 12″ and 15″ howitzers.

Railway Mountings.—These are of two types, viz., (*a*) those which are lowered on to the track for firing, and (*b*) those which fire from their wheels.

In the first the basic structure consists of a truck, the ends of which are raised and supported by bolsters resting upon bogies. The total number of axles depends as before upon the total weight, and is usually limited to about 15 tons for the British standard gauge. In the travelling position the bolsters take the weight through the medium of sliding blocks; when these are drawn clear the ends of the truck may be lowered by lifting screws until the centre portion, or "well," rests on the ends of the sleepers. The truck, now in the firing position with all the weight removed from the wheels, is then anchored by means of steel ropes and pickets or other devices. The carriage body rests on a roller ring in the well of the truck, so that all around traverse is obtainable.

The lateral stability of these mountings is not great, and is usually improved by the use of steel arms which project from the side of the truck and rest on the ground. Where no provision of this kind is made, firing below certain elevations may have to be prohibited except when the direction of the target is close to that in which the truck lies. In the case of howitzers this difficulty is sometimes obviated by increasing the elevation to obtain shorter ranges; for, since maximum range is obtained at an elevation of about 50°, any increase in elevation gives a shorter range. But this solution generally sacrifices accuracy in aim.

In a typical design of the second type of railway mounting, the truck itself forms the carriage body and is provided with bearings for the cradle trunnions. The truck body is supported by a bolster at each end, each bolster resting on one or more bogies; as before, the number of axles depends on the total weight. The bogies and bolsters form the basic structure in this case, and the truck body is allowed a limited amount of traverse on roller bearings across each bolster.

This type of mounting is only made use of in the case of very heavy guns of large calibre. A petrol or similar engine provides power for elevating if required, and the mounting is furnished with an air compressor plant for its pneumatic system. The equipment includes a winding gear for pulling the carriage forwards, for it runs back slightly on the track at each round.

Railway mountings are used for 9·2″ and larger guns and for howitzers of 12″ calibre and upwards. They possess considerable strategic mobility and are valuable in areas with good railway systems.

Fixed Mountings.—These are permanently emplaced and are mainly used to protect harbours, naval bases, etc., from action by enemy ships and aircraft, and strategic points inland from aircraft.

Generally speaking, all-around traverse is a feature of fixed mountings, and the basic structure is therefore circular in form, consisting of a holdfast or base and a pedestal. The holdfast comprises a concrete bed, the depth and size of which depend on the weight and size of the mounting. Buried in the concrete is a number of long steel bolts which project through a steel ring resting on the top of the concrete. After the concrete has thoroughly set, the pedestal is lowered on to this ring, and is secured to it by nuts screwed on to the long bolts. Pedestals are usually provided with levelling screws to correct any subsidence of the holdfast. In other cases extreme care must be exercised to obtain a truly level foundation for the pedestal.

Power is usually available in some form, and may be used for elevating, traversing and shell hoisting with the heavier natures. Hand operated gear is retained for use should the power fail.

Short recoil is a normal feature of fixed mountings: owing to the massiveness of the basic structure the question of stability does not arise, the chief factor affecting the length of recoil being the maximum stresses which the mounting can withstand. Short recoil has the advantage that it accelerates the service of the gun and simplifies the design of the cradle and recoil system. Apart from this, however, considerations of space would generally prohibit the use of long recoil in a fixed emplacement. The length of recoil for a modern 6″ mounting of this nature is about 18″.

Anti-aircraft Mountings.—The essential features of these necessitated by their peculiar rôle are:— (*a*) all-round traverse, (*b*) elevation up to about 90°, (*c*) rapid acting and easily operated gears, (*d*) loading at any angle and (*e*) short recoil.

Mountings may be mobile, semi-mobile or fixed, depending upon the nature of the holdfast. In other respects they resemble fixed mountings of the ordinary type, except that the pedestal becomes a base ring. This enables the carriage body to be of sufficient height to permit of loading at high angles of elevation, without greatly increasing the overall height of the mounting. The base ring supports the superstructure through the medium of steel rollers.

In the case of the mobile equipment, the holdfast is a motor lorry, and the base ring is secured to the chassis. When in action the latter is supported on long transverse baulks, so that firing stresses are not imparted to the springs of the vehicle, and a certain degree of lateral stability is ensured. This type of equipment possesses considerable tactical mobility, but is only suitable for light guns up to about 3″ calibre.

The holdfast of the semi-mobile equipment consists of a travelling platform to which the base ring is secured. The platform is towed behind a tractor and travels on one pair of wheels. It has two steel arms at each end, which when in action are swung outwards. The wheels are then removed and the whole is lowered to the ground by jacks. It is then secured by steel pickets. Heavier weapons can be mounted on this type of platform than on the lorry, but the time taken to get into and out of action is considerably longer.

The base ring of the fixed anti-aircraft mounting is secured to a holdfast identical with that described for other fixed mountings.

Anti-aircraft guns are longer and develop a higher muzzle velocity than field guns and in many cases are provided with semi-automatic breech mechanisms. This entails the provision on the mounting of a device to regulate the speed at which the gun runs forward at the higher elevations. The mountings are not fitted with shields.

Mortars.—The World War saw the reintroduction of the mortar, which up till then had been regarded as an obsolete weapon. The modern mortar is a short range piece giving a low muzzle velocity, so that only a small propellent charge is necessary. This enables a thin-walled bomb of large capacity to be used (*see* AMMUNITION), and the piece itself is short and of light construction.

A number of different designs of mortar of varying calibres were used during the period 1914–18. The mountings in some cases closely resembled those of ordinary field carriages in general character, being provided with traversing and elevating gears and recoil systems: others, such as the "Stokes" mortar were of much simpler design (*see* ARTILLERY). (G. G. T.)

NAVAL ORDNANCE

Naval Ordnance[1] is distinguished from Field Ordnance by the circumstance that the guns are carried on a rapidly moving platform subject to the uncertain oscillations of a ship at sea, and are required to hit a rapidly moving object. This entails special mountings, with very sensitive training, elevating, and sighting gear, suitable for counteracting such motion, and special firing arrangements and means of controlling the fire from favourable positions in the ship. The military artillerist is confronted with a task comparable to that of discharging a projectile from a gun in the Tower of London and placing it in the centre court at Wimbledon. The task of the naval artillerist, however, may be compared to firing from a rapidly moving train to hit another train, many miles away, moving at an unknown speed in an unknown direction. The anti-aircraft gunner has to deal with a rather similar problem, but the difficulties of the naval artillerist are considerably increased by the ship's motion, especially in a heavy sea.

[1]The subject is restricted to naval weapons and their mountings for the discharge of projectiles by propellants, and does not include destructive engines which contain their own propelling machinery, such as torpedoes and rockets.

Though the World War developed certain special weapons peculiar to each Service and associated with such special conditions as trench and anti-submarine warfare, the general character of naval service guns is similar to that of land service, the construction of which has been outlined. It is not the gun, but the means of working it, that differs considerably, hence the difference in the design of the mounting and in the fire control system is very marked. The mounting design is further affected by the centralized position of the ammunition supply and the availability of power in a ship—conditions which do not prevail in the field.

The development of naval guns has naturally been in the direction of increase in muzzle velocity and in size, giving greater accuracy, longer range, and greater striking energy. The progress during this century is indicated below:

Year	Gun	Approx. muzzle energy in foot tons
1900	12 in.-42 cal.	40,000
1908–09	12 in.-50 cal.	50,000
1912	13.5 inch	60,000
1915	15 inch	80,000
1925	16 inch	100,000

This increase in power and working pressure means a corresponding increase in the strength of the gun which has been obtained by progressive improvements in the quality of steel and the technique of construction. The power of the gun is decided by the primary purpose for which it is required such as penetration of armour at long range or repelling attacks by destroyers and aircraft. For the penetration of armour the higher the power the better, on the principle that success comes to the ship that can hit hardest and most often at the longest range. For defence from aircraft and both attack and defence in the case of destroyers, rapidity of fire is of greater importance than power.

In the nature of things, the size of the gun is related to the size of the ship, but the World War produced notable exceptions such as submarines armed with 12 in. and monitors with 18 in. guns. Attempts have been made by certain naval powers to reach agreement limiting the size of guns for certain classes of ships. As the result of the Washington conference (*q.v.*) in 1922 it was agreed between the signatories to restrict battleships to 16 in. and cruisers to 8 in. guns. At Geneva in 1927 agreement was reached between Britain, U.S.A. and Japan, to limit destroyers and submarines to 5 in. guns, but failure to solve the cruiser problem left this matter adjourned *sine die*.

NAVAL GUNS

It is convenient to classify naval guns in four categories:—

(1) **Automatic Guns.**—These are small calibre machines guns in which the loading action is entirely performed by the recoil energy. Such guns, of which the 2-pdr. Pom-Pom is typical, are used for anti-aircraft purposes, arming boats and operations on shore.

(2) **Semi-automatic Guns.**—These are light Q.F. guns in which part of the loading operation may be automatically performed by the counter-recoil of the gun. These weapons are used where rapid bursts of fire are specially necessary, as in defence against aircraft and destroyer attack. They form the main armament in many destroyers and the anti-aircraft armament in battleships and cruisers, in the latter case being mounted in special mountings capable of very high elevation. Guns in this class are generally supplied with fixed ammunition but the use of separate ammunition may be entailed by the confined situation.

(3) **Hand-worked Guns.**—These are light and medium calibre Q.F. or B.L. guns and form the main armament in some destroyers and cruisers and the secondary armament in battleships and large cruisers. A 6 in. projectile weighing 100 lb. is the heaviest weight which one man can conveniently load by hand; consequently, this size of gun is very generally adopted by all nations. The difficulty, however, of hand loading such a gun at high angles of elevation, such as are experienced in anti-aircraft defence, has led to it being mounted in power worked mountings in some

warships.

The weight of ammunition which is a consideration of particular importance in small vessels, is less for a B.L. than a Q.F. gun of the same calibre owing to the absence of the metal cartridge case.

(4) **Power-worked Guns.**—These are heavy guns, above 6 in. calibre, and are generally B.L., but may be Q.F. as in the case of German Krupp guns. They form the primary armament in battleships and large cruisers.

NAVAL GUN MOUNTINGS

These may be divided into two main classes:—(*A*) *Deck Mountings* attached to the ship taking guns in classes (1), (2) and (3). (*B*) *Turret Mountings* built into the ship to take guns in class (4). These are invariably worked by power, usually hydraulic, though certain nations, among them the United States, prefer electric power, and others a combination of both.

Considerations Affecting the Design of Naval Guns and Mountings.—The gun design is to some extent affected by the mounting conditions particularly as regards the gun's weight and the position of its centre of gravity. If the gun is for a deck mounting and for high angle purposes, it is desirable to keep its axis of suspension as low as possible for reasons connected with the ship's stability and for convenience in hand loading. Consequently, the centre of gravity must be close to the breech end, and the recoil must be short to avoid fouling the deck at high elevation. Also the gun should be heavy rather than light, or severe stresses may be brought on the mounting and deck structure during the short recoil.

If the gun is required for mounting in a turret, its axis of suspension should be as nearly as possible over the roller path on which the turret revolves, to reduce structural stresses incurred by the weight of the gun which in the case of 15 in. guns exceeds 100 tons. The axis should be as close to the front shield as possible, so that the opening in the armour necessary for full elevation is as small as possible. Consequently the position of the gun's centre of gravity may affect the diameter of the turret on account of the length of gun within it and so may affect the beam of the ship. This may be limited by available docking accommodation. The weight of the gun, mounting, and turret armour appreciably affect the ship's displacement, and should be kept as light as possible. This has led to double and triple gun turrets. The turret as a whole must be balanced, hence the weight of the gun must be compensated by the disposition of the loading machinery in the revolving structure. The heavier the gun the greater is the weight entailed in such machinery or in the thickness and overhang of the rear shield. The design of the mounting is affected by the class of ship for which the gun is required and by the position in the ship in which it is mounted.

The first consideration in selecting the position for mounting a gun is to obtain as large an arc of fire as possible. The centre line is naturally the most favourable for this purpose, and this has been universally adopted for the primary armament of battleships since the "Dreadnought" era. The selection of position has a large influence on the arrangement of the ship as in addition to the disposition of magazines and shell rooms, the effects of severe blast on the deck, superstructures and personnel must be met. Freeboard, or height above the waterline, is of importance, and lack of this severely handicapped the British ships in the Coronel action (*q.v.*).

Important requirements of a naval gun mounting are:—(1) Safety under all conditions of use. (2) Protection by armour from enemy action. For the safety of the ship, it is essential to reduce fire and explosion risk to a minimum, particularly as the gun's ammunition is in close proximity to the gun. This is effected by suitable breaks in the train of ammunition supply between the magazine and gun, also by enclosing the ammunition in flash-proof cases in addition to hoists. For heavy guns, air blast is provided, which operates automatically on opening the breech mechanism, and expels gases out of the muzzle of the gun. Water sprays also are fitted to drown any smouldering residue which may be left in the gun chamber or on the breech block. The safety of the gun's crew in operating turret machinery, and of the ship's personnel and ship's structure, is effected by suitable interlocking arrangements and automatic danger signals, which ensure the proper sequence of operations, and prevent the gun from being trained on a bearing where the line of fire is masked by ship's fittings, or where blast effects would be serious.

Protection is given by a shield carried on the mounting or by placing the gun in an armoured gun house. In the case of turret mountings, fixed armour surrounds the revolving structure extending below the water line; and the roof and sides of the turret above this armour are made of armour plate. The functions of a gun mounting are (1) to absorb the recoil and replace the gun in the firing position without incurring undue stresses on the deck structure. (2) To enable the gun to be rapidly and accurately laid and trained (*i.e.*, directed in the vertical and horizontal planes) through a wide arc whether the target be in view at the gun position or not. This demands very sensitive control for alinement, effected at the gun either directly through telescopic sights or indirectly as signalled from a control position. (3) To permit of rapid loading and a high rate of fire.

(1) **Recoil Arrangements.**—Guns are generally carried in a cradle in which they are free to recoil, the cradle being pivoted or supported by trunnions in the mounting. In the case of heavy guns the cradle is replaced by a carriage and slide. The carriage may be regarded as part of the gun to which it is rigidly attached, and the slide is pivoted to enable the gun to be laid, and forms a path on which the carriage can travel during recoil. The gun or carriage is attached to a piston which works in a cylinder attached to the cradle or slide. In some cases the piston is connected to the cradle and the cylinder is secured to, and recoils with, the gun. For heavy guns two pistons and cylinders may be employed. The energy of the recoil is absorbed mainly by the resistance offered to the passage of liquid from one side to the other of the piston, either through tapered grooves in the recoil cylinder or through a valve or orifice in the piston. In a 16 in. gun the initial velocity of recoil is 21 fs. and the recoiling mass (approximately 110 tons) is brought to rest in the short travel of 3·8 feet. Efficient buffering is arranged at the end of recoil to bring the gun quietly to rest before it is returned to the firing position either by springs, or by air compressed during the recoil action, and contained in a separate compartment fixed to the cradle. In "recuperator" mountings, the run out is effected by the pressure of air contained in a communicating cylinder or reservoir, acting on the liquid in a "run out" cylinder through a valve which controls the speed of run out. Suitable arrangements are made by a liquid seal to prevent any air from passing into the run out cylinder. In power-worked mountings the gun may be run out by hydraulic pressure acting on a ram or piston attached to the slide. It will be noted that the system of overcoming the recoil is hydraulic, whereas the counter-recoil may be mechanical (*i.e.*, springs), pneumatic, hydraulic or a combination of these systems. The primitive expedient of arranging for the gun to recoil up an inclined plane and to run out by gravity is no longer used.

(2) **Training and Elevating Arrangements.**—The training of a gun is effected by rotating the entire mounting about its vertical axis. In a hand-worked deck mounting which is supported on a live roller ring or pivoted on ball-bearings, this is carried out by worm gear fitted in the mounting which engages in a rack secured to the deck. In the case of light guns, this gear is usually arranged to disconnect, so as to allow the mounting to be trained from a shoulder piece in smooth weather. A turret mounting generally carries with it a hanging chamber and ammunition trunk (*see* illustration). It is supported on a live roller ring which travels on a fixed roller path built into the ship and the turret is rotated by a hydraulic engine which works a driving pinion gearing into a vertical rack fixed to the hull. The great weight of the revolving structure, which may exceed 1,000 tons in triple gun turrets, entails very powerful machinery to obtain the necessary nicety in movement required for accurate training, one minute of arc being of importance at long range.

In double or triple gun turrets, though the guns cannot be trained independently, the elevation or laying is generally inde-

pendent. It is effected by moving the gun slide in the vertical plane by one or two hydraulically operated rams, connected to the slide and working in cylinders fixed to the mounting. Another method of laying a gun commonly adopted in U.S.A. ships is by the rotation of a long screwed shaft driven by an electric motor which takes the place of the ram. Where very high angles of elevation are required involving a large movement the laying may be performed by a hydraulic swash plate engine (*q.v.*). Hand-worked guns are generally laid by the rotation of a pinion geared into a toothed arc attached to the cradle. In all cases the elevating gear is connected to the non-recoil portion of the mounting. In some turrets it is possible to lock the slides so that the guns are elevated together, and in other mountings (known as "twin" mountings) independent elevation is not possible.

(3) **Loading Operations in Turret Mounting.**—The possible rate of fire depends upon the rapidity with which successive rounds can be loaded. The loading cycle for a turret gun involves the following events:—

(a) The recoil and counter-recoil of the gun.

(b) Opening the breech and ejecting the fired tube (primer).

(c) Bringing the gun to the loading position which is a fixed angle varying in different turrets from 4° to 10° of elevation. In some turrets, such as that shown in the illustration, loading can be performed at any elevation through a loading arm at the rear end of the slide, which is designed for the automatic attachment of the ammunition cage, which then moves up and down as the gun is depressed or elevated. This enables the loading operation to proceed without the gun being brought to a fixed position. The loading arm carries on its extreme end a chain rammer for ramming home the projectile and charge, hence this operation also is independent of the angle of the elevation.

(d) Bringing the ammunition cage with projectile and charge from the waiting position in the chamber to the loading position or loading arm. (Bringing the ammunition from the shell room and magazine by the main trunk and transferring it to the loading cage is an operation which can be performed at any time and is not dependent on the working of the gun.)

(e) Ramming home the projectile and charge. In some mountings, where fixed loading is carried out, telescopic rammers are used and the charge is automatically picked up by the rammer behind the projectile and carried into the gun chamber in the same ramming operation with the projectile.

(f) The withdrawal of the rammer and cage.

(g) Closing the breech with a new tube in position.

When the loading is completed a hand-operated switch is put over. This break in the firing circuit is introduced to ensure safety from firing during the loading operations. The gun is now ready for firing, and this can be performed by completing the firing circuit by pressing a key either in a sighting position in the turret or in the director tower, according to which position is connected up.

NAVAL GUN SIGHTS AND GUNLAYING

Sights fitted with telescopes are attached to the cradle or connected with the trunnions of the slide. Setting the range on the sight gives it an angle of depression with the gun's axis. The movement of the gun necessary to aline the sight on the target gives elevation to the gun corresponding to the range on the sight.

It will be appreciated that change in the direction or bearing of the target may entail continuous training to keep on the object, and that change in range may entail constant alterations in the elevation of the gun. Such movements are, however, usually small, and readily adjusted by the responsible members of the gun's crew. A more difficult task in keeping the gun continuously laid is caused by the oscillatory motion of the ship, which, since it is of a harmonic and composite character, is very difficult to compensate. This motion is, as far as possible, discounted by means of "director firing" in which a definite position in the roll can be selected for discharging the gun. In this method of firing, an indicator is operated at the gun by an electrically connected master sight in the control position. This is followed by the action of the gun-layer, who keeps a pointer attached to the gun in coincidence with the director indicator, thus giving the gun an elevation corresponding to the setting of the master sight.

The setting of this sight involves the rangefinder range, and the "spotting" correction obtained from observation of the fall of the shot, which may be assisted by aircraft observation. This spotting correction is inevitable as the actual muzzle velocity of the gun may differ from that for which the sights are graduated owing to wear of the gun and to the temperature of the charge. Also the retardation of the projectile may differ from the normal on account of its form and weight and because of the density of the atmosphere. Such effects are as far as possible allowed for by calculation in the initial setting of the sight; but there remains a margin of error, which in most cases is chiefly due to the discrepancy between the rangefinder range and the true range.

FIRING GEAR

Under the conditions that prevail in a naval action, it is of great importance that the means of firing the gun should be as instantaneous and as reliable as possible. Where guns are directly fired from a control or director position, it is necessary for the main chain to the gun to be electrical, and the "firing interval" is reduced if this circuit fires an electric tube. Where a percussion tube is employed to fire the gun, the fire control circuit is arranged to release a striker by energising an electro-magnet and attracting an armature which releases the trigger. Owing to the mechanical movements involved, this latter method entails a longer delay.

The firing interval in the case of an electric tube is determined by the following train of events:—(1) Brain impulse interval between the director layer or gunlayer seeing his sight alined with the target and deciding to fire, and his finger pressing the contact button. (2) Completion of the circuit by the physical movement of the contact button, push or switch. (3) Heating the bridge and burning the powder in the tube. (4) The passage of the tube flash along the vent of the breech screw. (5) Ignition of the primer on the end of charge. (6) Ignition of charge. (7) Time taken by the projectile in passing down the bore.

An efficient firing gear reduces the firing interval to a minimum and makes the prospect of firing as reliable as possible. The possibility, however, of a misfire is usually provided for by some alternative system. In some cases an alternative electrical circuit is fitted which is brought into operation by a switch, and in other cases percussion firing is resorted to by either exchanging the electric tube for a percussion one or by employing a tube which is capable of being fired electrically and by percussion. Electrical firing lends itself very readily to the introduction of safety arrangements, *e.g.*, the circuit can be broken by the recoiling action of the gun and only completed when the gun is out in the firing position. It can be also broken when the breech is not closed and only completed when it is fully closed.

It will be evident from the foregoing that the use of a heavy naval gun entails great proficiency in drill and a considerable amount of organisation and intelligent co-operation in the personnel involved. The machinery and instruments concerned must be kept in a highly efficient condition to ensure that no link in the chain of operations fails. Alternative methods of loading and operating turret guns are provided in many cases, such as mechanical hand-loading or a secondary source of power in the event of the main system being put out of action. These add to the degree of training and skill required in the gun's crew. However great the power and mechanical perfection of the weapons, the spirit, resource, and efficiency of the man behind the gun will continue to be a matter of the highest importance. Other things being equal—the human element will decide the issue. (J. G. M. McH.)

ORDOS: *see* SHENSI.

ORDOVICIAN SYSTEM, in geology a term introduced by Lapworth in 1879 to include those rocks—well developed in the Welsh region formerly inhabited by the Ordovices,—which had been classed by Murchison as Lower Silurian and by Sedgwick

as Upper Cambrian (*see* SILURIAN). In the early part of last century all the rocks which lie beneath the Carboniferous Limestone were grouped together under the general name of Transition Series and it was not till 1831 that Sedgwick and Murchison made the first serious attempt to reduce them to order. Sedgwick started work in the Snowdon district and Murchison began upon the Welsh borders. By 1835 they had advanced so far that Murchison gave the name of Silurian system to the group of rocks with which he was dealing, while Sedgwick called his group the Cambrian series. At that time it was supposed that the Cambrian lay entirely below the Silurian. Subsequently it was shown that the two formations overlap, the upper part of Sedgwick's Cambrian being the same as the lower part of Murchison's Silurian. A prolonged controversy followed which has left its effects in a confusion of nomenclature even to the present day. It has, however, long been recognised that the Cambrian and Silurian of Sedgwick and Murchison include three natural groups, and in 1879 Lapworth proposed that these groups should be called Cambrian, Ordovician, and Silurian. Murchison's terminology is still often used, especially in Germany, and the three groups are called the Cambrian, the Lower Silurian and the Upper Silurian.

Although under all the variations of terminology the three groups are now universally recognised there are still differences of usage with regard to their precise limits. Whereas in extra-British areas there is a general concurrence of opinion as to the horizon at which the base should be drawn (zone of *Dictyonema flabelliforme*), most British geologists still adhere to the older classification, based largely upon structural considerations, in which the base is taken above instead of below the Tremadoc. There is also some divergence of opinion as to the horizon at which the upper limit should be drawn, the fossil evidence suggesting that it should include beds up to the time of appearance of the true Pentamerids and Monograpti, though mainly on lithological grounds it is generally taken below this level.

The various strata composing the System may be divided into several contemporaneous facies or types of deposit, controlled by different physical conditions at the time of formation, and since these same physical conditions also govern the nature of the organisms living in different parts of the sea, each facies of deposit tends to have a distinctive set of fossils.

The three principal facies can be recognized:

1. Shallow water marine facies
   (a) grits, sandstones and shales indicative of heavy sedimentation; fossils mainly trilobites and brachiopods.
   (b) shelly limestones evidently laid down in clean water; fossils mainly brachiopods, cystids, ostracods, and bryozoa.
2. Deeper water marine facies
   (a) nodular limestones; fossils mainly cephalopods (*Orthoceras*).
   (b) black shales; fossils, blind trilobites or trilobites with over-developed eyes. Often occurring in association with
   (c) fine black shales; fossils mainly graptolites.
3. Volcanic facies especially characteristic of British Isles.

The natural relationships of these different types are indicated by their field relations, the shallow water facies of either type may have a considerable lateral extension running parallel with the old coast line, but in a direction approximately at right angles passes into one or other facies of the deeper-water type, the subdivisions of which are often intercalated into one another, though the type with the most widespread development is undoubtedly that of the Graptolite Shale. The graptolites do not really belong to the black shale since it is likely that they were planktonic or pseudo-planktonic, but since quietness of the waters and absence of coarse sediment are the determining factors governing the distribution of both, the two are almost invariably associated.

Life.—The life of the Ordovician period presents a distinct advance in type upon that of the preceding Cambrian; as a whole it may be said to be characterised by three main features: (*a*) Acme of development of the trilobites. (*b*) Rise and dominance of the articulate brachiopods over inarticulate types. (*c*) Incoming in force and great development of the graptolites. The fauna consists on the one hand of a trilobite-brachiopod fauna characteristic of the shallow water facies, and a graptolite fauna characteristic of the deeper water facies, and it is by means of these great groups of organisms that the rocks belonging to the System have been divided up into a series of life zones. The graptolites utilised as *zone fossils* differ in different parts of the world, but though the *Index Fossil* may be different, there is a very wide agreement in the *General Assemblage* found at the same horizon within the Graptolite Shales all over the world, and there is likewise the same change from the early many branched forms to those with fewer branches, and from the pendent to the scandent direction of growth. The cell form too changes in the same manner from the straight to the slightly sinuous, and eventually to the decidedly sinuous type. Hence *Clonograptus, Dichograptus, Tetragraptus* and *Didymograptus* are characteristic of the Lower Ordovician; *Nemagraptus, Dicellograptus* and *Climacograptus* characterise the Middle Ordovician, and *Dicellograptus, Dicranograptus, Climacograptus* and *Diplograptus* the Upper Ordovician. The articulate brachiopods include the various subgenera of *Orthis, Strophomena Leptaena,* and *Plectambonites*, and, more particularly towards the top, forms with a definite internal brachial apparatus such as *Atrypa* and *Zygospira* make their appearance.

The trilobites reach their zenith of development and exhibit great variety in form, but whilst *Ceratopyge* is found only at the base, and forms like *Chasmops* and *Phillipsinella* only in certain beds in the Upper Ordovician, many genera or families have a long range; *Ogygia* for example is characteristic of the Lower Ordovician when it occurs, but the nearly allied *Asaphus* is found at all horizons. The forms of commonest occurrence are *Asaphus, Ogygia Acaste, Calymene, Placoparia, Illaenus, Homolanotus, Remopleurides, Cheirurus, Lichas,* and *Phillipsinella;* there are also blind trilobites such as *Trinucleus* and *Ampyx*, both of which are common, as is also *Aeglina* with its over-developed eyes.

Various Orthoceratidae are abundantly represented in the Orthoceras Limestone of Scandinavia; taken as a whole however the mollusca (*q.v.*) play a far more important part in the fauna of America than they do in Europe, both gasteropods and lamellibranchs being abundant at certain horizons, whilst the bryozoa are also important in America, and probably on account of the physical conditions, are far more abundantly represented.

Distribution.—Ordovician rocks have an almost world-wide distribution since they have been recorded from both Arctic and Antarctic regions, Europe, North America, South America (Bolivia), Asia (China, Burma, northern Himalayas, Shan States), northern Africa and Australia. The classic areas of development however are those of Europe and North America, and the other areas may be regarded in terms of these. In Europe they may be considered as having been laid down in two main areas, a northern area and a southern area. The northern area of deposition comprised the British Isles, the greater part of Scandinavia and the Baltic Provinces; it consisted of two gulfs penetrating far into the north Atlantic continent, the outermost of which was probably a true geosyncline and the inner an epicontinental sea; these were partially separated by a long island or peninsula extending from Scandinavia to Britain. The southern area is considered to have lain to the south of a land mass extending through Central Europe and comprising southern France, Spain and Portugal, Thuringia, the Fichtelgebirge, Kellerwald and Bohemia.

The differences in the faunas of these two areas has been regarded as in large measure dependent upon the existence of the separating land barrier, but it is possible that these differences may be due in part to facies, and the possibility of the effect of migration and counter-migration along the shore line must not be overlooked. Towards the close of the period at any rate this difference in faunas disappeared, for a uniform type of fauna characterises all areas of deposition whether they belong to the shallow-water or deeper-water facies.

In America shallow water facies of varied type predominated all along the submerged margin of the Canadian shield (epicontinental sea), but in the east and west, definite geosynclines originated, known as the Cordilleran and Appalachian geosynclines respectively, and it is to these that the Graptolite Shale facies mainly belong.

British Isles.—The British Ordovician rocks have always been much folded since their formation. They were laid down originally within the geosyncline of the northern area of deposition, part of

ORDOVICIAN SYSTEM

Europe								America			
British Isles		Scandinavia		N. W. Europe		Bohemia		New York State		Canada	
Shelly	Graptolitic	Shelly	Graptolitic	Shelly	Graptolitic	Shelly	Graptolitic	Shelly	Graptolitic	Shelly	Graptolitic
Ashgill	?Lowest Birkhill Shales Upper Hartfell Shales	Brachiopod Shales Upper Leptaena Lst. Trinucleus Shales	?Lowest Rastrites Shales Upper Dicellograptus Shales			D_5		(Taconic uplift)	Dicellograptus complanatus Shale		
Caradoc	Lower Hartfell Shales	Lower Leptaena Lst. Chasmops Lst. Cystidean Lst.	Middle Dicellograptus Shales	Schistes Supérieures Grès de May.		D_4 D_3		Richmond Lorraine Utica	Cincinnatian Upper part of New York Slate belt (Hudson River Shales)	Lorraine Utica	Graptolite Shales
Llandeilo	Glenkiln Shales and Cherts	Orthoceras Limestone	Lower Dicellograptus Shales	Schistes à Calymènes or Schistes Angers	Schistes à D.Euodus	D_2		Trenton Black River	Mohawkian Norman's Kill Beds	Quebec City	Dicellogr. Shales
Llanvirn	Llanvirn		Upper Didymograptus Shales		Schistes de Boutory		$D_{1\gamma}$	Chazy	Deep Kill Beds		Levis Shales
Arenig	Skiddaw Slates	Ceratopyge Lst. Shumardia Beds	Lower Didymograptus Shales	Grès Armoricain	Assise de Huy (Belgium)	$D_{1\alpha}$	$D_{1\beta}$	Beekmantown	Canadian		
Tremadoc	Dictyonema Beds	Obolus Appolinis Beds	Dictyograptus Shales		Assise de Viel-salm (Belgium)				Dictyonema Beds (Schaghticoke)	Sillery	

	Wales		Shropshire		Lake District		S. Scotland	
	S. Wales	N. Wales	W. of Longmynd	E. of Longmynd			Girvan	Moffat
Ashgillian	Slade, Redhill Beds				Upper Ashgill Shales			
					Middle Ashgill P. mucronatus Beds	Ardmillan Series	Drummock Group	Upper Hartfell Shales
	Shoalshook Lst.	Rhiwlas Lst.	Marrington Stage (Whittery Shales)	?Onny River Shales (Up. Trinucleus Shales)	Lower Ashgill Phillipsinella Beds (Keisley Lst.)		Barren Flags	Barren Mudstones
				Acton Scott Beds			Whitehouse Group	
Caradocian	Robeston Wathen Lst.	Bala Lst.	Hagley Stage	Longville Flags	Sleddale Group			
				Chatwall or Soudley Sandstones			Ardwell Group	Lower Hartfell Shales
		Bala Mudstones		Harnage Shales	Roman Fell Group			
	Dicranograptus		Aldress Stage					
		Sandstones		Hoar Edge Sandstone Grits				
	Shales	Dicranograptus Shales					Balclatchie Beds	
Llandilian	with Mydrim Lst.		Rorrington Stage			Barr Series	Benan Conglomerate	Glenkiln Shales and Cherts
		Volcanic Series			Borrowdale Volcanic Series		Stinchar Limestone	
							Kirkland Conglomerate	
	Llandilo Flags		Meadowtown Stage					
Llanvirnian	Llandilo Limestone		Betton Stage					
			Weston Stage					
			Stapeley Stage					
	Lower Llanvirn	Lower Llanvirn			Skiddaw			
			Hope Stage					
Arenigian					Slates		Ballantrae Volcanic Series	
	Tetragraptus Beds with volcanics	Tetragraptus Beds	Mytton Stage with Stiper Stones Quartzite at base					

Chirbury Series — Middleton Series — Shelve Series

Coniston Limestone Series

the northern margin of which appears to have lain along the Highland border, whilst its southern shore-line ran obliquely through the Welsh borderland and thence south into Cornwall. Hence in the neighbourhood of the Highland border (Girvan) and the Welsh borderland there is an extensive development of the shallow-water facies, which traced south-east on the one hand and more generally west and north-west on the other, pass into deposits of the deeper water facies characterised by graptolites. These sediments are however interrupted at different horizons by volcanic rocks though the intensity and duration of vulcanicity varied in different places. It is the folding of the sediments and the occurrence of these volcanic rocks on a grand scale that is responsible for the rugged mountain scenery of both north Wales and the Lake District. There appear in general to have been two main volcanic episodes, an earlier one (Arenig) characteristic more particularly of the marginal areas, of the geosyncline, and a later one (Llandilo-Caradoc) belonging to its more central portions. The table shows the succession in the classic areas of development.

European Continent.—In Scandinavia the Ordovician rocks have escaped the severe tectonic disturbances that have so generally affected the rocks of this age in other regions. In Norway their main development occurs in the Christiania (Oslö) basin, but in Sweden the best sections are those seen in the many table-mountains that have been cut out by circumdenudation, where the rocks can be studied lying horizontally one above the other. The recognition of the different facies of deposition is here particularly important; the classic areas are those of Skåne, Öland, Östergotland, Västergotland and Dalarne, and in these the shallow water and deeper water facies show varying degrees of development. In Skåne is found the most complete development of the Graptolite Shale facies, but this is associated in places with some Trilobite Shales and some thin bands of Orthoceras Limestone. In Dalarne on the other hand the facies is largely shallow water throughout and almost entirely calcareous, a similar facies being found in Öland where however the succession is incomplete above the horizon of the Cystid Limestone, and Dictyograptus Shales largely replace the Ceratopyge Limestone; in Östergotland the Ceratopyge Limestone is again replaced by Dictyograptus Shales but the upper part of the succession is complete, and in Västergotland Graptolite Shales not only replace the Ceratopyge Limestone but also the lower part of the Orthoceras Limestone. Hence the general succession in the different areas may be regarded as dependent upon the degree to which the various limestones are replaced by Graptolite Shale.

In the Baltic Provinces the succession is mainly of shallow water type, and affords perhaps the best development of the rocks of that type recognized in Europe. The succession presents some striking analogies with that of the Scandinavian shallow-water development of which it is no doubt the counter part on the southern shore line; hence the Vaginatenkalk and Echinosphaerite Kalk show many features in common with the Orthoceras Limestone and Cystid Limestone of the northern region. It does not appear possible however, to correlate exactly the beds that are said to overlie the Echinosphaerite Kalk, namely the Jewe Itfer, and Kuckers Schiefer, beyond the fact that they appear to belong to the Upper Ordovician.

At the base of the Ordovician succession in Bohemia, there is an unconformity of considerable importance so that the basal beds are naturally of a littoral character ($D_1\alpha$); above, Graptolite Shales of Arenig age occur, and the beds of Llanvirn age ($D_1\beta$) contain a mixed fauna of trilobites and graptolites; the remainder of the succession is formed a richly fossiliferous shallow-water series of sandstones and shales representing everything up to the top of the Ashgillian.

North America.—In the geosynclinal areas of North America, both shallow water and deeper water facies of deposit are found and these are often highly disturbed by the movements in which they have been involved since their deposition; outside these geosynclinal areas the beds show very little signs of any disturbance, are thinner and consist very largely of calcareous beds with different varieties of shallow water faunas.

The Graptolite Shale facies is best known in the area belonging to the Appalachian geosyncline, but includes also beds now lying outside it in the St. Lawrence valley which have probably been brought by thrusting into their present position. The classic development of the Graptolite Shale facies of the Lower Ordovician is that known as the Levis Shales of the Quebec group seen on the south shore of the St. Lawrence immediately opposite Quebec; the remainder of the Graptolitic facies is best known from New York State where they form the Hudson river Shales of Albany. The shallow water facies is found extensively in the north in the Hudson bay region (Manitoba, Hudson bay and the Arctic archipelago), and in the south or Mississippean region along the margins of the Canadian shield in Michigan, Wisconsin and Minnesota, and on the domes of Cincinnati and Nashville.

Australia.—In Australia the same three facies of the Ordovician are characteristically developed. Beds belonging to the shallow water facies have only up to the present been definitely recorded along the east to west line in Northern Territory in the heart of the continent (Tempe Downs, and Levi Range, south of the MacDonnell Ranges) the dominant type, which is found mainly in the eastern half of the continent, belonging to the Graptolite Shale facies; these are best seen in Victoria where the Lower Ordovician rocks of this type have become well known through their occurrence in the most productive gold field; Upper Ordovician of similar type, though less auriferous, occur east of a line running north from Melbourne, and are also found in New South Wales. Volcanic rocks of the age have an extensive development in central New South Wales and in Tasmania (*see* AUSTRALIA). (G. L. E.)

ORDU (anc. *Cotyora*, where the "Ten Thousand" embarked for home), the chief town of a vilayet, on the north coast of Asia Minor, between Samsun and Kerasund, connected with Zara, and so with Sivas, by road, and with Constantinople and Trebizond by steamer. Filberts are exported. Pop. (1927), 113,004.

ORDUIN-NASHCHOKIN, ATHANASY LAVRENTEVICH (?–1680), Russian statesman, was the son of a poor official at Pskov. He was the only Russian statesman of the day with sufficient foresight to grasp the importance to Russia of the Baltic seaboard.

Orduin abolished the onerous system of tolls on exports and imports, and established a combination of native merchants for promoting direct commercial relations between Sweden and Russia. He set on foot a postal system between Muscovy, Courland and Poland, and introduced gazettes and bills of exchange into Russia. With his name, too, is associated the building of the first Russian merchant-vessels on the Dvina and Volga.

See V. Ikonnikov, "Biography of Orduin-Nashchokin" (in *Russkaya Starina*, Nos. 11–12) (St. Petersburg, 1883).

ÖREBRO, a town of Sweden, capital of the district (*län*) of Örebro, lying on both banks of the Svartä a mile above its entrance into Lake Hjelmar, 135 m. W. of Stockholm by rail. Pop. (1928), 37,053. Örebro was in existence in the 11th century Its castle was erected by Birger Jarl in the 13th century, and twenty diets or important assemblies were held either in the castle or in the town. Such were the Örebro *concilium* of 1537, the diet of 1540 in which the crown was declared hereditary, and that of 1810 when Bernadotte was elected crown prince. In great part rebuilt since a fire in 1854, Örebro has a modern appearance. An ancient castle, however, with four round towers, still remains, and is used as a museum. There may be mentioned also the church of St. Nicholas, of the 13th century; and the King's House (*Kungsstuga*), an old and picturesque timber building. The patriot Engelbrecht (d. 1436) was born here. The Swedish reformers of the 16th century, Olaus and Laurentius Petri, are commemorated by an obelisk. Örebro is the centre of the Swedish shoe industry; trade is carried on, by way of the Örebro canal and lakes Hjelmar and Mälar, with Stockholm.

ORE DEPOSITS. The word "ore" is defined in the Oxford Dictionary as "a native mineral containing a precious or useful metal in such quantities and in such chemical combination as to make its extraction profitable," and this is the sense in which it is used in commerce and by miners, although writers on mineralogy and petrology apply the word to metalliferous minerals without the above-mentioned limitations.

Ore deposits are accumulations in Nature which have arisen by some form of concentration, either chemical or mechanical, or both. Prof. Kemp has made a useful comparison between the average percentages of the metals in the earth's crust and those necessary to constitute an ore suitable for profitable working. The two tabulations, slightly modified in the case of manganese and copper to conform with later improved practice, are here put side by side:—

Metals	*Average percentage in Earth's crust*	*Percentage necessary for profitable working*
Aluminium	8·13	30
Iron	4·71	35–65
Manganese	0·07	25–50
Nickel	0·01	2–5
Tin	0·000X–·0000X	1·5–3
Copper	0·0000X	1–10
Lead	0·0000X	2–2·5
Zinc	0·0000X	5–25
Silver	0·000000X	0·03–0·16
Gold	0·0000000X	0·003–0·00016
Platinum	0·00000000X	0·00005

The letter X indicates some undetermined digit.

A comparison of the two tabulations gives an idea of the degree of concentration that has been instrumental in the formation of ore deposits from the materials of the earth's crust. Research has shown that it is to the igneous magmas that we must look for the original source of these concentrations of the metals. The agents by which the metallic components of the magmas are segregated, or extracted from the rocks to which the magmas consolidate, and finally concentrated, are numerous. In the case of the molten magmas it is by the process known as *differentiation*, or by the escape of gases and vapours carrying volatile metallic compounds to the adjacent rocks—a process which is known as *pneumatolysis*. From the consolidated igneous rocks extraction is effected by hydrothermal solutions, whether of deep-seated or of meteoric origin. Further concentration takes place (1) by oxidation, hydration and solution in the zone of weathering and re-precipitation in the zone of secondary enrichment; (2) by the mechanical agents of erosion and sedimentation, and (3) by chemical and bacterial agents leading to precipitation in seas, lakes and swamps.

It will be seen from these considerations that ore deposits can be divided into two great classes according as they are of *primary* or of *secondary* origin.

The Primary Deposits may be subdivided into:—

(*a*) Magmatic differentiations within the boundaries of the igneous mass;
(*b*) Deep-seated injections of materials extracted from the magma by differentiation;
(*c*) Infillings and replacements at moderate depths by magmatic waters or by meteoric waters heated by descent;
(*d*) Infillings and replacements near the surface by waters of meteoric origin.

The Secondary Deposits are:—

(*a*) Oxidation and reduction ores in the zones of weathering and secondary enrichment;
(*b*) Residual ores;
(*c*) Detrital ores;
(*d*) Precipitated ores.

The form assumed by ore deposits will be referred to later. As regards their mineral composition, it is necessary in the first place to distinguish between the *ore* and the *gangue*, the latter being the name given to the minerals that accompany the ore.

In the deep-lying parts of the deposit, or what is often called the *primary sulphide zone*, the ore-forming metals occur in combination with sulphur, tellurium, arsenic and antimony (as sulphides, tellurides, arsenides and antimonides of one or other of the metals—gold, silver, mercury, lead, vanadium, zinc, nickel, cobalt, etc.), or as silicates (of iron, manganese), or oxides (of iron, tin, chromium). Occurrence in the native state is in this zone confined to a few of the metals (gold, platinum, iridium, palladium, etc.).

In the upper portion of the lodes, in the *zone of oxidation*, the metals occur as carbonates, sulphates, phosphates, arseniates, antimoniates, chromates, silicates, chlorides, oxy-chlorides and hydrates. Where special conditions involving strong reduction prevail certain metals appear in the native state (copper, silver, mercury).

The commonest gangue minerals in the deeper parts of the lodes are quartz and the sulphides of iron (pyrites, marcasite, arsenopyrite). Nearer the surface the hydrated forms of silica (opal and chalcedony), the carbonates of iron, calcium, barium and magnesium (siderite, calcite, aragonite, witherite, dolomite) and the sulphates of calcium and barium (gypsum, anhydrite, barytes) are common.

Important deductions as to the origin of an ore deposit can be drawn from the nature of its mineral associates, always provided that care is taken to distinguish between the different epochs of mineralization, *i.e.*, to say whether the mineral in question belongs to the primary period of mineralization, or has been introduced at a later date from without, or derived from the original mineral by the chemical action of permeating solutions. Thus, for example, the presence of fluorine, boron and phosphorus-bearing minerals, such as fluorspar, apatite, tourmaline and axinite, indicates deposition at a temperature above the critical temperature of water, by the aid of the so-called "mineralizers." Heavy anhydrous silicates such as the pyroxenes, the hornblendes and the dark micas, also imply a deep-seated origin at high temperatures. On the other hand, the presence of hydrated minerals, such as chlorite, opal, chalcedony and members of the zeolite group, points to an origin near the surface at comparatively low temperatures. The association of minerals belonging to the same epoch of formation is connoted by the term *paragenesis*.

MAGMATIC DIFFERENTIATIONS

Concentration by magmatic differentiation gives rise to ore-bodies associated mainly with plutonic rocks. These, because of the slowness with which they cool, offer the greatest facility for such concentration. A marginal segregation of the heavier minerals is brought about in the cooling magma either by fractional crystallization and gravitation of the crystals thus formed or by liquation, the latter process being a separation into two immiscible fluids, the heavier of which sinks to the bottom of the magma basin.

The density increases with the number of molecules of metallic oxides, such as those of iron, chromium, nickel, copper, calcium, magnesium. Hence these molecules will be more abundant in the lower than in the upper portion of a magma basin. In general, therefore, the net result is the formation of a basic peripheral zone and an acid (that is siliceous) central portion. As a rule the ores are concentrated in the peripheral portion, although exceptionally they occur in the heart of the igneous mass itself.

Deep-seated Injections.—The examples referred to in the preceding paragraphs are segregations within the igneous magma itself; but the majority of ores, although derived in the first instance from igneous magmas, are concentrated beyond the limits of the magma basins.

The formation of tin and copper deposits as the result of the consolidation of a granite magma is worthy of consideration in this connection. An undifferentiated granite magma may be considered as a solution containing, among other constituents, a certain amount of water and the chemically active elements boron, fluorine, chlorine, phosphorus, sulphur, tellurium, etc., which are spoken of as "mineralizers," since they possess the property of forming volatile compounds with the heavy metals. As the magma cools it separates into differentiates of varying composition; and consolidation of the different fractions takes place in the order of decreasing viscosity, the final residuum containing an excess of silica, a portion of the alkalies, practically all of the water and compounds of the metals, tin, tungsten, molybdenum, uranium, lead, copper, iron and many of the rarer metals.

In the early stages of consolidation cracks and fissures are formed in the cooling crust, into which the liquid residuum of the magma is injected. The earliest injections give rise to quartz-porphyries and felsites; later differentiates are pegmatites and aplites; while the most acid extract consolidates as almost pure quartz. While the temperature of the crust is still high and before

it has fallen below the critical temperature of the acid vapours, a proportion of the latter escapes into the surrounding rocks. These gaseous emanations deposit their mineral burden to a minor extent in fissures in the solidified crust of the igneous mass itself; but the main deposition is in the older rocks beyond, to which access is gained through bedding planes, joints, faults and crush-zones.

The tin-ore deposits contain the metal in the form of the oxide, SnO_2 (cassiterite) which is probably derived from the granite in the form of fluoride of tin—SnF_4—a volatile compound which, emitted at a high temperature, decomposes at a lower temperature in the presence of water vapour to a dioxide of tin, as shown by the following equation:

$$SnF_4 + 2H_2O = SnO_2 + 4HF$$

The deposits are characterized by the presence of the fluorine-bearing minerals—fluorspar (fluoride of calcium) and topaz (a fluoride and silicate of aluminium) and the boron-bearing minerals —tourmaline and axinite; whilst among metallic compounds are found wolfram (a tungstate of iron and manganese), ilmenite (a titanate of iron) and various sulphides and arsenides of copper, iron, lead and silver. Some of these compounds often constitute valuable ore-deposits of the respective metals. For instance, in Cornwall the upper portions of the lodes, to-day being mined exclusively for tin, carried copper in such quantities as to have made that county the world's chief producer of that metal in the early part of the 19th century. This depth-change in mineral content is a function of the temperature and pressure of the ascending mineral-bearing vapours and solutions and is sometimes referred to as the *zonary distribution* of ores. Experience has shown that the order of the zones of ore occurrence in the Cornish lodes from below upwards is tin, tungsten, copper, zinc, lead, silver, and this is the order of increasing solubility of the compounds of these metals in the ascending magmatic waters.

The highly-heated soluble constituents of the intrusions as they pass into the invaded formations profoundly modify their mineral composition. Among the sediments, the aluminous (shales and slates) and the calcareous (limestones) are the most subject to modification. The aluminous rocks develop tourmaline, sillimanite, staurolite, andalusite and topaz—all silicates of alumina, while the calcareous rocks yield garnet, axinite, wollastonite, diopside, scapolite, vesuvianite and epidote—all lime-bearing silicates.

In places these contact phenomena are accompanied by the development of ores, and thus give rise to an important class of ore-bodies generally described as *contact-deposits*. As a rule they are metasomatic replacements of limestone. Excellent examples are found in the so-called porphyry-copper deposits of the Western States of America (*e.g.*, in Arizona, New Mexico and Utah), where copper ores occur in limestone at its contact with intrusive monzonite and quartz-porphyry. The principal contact minerals are garnet (andradite) and epidote. The primary ores are cupriferous iron pyrites and zinc-blende to which must be added the high grade copper sulphides—chalcocite and bornite, in the zone of secondary enrichment. Near the surface, subsequent leaching by meteoric waters generally gives rise to a zone which may be barren, but in places contains oxides and carbonates of copper.

Equally important are the iron-ore deposits, which occur in limestone at its contact with igneous intrusions of an acid or intermediate type. Magnetite is the principal ore mineral, although haematite also occurs but in smaller quantity. Characteristic associates are the iron-garnet (andradite), the iron-pyroxene (hedenbergite), olivine and ilvaite. Deposits of this character are found in the Banat province of Hungary, on the island of Elba and in the Oslo district of Norway.

HYDROTHERMAL DEPOSITS

The part played by water in the formation of ore deposits is of the first importance, for on account of its mobility and solvent action, which is enormously increased at high temperatures and pressures, it is the universal vehicle for the transference of mineral matter.

In the hydrothermal circulation the mineral-bearing solutions are in part directly connected with igneous magmas, namely in so far as they are formed by the cooling of aqueous vapours given off at a late stage in their consolidation. A considerable proportion, however, are no doubt surface waters (*i.e.*, meteoric in origin), which, descending along fractures, derive their thermal properties from the secular heat of the earth, or by coming in contact with, or into the near neighbourhood of, igneous intrusions.

Of the water that falls as rain one part is the *run-off*, that is to say, water that reaches the rivers without having penetrated the surface. A second part is returned into the atmosphere by *evaporation;* while a third part disappears into the soil and under-lying rocks by *percolation*. Under the influence of gravity the water of percolation penetrates into the earth's crust, first through the superficial weathered and disintegrated layers and then through the more solid rocks by way of the fractures of jointing and faulting, the planes of bedding or the pore-spaces between their constituent minerals.

It is a matter of common observation that at a variable depth below the surface, there is a connected body of water, which permanently fills all openings. The surface of this sea of water is called the *level of the ground-water*, the *permanent water level*, or the *water-table;* it is the upper level of the *belt of saturation*.

Above the permanent water level is the *zone of percolation* in which the openings in the rocks are only intermittently filled with water. This water is in active movement and air is present. The thickness of the zone of percolation varies greatly. At sea-level and at, or near, streams or lakes the level of the ground-water reaches the surface; in average areas it is from 10 to 1,000ft. below the surface; in high-lying districts with small rainfall it may be 100 to 300ft. below the surface, and in elevated desert regions as much as 1,000 to 2,000ft. below the surface.

The belt of saturation is divisible into two portions. The upper portion, or that part which has a means of horizontal escape and discharge, is the *zone of discharge*. In general, it lies between the water-table and sea-level. In it the circulation is vigorous, as is evidenced by the vast volume of water discharged by springs.

The bottom part of the belt of saturation is the *static zone*. In it the waters are practically stagnant, or at best move very slowly. Near the bottom limit of the static zone the water gradually diminishes until the *dry zone* is reached. The boundary between these two zones is quite irregular, descending to great depth along fractures and rising high in solid ground. The lower levels of most deep mines are in the dry zone, in some places reached at a depth of not more than 1,000 to 1,500ft. below the surface.

The waters circulating in the zone of percolation are cold, contain free oxygen and are acid with dissolved carbon dioxide. Such waters have been termed *vadose* (Lat. *vadosus*, shallow) by Pošepný. They have a strong oxidizing effect on sulphides, pyrites for instance being decomposed with formation of oxide of iron and sulphuric acid. The net effect of the vadose circulation, therefore, is destruction, and the zone of percolation is practically coincident with the *zone of weathering*, although the latter overlaps the upper portion of the zone of discharge.

In the zone of discharge the waters, as they descend, lose their oxygen and carbon dioxide and deposit material brought from the zone of weathering. When they have access to open channels they penetrate deeper and deeper, absorb heat and thus become powerful solvents of the metallic sulphides and tellurides.

Ultimately these heated waters, together with those of magmatic origin, ascend, and as they cool and mingle with the descending vadose waters deposit their mineral burden, either in the main channels of circulation, thus forming *ore-veins*, or in the pores of the rocks forming the so-called *cemented* ore-bodies.

As the openings become closed by cementation, however, the circulation becomes feeble and ultimately completely stops, although earth movements may refracture the rocks and inaugurate a new circulation. The vertical movement of the water is confined to the zone of fracture and cementation. Below this zone, the pressure is sufficiently great to produce a differential movement of the rock particles, and thus to close all openings by *rock-flow*. For free upward movement the ground must be fissured, fault-fractures, especially when brecciated, and shear-zones are preferentially used by the ground waters, and these, therefore,

frequently become the seat of the deposition of ores. The existence of impervious formations is an important factor in directing the general circulation of underground waters, and in the localization of ore deposits.

The deposition of minerals from solution is brought about in a variety of ways. Solutions which are unsaturated at depth become, as they ascend, saturated by decrease of temperature and pressure. Chemical reactions also come into play—for instance, between solutions of different origin, between solutions and solids and between gases and solutions. Under one or more of these conditions the metallic burden is precipitated, lining and ultimately filling the channels traversed by the solutions. But not only are open channels filled: the wall rocks of the fissures may be affected or the constituent minerals of the rocks attacked by the penetration of the circulating waters. Consequently, two distinct classes of hydatogenetic ore-bodies must be distinguished, namely *cavity-fillings* and *metasomatic replacements*.

Cavities in rocks are due to a variety of causes. The openings may be those of discission, *i.e.*, fractures of dislocation (faults), or contraction-joints; they may be the interstices of sediments or gas-pores in lavas; they may be due to the folding of sedimentary beds (saddle and trough openings); or they may be solution-cavities in limestone and dolomite, *i.e.*, caves, sink-holes and enlarged joints and bedding planes. The filling of fault-fissures, zones of brecciation, interstitial openings and the vesicular cavities of lavas, gives rise to important ore deposits.

Metasomatic replacement is responsible for the formation of perhaps the largest class of ore-bodies. By metasomatism is meant the replacement molecule by molecule of a constituent of a rock by new mineral matter. Such replacements can be effected not only by water below the critical temperature, as in the hydrothermal circulation, but also by gases, as in the case of pneumatolytic replacement.

Since different minerals are differently affected by solutions, rocks will be more or less completely replaced according as they are made up of aggregates of the same or of different minerals. Limestones and dolomites, which are composed almost entirely of either calcite or the mineral dolomite, are far more liable to extensive and complete replacement than any other type of rock. They lend themselves to replacement both by the facilities they offer for circulation and by the solubility of the carbonates of which they are composed.

Where rocks of differing susceptibility to replacement occur in alternate beds the more soluble will be preferentially replaced, thus giving rise to a bedded type of ore deposit. Impervious beds crossing the paths of vertical fissures retard or stop the flow of solution, with the result that the latter, by spreading out beneath or above the impervious layer, tends to form characteristic pear-shaped replacements. In cases where there is a rapid alternation of impervious and permeable layers, selective action leads to the formation of serrated or tooth-shaped ore-bodies.

In sandstones whose cement is calcareous, the replacement of the calcite by ores is common; but it is sometimes difficult to say whether the disseminated ore particles have been produced by replacement, or by the filling of inter-granular spaces. Disseminated ore-bodies may also be produced by the differential alteration of igneous rocks, since these are aggregates of minerals varying in susceptibility to alteration.

Among the best examples of metasomatic replacement are the lead and zinc deposits found in limestone. Sulphides of lead and zinc are soluble in alkaline sulphides without decomposition. In contact with limestone such solutions deposit these sulphides as galena and zinc blende. Two types are common, viz., *flats* and *pitches*. A flat is a replacement which has progressed outwards into the limestone from bedding planes. On the other hand, a pitch is a replacement which has been effected from joints in the limestone. The names refer to the horizontality, on the one hand, and to the steep dip, on the other, of the respective deposits.

OXIDATION AND REDUCTION ORES

The free circulation in the zone of percolation of waters charged with oxygen and carbon dioxide makes it, in effect, one of oxidation, in which rocks and ore deposits become disintegrated and their component minerals decomposed with removal of the soluble constituents. The chief chemical processes involved are hydration, oxidation and carbonation. Silicates are broken down, the alkalies and alkaline earths being removed as soluble bi-carbonates, whilst silica is set free. Sulphides give place to soluble sulphates or to sulphuric acid.

The soluble compounds are carried down to the belt of saturation. A portion is lost in the waters escaping in the zone of discharge. The remainder is deposited as the descending acid waters become neutralized by the alkaline waters of the lower zone.

The changes produced in ore deposits by the process described above are most striking, and of the greatest economic importance. Those metals that form soluble compounds are removed from the zone of weathering, leaving in most cases an impoverished residual material. On the other hand, the precipitation of new metallic compounds or of the metals themselves at lower levels leads to enrichment at those levels. As a rule oxy-salts, halogen salts and native metals are precipitated above the water-table, while secondary sulphides are deposited below it.

The dictum of the mining camp that lodes become richer in depth, is therefore only true as regards their upper portions. In progressing from the outcrop downwards, a barren or lean portion of the lode is first passed through. As the water-table is approached, the metal content increases, attaining a maximum in a zone of secondary sulphides below it; the grade then falls until a minimum is reached in the unenriched zone of lean primary sulphides.

The *zone of secondary enrichment* is of prime importance for the mining of copper and silver, the bulk of these metals being won from it. Copper mines, rich in their upper levels, become poor in depth and ultimately unpayable when the lean primary ores are reached, unless the deposits are sufficiently large to be worked at a very low cost. The primary ore is almost invariably a cupriferous iron pyrites. On oxidation the copper goes into solution either as sulphate or as a bi-carbonate, and is removed, leaving behind the iron oxides. Consequently a prominent feature of copper lodes is the existence at or near the surface of a *gossan* or *iron-cap* (*chapeau de fer*), from which the valuable copper content has been removed. In wet climates the gossan consists almost entirely of hydrated oxides of iron. In drier climates, the anhydrous oxide (haematite) occurs; and in still drier climates (for instance the rainless regions of Arizona and Chile) gossans contain chlorides and sulphates of copper, which in wet climates are unable to exist in the solid state.

The copper minerals especially characteristic of the upper portion of the zone of secondary enrichment are the hydrated carbonates—malachite ($CuCo_3{\cdot}Cu[OH]_2$) and ($2CuCO_3{\cdot}Cu[OH]_2$), chessylite, the hydrated silicates—chrysocolla ($SiO_2{\cdot}CuO{\cdot}2H_2O$), and an oxy-chloride—atacamite ($CuCl_2{\cdot}3Cu[OH]_2$), together with native copper. Lower down, the sulphides—chalcocite (Cu_2S), bornite ($3Cu_2S{\cdot}Fe_2S_3$) and covellite (CuS), are found.

Detrital Ores.—The work of weathering is twofold; namely, mechanical disintegration and chemical change. Comparatively few minerals resist the attack of the chemical agents, but amongst them there are some that are of importance from the economic point of view—*e.g.*, gold, platinum, magnetite, ilmenite, cassiterite, wolfram, monazite, corundum, diamond, etc. The agents of mechanical disintegration are the diurnal and other variations of temperature, the expansion of water on freezing, the erosion due to running water, the sand-blast action of wind, etc. The detritus is carried down the slopes of the hills by running water and distributed according to specific gravity and size of grain.

The transported material accumulates in the valleys of rivers, in lakes or on sea beaches, and the resulting deposits are accordingly classed as alluvial, lacustrine and marine gravels ("placers"). A large proportion of the world's gold has in the past been won from them. On account of its high specific gravity the metal is concentrated in the coarse gravels and among the boulders at the bottom of the placers, the most valuable accumulations being often actually on the bed-rock itself. If the latter happens to con-

sist of steeply-dipping schists or slates, the upturned edges of the latter act as natural riffles, or bars, which catch and retain the gold particles. Accumulation also takes place on what are known as "false bottoms," which are beds of clay or sand cemented by iron ("pan") and alternate with the beds of gravel.

Placer gold is usually associated with a heavy black sand consisting of magnetite, ilmenite and haematite, together with chromite, garnet, zircon, spinel and other heavy resistant minerals; but obviously the particular association is determined by the nature of the parent rock. The character of the gold is variable: it occurs in flat scales and flakes, in rounded particles, and as irregularly-shaped grains and nuggets bearing evidence of much attrition. In size it varies from the finest dust to nuggets weighing thousands of ounces. It is probable that these large nuggets have increased in size since they were first deposited. The fact that auriferous pyrites are found replacing the woody fibre of tree stems in the alluvial drifts of Victoria and California shows that under favourable conditions an enrichment through chemical action (that is, solution and recrystallization) can take place.

The richest gravels are formed by a re-sorting of earlier auriferous gravels, terraces of the latter being often situated several hundred feet above the workable deposits.

Placers occur in the river systems of every part of the world; but the greatest amount of gold has been won from the Recent and Pleistocene gravels of California, Alaska, Australia and Siberia. The older gravels are often deeply buried under a thick cover ("over-burden") of clay, soil, peat and moss, which is sometimes permanently frozen, as in the tundras of Siberia and Alaska; while in Australia and California the ancient river systems are concealed by later flows of lava, their auriferous gravels being then known as "deep leads."

Auriferous beach deposits or marine placers are formed on certain coasts where the conditions are favourable for the separation, by surf action, of the gold and heavy minerals from the sand and lighter stones. Such deposits occur in New Zealand, on the beaches of Oregon, Alaska (Nome and Cape Yagtag), Chile, and Nova Scotia. Usually the gold occurs in a black sand consisting of magnetite, ilmenite and haematite; but these mineral associations are not constant: for instance, while in New Zealand the black sands are so rich in iron that it has been seriously proposed to work them for that metal, in the Cape Yagtag deposit the iron-ores are absent, their place being taken by garnet.

The auriferous conglomerates (locally termed "banket") of the Witwatersrand in the Transvaal, which have produced so large a proportion of the world's gold since their discovery in 1886, are considered by some to be ancient placers. Against this view, and in favour of a secondary origin for the gold, it might be urged that the latter shows no evidence of detrital origin, occurring, as it does, in crystalline particles and minute flakes in close association with pyrites. Moreover, the rest of the cement consists of crystalline quartz which has evidently been introduced, like the pyrites, subsequently to the deposition of the gravels. The only unmistakably primary constituents, besides the quartz pebbles, are diamonds, chromite and zircon, while the following minerals of secondary origin occur in the cement: quartz, chlorite, chloritoid, pyrites, marcasite, pyrrhotite, galena and blende.

If it be conceded that the gold, derived from the denudation of quartz veins in the schists and granite of the Primitive System, was deposited simultaneously with the quartz pebbles of the gravels, it must, on the other hand, be admitted that the original alluvial gold has been completely dissolved and re-precipitated.

Platinum is occasionally associated with gold in the residual and alluvial gravels of California, British Columbia, Brazil, Colombia and Borneo.

In districts where granite prevails the residual and river gravels often contain cassiterite, and such stanniferous gravels form the source of the bulk of the tin production of the world. They occur in Cornwall, the Malay States, Australia, Tasmania and in South Africa (Swaziland and the Transvaal).

RESIDUAL ORES

The residual deposits always attain their greatest development in those countries that have been unsubmerged for a vast period of time; and where the weathered products have neither been pared off by glacial erosion, nor the solid rocks protected by superficial accumulations. Under especially favourable conditions of climate and topographic relief, disintegration, accompanied by the removal of soluble material, has progressed to many hundreds of feet below the surface, the whole of this zone consisting then of soft decomposition products that bear no likeness to their parent rock, although certain original structures, such as bedding and foliation, may be retained.

The materials composing the bulk of the residual deposits are gravel, quartz-sand and clay or lithomarge (an amorphous hydrated aluminium silicate, having the composition of kaolinite, viz.: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$ and more exceptionally the mixture of hydrated oxides known as *laterite*. This latter material occurs in tropical and semi-tropical countries like India, the Malay Peninsula, the Dutch East Indies, South America, and East, West and South Africa; in fact, it appears to be one of the commonest residual products of ferruginous and aluminous rocks under suitable climatic conditions.

A great number of analyses of laterite have clearly established the fact that it consists to a large extent of a mixture of oxides and hydrated oxides of iron, aluminium, titanium and manganese: they show also that the water is chiefly combined with the aluminium oxide, the iron oxide being mostly present in the anhydrous or slightly hydrated condition (haematite or turgite). The ratio between the iron oxides and the aluminium oxides may vary to any extent, so that, while some laterites approximate in composition to high-grade iron-ores, others are almost pure bauxite which is the chief source of the metal aluminium. When manganese is present, it usually occurs in nodular concretions of psilomelane, wad or pyrolusite, which are sometimes sufficiently abundant to constitute ores of manganese. Mixed with these oxides in varying proportion are a lithomargic clay and quartz sand.

There has been much discussion and considerable divergence of opinion as to the origin of laterite; but all are agreed that it may result from the decomposition of a great variety of rocks, whether of igneous, sedimentary or metamorphic origin. The generally accepted view is that laterite is a residual accumulation produced by the removal in solution of combined silica, lime, magnesia and the alkalies, assisted by metasomatic replacement with material brought from the underlying rock in periods of desiccation by capillarity, aided perhaps by the rootlets of forest trees.

Laterite, when exceptionally rich in iron, is of considerable economic importance. Such, for instance, are the iron ores of Cuba, which occur as residual mantles on the high-lying plateaux of Malaya and Moa. Similar deposits occur in the Philippines, in Borneo, and in West Africa. The iron ores of Bilbao in Northwest Spain are also in part residual deposits.

Workable manganese deposits are nearly always residual concentrations from manganese minerals sparsely distributed through igneous rocks and crystalline schists. Deposits of this character are widespread in India, United States, Brazil, West Coast of Africa and many other places.

The nickel deposits of New Caledonia are of residual origin, the nickel ores being hydrated silicates (garnierite and genthite) occurring as earthy and brecciated masses in a ferruginous and clayey mantle overlying serpentine and peridotite.

Residual gravels containing tinstone and wolfram occur on Bodmin Moor in Cornwall. Others containing galena have been profitably worked in North Wales and again others, containing zinc ores, have been exploited as a source of that metal in Galicia. They have originated by the weathering of veins in limestones, chemical action on the soluble limestone having outpaced the mechanical erosion of the resistant minerals of the veins.

Precipitated Ores.—Many deposits of iron ore owe their origin to the precipitation in seas, lakes and swamps of iron derived from the decay of rocks in the zone of weathering. Iron goes into solution in this zone either by the oxidation of the sulphides of that metal, or by the breaking up of ferro-magnesian silicates. Soluble iron compounds are also formed by the action of certain bacterial organisms present in the soil. Reduced by these organ-

isms to the ferrous state, the iron combines either with the organic acids of the humus, or with the carbonic acid of the atmosphere, to form a soluble bicarbonate.

On exposure to air, or in the presence of plant life, carbon dioxide is given off and iron carbonate is precipitated, as shown by the following reaction:

$$H_2Fe(CO_3)_2 = FeCO_3 + CO_2 + H_2O$$

The ferrous carbonate rapidly oxidizes to ferric hydrate, and is deposited as *bog-iron* or *iron-pan*. A continuous layer of this pan consequently tends to form below insufficiently drained clayey and peaty soils. The formation of ferric hydrate in stagnant swamp water, where ferrous carbonate is undergoing oxidation, may actually be seen in operation, the iridescent films that form on such water being an indication that the reaction is taking place.

When the waters deposit iron in the presence of much carbonic acid, or of decaying organic matter, siderite ($FeCO_3$) is deposited. In muddy waters the silt goes down with the iron carbonate leading to the formation of *clay-ironstone*. These clay-ironstones or spathic ores as they are also termed, occur in the coal measures of the British Isles and in those of Westphalia and North America, and are an important source of iron. Though the iron content does not on the average amount to much more than 30%, the comparative leanness of the ore is compensated by the low percentage of phosphoric acid, which seldom rises above one per cent. The *black-band* ores of the coal measures are a similar deposit, but differ from the bulk of the clay-ironstones by the high percentage of vegetable or peaty matter they contain; sufficient to furnish the fuel required to calcine them. Such ores represent what was once a carbonaceous mud in which ferrous carbonate was precipitated. The Scandinavian *lake-ores* are an interesting example of precipitated iron ores.

The Jurassic iron ores of England and the similar *minette* ores of Lorraine and Luxembourg on the Continent, which constitute the greatest reserves of iron ore in Europe, form well-defined beds in a sedimentary series of sandstones, shales and limestones. Although low in iron (25 to 40% metallic iron) in many cases their large lime content makes them largely self-fluxing, and having a high percentage of phosphorus they are admirably suited for the production of pig iron for the basic process of steel-making. Their oolitic structure (so named from the resemblance to fish roe) is produced by the deposition of carbonate of lime and carbonate of iron around sand grains or fragments of fossils. In the zone of weathering, the spathic ores are oxidized to limonite, a change in colour from green to red being characteristic. Some secondary enrichment also takes place under favourable conditions. These iron ores are worked in England on three horizons, namely the Inferior Oolite (*Dogger* or *Northampton stone*) the Middle Lias (*Marlstone*) and the Lower Lias (*Frodingham stone*).

The metal content of the copper-bearing sandstones so widely distributed throughout the world, owes its origin, partly to precipitation and metasomatic replacement, partly to sedimentation. The prevalence of these deposits in the red beds of the Upper Carboniferous, Permian and Trias formations indicates sedimentation in the shallow seas of desert regions where evaporation was rapid. The copper was no doubt leached out, from earlier copper deposits in continental areas, by meteoric waters rich in sodium chloride and calcium sulphate. Transported as sulphate or chloride it was precipitated in inland seas or lakes and reduced to chalcocite by decaying organic remains. The replacement of tree-trunks and other plant remains as well as of the cementing material of the sandstones by chalcocite is a feature of these deposits.

The accumulation of cupriferous detritus while sedimentation was in progress, was no doubt a factor of the concentration in some cases, but such material of the original deposit would, of course, be subsequently modified by the circulation of the ground waters. Associated minerals are calcite, gypsum and barytes. In the zone of weathering the copper ores are oxidized to the green and blue carbonates—malachite and azurite.

THE FORM OF ORE DEPOSITS

Ore deposits occur in a multitude of different forms, but for convenience these may be reduced to two types—namely the tabular or *sheet-like* and the *non-tabular*.

Tabular deposits are either beds forming a part of the general stratification of the country, or veins or lodes that have been formed by the filling of fissures, or the replacement of their adjacent "country." As a rule, the veins cut across the stratification; more rarely they conform with the strike and dip of the formation in which they occur and are then termed *bedded veins*. Where a number of parallel fissures are irregularly connected the system is known as a *composite vein* or *lode*. The term *linked veins* is used in a similar sense. A system of closely spaced and parallel veins is spoken of as a *sheeted zone*. *Gash veins* are those that do not extend beyond a given bed of the formation in which they occur, usually limestone.

Although veins have been defined as tabular deposits, the parallelism of their bounding surfaces is only true in a very general sense, for unless they are fissure-fillings they have more often than not only one well-defined wall, and in some cases none at all. In mining, however, it is usual to speak of the hanging wall and the foot wall of a vein to distinguish the limits of the workable deposit whether they are well-defined or not.

Where the filling of the fissure has been followed by differential movement, one or both of the walls are usually smooth and polished (*slickensides* or *friction-planes*), and between the actual vein-filling and the wall of the country rock there is often a thin selvage of comminuted rock or clay known as *flucan*.

Where the fissuring was accompanied by dislocation, as is mostly the case, the veins have a lenticular character along both the strike and dip. This lenticular character is due to the differential movement of curved or warped surfaces. Between the lenses the fissure is often so constricted that no ore occurs at all. When the axes of the lenses lie in one plane the lenses are connected by stringers; when they lie *en échelon* they are usually disconnected.

Not every part of a vein is equally mineralized: the pay-ore tends to localization in certain definite portions of the vein separated by low-grade material or even by barren gangue. The richer portions are termed *ore-shoots*. If they have a tendency towards the horizontal, they are distinguished as *ore-courses* or *ore-horizons;* if, on the other hand, they tend towards the vertical, they are known as *columnar ore-shoots* or *chimneys*. But the term ore-shoot is not restricted to the occurrence of high-grade material in a low grade matrix; it is also applied to the development along a fissure of lenticular bodies of pay-ore, separated by barren country rock. It has been proposed to call this latter class of ore-shoot *shoots of occurrence*, and to use the term *shoots of variation* for the former. Shoots of variation are usually distinguished from shoots of occurrence by a gradual diminution of the values near the boundaries of the ore-shoot.

Non-tabular deposits vary greatly in shape and size. They may be large irregular masses or small pockets of solid ore, or they may be *stockworks, i.e.*, reticulated masses in which a multitude of small veins traverse a portion of the country rock. Of exceptional character are *chimneys* or *pipes*, which are ore-bodies having a rudely circular or elliptical cross-section with considerable vertical extent. *Saddle-reefs* are a special type of cavity-filling. Those of Bendigo in Victoria, Australia, have resulted from the folding of the Ordovician strata into a series of anticlines and synclines. The deposition of quartz in the openings formed at the crest of the anticline below a sandstone and above a shale bed has given rise to auriferous ore-bodies. Since the sandstone and shale beds alternate repeatedly the saddle-reefs occur, one above the other as disconnected ore-bodies, in what is known to the miners as the "centre country." Thus the New Chum and Victoria mine had 30 superimposed saddle-reefs, down to a depth of 2,300ft. The deepest mines are working at about 4,000ft.

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(F. H. HA.)

ORE DRESSING is an important process in the field of mining (*q.v.*). It may be defined as mechanical concentration whereby valuable minerals in an ore are separated from worthless impurities or gangue and is distinguished from metallurgy which employs chemical methods for recovering metals and metallic compounds from rich ores or from the concentrated products of the ore dresser. Without this relatively cheap process of enrichment as compared to expensive metallurgical processes, the cost of common metals, such as lead, zinc and copper and many mineral products, would be far above present prices, and, as richer ore deposits continue to be exhausted, ore dressing will become of still greater importance. As an illustration of what ore dressing is doing for copper alone, the so-called porphyry-copper mills may be cited. In some of these mills 100 tons of ore assaying not over 1% copper will yield three tons of concentrates assaying 30% copper and 97 tons of waste tailings assaying about 0·1% copper. Thus the copper lost in the tailings is not over one-tenth of the total copper in the original ore and the expensive metallurgical process has to treat only three tons of concentrates as compared to 100 tons of original ore if concentration were not used. A single mill may treat as high as 20,000 tons of ore in 24 hours. Terms also used more or less as practically synonymous with ore dressing are milling, washing and concentration.

Ores in the majority of cases do not consist of a single mineral in a high degree of purity, but are a more or less complex mixture of different minerals, some valuable and some worthless. Native gold, tin, stone and many gems may occur mixed with gravel in placer deposits. Native copper is found sprinkled through rock masses. Diamonds are enclosed in a matrix of hard rock. Native gold is also found encased in quartz veins. The minerals of base metals, such as lead, zinc and copper, are commonly sulphides, oxides or other chemical compounds of these metals and occur distributed through solid rock or gangue in veins and other types of ore deposits. A given deposit may contain minerals of only one metal, or two or more metals may be represented and in the latter case the problem of the ore dresser becomes harder as he has not only to eliminate the waste gangue but also to separate the minerals of one metal from those of another. Beside minerals of the metals, there are many non-metallic minerals which likewise require elimination of gangue by concentration before these minerals become marketable. Among such minerals are mica, graphite, feldspar, asbestos, fluorspar, phosphate rock and the abrasive minerals garnet, emery and corundum. Even common sand and gravel may be washed to get rid of undesirable constituents and likewise clay to free it from grit and mica. The best examples of ores which do not require concentration are the iron ores of the Lake Superior region. Much of our bituminous coal is also sufficiently free from impurities to be marketed direct but even on iron and coal considerable washing is in use for lower grade deposits and this is bound to increase as the richer deposits are worked out. The subject will be considered in three divisions: (1) Properties of minerals which aid their separation; (2) Individual machines and unit operations; (3) Complete mill systems.

Specific Gravity has been the most important property in concentration. Valuable minerals are usually heavy and gangue minerals light, although there are exceptions. Thus the rate of settling in water or air or the tendency of a mass of grains to stratify when acted on by currents of water or air makes it possible to separate a lighter mineral from a heavier one. Size has to be considered also since a large grain will settle faster than a small grain of the same mineral and, consequently, large grains of light minerals are equal settling with small grains of heavy minerals. Separation based on specific gravity is commonly called gravity concentration. Colour, lustre and fracture are of aid when valuable minerals are being separated from waste by the process of sorting or picking by hand selection. These properties also enable the operator to make the proper line of division between the products coming off a concentrating machine. Fracture and cleavage will affect the form of the grains produced by crushing. Flat grains settle less readily than rounded or cubical grains. Hardness, toughness, friability and brittleness affect the power used in crushing ores. Decrepitation which causes some minerals to fly to fine pieces when heated enables such minerals to be separated from other minerals which do not decrepitate and thus remain coarse.

Magnetism is a property possessed by certain minerals in a greater or less degree and electro-magnets of varying strength will separate such minerals from one another and from non-magnetic minerals. Some minerals, notably pyrite, are made magnetic by heating and become susceptible to magnets. Pyrite is also made porous by heating or roasting which changes its apparent specific gravity and may aid its separation. Electrostatic charges which are taken on quickly from an electrode by good conductors such as metals and sulphide minerals, except zinc sulphide, cause such minerals to be repelled more quickly from the electrode than gangue minerals and zinc sulphide which are poor conductors and receive the charge more slowly. Adhesion makes gold stick to a copper plate which has been amalgamated or coated with mercury and diamonds stick to a greased plate while associated waste minerals are washed down over the plate in both cases without adhering. The flotation property of minerals is a complex action not fully understood but it involves intermolecular forces of surface tension, adhesion and adsorption along with static electric charges and even chemical action. This process has developed rapidly in recent years and now vies with gravity concentration in importance and is therefore treated under a separate heading.

Crushing.—Unless an ore occurs as a placer or gravel deposit, it must first be crushed to free the valuable minerals from the attached gangue and the amount of crushing necessary will depend on the fineness of dissemination of the mineral. Furthermore, the final separation of the crushed material usually involves preliminary preparation by sizing or classification to yield a series of graded products going to different types of concentrating machines since no one machine can make a satisfactory separation when fed with a mixture of coarse and fine. When all the ore is reduced directly to a fine state, as for flotation, this preliminary grading is unnecessary.

Crushing customarily proceeds in steps and the best practice is to remove from the feed to any one crushing machine all particles which are already as fine as the product of that machine. Some machines, such as stamps, have a screen as an integral part of the machine to guarantee that the product shall all be below a specified maximum size while other machines, such as rolls and ball mills, require that a screen or classifier be connected in "closed circuit" with the crushing device to size out the finished product and return the coarse unfinished material for further reduction. Roughly, the field of coarse crushing involves the use of breakers of the Blake or gyratory type which receive lumps up to 5 or 6 ft. in diameter and reduce in a series of steps, with a reduction in size of about one-quarter at each step, down to a final product 1 or 1½ in. in size. For intermediate crushing, there are rolls, steam stamps, Symons disc crushers, both horizontal and vertical and Symons cone crushers. Rolls handle feeds up to 1 or 2 in., make about one-fourth reduction in size and can crush economically down to ¼ or $\frac{1}{16}$ inch. Steam stamps, which are limited to use on the special problem of native copper ore, strike an extremely powerful blow by a steam-driven pestle in a mortar. The feed is 2 or 3 in. in size and the product ¼ or ½ inch. The Symons machines are relatively new but are finding wide application in the field of crushing between 6 or 8 in. feed and around ½ in. product. In the Symons cone, the central gyrating cone is very flat and is overlain instead of surrounded

by the fixed ring. The Symons disc crushers have a wobbling or tipping disc and a fixed disc. At a given instant, a point on the circumference of the wobbling disc is approaching the fixed disc while a point 180° away or diametrically opposite, is receding. This motion progresses around the circle so that in a complete wobble the space between the discs has opened and closed at every point. Many devices have been used for fine crushing or grinding but the more important are gravity stamps, roller mills, grinding pans, ball mills, rod mills, tube mills, Chile edgestone mills, arrastras and hinged hammer mills. The gravity stamp is discussed under AMALGAMATION: *In Metallurgy*. The grinding pan is a modification of the amalgamation pan which is also referred to under Amalgamation. The arrastra or drag-stone mill grinds the ore by dragging flat stones around a circular stone pavement. Roller mills employ cylinders which roll around inside a circular ring and ore is crushed between the rollers and the ring by pressure developed through centrifugal force or springs. Chile mills have heavy horizontal rollers travelling around a circular path. Hinged hammer mills and other forms of beating mills utilize the crushing effect of blows delivered upon the ore in space by arms or blades revolving at very high speed. Ball mills, rod mills and tube mills are horizontal revolving cylinders in which are iron balls, steel rods or flat pebbles to grind the ore as it passes through the cylinder from end to end. These revolving mills are used almost universally in ore dressing for wet fine grinding of ore for tabling and flotation, in gold and silver milling for preparing ore for cyaniding and in reducing all sorts of commercial products wet or dry, even down to impalpable powder. Feed may be as coarse as 1 or 2 in., but ¼ or ½ in. is more economical. Hinged hammer mills are best suited to soft materials. Arrastras are nearly obsolete, as also are grinding pans. Roller mills and Chile mills are no longer used to any extent in ore dressing but find some application in commercial grinding. The use of gravity stamps is confined to gold milling. Fine grinding consumes much power since the power required increases in geometrical ratio with the fineness of the product.

Screens.—To insure a definite maximum size of particle in crushing operations and also to prepare the ore into a series of products for final separation, ranging from coarse to fine, screens are commonly used for wet work above 1 or 2 millimetres. They may be made of parallel bars or grates, of plate with holes punched out or of woven wire cloth. Common types have the form of fixed incline screens, of gently sloping revolving cylindrical screens or trommels, of plane surfaces set nearly horizontal and shaken endwise or sidewise, of horizontal or gently sloping plane surfaces in which the whole screen and frame is given a relatively slow bumping motion, of an inclined woven wire screen which is given a very rapid vibration in a direction perpendicular to the plane of the screen or of an endless travelling belt of woven wire cloth. Fixed inclined screens are used only for coarse work above 1 or 2 in. and belt screens only for fine work below 1 mm. while vibrating screens are the favourite screen to-day for work between 1 mm. and 1½ inches.

Classifiers are used for wet grading of material below 1 or 2 mm. which is the practical limit of wet screening. Hydraulic classifiers consist of a trough with a series of pockets. The ore, carried along by water, is successively subjected to a series of currents of water from pipes. The velocities of these currents decrease in succeeding pockets so that the material discharged from the spigots ranges from coarse heavy particles in the first pocket to fine light particles in the overflow of the last pocket. Box classifiers or spitzkasten use no rising currents but increase the size of successive settling chambers so that finer and finer particles settle out from the horizontal carrying current. Mechanical classifiers employ raking devices which stir up the pulp so that only coarser particles can settle and be raked up an incline and thus removed from the pulp which still contains the finer particles in suspension. Settling tanks and thickeners are large vats in which the water moves extremely slowly so that solids settle out almost completely and are discharged from the bottom while clear water overflows from the top.

Hand Picking is used occasionally to remove either rich material or waste material by hand from a stream of ore on a conveying belt or moving table. The economical minimum limit of hand picking is around 2 inches. Where hammers are used in connection with hand picking to cleave lumps of mixed values and waste, the operation is called cobbing.

Log Washers and Wash Trommels serve to disintegrate certain types of ores such as nodules of iron oxide in a clay matrix. They agitate the mass of ore and water, thus freeing the nodules from the clay and washing away the clay in the overflow at the lower end of the log washer or in the undersize of the trommel.

Jigs are the almost universal machines for separating ore in sizes ranging from 1½ or 2 in. down to $\frac{1}{10}$ inch. In the movable-sieve type the ore on a screen is stratified by moving the screen up and down in water, while in the fixed-sieve or Harz jig a plunger on one side of the partition causes an alternate up and down current through the ore on a fixed sieve. Heavy minerals settle into the bottom layer of the bed, while lighter minerals are in the top layer. These heavy minerals, if fine enough, pass through the sieve into the hutch below and issue from the spigot outlet at the bottom. If too coarse to pass the sieve the concentrates layer is removed continuously by a device known as an automatic discharge. Fresh water is added continuously. A jig may have from one to six cells in series.

Jerking Tables: Wilfley Table.—These tables take up the work where jigs leave off at about $\frac{1}{10}$ in. and may handle graded material down as fine as ¼ millimetre. The Wilfley table represents the original of this type of table and consists of a four-sided plane surface having a slight slope downward. A series of riffles or thin cleats are tacked on a smooth table top and each riffle has its maximum vertical thickness at the right and tapers down to nothing at the left. Ore and water are fed at one end of the upper edge, while wash water is fed along the remainder of the upper edge. The combination of the bumping action moving the ore lengthwise of the table toward the left and of the washing action of the water across the table at right angles to the bump, causes the ore to spread out in the form of a fan with concentrates nearest the upper or wash water side. The concentrates are finally bumped over the end while the tailings are washed over the lower edge.

Vanners and Slime Tables which are suited for finer material (½ mm. maximum) are much less used since the development of the flotation process. The vanner feeds the ore and water on an endless rubber belt. Wash water, together with the slope of the planes and the speed of the belt travel, determines the character of the grain that can pass over the roller and be washed off into the concentrates tank. All other grains of lighter waste mineral are washed down the planes and into the tailings. A revolving type of slime table consists of a flat cone. Ore and water are fed at the centre over one-half of the circle. Light minerals reach the circumference of the table first and are discharged as tailings. Middlings are carried around by the revolution of the table and are washed off by the curved water jet and concentrates are finally removed by strong jets of water from the straight pipe. Many other forms of vanners and fixed and moving slime tables and buddles with various materials to form the separating surface have been used for concentrating fine slimes.

Electro-magnets are in use in most modern mills to remove metallic iron, such as bolts, nuts and broken drills, which has become mixed with the ore during mining. Magnetic separation is also applied where one of the minerals to be separated possesses magnetic properties. Magnets are of many types to operate on different sizes of ore, wet or dry, or to give high or low strength of field.

Dry or Pneumatic Concentrating Devices may be classifiers, jigs or tables. In every case the separation is by specific gravity, and air currents replace water currents as the separating medium. Flotation machines are described under FLOTATION. Other miscellaneous separators based on principles outside of specific gravity, magnetism and flotation, are not of sufficient importance to warrant any description here.

Accessory Apparatus.—In addition to the machinery for crushing, grading and concentrating, an ore dressing plant includes

other apparatus which is absolutely essential even though performing no actual separation. Under such apparatus may be listed storage bins for ore and products; sampling devices; automatic feeders and distributors or dividers; chutes and troughs or launders for dry and wet material; conveyors, of which the belt and pan types are most common; bucket elevators for dry ore or ore with water; centrifugal pumps for water mixed with sand or slime or for water alone; unwatering devices for recovering water; filters for fine concentrates; driers for removing moisture from ore or from concentrates; dust collecting systems; automatic weighing machines.

Complete milling processes are of wide variety according to the nature of the material to be concentrated. Perhaps the simplest process is the treatment of sands and gravels which contain valuable minerals such as gold, platinum and gems. A long trough or sluice is used on the bottom of which are small depressions called riffles in which the heavy values settle. The rough concentrates thus produced are removed or "cleaned up" periodically and are usually further enriched by some finishing treatment such as amalgamation, hand panning, tabling or magnetic separation.

Sulphide ores consisting of gangue mixed with sulphide of a single metal such as of iron as pyrite or of zinc as sphalerite or of lead as galena or of copper as chalcocite, bornite or chalcopyrite, may have the sulphides occurring as relatively large masses in the gangue, in which case the ore is crushed in a series of steps using breakers and rolls or Symons crushers until the sulphide grains are largely freed from the adhering gangue. This size may vary from 1 in. down to 1 mm. according to the ore. The crushed material is next graded by screens and classifiers into one or more coarse sizes for jigs, one or more sand sizes for tables and slimes for flotation. The jigs, tables and flotation each make clean concentrates to be saved and waste tailings to be discarded and usually also a middling product which, if coarse, must be recrushed and retreated or, if fine, needs only retreatment without any crushing. If the sulphides are finely disseminated through the gangue, the ore is crushed down to $\frac{1}{4}$ mm. or finer, using ball mills or rod mills as the last step in crushing and all of it treated by flotation. Occasionally the metals occur, not as sulphides, but as oxides, carbonates or silicates but the process is similar to that for sulphides except that flotation has not yet been found to be applicable to oxidized ores of zinc or iron.

Where ores are complex, that is, containing sulphides of two or more metals, the tendency of modern practice is to discard gravity concentration and separate the different metallic sulphides from one another and from the gangue by differential flotation.

Tin ore in Cornwall contains cassiterite associated with sulphides of other metals, with wolfram and with siliceous gangues. The ore is broken to about 3 in. and hand picked to remove any lumps of clean minerals and the residue is crushed in gravity stamps to about $\frac{1}{2}$ mm. and concentrated by gravity by a rather complex system of jerking tables, vanners and slime tables of various kinds. Wolfram may be removed from the final concentrates by magnets. Sulphides may be separated from cassiterite by flotation as is the common practice on tin ores in Bolivia.

Native copper ores at Lake Superior are crushed in breakers to about 3 in., further reduced in steam stamps to about $\frac{3}{8}$ in. and then graded by hydraulic classifiers into a series of products, usually six. The coarser products are jigged and the finer products are tabled. Coarse middlings are reground in ball mills and retabled. One mill uses flotation for slimes.

Iron is a relatively cheap metal so the concentration of iron ores must be on a large scale and at low cost. If the mineral is magnetite, the process is to crush the ore in breakers and rolls sufficiently to free the mineral and then use low power electromagnets, either wet or dry, to take out the magnetite. On hematite and limonite ores, the concentration of the crushed ore is usually by log washers or similar devices, but sometimes by jigs and tables. Slimes are thrown away without any attempt to recover the iron in them.

Manganese ores containing pyrolusite as the valuable mineral are handled in much the same way as hematite iron ores. For the special problem of the franklinite ores at Franklin, N.J., the ore, after crushing and sizing is run dry over high power Wetherill magnets which take out the franklinite and send the residue to wet jigs and tables which separate oxide and silicate zinc minerals from the waste limestone tailings. The treatment of gold ores is covered elsewhere under AMALGAMATION and CYANIDE PROCESS.

Many non-metallic minerals require concentration which may involve special processes. Serpentine rock containing asbestos is first cobbed and hand picked for coarse masses of solid asbestos. The residue is disintegrated by a form of hammer mill which reduces the rock to sand and liberates the fibre as a fluffy mass which when sent to a screen remains on the screen as oversize, while the sand passes through as undersize. Diamondiferous rock in South Africa is crushed in breakers and rolls, agitated with water in large circular pans to remove light fine waste material and leave a concentrated residue to go to jigs. The diamonds are recovered from the jig concentrates by hand picking on the coarse and greased table on the fine.

Phosphate deposits in hard rock use crushers and log washers or in soft rock or pebble form only log washers. Graphite ores employ crushing and flotation with special electrostatic process for removing mica from the concentrates. Ores of corundum, emery, ilmenite and such like, generally require a combination of gravity treatment on tables followed by further cleaning on magnets.

Coal preparation is a form of ore dressing which is based on the same fundamental principles as ore dressing, but which employs some additional processes and apparatus to meet the needs of the special problem of saving the light weight coal from the heavier slate impurity on a large scale at a low cost and with a minimum loss of coal. (C. E. L.)

OREGON, popularly known as the "Beaver State," is one of the north-western States of the United States of America, lying on the Pacific slope between 42° and 46° 18′ N. lat., and 116° 33′ and 124° 32′ W. longitude. It is bounded on the north by Washington, from which it is separated in part by the Columbia river and in part by the 46th parallel, on the east by Idaho, from which it is separated in part by the Snake river, on the south by Nevada and California and on the west by the Pacific ocean, upon which it has a tidal shore line, omitting islands, of 429 miles. It has an extreme length E. and W. of 375m., and extreme width N. and S. of 290m. and a total area of 96,699 sq.m., of which 1,092 sq.m. are water surface. Spanish, French and Indian sources for the name "Oregon" have been suggested but its definite origin is unknown. The first known use of the word is by Major Robert Rogers in his plans for an exploring expedition to the north-west coast in 1767. He applied it to a river flowing into the Pacific ocean of which he had heard and it was later applied to the Columbia river and then to the entire territory drained by the river. Out of this original territory other States were created until only the present area was left to bear the name.

Physical Features.—The coast of the State extends in a general north and south direction for about 300m. and consists of long stretches of sandy beach broken occasionally by lateral spurs of the Coast Range, forming small bays. Parallel with the coast and with its main axis about 20m. inland is an irregular chain of hills known as the Coast Range. It does not attain a height greater than 4,097ft., but has numerous lateral spurs, especially toward the west.

Several small streams, among them the Nehalem, Coquille, Rogue and Umpqua rivers, cut their way through the Coast Range to reach the ocean. For the northern two-thirds of its length in Oregon, the Coast Range is bordered on the east by the Willamette valley, a region about 200m. long and about 30m. wide, and the most thickly populated portion of the State; here, therefore, the range is easily defined, but in the south, near the Rogue river, it merges apparently with the Cascade and the Sierra Nevada mountains in a large complex group designated as the Klamath mountains, lying partly in Oregon and partly in California, and extending from the northern extremity of the Sierra Nevada to the sea. A number of ridges and peaks bearing special names, such as the Rogue river, Umpqua and Siskiyou mountains, belong to this group. The Cascade mountains, the most important range in Oregon, extend parallel with the coast

and lie about 100m. inland. The peaks of this system are much higher than those of the Coast Range, the highest of them being cones of extinct volcanoes. Mt. Hood (11,225ft.), the highest point in the State, Mt. Jefferson (10,200ft.), the Three Sister Peaks, Mt. Adams, Bachelor mountain and Diamond Peak, all have one or more glaciers on their sides.

The Cascade mountains divide the State topographically into two sharply contrasted parts. West of this range the country exhibits a great variety of surface structure, and is humid and densely wooded; east of the range it consists of a broken tableland, arid or semi-arid, with a general elevation reaching 5,000 feet. This eastern tableland, though really very rugged and mountainous, has few striking topographic features when compared with the more broken area to the west. In the north-eastern part of this eastern plateau lie the Blue mountains, which have an average elevation of about 6,000ft. and decline gradually toward the north. A south-western spur, about 100m. in length, and the principal ridge together enclose on several sides a wide valley drained by the tributaries of the John Day river. Draining the eastern slopes of the Cascade Range for the northern two-thirds of its length and flowing into the Columbia a few miles west of the mouth of the John Day river is the Deschutes river, flowing through a valley less arid than the plateau region to the south-eastward. South-east of the Deschutes river and south of the Blue mountains lies the Great Basin region. In Oregon this area extends from the Nevada boundary northward for about 160m. and embraces an area of about 16,000 sq. miles. All of its streams lose their waters by seepage or evaporation. Many of the mountains within the basin region consist of great faulted crust blocks, with a general north and south trend. One face of these mountains is usually in the form of a steep palisade, while the other has a very gradual slope. Between these ridges lie almost level valleys, whose floors consist partly of lava, partly of volcanic fragmental material, partly of detritus from the bordering mountains.

Some large permanent lakes occupy the troughs between faulted blocks in southern Oregon, among them Malheur and Harney lakes in Harney county, Lake Albert, Warner and Summer lakes in Lake county. All of these are salt and shallow, and shrink to small proportions in the dry season. East of the Steens mountains there is, besides a number of small alkaline lakes, a playa, or mud flat, known as the Alvord Desert, which in the spring is covered with 50 to 60 sq.m. of rain water but a foot or two in depth. In the north-western quarter of the basin, occupying a level tract 150m. long and 30–50m. wide, is the Great Sandy desert. Its surface consists of a thick sheet of pumiceous sand and dust, from which arise occasional buttes and mesas. There are no surface streams even in the wet region, and no potable waters have been found. South-west of the basin and draining the southern third of the eastern Cascade slopes is the Klamath valley and river, containing the Upper and Lower Klamath lakes, much noted for their scenic beauty. Near the north-western boundary of Klamath county is Crater lake, whose surface is 6,239ft. above the sea. This lake lies in a great pit or caldera created by the wrecking in prehistoric times of the volcano Mt. Mazama, which according to geologists once had an altitude of about 14,000ft. above the sea and of 8,000ft. above the surrounding tableland; the upper portion of the mountain fell inward, possibly owing to the withdrawal of interior lava, and left a crater-like rim, or caldera, rising 2,000ft. above the surrounding country. The lake is 4m. wide and 6m. long, has a depth in some places of nearly 2,000ft. and is surrounded by walls of rock from 500 to 2,000ft. high. In spite of its great elevation the lake has never been known to freeze, and though it has no visible outlet its waters are fresh.

East of the Great Basin and the Blue mountains is the region tributary to the Snake river. The southern half, drained by the Owyhee river, is much like the Great Basin, being arid and plain-like in character. North of the Owyhee the chief tributaries of the Snake are the Malheur, Burnt, Powder and Grande Ronde rivers flowing through small but beautiful and fertile valleys.

Climate.—Along the coast the climate is humid, mild and uniform; in the eastern two-thirds of the State, from which the moisture-laden winds are excluded by the high Cascade Range, the climate is dry and marked by great daily and annual ranges of temperature. Along the coast the temperature is never as high as 100° or as low as zero. In the Willamette valley a few degrees may be added to each extreme, but rarely is there freezing weather; flowers bloom at Portland the year round. Along the coast precipitation is 138in. annually; in the valleys east of the Coast Range it varies from about 20in. at the southern end to 45 in. at Portland; along the Columbia valley east of the Cascades, from 10 to 15in.; in the valleys and foothills of the Blue mountains, from 12 to 25in., and, in the plateau region of central and south-eastern Oregon, from 2 to 22 inches. At Portland for 52 years ending 1923 the normal temperature for the summer months was 64° and for the winter months 40°, with extremes of −2° and 102°; average annual rainfall 45·1in., and average annual humidity 74%. In the Columbia river valley east of the Cascades, records for the same period at Walla Walla, Wash., very near the Oregon boundary, show a summer normal of 72° and a winter normal of 35°, with extremes of −17° and 113°; average annual rainfall 17·7in. and average annual humidity 65%.

Government.—Oregon is governed under its original Constitution adopted in 1857, though many amendments have changed it in a number of important respects. This Constitution may be amended: (1) by a majority of the popular vote if the amendment has been passed by a majority vote of the legislature, (2) by direct initiative petition by the people or (3) by a Constitutional Convention, which may not be called, however, unless the law providing for it is approved by popular vote. The legislative power is vested in a legislative assembly of two houses, but limited by the direct action of the people who possess the initiative and referendum. The upper house is composed of 30 senators, and the lower house of 60 representatives (the number in both cases is the maximum allowed by the State Constitution), elected for four and two years respectively. The regular session is held in January of odd-numbered years. A bill not vetoed by the governor in five days becomes a law; if vetoed, it must be re-passed by a two-thirds vote in each house. The governor has a "single item veto" in addition to the general veto.

An amendment to the Constitution, passed in 1902, initiated measures which have become widely known as the "Oregon system." Its distinctive features are: (1) the initiative, (2) the referendum, (3) constitutional amendment by direct action of the voters, (4) direct primary, (5) Corrupt Practices act, (6) presidential preference primary, (7) campaign text-books, (8) the recall. For the initiative 8% of the number voting for justice of the supreme court at the last general election must sign petitions on which the proposed law is printed before it is put upon the ballot at the next election. Five per cent of the voters signing such petitions secure a referendum on any law passed by the legislature, and the legislature may itself refer any law it has approved to the people at the next election for their approval. All public officials are subject to the recall, adopted in 1908. It is rarely put into practice. An important and useful feature of the "Oregon system" is the campaign text-book. In the case of individual candidates the expense is borne partly by the candidates themselves.

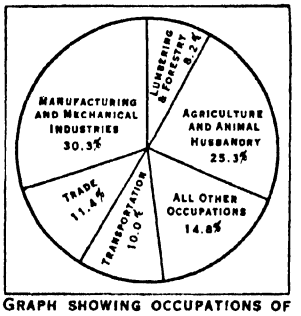
The executive power in Oregon is vested in a governor elected for a four-year term. There is no lieutenant governor. The principal administrative officials of the State, all elected, are the secretary of State, treasurer, attorney general, superintendent of public instruction, dairy and food commissioner, and labour commissioner. A greater number of other administrative officers are appointed by the governor, among them the adjutant general, the State forester, State game warden, State health officer, State librarian, three State highway commissioners and three public service commissioners. A large number of State boards and commissions whose members are appointed are also necessary for the administration of Government, among them the board of control, land board, tax commission, board of education, public service commission, industrial accident commission, water board, parole board, board of health, industrial welfare commission and the Oregon State library.

The administration of justice is entrusted to a supreme court, circuit courts, county courts and justices of the peace. There are

also municipal courts in the cities and several special courts in Multnomah county. There are seven supreme court justices elected for a term of six years. The sessions of the court are held both at Salem and Pendleton. Circuit courts are held in 17 judicial districts, many districts having several justices. The Constitution of Oregon provides that in civil cases three-fourths of a jury may render a verdict. The county court is an administrative, not judicial body, consisting of the county judge and two commissioners. The county judge, however, handles probate and juvenile court matters, in addition to his administrative duties.

Population.—The increase in population in Oregon has been as follows: 90,923 (1870); 174,768 (1880); 317,704 (1890); 413,536 (1900); 672,765 (1910); 783,389 (1920). The estimate of the Federal Census bureau is 902,000 inhabitants in 1928. Between 1900 and 1910 the increase was 62·7%, but between 1910 and 1920 it was only 16·4%. The density increased from 4·3 per sq.m. in 1900 to 8·2 per sq.m. in 1920. In 1920 there were 103,001 persons (13·3%) born in foreign lands. Of the foreign born 21,089 were from Scandinavian countries (Swedes predominating), 16,348 from the United Kingdom and Ireland, 13,774 from Canada, 13,740 from Germany, 6,979 from Russia, 6,050 from Finland, 4,324 from Italy and 4,166 from Switzerland. Other countries were represented by less than 2,000 each. There were in addition to the whites, 2,144 negroes, 4,590 Indians, 3,090 Chinese and 4,151 Japanese in the State in 1920.

Urban and rural populations were very closely balanced in 1920, being 391,019 and 392,370 respectively. In 1910 urban population had represented 45·6% of the entire population. With the exception of Washington and Montana, Oregon had in 1924 the lowest birth rate of any State in the registration area—18·8 births per 1,000. Except for 1922 the infant mortality rate from 1919 to 1924 inclusive was lower than that for any other State in the Union. Only 0·4% of the native whites were illiterate as compared with 5·1% of the foreign born.



GRAPH SHOWING OCCUPATIONS OF MALES OVER 10 YRS. OLD ENGAGED IN GAINFUL OCCUPATIONS, 1920

Portland, the leading city, had in 1925 an estimated population of 282,383. The population of Salem, the capital, was estimated at 19,709. Astoria and Eugene were estimated to contain 16,535 and 11,421 inhabitants respectively. Corvallis, La Grande, Medford, Oregon City, Pendleton, The Dalles, Baker City and Bend were the other cities with a population over 5,000 in 1920.

Finance.—The value of all tangible property in Oregon was estimated in 1912 at $2,057,000,000, and in 1922 at $3,419,000,000. The assessed valuation of taxable property was $1,009,499,000 in 1922 and $1,110,677,000 in 1926. Receipts of the State treasury for the biennium 1924–26 were $79,548,279 and expenditures were $81,710,437. Of this the general fund received $31,417,282 and disbursed $32,090,702. There were a great number of special funds also, most important among them being the highway fund which disbursed $24,236,882 during the biennium, the World War veterans' aid fund disbursing $11,823,348, the industrial accident fund disbursing $5,964,369, and the common school fund disbursing $2,370,946. The general fund is derived largely from a direct property tax, also from fees, licences, and special taxes. The direct property tax for the State general fund amounted to $2,992,518 in 1925, and $3,404,949 in 1926.

Oregon was the first State to levy a tax on gasolene as a means of financing highway construction and maintenance. Fees of the motor vehicle department amounted to $11,337,000 and were also used for highway purposes. The total revenue of the State in 1925 secured by direct and indirect taxation amounted to $24.20 per capita. Expenditures for current expenses amounted to $15.01 per capita; the rest was for permanent improvements.

The total indebtedness of the State in 1926 was $64,171,060, of which $36,677,750 was for highway bonds; $25,000,000 for State veterans' aid, to offset which the State held first mortgages on real property within the State and other assets amounting to $21,254,863.89; $2,043,310 for interest paid on irrigation district bonds on which the State was obligated to act as a guarantor, and $450,000 for farm credits. Provisions were made for the retirement of all these bonds as they came due. County indebtedness in 1926 amounted to $27,217,848, school districts indebtedness to $17,787,365 and city and town indebtedness to $66,950,286.

In 1926 there were 266 banks in the State, 99 of them national banks, with total resources of $342,417,949. Their total deposits Dec. 31, 1926, were $296,533,000 of which $113,776,000 were on savings accounts.

Education.—The school system of Oregon is under the control of a State board of education composed of the governor, secretary of State and the superintendent of public instruction. The progress of education in the State is represented in the following figures: the school enrolment of 134,468 in 1913 increased to 175,510 in 1924 and 185,959 in 1927. High school enrolment increased from 9,000 to 34,719 and 41,258 for the same years. The total cost of education increased from $6,456,638 in 1913 to $19,119,271 in 1924 and $23,783,852 in 1927 while the per capita per pupil attending increased from $55.10 to $122.80 and $141.51.

The average number of days taught increased from 151 per year in 1913 to 161 in 1927, while the number of teachers increased from 5,515 to 7,822. Of the 185,959 pupils enrolled for the year 1926–27, 144,701 were in grade schools and 41,258 in high schools. In that year 15,702 pupils completed the eighth grade and 6,670 were graduated from high school. There were 5,789 grade school teachers and 2,033 high school teachers. There were 2,506 schoolhouses in operation during the year, 1,560 of them one-room schools and 297 two-room schools. The consolidation of schools is making steady progress, thus eliminating the weaker rural schools.

In 1927 there were 107 consolidated schools, with a cost for transporting pupils of $466,404.32. There were 278 high schools in the State in 1927, 78 of which were union schools.

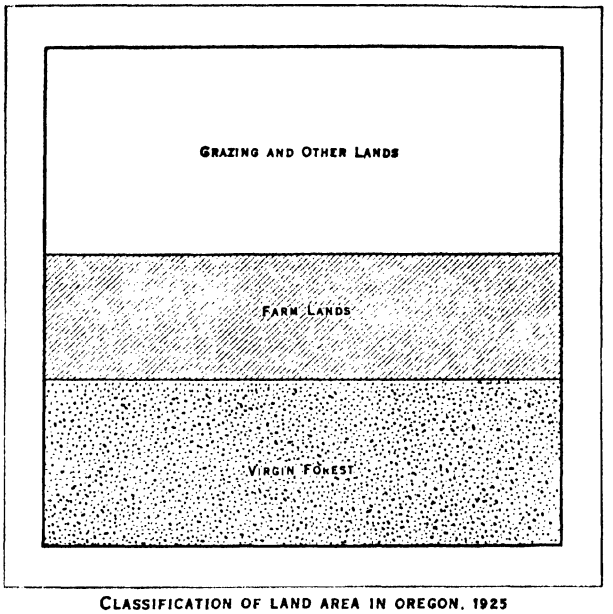
State institutions of higher learning are the State Normal school at Monmouth, the Southern Oregon State Normal school at Ashland, the Oregon Agricultural college at Corvallis, and the University of Oregon at Eugene. The first was the only State normal school until 1925 when the legislature appropriated $175,000 as a special building fund for the Southern Oregon State Normal school and provided an annual tax levy of $\frac{1}{2}$ of a mill for its support and maintenance. It opened in 1926. The Normal school at Monmouth had an average attendance in 1924 of 777 students, but it was unable to meet the demands of the State for trained teachers. Oregon Agricultural college had in 1924–25 an enrolment of 3,158. The distribution was as follows: engineering, 814; agriculture, 452; home economics, 486; commerce, 917; forestry, 112; pharmacy, 157; vocational and educational courses, 220. The Agricultural college also has charge of the eight agricultural experiment stations located at Corvallis, Union, Moro, Hermiston, Talent, Burns, Astoria and Hood River. Its extension service work throughout the State is also of very great importance. The University of Oregon, founded in 1872, had in 1924–25 an enrolment of 2,757 full-time students, though the total enrolment in all departments, including extension work, was 7,522.

Penal and Charitable Institutions.—The Oregon State penitentiary, situated at Salem, is under the control of the governor. Its average daily population increased from 419·8 in the biennium 1922–24 to 499·6 in 1924–26. The prison has the most complete whipping, retting and scutching flax plant in the United States, also a lime plant doing excellent business, and a 43½ac. farm. These industries furnish employment for the prisoners, who are paid a small wage for their labour, and help to support the institution. There is a prison library of 25,000 volumes. Under the direction of the Oregon State board of control are the Oregon State hospital for the insane at Pendleton and similar institutions throughout the State.

Oregon also provides State aid to a number of private charitable institutions in accordance with a law enacted in 1913. Such institutions make application to the board of health and, the application being approved, receive $20 a month for each charity

child under five years of age, and $16 per month for each child over five and under 17 years. The State child welfare commission passes on all petitions for adoptions, and inspects all institutions and maternity homes for which it issues licences.

Agriculture and Live-stock.—Agriculture is the main industry of Oregon. Of 61,188,480ac., the total area of the State, 23·1% or 14,120,000ac. was in farm land in 1925. This represented an



CLASSIFICATION OF LAND AREA IN OREGON, 1925

increase of 578,000ac. over 1920. Public lands still unappropriated and unreserved amounted to 28,583,778ac. in 1925 and 26,872,218ac. in 1926. This represented over five-twelfths of the State. Homesteads in 1925 amounted to 209,085ac. and in 1926 to 144,962 acres. Of the last named, 98,466ac. was for stock-raising only. The number of farms increased from 50,206 in 1920 to 55,910 in 1925; the average acreage per farm decreased from 269·7 to 252·5 during the same years. The value of farm land dropped from $586,242,000 in 1920 to $505,141,430 in 1925 but the value of farm buildings increased from $88,971,000 to $110,927,340. Farms operated by tenants, contrary to the general tendency in the United States, decreased from 18·8% in 1920 to 16·8% in 1925. These statistics reveal that Oregon survived the period of agricultural distress following the World War with more success than most States. The good showing of the figures is due largely to steady production in the dairy and diversified farming valleys west of the Cascades. Dry-land farming suffered a serious post-war setback.

Wheat is the principal crop, the acreage increasing from 890,000ac. in 1924 to 1,026,000ac. in 1926, the production from 14,693,000bu. to 19,586,000bu. and the value from $18,954,000 to $23,503,000. Wheat is raised mainly in eastern Oregon and north along the Columbia river; west of the Cascades farmers find their land too valuable as a rule to devote to the crop. Oats to the amount of 10,560,000bu. valued at $5,386,000 was raised on 320,000ac. in 1925. Barley to the amount of 2,378,000bu. valued at $2,313,000 was raised on 96,000 acres. Indian corn increased in importance, the 1926 yield of 2,475,000bu. grown on 75,000ac. being valued at $2,475,000. The 1921–25 average yield of corn per ac. was 31·5bu., which was higher than that of Missouri, and higher than the 27·8 average of the United States. Hay is second in importance to wheat only. In 1926 2,034,000 tons valued at $21,294,000 were raised on 1,147,000 acres. Of this, 688,000 tons were alfalfa. Potatoes valued at $4,500,000 were raised on 45,000ac. (100bu. per ac.) in 1926.

Oregon is also an important fruit-raising State, and many western valleys are largely given over to the industry, notably the Rogue and the Hood river valleys. Large orchards are found also in the Willamette valley and in the sheltered valleys of the Blue mountains in the north-east. The apple crop in 1925 amounted to 5,400,000bu. valued at $6,750,000 and in 1926 to 8,036,000bu. valued at $5,653,000. There has been a steady increase in pear raising until in 1926 Oregon ranked third among the States with a crop of 2,100,000bu. valued at $1,785,000. There were 384,000bu. of peaches raised in 1926, and large quantities of cherries and plums. A fair estimate of Oregon's 1927 prune crop is 40,000,000 pounds. The crop of strawberries amounted to 6,209,000qt. valued at $682,000.

Irrigation is nowhere necessary west of the Cascade Range but is necessary in eastern Oregon except in a few valleys along the Columbia and in the Blue mountains. There were but 1,925,987ac. included in irrigation enterprises in 1920 as compared with 2,527,208 in 1910. However the acreage actually irrigated increased from 686,000 to 986,000. Capital invested increased from $12,760,214 to $28,929,151, or from $15.36 to $21.52 per acre. The average cost of maintenance was in 1920 $1.19 per ac. as compared with $2.43 for all irrigated land in the United States. Crops grown on irrigated land in 1919 averaged $44.77 per acre.

Great numbers of beef cattle are raised in eastern Oregon, while the Willamette and coast districts are especially favourable to dairying. Cattle of all kinds decreased in number from 796,000 in 1925 to 687,000 in 1927 but increased in value from $28,073,000 to $28,830,000, or from $35.30 to $40.00 per head. Milch-cows and heifers numbered 214,000 in 1927 with an average value of $65.00 per head. Creamery butter production increased from 14,228,000lb. in 1920 to 21,575,000lb. in 1925. Cheese production in that year amounted to 9,923,000lb., giving Oregon third place in rank among the States. The market for the products of the dairying industry is found in the growing cities of the Pacific coast. Eastern Oregon is noted for sheep-raising. The number of sheep decreased from 2,250,000 in 1920 to 1,868,000 in 1923, but increased to 2,226,000 in 1927. Their total value in the same years amounted to $24,035,000, $8,742,000 and $23,092,000 respectively. These figures show the depression in the industry shortly after the World War, but an increase in wool prices in 1924 helped in its rapid recovery. The wool production increased from 14,790,000lb. in 1923 to 18,321,000lb. in 1926 and the value of the crop in that year was $5,514,000. The weight per fleece is generally high, in 1926 averaging 9·3lb. as against 7·8lb. for the entire United States. Swine are slowly increasing in numbers; the 245,000 in 1927 were valued at $3,920,000. Horses decreased in number from 225,000 in 1925 to 201,000 in 1927, and were valued in that year at $12,405,000. Poultry-raising is developing into an important industry.

Mining.—The value of the mineral products of Oregon was $5,496,253 in 1920, $6,054,487 in 1923 and $7,826,711 in 1925. The value of gold, silver, copper and lead produced in Oregon in 1926 was $334,300, a decrease of $96,453 or 22% as compared with the value of these metals produced in 1925. The production of non-metals showed an increase. Oregon supplies its own needs in building stone, 73 plants in 1925 quarrying sandstone, granite, marble and volcanic tuff to the value of $1,858,644. The tuff, occurring over a wide area in eastern Oregon and in parts of western Oregon, has proved especially valuable, for it is easily worked, of pleasing appearance, light in weight yet strong and durable. Sand and gravel valued at $1,998,545 was used in various construction operations in 1925. Clay products of 1925 were valued at $839,286, the State fully supplying its own demands. There is an abundance of materials for making lime and cement and three Portland cement factories, situated at Portland, Ashland and Lime, were in operation. The Coos bay coal-field is the only notable coal producing district in the State. Iron is found in commercial quantities in Columbia and Washington counties. Between 1860 and 1880 the mining of precious metals was a major industry in Oregon, and responsible for the early settlement of many localities; but by 1920 the total value of all metals mined was but $1,541,051 and in 1923 it was only $767,590. In 1926, the output of gold and of silver decreased 28% and 20% respectively, while that of copper and of lead increased 131% and 113% respectively, over 1925. Gold ores

came from eight counties but 88% of all produced was from Baker and Grant counties. Also 90% of all copper ore in the State was produced in these counties.

Fisheries.—The fisheries of Oregon in 1922 employed 5,497 persons, represented an investment of $4,892,576, and produced 22,371,764lb. of fish valued at $1,255,689. In 1923, 4,230 fishermen were employed and the yield was 32,982,678lb. valued at $3,500,171. Of the 1923 catch 27,277,000lb. or about 85% of the total was salmon, valued at $3,057,937.

Forests and Lumbering.—It is Oregon's distinction that within her borders is more standing timber than in any other State. It amounts to about 400,000 million board feet or nearly one-fifth of the supply of the whole United States. Of this, 10,684,883ac. are privately or State owned, while 13,216,240ac. are in the 15 national forests of the State. The national forests include all the higher mountain areas. The backbone of the Cascade Range and its higher slopes from Mt. Hood to California comprises six forests of about 1,000,000ac. each. In the Coast Range are two forests with a combined area of 1,500,000ac. while in the Wallowa and Blue mountains in eastern Oregon are six more totalling some 5,500,000 acres. On the western slopes of the Cascades especially at the lower elevation are some of the finest stands of timber in the world made up of such species as Douglas fir, western hemlock and western cedar. On the east slopes of the Cascades and in the Wallowa and Blue mountains where the climate is much drier the timber is more open, and Ponderosa pine replaces Douglas fir as the chief commercial tree.

Lumber production rose from 2,022,000 board feet in 1919 to 3,966,000 board feet in 1923, and 5,466,500,000 board feet in 1926. In 1926 and 1927 Oregon ranked in output second only to Washington. Of the 4,967,000,000 board feet sawed in 1927 2,803,000,000 were Douglas fir, 1,000,000,000 Ponderosa pine, 725,000,000 hemlock, 125,000,000 Sitka spruce, 105,000,000 red cedar, 100,000,000 Port Oxford cedar, 75,000,000 miscellaneous soft woods, and 35,000,000 hardwoods. Oregon ranked second to Washington in the production of laths and shingles. The lumber industry in all its branches gave employment to about 50,000 men. The value of the cut in 1927 was $105,000,000.

Manufactures.—In the decade 1914–23 the value of Oregon's manufactures more than tripled. There were, in 1914, 2,320 factories employing an average of 28,829 workers, paying $20,932,000 in wages, producing goods valued at $109,762,000, of which $46,504,000 was added by manufacture. In 1923 there were 1,909 establishments, employing 62,655 workers, paying $81,769,000 in wages, producing goods worth $363,715,000 of which $167,794,000 was added by manufacture.

The 1,908 industrial establishments operated in 1925 gave employment to 59,579 wage-earners and had an output valued at $352,948,841. The leading products were those of lumber in the manufacture of which Oregon ranked third among the States. There were, in 1925, 364 sawmills, employing 31,217 workers, producing lumber products valued at $120,570,255. The products next in importance were those of 62 flour and grain mills which were valued at $28,179,224. The products next in value were: butter, cheese and evaporated milk, $17,313,481; slaughtering and meat packing products, $17,215,966; canning and preserving fruits and vegetables, $12,513,211; foundry and machine shop products, $10,581,996; printing and publishing, newspapers and periodicals, $10,406,032; bakery products, $10,102,706; planing mill products, $9,926,417; paper and wood pulp, $9,841,038; furniture, $6,618,614; construction and repair done in steam railway shops, $6,264,468; and canning and preserving fish, oysters, crabs, etc., $5,898,762.

Transportation and Commerce.—The railway mileage of the State increased from 2,413 in 1910 to 4,111 in 1925, of which 754m. were electric roads operated by nine separate companies. The main steam railway lines were those of the Union Pacific, the Southern Pacific, the Great Northern and the Northern Pacific. The Union Pacific crosses the north-eastern corner of the State to the Columbia river, which it follows to Portland. The Southern Pacific owns the main line between Portland and California, crossing the State north and south along the Willamette, across the Umpgua and Rogue river valleys and via the Klamath region. The mileage extension between 1910 and 1927 consisted mainly of branches from the Union Pacific into east-central Oregon from the east, and into west-central Oregon from the north; from the Southern Pacific line to the Pacific coast at Tillamook and Coos bay, and from the Willamette valley to Klamath Falls; and a line owned by the Great Northern from the Columbia river up the Deschutes river to a connection with the Southern Pacific Klamath Falls extension and then by common user to the southern border of the State. The Northern Pacific and the Great Northern by a joint line on the Washington side of the Columbia river provide a water grade to Portland, a terminus of both systems.

The development of the State highway system begun in 1917 has been regularly carried forward: at the beginning of the year 1927 the total mileage was 4,468, of which 3,220m. were surfaced. The total mileage of roads other than State highways was 45,306, of which 7,746m. were surfaced. Expenditures for State highways in 1925 were $15,553,000; the added expenditures of counties, townships and districts brought the year's total to $28,928,000. In 1926 there were 233,568 motor vehicles in Oregon, or 266 per 1,000 population. Receipts for the registration of motor vehicles amounted to $6,018,000; from the three cent gasolene tax, $3,334,000.

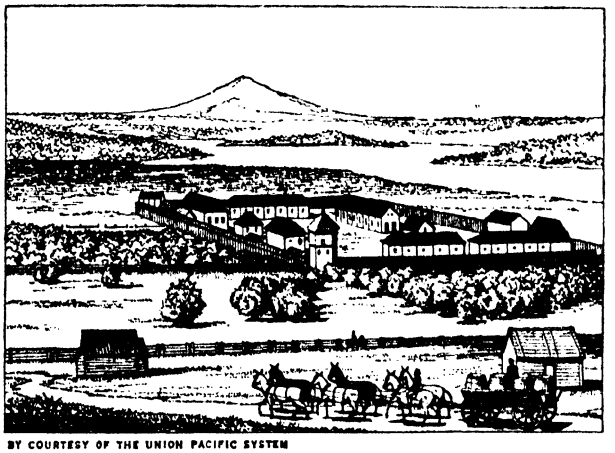
A deep water channel in the Columbia and Willamette rivers makes Portland accessible for ocean-going vessels, and about 70% of water-borne commerce of Oregon in 1926 was carried to or from that port. The total ocean commerce of Oregon in 1926 was 7,117,400 short tons. Of this amount 6,296,683 tons entered or cleared the Columbia river; the water-borne commerce of Portland alone was 4,834,094 tons.

History.—The Spanish pilot, Bartolomé Ferrelo, who in 1543 made the farthest northward voyage along the Pacific coast recorded in the first half of the 16th century, may have sighted the shores of Oregon. So also the famous English captain, Francis Drake, who in 1579 coasted these shores seeking a route home by a north-west passage, is supposed to have reached a point near 43° lat. before giving up the search and turning westward across the Pacific. In 1603 the Spaniards Vizcaino and Aguilar also passed 42° lat., Aguilar claiming to have reached a point of land near 43° which he called Cape Blanco. The Spanish, however, were too interested in the profitable trade between their colonies and the Far East to give much attention to north-west exploration and it was not until 160 years later that the fear of Russian and English encroachment caused them to send out further expeditions. In 1774 Juan Pérez was sent out with orders to proceed to 60° latitude. He turned back at 54° but was the first to sail along the entire coastline of the Oregon country. The following year Bruno Heceta commanded another expedition which near Point Grenville made the first landing in the region. They erected a cross and in formal ceremony took possession for Spain.

The Spaniards made no effort to colonize north-western America or to develop its trade with the Indians, but towards the end of the 18th century the traders of the great British fur companies of the north were gradually pushing overland to the Pacific. Upon the sea, too, the English were not idle. Capt. James Cook in March 1778 sighted the coast of Oregon in the lat. of 44°, and examined it between 47° and 48° in the hope of finding the Straits of Juan de Fuca described in Spanish accounts. Soon after the close of the Revolutionary War American merchants began to buy furs along the north-west coast and to ship them to China to be exchanged for the products of the East. It was in the prosecution of this trade that Capt. Robert Gray (1755–1806), an American in the service of Boston merchants, discovered in 1792 the long-sought river of the west, which he named the Columbia, after his ship. By the discovery of this river Gray gave to the United States a claim to the whole territory drained by its waters.

Land exploration soon followed these discoveries along the coast. Alexander Mackenzie, in the service of the North West Company, in 1793 had explored through Canada to the Pacific coast in lat. about 52° 20′ N., and Meriwether Lewis and William Clark, American explorers acting under the orders of President Jefferson, in 1805–06 had passed west of the Rocky mountains

and down the Columbia river to the Pacific ocean. Both British and American adventurers were attracted to the region by the profitable fur trade. In 1808 the North West Company had several posts on the Fraser river, and in 1810 and 1811 they built others south of the 49th parallel. In 1811, also, the Pacific Fur Company, under the guidance of John Jacob Astor of New York, founded a trading post at the mouth of the Columbia which they



BY COURTESY OF THE UNION PACIFIC SYSTEM

FORT VANCOUVER OF THE HUDSON'S BAY CO. ESTABLISHED IN 1815. AFTER A SKETCH MADE BY STANLEY IN 1854

called Astoria, and set up a number of minor posts on the Willamette, Spokane and Okanogan rivers. On hearing of the war between England and the United States, Astor's associates, deeming Astoria untenable, sold the property in 1813 to the North West Company. The British took formal possession and renamed the post Ft. George.

Soon after the restoration of peace between England and the United States there arose the so-called "north-western boundary dispute" or "Oregon question" which agitated both countries for a generation and almost led to another war. The United States was willing at the time to extend the north-western boundary along the 49th parallel from Lake of the Woods to the Pacific, but to this the British Government would not consent, so in 1818 both nations agreed to a "joint occupation" for ten years of the country "on the north-west coast of America, westward of the Stony (Rocky) mountains." By treaty the following year Spain waived her claim to the territory north of 42° in favour of the United States, and in 1824 Russia likewise agreed to make no settlements south of 54° 40′. In 1827 the agreement of 1818 for joint occupancy by Great Britain and the United States was renewed for an indefinite term, with the proviso that it might be terminated by either party on 12 months' notice.

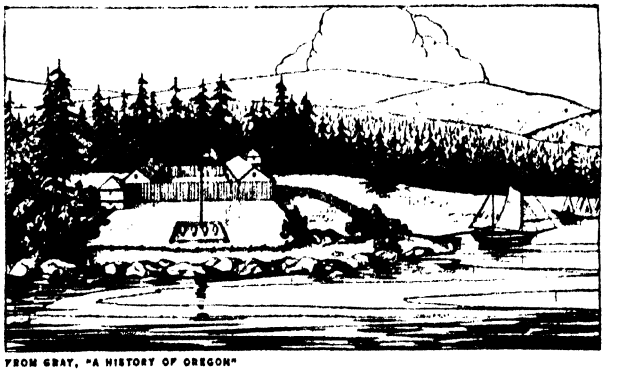
For the next three decades the history of Oregon is concerned mainly with the British fur traders and the American immigrants. The Hudson's Bay Company absorbed its rival, the North West Company, in 1821, and thus secured a practical monopoly of the trade of the Oregon region. Its policy was to discourage colonization so as to maintain the territory in which it operated as a vast preserve. The company sent to the Columbia river as its governor west of the Rocky mountains Dr. John McLoughlin who ruled the vast empire firmly and wisely for 22 years and became affectionately known as the "Father of Oregon." His capital was at Ft. Vancouver which he built on the north bank of the Columbia opposite the mouth of the Willamette river. In 1829 he also built an establishment at the falls of the Willamette which determined the site of Oregon City. Though it was against the company's interests he generously aided the American colonists who later came to the region, and later in life, after American Government was extended over the country, became himself a citizen of the United States.

The elderly employés of the company were urged by McLoughlin, when they wished to retire from active service, to settle with their families in the Willamette valley. There were a number of these first settlers, mostly Frenchmen, there by 1835. In 1834 Jason and Daniel Lee arrived from the United States and founded Methodist missions in the valley. In 1837 20 more missionaries arrived and a branch mission was opened at The Dalles. In 1838 Jason Lee started overland for the States, and his lecturing and preaching not only raised money for the mission but aroused great interest in Oregon, with the result that the American element was increased in 1840 by 50 more arrivals by sea. It now numbered 151. In 1842 the first immigrant train over the Oregon trail, headed by Elijah White and piloted by Thomas Fitzpatrick, arrived. The following was the year of the "Great Migration" when nearly 900 men, women and children likewise followed the trail and settled in the Willamette valley. After this the flow of immigrants steadily increased, about 1,400 arriving in 1844 and 3,000 in 1845.

The American settlers set in motion a movement for the immediate and permanent settlement of the Oregon dispute. They had in 1843 established for themselves a provisional Government, but settlement and business undertakings were held back until their future rulers and the nature of their permanent Government were settled. The western States rallied to their support with the result that the Democratic National convention in 1844 declared the title of the United States to "the whole of the Territory of Oregon" to be "clear and unquestionable," and the party made "Fifty-four forty or fight" a campaign slogan. Upon the success of the party, negotiations were entered into which resulted in a compromise treaty (1846) fixing the boundary between Oregon and British possessions at its present position, and giving the United States complete title to all land to the southward.

Territorial status and a Territorial Government were delayed until 1848 owing to opposition from the slavery element in Congress. As then constituted the Territory included the present States of Oregon, Washington, Idaho and parts of Montana and Wyoming. Its area was reduced in 1853 by the creation of the Territory of Washington. The discovery of gold in California drew many Oregon settlers to that country in 1848–50, but this exodus was soon offset as a result of the enactment by Congress in 1850 of the "Donation Land Act" by which settlers in Oregon were entitled to large tracts of land free of cost. The number of claims registered under this act was over 8,000.

In 1857 the people voted for Statehood; in the same year a Constitutional Convention drafted a Constitution which they adopted in November, and on Feb. 14, 1859, Oregon was admitted into the Union with its present boundaries. Gold had been discovered in paying quantities at Jacksonville in southern Oregon in 1815, and in 1861 was discovered in eastern Oregon along the John Day and Powder rivers. Each of these discoveries resulted in a stampede which settled a region which otherwise would have been settled very slowly. The increase of mining population in Oregon and Idaho encouraged agricultural development in that it provided markets. Permanent settlements were made in all the important valleys of eastern Oregon in the '60s. By 1870 the population of the State was 91,000. In the next 20 years it nearly doubled. This increase was due largely to the opening of railroad



FROM GRAY, "A HISTORY OF OREGON"

THE SETTLEMENT OF ASTORIA, OREGON, IN 1811, FOUNDED BY JOHN JACOB ASTOR AT THE HEAD OF THE COLUMBIA RIVER

connections with the outside world. Two lines, one on each side of the Willamette river, to connect with a line in California, were begun in 1868, but progress was so slow that the connection was not made until 1884. Meanwhile a line had been built up the Columbia river to meet the northern transcontinental lines being built west through Idaho, and this junction was effected in 1883. Many local lines were also built. During this period grazing spread over eastern Oregon, and developments in other industries began which later decades were merely to expand and enlarge.

The political complexion of the State has been generally Republican, although the contests between the two leading parties were often very close. Since the admission of Oregon into the Union up to 1928 there had been seven Democratic and nine Republican governors, but in only two instances did the State's electoral vote go to the Democratic presidential nominee.

BIBLIOGRAPHY.—The reports of the various State departments and State officials are invaluable for up-to-date general and specific information. Consult also the *Oregon Blue Book*, published biennially by the secretary of State; *The Mineral Resources of Oregon*, published irregularly, 1914 *et seq.*, by the Oregon Bureau of Mines and Geology; *The National Forests of Oregon*, published (1923); by the U.S. Department of Agriculture; forest service. For Government: G. L. Reed, *Where the People Rule; or the Initiative and Referendum, direct primary law and the recall in use in the State of Oregon* (San Francisco, 1914); H. B. Augur, *Government in Oregon* (1919); C. H. Carey, *The Oregon Constitution* (Salem, 1926). For history: W. H. Gray, *History of Oregon, 1792–1849* (Portland, 1870); H. H. Bancroft, *History of the Northwest Coast* (San Francisco, 1884), and *History of Oregon* (San Francisco, 1886–88); *Quarterly of the Oregon Historical Society* (1900 *et seq.*); H. S. Lyman, *History of Oregon* (1903), the best complete history of the State; F. V. Holman, *Dr. John McLoughlin, the Father of Oregon* (Cleveland, 1907); C. H. Carey, *History of Oregon* (Portland, 1922); J. B. Horner, *A Short History of Oregon* (Portland, 1924); H. W. Scott, *History of the Oregon Country* (1924); P. J. De Smet, *Oregon Missions* (various editions); J. H. Gilbert, "Trade and Currency in Early Oregon," *Columbia Univ. Studies in Economics* (vol. xxvi. No. 1, 1907); Julian Hawthorne, *The Story of Oregon* (1892); A. Atwood, *The Conquerors* (1907); T. T. Geer, *Fifty Years in Oregon* (1912); George H. Putnam, *In the Oregon Country* (1915); D. Murphy, *Oregon the Picturesque* (Boston, 1917); W. D. Lyman, *The Columbia River* (1917); A. D. Pratt, *A Homesteader's Portfolio* (1922); Washington Irving, *Astoria* (various editions). For bibliography consult C. W. Smith, *Checklist of Pacific Northwest Americana* (1921). (E. B. P.)

OREGON CITY, a city of Oregon, U.S.A., on the east bank of the Willamette river, 12 m. S. by E. of Portland; the county seat of Clackamas county. It is on the Pacific highway, and is served by the Southern Pacific, the Willamette Valley Southern, and electric railways, and motor-coach lines. Pop. (1920) 5,686 (87% native white); 1928 local estimate 7,000. The river here makes a plunge of 40 ft. over a basalt ridge, and then flows between steep walls of solid rock 20 to 50 ft. high. The abundant water-power is used for the manufacture of lumber, paper and pulp, flour, woollen fabrics and various other commodities. Next to Astoria, Oregon City is the oldest settlement in the State. In 1829 Dr. John McLoughlin, chief agent of the Hudson's Bay Company, established a claim to the water-power at the falls and to land where the city now stands, and began the erection of a mill and some houses. In 1840 he laid out a town and named it Oregon City, but his claim was disputed by a Methodist mission, and in 1850 Congress gave a great part of his claim for the endowment of a university. The Oregon legislature in 1862 restored the land to McLoughlin's heirs. The city was chartered in 1850. In 1924 a commission-manager form of government was adopted.

OREGON-GRAPE (*Mahonia Aquifolium*), a North American evergreen shrub of the family of Berberidaceae, closely allied to the barberry (*q.v.*), found from British Columbia to California and eastward to New Mexico. It grows from 3 to 6 ft. high and bears large pinnate leaves composed of five to nine thick, spiny-toothed, somewhat holly-like leaflets, bright yellow flowers in erect racemes, followed by showy clusters of small blue berries. The plant is the floral emblem or State flower of Oregon, and is widely grown as an ornamental.

OREGON MYRTLE (*Umbellularia californica*), a North American tree of the laurel family (Lauraceae), called also California laurel, native to Oregon and California. It attains a height of 90 ft. and a trunk diameter of 5 ft., and bears lance-shaped, fragrant leaves, greenish-yellow flowers, in small clusters, and a somewhat olive-like, dark purple fruit (drupe). It yields one of the most valuable cabinet woods produced in the Pacific States. (*See* LAURACEAE.)

OREGON PINE: *see* DOUGLAS FIR.

OREGON TEA-TREE (*Ceanothus sanguineus*), a name given to a large shrub of the buckthorn family (Rhamnaceae), called also buck-brush, native from northern California to British Columbia and eastward to Montana. It grows about 10 ft. high and bears reddish branchlets, thin, smooth, ovate, toothed leaves, and compound clusters, 2 to 4 in. long, of small white flowers. As in case of the New Jersey tea (*q.v.*), its leaves have been used as tea. (*See* CEANOTHUS.)

OREGON TRAIL: *see* OLD OREGON TRAIL.

O'REILLY, JOHN BOYLE (1844–1890), Irish-American politician and journalist, was born near Drogheda on June 28, 1844, the son of a schoolmaster. After some years of newspaper experience, during which he became an ardent revolutionist and joined the Fenian organization known as the Irish Republican Brotherhood, he enlisted in 1863 in a British cavalry regiment with the purpose of winning over the troops to the revolutionary cause. At this period wholesale corruption of the army, in which there was a very large percentage of Irishmen, was a strong feature in the Fenian programme, and O'Reilly was successful in disseminating disaffection in his regiment. In 1866 the extent of the sedition in the regiments in Ireland was discovered. O'Reilly was tried by court-martial and sentenced to be shot, but the sentence was commuted to 20 years' penal servitude. After confinement in various English prisons, he was transported in 1867 to Bunbury, Western Australia. In 1869 he escaped to the United States, and settled in Boston, where he became editor of *The Pilot*, a Roman Catholic newspaper. He subsequently organized the expedition which rescued all the Irish military political prisoners from the Western Australia convict establishments (1876). He was the author of several volumes of poetry, and of a novel of convict life, *Moondyne*. He died in Hull, Mass., on Aug. 10, 1890.

See J. J. Roche, *Life of John Boyle O'Reilly* (Boston, 1891).

OREL or **ORLOV,** a province of the Russian S.F.S.R., surrounded by those of Bryansk, Kaluga, Tula, Tambov, Voronezh and Kursk. Area 29,973 square kilometres. Pop. (1926) 1,883,423. The province is much smaller than the pre-1917 province of the same name, Bryansk being now a separate province. Orel forms part of the recently constituted Black Earth Area (Central). The province consists mainly of dissected plateau, drained by the Oka and its tributaries, flowing into the Volga, and the Sosna. On the water-partings between the streams, the Kurgans or artificial mounds, some containing burials and some being remains of earthworks, stand out sharply. In the Bolkhov and Dmitrov districts, the soil is podzol (*see* RUSSIA: *Soils*), but the rest of the province is covered with black earth. The forests have practically all disappeared and there is a great scarcity of wood and of fuel. For climate, the difficulties of agriculture and general social conditions *see* VORONEZH. Average January temperature 14·8°, average July 67°.

The chief crops in 1926 were rye, oats, potatoes, millet and hemp. Very little wheat or sunflower seed is grown. Cattle, sheep and pigs are bred; in pre-World-War times Orel was noted for horse breeding, but their numbers diminished greatly owing to war requisitions and they are slow to recover. Livensk and Malo-archangel have however recovered their former position as regards horse breeding. Factory industries include the making of chemical manure from the phosphorites of the province, iron-mining and smelting in the Zinoviev district, near Dmitrovsk, and at Elets, flour-milling, distilling, leather and chalk. Koustar (peasant) industries include the making of ploughs, rope, makhorka tobacco, carpets, and, in the Elets district, lace. The province suffered much during the Civil War 1917–20, and Elets changed hands several times. The chief towns are Orel and Elets.

In the 9th century a Slav tribe, the Vyatichis, was established on the Oka river and paid tribute to the Khazars. They recognized the rule of Rurik from 884 and were later absorbed in the principality of Chernigov. Their wealthy towns and villages were

devastated by the Mongols in 1239–42 and the region was reduced to poverty. The Russians erected forts and established colonies in the 16th century. In 1610 Orel then known as the Ukrayna or Ukraine (*i.e.*, "border region") was the scene of civil warfare under the false Demetrius. From 1917 to 1920 it was again the scene of civil struggles.

Orel, the chief town of the above province, situated at the confluence of the Orlik with the Oka river, and at the junction of roads and railways linking it with Moscow, Bryansk, Kharkov and the east, in 53° N., 36° 8′ E. Pop. (1926) 75,698.

O'RELL, MAX, the *nom-de-plume* of PAUL BLOUET (1848–1903), French author and journalist, was born in Brittany in 1848. He is chiefly remembered for his once famous book, *John Bull et son Ile.* He died in Paris, on May 25, 1903.

ORELLANA FRANCISCO DE (*c.* 1490–*c.* 1546), Spanish soldier, and first discoverer of the Amazon, was born at Truxillo about 1490. He sailed for Peru in 1535, and in 1540–41 accompanied Pizarro's expedition from Quito to Napo in the capacity of lieutenant. Early in 1541 he was sent ahead of the main party to obtain provisions, but he deserted his charge, either from necessity or choice, and continued his journey down the Rio Napo to the valley of the Amazon, whose course he explored from its source in the Andes to the Atlantic; he reached the coast in Aug. 1541. He is reported to have encountered a tribe of female warriors, of whom he had been told by the Indians, and from whom the name of the river is derived. On his return to Spain he was granted the right to conquer the newly discovered lands, but an expedition, undertaken in 1544 for this purpose, met with little success. Orellana died, probably in Venezuela, about 1546.

See "The Voyage of Francisco de Orellana down the River of the Amazons," trans. C. R. Markham, from A. de Herrera's *Historia general de las Indias occidentales* (Hakluyt Society *Publications*, vol. xxiv., 1859).

ORELLI, JOHANN CASPAR VON (1787–1849), Swiss classical scholar, was born at Zürich on Feb. 13, 1787. His cousin, JOHANN CONRAD ORELLI (1770–1826), was the author of several works in the department of later Greek literature. From 1807 to 1814 Orelli worked as preacher in the reformed community of Bergamo and published *Contributions to the History of Italian Poetry* (1810) and a biography (1812) of Vittorino da Feltre, his ideal of a teacher. In 1814 he became teacher of modern languages and history at the cantonal school at Chur (Coire); in 1819, professor of eloquence and hermeneutics at the Carolinum in Zürich, and in 1833 professor at the new university, the foundation of which was largely due to his efforts. He had already published (1814) an edition, with critical notes and commentary, of the *Antidosis* of Isocrates. The three works upon which his reputation rests are the following. (1) A complete edition of Cicero in seven volumes (1826–38). (2) The works of Horace (1837–38; 4th ed., 1886–92). (3) *Inscriptionum Latinarum Selectarum Collectio* (1828; revised edition by W. Henzen, 1856). His editions of Plato (1839–41, including the old scholia, in collaboration with A. W. Winckelmann) and Tacitus (1846–48, new ed. by various scholars, 1875–94) also deserve mention. Orelli died at Zürich on Jan. 6, 1849.

See *Life* by his younger brother Conrad in *Neujahrsblatt der Stadtbibliothek Zürich* (1851); J. Adert, *Essai sur la Vie et les Travaux de J.C.O.* (Geneva, 1849); H. Schweizer-Sidler, *Gedächtnissrede auf J.C.O.* (Zürich, 1874); C. Bursian, *Geschichte der klassischen Philologie in Deutschland* (1883).

ORENBURG, a province of the Russian S.F.S.R., consisting mainly of the former Orenburg and Orsk districts of the much larger pre-1914 province of the same name. Area 57,201 sq. km. Pop. (1926) 674,199. It is a narrow strip lying between Bashkiria on the north and Kazakstan on the south, widening out to the east and west. The province is hilly, except for the valleys of the Ural river and its tributaries, the Sakmara and the Or. It belongs to the region of perennial drought and dry and desert steppe: the soils are chestnut-brown clays and sands with salt efflorescences, on which crops can be raised successfully if drought is not too severe and if careful attention is paid to manuring and to the type of cultivation. Some fertile black earth occurs in the valleys. The average January temperature is 3·4° F. July 70·9° F, average rainfall 15·2 inches. Coal and rich layers of rock salt are found near Iletsk, in the south of the province and phosphorite exists. The peasants are specially skilled in the preparation of leather and the women knit the famous Orenburg goats' wool shawls.

The district lies on the border region between the territory of the Bashkirs and that of the Kirghiz; the Bashkirs were brought under Russian rule in 1557, and the fort of Ufa was built to protect them from Kirghiz raids. The frequent risings of the Bashkirs and the raids of the Kirghiz led the Russian government in the 18th century to erect a line of forts and blockhouses on the Ural and Sakmara rivers, which were afterwards extended southwestwards towards the Caspian and eastwards towards Omsk, and Orenburg became the central point of these military lines.

ORENBURG, the chief town of the province of Orenburg, situated on the Ural river in 51° 46′ N., 55° 7′ E. Pop. (1926) 121,975. The opening of the Orenburg-Tashkent railway in 1905 greatly increased its importance, and it has an important railway workshop for this line. Its industries include the making of metal goods and bricks, saw-milling and brewing. Trading caravans from the Central Asiatic Republics bring carpets, silk, cotton, lambskin, wool and dried fruits to Orenburg to exchange against textiles, metal goods, and other products of European Russia. Cattle, horses and sheep from the steppe lands are brought to its market, and animal products including frozen meat, hides, sheepskins, tallow and bristles are sent by rail to Samara and the west. Its population is mixed and includes Russians, Tatars, Kirghiz and Bashkirs, among others. In 1735 a fort was erected at the confluence of the Or and Ural rivers as an outpost of Russia against the Bashkirs and Kirghiz, and was called Orenburg. In 1740-43, the fortress was moved 120 m. down the Ural river to its present position and the former Orenburg was re-named Orsk. Heavy fighting occurred here after the 1917 revolution, and in that year its population was swollen to 140,588 by refugees. During the famine of 1920–1, the town suffered severely and the population dropped proportionately.

ORENDEL, a Middle High German poem, of no great literary merit, dating from the close of the 12th century. The story is associated with the town of Treves (Trier), where the poem was probably written. The introduction narrates the story of the Holy Coat, which, after many adventures, is swallowed by a whale. Orendel, son of King Eivel of Treves, who had embarked with 22 ships in order to woo the lovely Brida, the mistress of the Holy Sepulchre, is wrecked, and falls into the hands of the fisherman Eise, in whose service he catches the whale and recovers the Holy Coat. The poem exists in a single ms. of the 15th century, and in one printed version dated 1512. It has been edited by von der Hagen (1844), L. Ettmüller (1858) and A. E. Berger (1888); there is a modern German translation by K. Simrock (1845).

See H. Harkensee, *Untersuchungen über das Spielmannsgedicht Orendel* (1879); F. Vogt, in the *Zeitschrift fur deutsche Philologie*, vol. xxii. (1890); K. Müllenhoff, in *Deutsche Altertumskunde*, vol. i. (2nd ed., 1890), pp. 32 *seq.*; and R. Heinzel, *Über das Gedicht von König Orendel* (1892).

ORENSE, an inland province of north-western Spain, formed in 1833 of districts previously included in Galicia, and bounded on the north by Pontevedra and Lugo, east by Leon and Zamora, south by Portugal, and west by Portugal and Pontevedra. Pop. (1920) 412,460; area 2,694 sq.m. The surface of the province is almost everywhere mountainous. Its western half is traversed in a south-westerly direction by the river Miño; the Sil, a left-hand tributary of the Miño, waters the north-eastern districts; and the Limia rises in the central mountains and flows west-south-west, reaching the sea at the Portuguese port of Viana do Castello. The railway from Monforte to Vigo runs through the province. There are iron foundries. The chief towns are Orense (*q.v.*), Allariz (9,043), Carballino (9,541), Viana del Bollo (8,045), Nogueira de Ramun (8,201), Boborás (7,239), Cartelle (7,200) and La Vega (6,027). Eighteen other towns have over 5,000 inhabitants.

ORENSE, an episcopal see and the capital of the Spanish province of Orense, on the left bank of the river Miño, and on the Tuy-Monforte railway. Pop. (1920), 17,581. The river is

here crossed by one of the most remarkable bridges in Spain. It was built by Bishop Lorenzo in 1230, but has frequently been repaired. The image of El Santo Cristo in the Gothic cathedral is celebrated throughout Galicia. The warm springs known as Las Burgas, attract many summer visitors; the waters were well known to the Romans, as their ancient names, Aquae Originis, Aquae Urentes, or perhaps Aquae Salientes, clearly indicate. They named Orense Aurium, probably from the alluvial gold found in the Miño valley. Chocolate and leather are manufactured, and there are saw-mills, flour-mills and iron-foundries.

OREODON (*i.e.*, "hillock-tooth"), an Oligocene genus of North American primitive ruminants related to the camels, and typifying the family *Oreodontidae*. Typical Oreodonts were long-tailed, four-toed, partially plantigrade ruminants with sharp-crowned crescentic molars, of which the upper ones carried four cusps, and the first lower premolar, canine-like both in shape and function. *See* TYLOPODA.

ORESTES, in Greek legend, son of Agamemnon and Clytaemestra. According to the Homeric story he was absent from Mycenae when his father returned from the Trojan War and was murdered by Aegisthus. Eight years later he returned from Athens and revenged his father's death by slaying his mother and her paramour (*Odyssey*, iii. 306; xi. 542). For later forms of the legend of his return, *see* ELECTRA.

In post-Homeric writers, Orestes, after the deed, is pursued by the Erinyes (*q.v.*). He takes refuge in the temple at Delhi. Apollo sends him to Athens to plead his cause before the Areopagus. The Erinyes demand their victim; he pleads the orders of Apollo; the votes of the judges are equally divided, and Athena gives her casting vote for acquittal. The Erinyes are propitiated by a new ritual, in which they are worshipped as Eumenides (the Kindly), and Orestes dedicates an altar to Athena Areia. According to Euripides, some of the Erinyes were not satisfied, so Orestes was ordered by Apollo to go to Tauris, carry off the statue of Artemis which had fallen from heaven, and bring it to Athens. He repairs to Tauris with Pylades, the son of Strophius and the intimate friend of Orestes, and the pair are at once imprisoned by the people, among whom the custom is to sacrifice all strangers to Artemis. The priestess of Artemis, whose duty it is to perform the sacrifice, is his sister Iphigeneia (*q.v.*). A recognition is brought about, and all three escape together, carrying with them the image of Artemis. After his return to Greece, Orestes took possession of his father's kingdom of Mycenae, to which were added Argos and Laconia. To gain possession of Hermione, whom Neoptolemus had married, he murdered the latter at Delphi. He is said to have died of the bite of a snake. The development of the legend is the result (*a*) of the post-Homeric horror of bloodshed (Erinyes; to Homer, Orestes does nothing which is not entirely admirable); (*b*) of the growing interest in cases of conscience (conflict of the duty of revenge and the sacredness of his mother's person); (*c*) of the development of modern ideas of ethics and jurisprudence (the Areopagus consider motive and mitigating circumstances, instead of merely regarding the act); (*d*) of the replacement of blood-feud by State intervention and formal trial.

See Jebb, introduction to Sophocles, *Electra;* Höfer in Roscher's *Lexikon*, art. "Orestes." (H. J. R.)

ORFE or **GOLDEN ORFE,** a variety, originating in Germany, of the ide (*Idus idus*), one of the *Cyprinidae* and allied fairly closely to the roach (*q.v.*).

ORFILA, MATHIEU JOSEPH BONAVENTURE (1787–1853), French toxicologist and chemist, was by birth a Spaniard, having been born at Mahon in Minorca on April 24, 1787. After studying medicine at the universities of Valencia and Barcelona, he settled in Paris to study under the chemist L. N. Vauquelin. In 1811 he graduated and immediately became a private lecturer on chemistry in the French capital. In 1819 he was appointed professor of medical jurisprudence, and four years later he succeeded Vauquelin as professor of chemistry in the faculty of medicine at Paris. In 1830 he was nominated dean of that faculty. He died in Paris on March 12, 1853. Orfila's fame rests on his *Traité des poisons*, or *Toxicologie générale* (1813).

ORFORD, ROBERT WALPOLE, 1ST EARL OF (1676–1745), generally known as SIR ROBERT WALPOLE, prime minister of England from 1721 to 1742, third son of Robert Walpole, M.P., of Houghton in Norfolk, was born at Houghton on Aug. 26, 1676. He was an Eton colleger from 1690 to 1695 and was admitted at King's College, Cambridge, as scholar on April 22, 1696. At this time he was destined, as a younger son, for the church, but the death of two elder brothers made him heir to an estate producing about £2,000 a year, whereupon he resigned his scholarship and was withdrawn from the university.

Walpole sat in parliament at first for the family borough of Castle Rising (1701) and then for King's Lynn, which he represented until he was raised to the peerage. In June 1705 he was appointed one of the council to Prince George of Denmark, the inactive husband of Queen Anne, and then lord high admiral of England. On Feb. 25, 1708, he succeeded Henry St. John as secretary at war, and was thus brought into immediate contact with the duke of Marlborough and the queen. With this post he held for a short time (1710) the treasurership of the navy, and was admitted to the inmost councils of the ministry. He could not dissuade Godolphin from the impeachment of Sacheverell, and when the committee was appointed in Dec. 1709 to draw up the impeachment Walpole was nominated one of the managers for the House of Commons. Walpole shared in the general wreck of the Whig party, and in spite of the flattery, followed by the threats, of Harley he took his place with his friends in opposition. Both in debate and in the pamphlet press he vindicated Godolphin from the charge of peculation, and in revenge for his zeal his political opponents brought against him an accusation of personal corruption. On these charges he was in 1712 expelled from the House and spent a short time in the Tower. His prison cell became the rendezvous of the Whigs, while his praises were sung in popular ballads. In the last parliament of Queen Anne he defended Sir Richard Steele against the attacks of the Tories.

After the accession of George, the Whigs for nearly half a century retained the control of English politics. Walpole, who had supported the Hanoverian succession, obtained the lucrative post of paymaster-general of the forces in the administration which was formed under the nominal rule of Lord Halifax, but of which Stanhope and Townshend were the guiding spirits. Walpole was chairman of the committee appointed to inquire into the acts of the late ministry, and especially into the Peace of Utrecht, with a view to the impeachment of Harley and St. John. Halifax died on May 19, 1715, and after a short interval Walpole became first lord of the treasury and chancellor of the exchequer (Oct. 11, 1715). Jealousies, however, prevailed among the Whigs, and the German favourites of the new monarch quickly showed their discontent with the heads of the ministry. Townshend was forced to resign his secretaryship of state for the viceroyalty of Ireland, but he never crossed the sea to Dublin, and the support which Sunderland and Stanhope, the new advisers of the king, received from him and from Walpole was so grudging that Townshend was dismissed from the lord-lieutenancy (April 9, 1717), and Walpole on the next morning withdrew from the ministry. They plunged into opposition with unflagging energy, and in resisting the measure by which it was proposed to limit the royal prerogative in the creation of peerages (March–Dec. 1718) Walpole exerted all his powers. This display of ability brought about a partial reconciliation of the two sections of the Whigs. To Townshend was given the presidency of the council, and Walpole re-assumed the paymastership of the forces (1720).

On the financial crash which followed the failure of the South Sea scheme, Walpole was regarded by the general public as the indispensable man. Stanhope and James Craggs, the two secretaries of state, died, John Aislabie, the chancellor of the exchequer, was committed to the Tower, and Sunderland, though acquitted of corruption, was compelled to resign. Walpole, at first lord of the treasury and chancellor of the exchequer (April 1721), became with Townshend responsible for the government (though for some years they had to contend with the influence of Carteret), the danger arising from the panic in South Sea stock was

averted by its amalgamation with Bank and East India stock, and during the rest of the reign of George I. they remained at the head of the ministry. The hopes of the Jacobites, which revived with these financial troubles, were disappointed. Atterbury, their boldest leader, was exiled in 1723; Bolingbroke sued for pardon, and was permitted to return to his own country. Peace was assured by a treaty between England, Prussia and France concluded at Hanover in 1725.

In 1727 George I. died, but the confidence which the old king had reposed in him was renewed by his successor, after a brief period of coldness, and in Queen Caroline the Whig minister found a faithful and lifelong friend. For three years he shared power with Townshend, but quarrelled with him in 1730, and Townshend retired into private life. Walpole's administration was based on two principles, sound finance at home and freedom from the intrigues and wars which raged abroad. On the continent congresses and treaties were matters of annual arrangement, and England enjoyed many years of peace. Walpole's influence received a serious blow in 1733. The enormous frauds on the excise duties forced themselves on his attention, and he proposed to check smuggling and avoid fraud by levying the full tax on tobacco and wine when they were removed from the warehouses for sale. His proposals met with violent opposition, and had to be dropped. Several of his most active antagonists were dismissed from office or deprived of their regiments, but their spirits remained unquenched, as the incessant attacks in the *Craftsman* showed, and when Walpole met a new House of Commons in 1734 his supporters were far less numerous. The Gin Act of 1736 led to disorders in the suburbs of London; and the imprisonment of two notorious smugglers in the Tolbooth at Edinburgh resulted in the Porteous riots described in the *Heart of Midlothian*. These events weakened Walpole's influence in the country, but his parliamentary supremacy remained unimpaired, and was illustrated in 1737 by his defeat of Sir John Barnard's plan for the reduction of the interest on the national debt, and by his passing of the Playhouse Act, for the regulation of the London theatres.

That year, however, heralded his fall from power. His constant friend Queen Caroline died on Nov. 20, 1737, and Frederick, prince of Wales, whose request for an increase in his official allowance had been refused, became his active opponent. The prince controlled many boroughs within the duchy of Cornwall, and he attracted Pitt, the Grenvilles and others to his cause. The leading orators of England thundered against Walpole in the House of Commons, and the press resounded with the taunts of the poet and pamphleteer, illustrious and obscure, who found abundant food for their invectives in the troubles with Spain over its exclusive pretensions to the continent of America and its claim to the right of searching English vessels. Walpole long resisted the pressure of the opposition for war, but at the close of 1739, as the king would not allow him to resign, he was forced into hostility with Spain. The Tory minority known as "the patriots" had seceded from parliament in March 1739, but at the commencement of the new session, in Nov. 1739, they returned to their places with redoubled energies. The successes of the troops brought little strength to Walpole's declining popularity, and in the new House of Commons of 1741 political parties were almost evenly balanced. Their strength was tried immediately on the opening of parliament. Walpole was defeated. On Feb. 9, 1742 he was created earl of Orford, and two days later he ceased to be prime minister. A committee of inquiry into the conduct of his ministry for the previous ten years was ultimately granted, but its deliberations came to nothing. Walpole died at Arlington Street, London, on March 18, 1745, and was buried at Houghton on March 25. With the permanent places, valued at £15,000 per annum, which he had secured for his family, and with his accumulations in office, he had rebuilt the mansion at great expense, and formed a gallery of pictures within its walls at a cost of £40,000, but the collection was sold by his grandson for a much larger sum in 1779 to the empress of Russia.

Walpole was twice married—in 1700 to Catherine Shorter (d. 1737) and in March 1738 to Maria Skerret.

Sir R. Walpole's life has been written by Archdeacon William Coxe (1798 and 1800, 3 vols.), A. C. Ewald (1878) and John Viscount Morley (1889). *See* also *Walpole, a Study in Politics*, by Edward Jenks (1894); *English Hist. Rev.* xv., 251, 479, 665, xvi., 67, 308, 439 (his foreign policy, by Basil Williams); *Bolingbroke*, by Walter Sichel (1901–02, 2 vols.); the histories, letters and reminiscences by his son, Horace Walpole; and the other lives of the chief political personages of the period.

ORFORD, a small town of Suffolk, England, 16 m. N.E. of Ipswich. Pop. (1921) 818. It lies by the right bank of the river Alde, here confined by a storm beach, near the promontory of Orford Ness. The Decorated church of St. Bartholomew retains a ruined Norman chancel. Of Orford castle the keep remains; it is built of Caen stone and flintwork, and is of Norman date.

ORGAN, in music, the name given to the well-known wind instrument (from Gr. *ὄργανον*, Lat. organum, instrument).

EARLY HISTORY

The earliest authentic records of the organ do not extend beyond the second century B.C., but the evolution of the instrument from the syrinx (*q.v.*) or Pan-pipe goes back to a remote period. The hydraulic and pneumatic organs of the ancients were practically the same instrument, differing only in the method adopted for the compression of the wind supply; and the syrinx seems to have been recognized by the ancients as the precursor of both. Thus Hero of Alexandria, in his description of the hydraulic organ, calls it a syrinx. Philo of Alexandria (*c.* 200 B.C.), mentioning the invention of the hydraulis by Ctesibius, says, "the kind of syrinx played by hand which we call hydraulis."

In the earliest organs there is no doubt that the pipes consisted of lengths of the large reed known as *κάλαμος* used for the syrinx, but converted into open flue-pipes. Instead of cutting off the reed immediately under the knot, as for syrinx pipes, a little extra length was left and shaped to a point to form a foot or mouth-piece, which was placed over the aperture in the wind-chest, so that it caused the stream of air to split in two as it was driven through the hole into the pipe by the action of the bellows. A narrow fissure was made through the knot near the front of the pipe, and above it a horizontal slit was cut in the reed, the two edges being bevelled inwards. When the wind was pumped into the chest it found an outlet through one of the holes in the lid, and the current, being divided by the foot of the pipe, became compressed and was forced through the fissure in the knot. It then ascended the pipe in an even stream, as yet silent, until thrown into commotion by another obstacle, the upper sharp edge or lip of the notch, which produced the regular flutterings or pulses requisite for the emission of a note.

In order to convert the syrinx into a mechanically played instrument, the addition of the actuating principle of the bag-pipe was necessary. It is probable that in the earliest attempts the leather bag was actually retained and that the supply of wind was still furnished by the mouth through an insufflation pipe. Such an instrument is described and illustrated by Father Athanasius Kircher, but his drawing should be accepted with reserve. In the instrument, which he calls the *Magraketha* or *Mashrokitha* of the Chaldees, the bag is described as being inside the wind-chest, the insufflation pipe being carried through a hole in the side of the box. Little wooden sliders manipulated by the fingers formed a means of controlling the escape of the wind through any given pipe.

Of organs in the next stage of development, namely with bellows, several examples in pottery are extant, and also a description in the Talmud. The quotation as given by Blasius Ugolinus states that the instrument known as the *Magrepha d'Aruchin* "consisted, as the Schilte Haggiborim teaches, of several rows of pipes and was blown by bellows. It had, besides, holes and small sliders answering to each pipe, which were set in motion by the pressure of the organist; the vent-holes being open, a wonderful variety of sounds was produced."

In regard to the hydraulic organ, some writers have considered that the invention of the hydraulis in the 2nd century B.C. by Ctesibius of Alexandria constituted the invention of the organ, and that the pneumatic organ followed as an improvement or variety, but such a suggestion can hardly be accepted. It is most improbable that a man busy with the theory and practice of

hydraulics would *invent* a highly complex musical instrument in which essential parts lying outside his realm, such as the flue-pipes, the balanced keyboard, the arrangements within the wind-chest for the distribution of the wind, are all in a developed state. It would be a case for which no parallel exists in the history of musical instruments, all of which have evolved slowly and surely through the ages. On the other hand, given a pneumatic organ in which the primitive unweighted bellows worked unsatisfactorily, an engineer would be prompt to see an opportunity for the advantageous application of his art. There are two detailed descriptions of the hydraulis extant, both of which presuppose the existence of a pneumatic organ. One is in Greek by Hero of Alexandria, the other in Latin by Vitruvius (*De Arch.* l.b. x. cap. ii.).

The principle of the hydraulis, which long remained a mystery, is now well understood. An inverted funnel, or bell of metal, standing on short feet and immersed in water within the altar-like receptacle forming the base or pedestal, communicated, by means of a pipe, with the wind-chest, placed above it. When the air was pumped into the funnel by the alternate action of two pumps, one on each side of the organ, constructed bucket within bucket and fitted with valves, the water retreating before the compressed air, rose in the receptacle and by its weight held the air in a state of compression in the funnel, whence it travelled through the pipe into the wind-chest. For an interesting discussion of the hydraulic organ, based on a careful first-hand study of the ancient writers *see* two articles in *The Organ* for Jan. and April, 1923 by D. Batigan Verne.

The nature of the hydraulis made it possible to construct large organs of powerful tone more suitable for use in the arena than the small pneumatic instruments, but the hydraulic organ never entirely supplanted the pneumatic, which was probably not so imperfect at the beginning of our era as has been thought, and which was destined to establish its supremacy in the end.

In France and Germany the Romans must have used organs and have introduced them to the conquered tribes as they did in Spain, but the art of making them was soon lost after Roman influence and civilization were withdrawn. Pépin, when he wished to introduce the Roman ritual into the churches of France, felt the need of an organ and applied to the Byzantine emperor, Constantine Copronymus, to send him one, which arrived by special embassy in 757 and was placed in the church of St. Corneille at Compiègne. The arrival of this organ was obviously considered a great event, since it is mentioned by all the chroniclers of the time. Charlemagne received a similar present from the emperor of the East in 812, of which a description has been preserved.

Considerable activity was displayed in England in the 10th century in organ-building on a large scale for churches and monasteries, such as the monster organ for Bishop Alphege at Winchester, which had 400 bronze pipes, 26 bellows and 2 manuals of 20 keys, each governing 10 pipes.

In regard to the details of these early instruments, as represented in contemporary illustrations, it may be noted that there is no miniature on record in which the fist action on the keys is indicated, the performer during the 10th, 11th and 12th centuries being depicted in the act of drawing out the stop-like sliders—as for instance, in the 12th-century manuscript Bible of St. Etienne Harding at Dijon, where the organist is playing the notes D and F, the sliders being lettered from C to C. From the 13th century the keys are shown pressed down by means of one finger or of finger and thumb. In the beautiful Spanish ms. said to have been compiled early in the 13th century, known as the *Cantigas de Santa Maria,* a portative is shown having balanced keys, one of which is being lightly pressed by the thumb, the instrument resting on the palm—while the left hand manipulates the bellows. The keys themselves varied in shape, being either like a T; a wide rectangle, with or without the corners rounded off, or a narrow rectangle. The earliest instance of a chromatic keyboard is that of the organ at Halberstadt built in 1361 and restored in 1495.

(K. S.)

THE MODERN ORGAN

In former centuries organs were seldom to be found outside places of worship, but at the present day they are built for use in private residences, concert and public halls, cinematograph theatres, and in many playhouses of the United States and Canada.

The sounds of an organ are produced from pipes of varying shapes and sizes, made to "speak" by means of air under pressure. The sounding of the pipes is determined by the use of the keys, some of which are played by the hands, some by the feet. The keys of the organ resemble those of the pianoforte in appearance; but whereas the pianoforte has only one keyboard or manual the organ may have four or five in addition to a keyboard of foot pedals.

Stops.—Each organ pipe sounds one note only and is a member of a larger unit known as a stop; each stop is a member of a still larger unit known as a sectional or divisional organ; while each sectional organ is a member of the grand organ in its totality.

To the layman the term "stop" usually denotes the knobs grouped on each side of the organist as he sits at his console or control board. In watching the organist pull out or push in these knobs with varying musical results he does not think twice about accepting the term "stop," as popularly understood. To the organ builder, however, it means one thing and one thing only, namely, a rank of pipes.

The pipes of a given stop therefore all produce sounds of similar quality, but necessarily of different pitches. No two stops are exactly similar in quality; on the contrary, they all differ, like the various instruments in an orchestra. Some stops are of high pitch, some of low; some have a thin, some a full quality of tone. The knob at the console is the only part of the stop mechanism that is visible, being merely a handle which actuates the valve admitting wind to the stop itself. Every stop has a separate knob, just as every note has a separate key. Unless one of the knobs were drawn no sound would result when the organ was played.

Sectional Organs.—Passing on to the next size of unit, we come to the sectional organs mentioned. Each of these organs is played from its own clavier or manual and has its own special *timbre* and utility. An organ of five manuals (where found) would commonly comprise a Great Organ, a Swell Organ, a Choir Organ, a Solo (or Orchestral) Organ, and an Echo (or else Bombarde) Organ. Moreover, save only in the tiniest instruments, there is also a Pedal Organ played by the feet of the executant.

The normal range or compass of the manuals is 61 notes, *i.e.*, 5 octaves, from CC in the bass to C'''' in the treble (though certain organ builders of the United States have adopted a manual compass of 7 octaves); that of the pedals is 32 notes, *i.e.*, 2½ octaves from CCC in the bass (lowest C on the pianoforte) to the G below middle C. In other words, a manual stop ordinarily comprises 61 pipes and a pedal stop 32 pipes.

Organ-pipes.—These are primarily divisible into two main genera, namely flue and reed. Flue-pipes bear a strong resemblance to the humble "penny whistle," both as to appearance and physical behaviour—except that a flue-pipe does not sound more than one note. In reed pipes the wind vibrates a curved brass tongue over the surface of a reed or shallot, so that the oscillations of the tongue cause the speech of the pipe. Associated with the reed is a metal resonator, which exercises much the same function as the "loud-speaker" horn of a radio-outfit.

Both genera have in common the properties of pitch and quality. With a flue-pipe the pitch is lower as the tube or body is longer; with a reed-pipe pitch depends on the vibrating length of tongue and on the position of the spring wire, which can be made to increase or diminish this length. The quality of a flue-pipe is affected mainly by the diameter (or scale) of the body relative to the length, the wider scale giving the fuller tone and vice versa; the quality of reeds is affected by the length of resonator, their shape and scale, the thickness of the tongues and other factors.

But the souls of organ pipes are all in the hands of the "voicer," and their ultimate character depends more on the process known as "voicing" than on anything else.

Although most of the flue-pipes in an organ are open at the ends to the atmosphere, there is also a considerable class having its bodies closed by a cap or stopper. Known as gedeckts or bourdons, these pipes are peculiar in that they speak a note nearly an octave lower than an open pipe of the same length. Another

class has the bodies pierced about midway with a small hole, the result being that they sound an octave higher than ordinary pipes of the same length. These are called harmonic pipes.

Voicing and Tuning.—Voicing consists for the most part in adjusting the mouth-pieces of a flue-pipe or the tongue-curvature of a reed in such a manner that the desired quality of tone or timbre is permanently obtained. The final process of voicing is

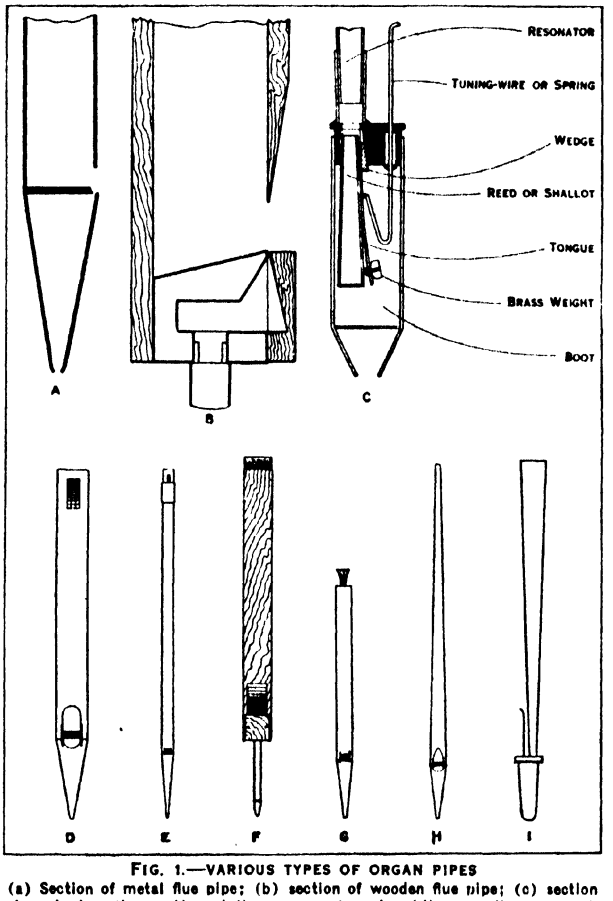


FIG. 1.—VARIOUS TYPES OF ORGAN PIPES
(a) Section of metal flue pipe; (b) section of wooden flue pipe; (c) section of reed pipe (trumpet) and its component parts; (d) open diapason; (e) Viola da gamba; (f) clarabella, or Hohl-Flöte; (g) Gedeckt; (h) Gems-Horn or Spitz-Flöte; (i) trumpet or cornopean (reed). (Not to scale)

known as "regulation" and means the making uniform in power of every pipe in a stop. This the voicer achieves by admitting a greater force of wind through the "foot" of the pipe, if he wishes to louden its tone; or by reducing the foothole and so reducing the wind, if he wishes to soften it.

For tuning various methods are employed, according to the character of the particular class of pipe being dealt with. Thus some flue-stops are tuned by moving up or down a metal sleeve which fits over the top of the pipe, the speaking length of which is in this way increased or diminished. Others—especially "upper-work" stops—have to be coned in or expanded slightly at the ends, according to whether it is intended to flatten or sharpen the pitch. Others again are tuned by pressing in or pulling out a metal piece affixed in or near the tops of the pipes. As for gedeckts the caps or stoppers afford an easy means of altering the pitch.

Names of Stops.—In making the acquaintance of organ stops for the first time many persons fall into the error of putting far too much faith in the names. Organ stops, it is true, resemble orchestral instruments to the extent that they bear names which are supposed to distinguish them from one another; but so far from the "orchestral" analogy holding good generally, it fails for two reasons—first, because organ builders have invented a hundred and one fancy names to denote pretty much the same kinds of stops; secondly, because they do not all agree as to what a given name is to denote.

Proceeding then on these lines, we may group flue-stops into three broad species—flute, diapason and viol. Flutes are either open or closed (*i.e.*, gedeckts), harmonic (*i.e.*, of double-length) or non-harmonic. Diapason stops on the whole have a natural and normal organ tone, familiar to everybody. Viols are of smaller scale than diapasons and so are of comparatively thin and stringy tone. Several stops stand on the borderland between two species; but the majority can be brought under one of the foregoing heads, quite apart from their loudness and intensity.

In reedwork the French horn is, roughly speaking, the equivalent of the flute, the trumpet of the diapason, the English horn (cor anglais) of the viol species. The clarinet corresponds with a gedeckts and has resonators of only half length, just as the harmonic reeds have resonators of double length. For the resonators of reeds are of about the same length on the bodies of flue-pipes giving the same pitch of note and in these two cases at least, they depart similarly from the normal. But at all times the reed stops are much less numerous than the flue, and although often blown by a wind of much heavier pressure do not compete with them on their own ground.

Pitches of Stops.—Organ stops which speak at the pitch indicated by the written notes are called 8ft. or "unison stops" because an open flue-pipe about so long would be needed to sound CC, the lowest note of the manual clavier. By analogy reeds and even gedeckts are 8ft. stops, if they sound at 8ft. or "unison" pitch throughout. So, too, the 16ft. stops are those which sound an octave below the "unison" pitch of the manuals. A gedeckt with a body 8ft. long would still be a 16ft. stop, because of its 16ft. pitch. Stops as grave as of 32ft. pitch appear on the pedal and in very large organs on the manuals, their name signifying a pitch two octaves below that of the manuals.

Of stops which sound higher than the 8ft. pitch of the keys the 4ft. stops give the octave, 2⅔ft. stops the twelfth, 2ft. stops the fifteenth or super-octave, 1⅗ft. stops the seventeenth or tierce, 1⅓ft. stops the nineteenth or larigot, 1⅛ft. stops the flat twenty-first or septième, 1ft. stops the twenty-second, and so (in theory at least) ad infinitum, the interval between the ranks becoming smaller as the ranks themselves are of acuter pitch, in accordance with the natural law of what is known as the *harmonic series*. Practical considerations, however, must always set arbitrary limits, and in this case they rule: (1) ranks above the fifteenth are too small and acute to be carried through the whole compass of the keyboard in an unbroken form; (2) no rank more dissonant than a minor seventh—or at most a major second—is tolerable anywhere in the tonal economy of the organ; (3) for most ordinary purposes ranks sounding octaves, thirds and fifths sufficiently represent the harmonic series. As a matter of practice all stops above the fifteenth form a part of what are called the mixtures, and except for special purposes (*see* later under *Choir Organ*, where the purpose of independent mutations is discussed) are employed collectively as "upperwork." Manual stops of 16ft., 8ft. and 4ft. pitches, being the most consonant with the unison or standard, are termed "foundation work" (Fr. *fonds*); and thus, in the upper work and in the foundation work respectively, the two complementary ideas of brilliance and gravity are fulfilled. The twelfth and fifteenth are sometimes independent ranks, sometimes part of the mixtures. As a rule, flute and viol stops are confined to the foundation pitches—reeds always. But diapasons being of a tone peculiar to the organ represent upperwork as well as foundation.

And now to consider the stops as grouped in the various sectional organs and the sections themselves as related to the organ at large, premising that letters attached to stop-names in this article indicate their genus, species or tone-quality, *i.e.*, d = diapason, f = flute, v = viol, g = gedeckt, r = reed, echo = lesser-toned.

Great Organ.—The Great Organ (Fr. *Grand Orgue*; Ger. *Hauptwerk*) as its name implies is the most important of these, and forms the tonal backbone of the whole instrument.

In English and American organs it is chiefly conspicuous for a diapason quality which pervades it throughout. Especially typi-

cal is the open diapason 8ft. without which scarcely an organ was ever built. To supply the requisite foundation for a large Great Organ there may be as many as three or four open diapasons, though they would not all be similarly scaled and voiced. If the first diapason is a powerful stop of full and round quality, the second is almost sure to be of a lighter and sharper tone; and sometimes in the interests of variety a geigen (dv) or gemshorn (dg) is substituted for the third or fourth.

The double open diapason, 16ft. octave or principal 4ft., twelfth 2⅔ft., fifteenth 2ft., and mixtures are equally germane to the Great Organ, and may be likened to the roots, branches and twigs of the diapason trunk.

On the other hand the substratum of the French Great Organ is not so much a diapason as a flute one; for flutes are regarded as a kind of neutral canvas on which other and more positive tone colours (especially diapasons) can be laid and mixed. Again, Spanish Great Organs have no open diapasons as understood by English-speaking musicians; instead they have a foundation of hybrid flute-viol kind which is said to be particularly disagreeable. Nor does the average German Great Organ appeal to our ears much more, since its pipes are too often made of thin metal, and as a consequence sound hard and brassy. The gedeckts, *e.g.*, bourdon 16ft., stopped diapason 8ft., flute couverte 4ft., add considerable body to the diapasons besides having their own special value. In the United States a Doppelflöte (gedeckt with two mouths) is very popular. Where neither money nor space can be found for the pipes of actual 16ft. length, a bourdon 16ft. (g) frequently takes the place of a double open diapason.

Open flutes are nearly always present at 8ft. and 4ft. pitches and under a diversity of shapes and names—clarabella, wald flute, tibia, melodia, flute ouverte, etc. Viols, however, are thought to mar the sovereignty of diapason tone, and so are less common on the English Great Organ than abroad.

The usual complement of Great Organ reeds amounts to trumpets, 16ft., 8ft., and 4ft., going by the name of contra (tromba) or bombarde 16ft., tromba, trumpet or posaune, 8ft.; clarion or octave (tromba) 4ft. For a small Great Organ a single tromba or trumpet 8ft. suffices, or else the reed class may be omitted altogether from this section. To which it may be added that most builders to-day prefer to furnish all their chorus reeds with harmonic or double-length trebles which stand in better tune than the non-harmonic.

Swell Organ.—The Swell Organ (Fr. *Récit;* Ger. *Schwellwerk*) again almost explains itself. For inasmuch as organ pipes are naturally incapable of crescendo and diminuendo, a whole section of stops is played from a separate manual, and made expressive by artificial means. That is to say, all the pipes of the Swell Organ are enclosed in a large box which is faced on one side with a set of balanced shutters, not unlike the louvres of a venetian blind. As the shutters are opened electrically by the organist from the console, the volume of tone increases; as he closes them, it diminishes. Most people can easily recognise the sound of a full swell by the peculiar "tingling" effect it has when the shutters are nearly or completely closed. This effect indeed gives the best indication as to the basis of the Swell Organ: for it is shown to depend almost entirely on reeds and mixtures. Were all other stops omitted, a "skeleton" Swell would suffice for this effect, consisting of double trumpet 16ft., trumpet 8ft. (cornopean), clarion 4ft., plus brilliant mixtures to crown the whole.

At the same time a Swell Organ confined to a reed basis would not be practical politics; and so it comes about that other stops, both reed and flue, are required also here. The oboe, for instance (=echo horn), and the unda maris or voix celeste (a pulsating stop made up of two out-of-tune dulcianas) are almost universal. Hardly less so are narrow scale gedeckts of some kind (lieblich or rohr) in the foundation pitches. Nor is the entry of the diapason series delayed, though its stops will be of lighter calibre than those on the Great. The Swell mixtures belong properly to the diapason series, and only by design to the reed chorus, and so should not be voiced to emulate the sound of smashing glass, as sometimes happens. Then salicional (echo vd), spitz flute (dg), aeoline (echo v), wald flute (f), etc., should all be added to the list of unobtrusives, but usefuls.

In a small Swell Organ a contra-oboe or fagotto 16ft. generally appears as its first double; for a reed has the advantage over, say, a bourdon or contra-salicional 16ft. in taking up less room inside the swell-box, while contributing directly to the reed foundation.

Choir Organ.—The Choir Organ (Fr. *Positif;* Ger. *Oberwerk* or *Positiv*) belongs to one or other of two well defined types. It is either an Echo Great Organ in the true sense and in the old style; or else it stands in a swell-box and is less exclusive in caste.

If a miniature Great Organ, it comprises a lightly blown diapason series (16ft. to mixtures), a gedeckt or two, and perhaps even a low-pressure trumpet. In its other capacity it has an ensemble of mild flutes and viols, rather than one of pure diapason complexion, though of course there is no actual ban on diapasons. Viola da gamba, viola d'amore, fugara (v), chimney flute, cor de nuit, quintaten (g), flauto amabile, wald flute, harmonic flute (f) at 8ft., 4ft. and 2ft. pitches, the gemshorn family at all pitches—none of these are out of place so long as the key-note is gentleness and moderation in scales and wind pressures. If the Swell Organ contains a voix celeste of two salicionals (echo dv), occasion is sometimes taken to provide the Choir with a contrasting flute celeste of two gedeckts. The dulciana (echo d), or salicional 8ft., is of course indispensable and in larger instruments it may appear at 16ft., 4ft. and/or 2ft. also. Nor does a delicate mixture of dulciana or salicional pipes ever come amiss, though it is surprising how few organ-builders care about stops of so refined a tone.

An enclosed Choir Organ frequently houses the independent mutation stops, which are found to answer best in the shape of gedeckt pipes. Mutations commonly used are: nazard or twelfth (2⅔ft.), tierce or seventeenth (1⅗ft.), larigot or nineteenth (1⅓ft.), septième or flat twenty-first (1⅐ft.) and if it may be termed a mutation, the octavin or twenty-second (1ft.). With these or an even fuller muster to hand immense colouristic possibilities lie in front of the organist. Like a chemist in a laboratory he has only to mix one or two mutations with a 4ft. or 2ft. stop or even with another mutation to create new tonal compounds of rare and surprising piquancy. An excellent "orchestral oboe" can be made from this recipe—viole 8ft., nazard 2⅔ft. and tierce 1⅗ft.

Reeds are neither few nor insignificant on the French *Positif*, but in England the Choir is more often than not limited to a clarinet or cor anglais 8ft.

Solo Organ.—The Solo (or Orchestral) Organ differs from the three foregoing sections in one practical respect. Hitherto we have been dealing with units which were designed with the aim of building up a harmonious whole.

It is not perhaps overstating the case to say that the English Solo Organ is considered successful in proportion as it is anomalous in relation to the rest of the instrument. Being largely imitative of orchestral instruments, its stops, both reed and flue, represent extremes of scaling and voicing; and so have a poor blending capacity.

The Orchestral Organ may be regarded as a modern off-shoot of the Solo, which it sometimes includes on the fourth manual. So many solo stops are intended to resemble orchestral instruments, so many "orchestral" or imitative stops are distinctive enough to take a solo melody or melodic part, that the two names must largely overlap. Some builders, however, prefer to assign the Solo and Bombarde to a fifth manual, while retaining the fourth for an Orchestral pure and simple. Or, if there are only four manuals all told, the Choir and Orchestral are made to share the third, Solo and Bombarde the fourth.

Among the most prominent features of the Solo-Orchestral section is a pungent viol family. This may be more or less fully developed from the 16ft. contra-viol or violone, through the unison viol d'orchestre or violoncello to a viol mixture of 3 or more ranks, according to the size of the section.

In complete contrast stand the powerful orchestral flutes, which are invariably harmonic and appear at 8ft., 4ft. and 2ft. pitches. One name for the 4ft. rank is flauto traverso, the 2ft. nearly always being termed piccolo. Of gedeckts a large-scale tibia clausa is at once the most effective and the most vulgar.

Bassoon or fagotto 16ft., clarinet 8ft. (and sometimes 16ft.), orchestral oboe 8ft., orchestral trumpet 8ft., French horn 8ft., English horn 16ft. and 8ft., are all imitative reeds which find an appropriate home in this section. Though probably more valuable as a "timbre-creator" than an imitative stop the vox humana passes for "orchestral" and is included here.

As befits its character, the Solo-Orchestral section must be

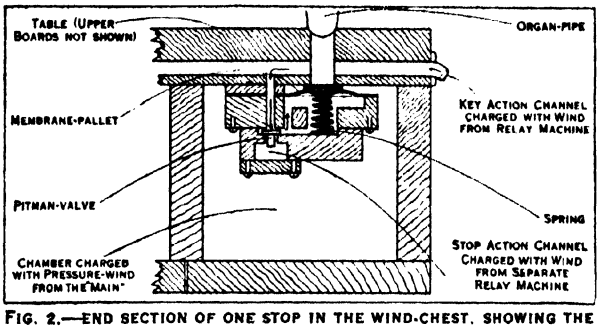


FIG. 2.—END SECTION OF ONE STOP IN THE WIND-CHEST, SHOWING THE INITIAL STAGE IN THE PROCESS OF JOINING THE PIPES WITH THE KEYS AND STOP-KNOB

enclosed in its own swell-box and voiced on a fairly heavy wind pressure, so that its stop may tell out clearly.

Echo Organ.—If the principle of *seniores priores* counts for anything, an enclosed Echo Organ ought to occupy the fifth manual, when one is provided: for such is its traditional place. In the churches of the United States Echo Organs are frequently met with, but without a fifth manual in the console. Modern English practice, however, seems inclined to favour the case of a Solo-Bombarde section instead of an Echo Organ for this manual, particularly if tubas are absent from the fourth manual. This would consist of heavy-pressure tubas (r) at the foundation pitches, and a chorus mixture of 6 ranks or more, the whole forming a forte-fortissimo ensemble. A stentorphone 8ft., *i.e.*, a monstrous solo diapason is often included.

Pedal Organ.—The Pedal Organ supplies a general bass to the whole organ, its stops therefore being pitched an octave lower than those of the manuals having the same nomenclature. Thus the "unison" stops are 16ft. instead of 8ft. A pedal double diapason would be 32ft. instead of 16ft. pitch, a pedal fifteenth 4ft. instead of 2ft., a pedal tierce 3⅕ft. instead of 1⅗ft., and so on.

A minimum Pedal Organ could consist of gedeckt or bourdon (16ft. closed wood) and from these the 8ft. and 4ft. pitches could be derived to form three stops in all. After which the Pedal Organ increases *pari passu* with the numerical growth of the manual stops. Soon one or more open diapasons 16ft. become imperative to balance the Great diapasons. Next a double open diapason 32ft. is the proper offset to 5 or 6 ranks of Great mixtures. From which it is but a short step to establish a diapason series from 32ft. to mixtures, thus making the Pedal Organ a complete entity on its own account. Large French Pedal Organs are especially rich in mixtures and mutation ranks, which contribute of course to reinforce the foundation. Other stops which are required as bass counterparts to manual tones include tibia (f), salicional (echo vd), geigen (vd), contrabass or violone (v), quintaten (g), etc.; and all these are amenable to extension into higher pitches.

Turning to the reeds we see the same rule of balance and expansion working itself out. As soon as an organ is large enough to contain either a tuba or Great trumpets 16ft., 8ft. and 4ft., there enters inevitably a heavy-pressure Pedal trombone, ophicleide or bombarde 16ft. Any further increase of powerful reed tone on the manuals is met by enlisting the aid of the Pedal contra (bombarde) 32ft., the clarion or octave (trombone) 8ft. and occasionally the octave clarion 4ft. A well equipped Pedal Organ would also have one or two lighter reeds such as cor anglais, clarinet, waldhorn and bassoon, "borrowed" from the manuals.

Windchest.—If we may regard all intermediary mechanisms which join the fingers of the organist with the sounding of the pipes as links in a chain, the first "link" claiming our attention is the windchest.

Now, a windchest has this double function: on the one hand it carries the pipes themselves; on the other it contains within it an apparatus for distributing wind to these pipes. (Each chest carries not more than nine stops.) In shape it is a box of thick pine about 8ft. long × 9½in. deep, divided into as many longitudinal compartments as there are stops to be accommodated. Over its top surface (called the "table") are the "upperboards" on which the pipes stand. Over the upper boards and raised about 4½" above them are the rackboards which keep the pipes in an upright position. Fig. 2 shows a form of windchest, which has already enjoyed a wide vogue in the United States having been largely popularized by the Skinner Organ Co., of Boston, Mass. For the sake of simplicity it has been thought desirable to indicate one key action and one stop action only—*e.g.*, tenor F. and open diapason; but the reader must imagine the same mechanism multiplied to the extent of *n* stops × 61 times. The *raison d'être* of all windchests is the same—to enable the pipes to sound when the pallets below them have collapsed and have allowed the wind to flow through the orifices commanded by the pallets. This point is stressed, because it should be stated that what has been described is known as a modern "sliderless" chest (for the obsolescent "slider" windchest, *see* the Bibliography).

Relay Machine.—After the windchest itself comes the relay machine, which may be looked upon as the next link in our "chain." This serves to keep the key channels charged with pressure-wind, or to open the same to the atmosphere when the keys are pressed; also it is the place where the pneumatic portion of the "chain" joins the electric, and one motive force is substituted for another. Its component elements are as illustrated.

To each of the longitudinal stop channels in the windchest is attached an exactly similar apparatus; so that henceforward both key and stop "chains" continue in the form of electric wires from the magnets as shown in the illustration. These wires may be regarded as the third link in the "chain."

Console.—At the other end of the "chain" is the console or composite keyboard at which the organist sits. Here the "chain" terminates in the outward and visible keys, stop-knobs and other accessories, used by the player to control the organ. In the United States scarcely two builders work to the same plan of console, and as a result hardly two consoles are alike. Fig. 4 shows a typical English model of dignified and not unprogressive design. This would consist of 2–5 manuals according to the number of sectional organs, and a radiating-concave pedal clavier lying about 31 inches under the surface of the lowest manual. By English

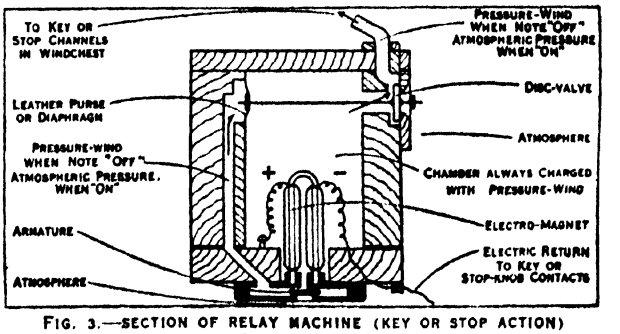


FIG. 3.—SECTION OF RELAY MACHINE (KEY OR STOP ACTION)
The second stage of process of joining the organ-pipes with keys and stop-knobs is shown, with the machine "off," the key or stop action being at rest

convention the Choir manual is the lowest, the Great the next, the Swell the third, the Solo (or Orchestral) the fourth, and the Echo (or Bombarde) the topmost. The stop-knobs are shown projecting from the jambs to right and left of the console. On the face of each knob is engraved the name of the particular stop and its approximate pitch-length in terms of feet—*e.g.*, clarinet 8ft., twelfth, 2⅔ft., bourdon 16ft.—so that a moderate knowledge of technical nomenclature combined with the habit of seizing the meaning of such figures on the stop handles will be found to suffice as a key to the complexities of all consoles. The stop-knobs controlling the various sectional organs are, of course, grouped

together systematically so as to avoid any confusion, and in a 5-manual organ would be disposed thus:—

Left Jamb.	*Right Jamb.*
Swell Organ.	Great Organ.
Solo (or Orchestral) Organ.	Pedal Organ.
Bombarde (or Echo) Organ.	Choir Organ.

Over the top manual are ranged the ivory tilting-tablets, which operate the couplers. These provide for the coupling of almost any one clavier to another, at unison (8ft.) pitch, and also at

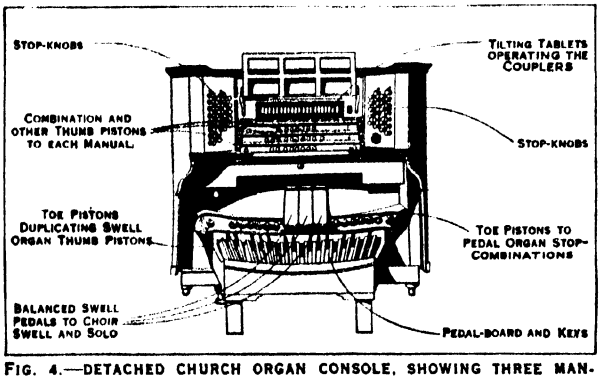


FIG. 4.—DETACHED CHURCH ORGAN CONSOLE, SHOWING THREE MANUALS AND PEDAL

sub-unison (16ft.) and octave (4ft.). Moreover, any manual except the Great may be duplicated *on itself* at sub-octave and octave pitches. Sometimes too there is a "unison silent" coupler which cuts out the 8ft. pitch of every stop drawn on the manual in question. Only the Great Organ remains constant, except as against the Pedal to which all manuals can be coupled.

Unless the action be tubular pneumatic or tracker—both older and non-electrical methods of forming our figurative "chain"—it is customary to detach the console and place it at some distance from the organ, connection being made by electric cables. For descriptions of pneumatic and purely mechanical actions, *see* G. A. Audsley's *The Art of Organ Building*.

But to revert to the key action "chain." Every manual and pedal key in the console has a thin bar of copper attached to it, so that when pressed it bridges the gap in the "return" wire and closes the circuit. The stop action "chain." operates on an identical principle and need not be further described.

Except the combination piston action, the sole remaining "chain" is the coupler action. This has its beginning and end in the console itself, and is merely a cut-out switch intercepting the 61 key circuits simultaneously. Every new coupler means an extra switch and an extra "return" wire in the key contacts, all "mains" throughout being permanently conjoined with the + terminal. The reader should appreciate, however, that the moving in or moving out of a coupler-switch is a purely local and external process. Although actually performed by means of solenoids or electro-pneumatic motors, it might just as well be done by hand, could the organist only reach out to the switchboard at the back of the console.

Controls.—The combination pistons under each manual control not individual stops of that manual, but groups of stops. When pressed by the organist's thumb they have the effect of throwing out whatever combination of stops he may have selected, without his having to touch the knobs. The Pedal Organ combination pistons are pressed by the right foot of the organist. On luxuriously equipped consoles it has become customary to fit also four or five general pistons, *i.e.*, having a jurisdiction over every stop and coupler in the organ. In an up-to-date console all pistons should be readily adjustable by the player, so that he may set them to operate whatever selections of stops he pleases.

Unit System.—Nearly all organs designed for cinematograph theatres are built on what is known as the unit or extension system; and in this respect are to be distinguished from the orthodox type which has been described. The distinction lies in the fact that whereas an orthodox organ has separate and individual stops for each manual and pedal, a unit organ employs the same rank of pipes again and again at various pitches and (rather misleadingly) under various names. By way of illustration take the case of a series of four gedeckt stops—bourdon 16ft., tibia clausa 8ft., zauberflöte 4ft., piccolo 2ft. Under the orthodox system each stop would be a separate rank consisting of 61 pipes, the total number of pipes being 244. Under the unit system there would be one master rank of only 97 gedeckt pipes (eight octaves), and from this rank the four "stops" would be derived at the four different pitches and under the four different names.

The unit system has been mentioned here, because at the heart of it all is the coupler switch just described. What has really happened is that couplers acting at the various pitches have taken the place of independent stops, and the electric wiring has been done for a wholesale adoption of switches instead of draw-stop actions. If so many "stops" are to be extracted from one parent rank, a corresponding number of electric switches will be needed, together with an equal number of return wires on each of the key contacts.

At the switch-board is effected also "duplexing," or rendering a stop available on more than one clavier—a necessary facility in the theatre organ and even in the Pedal section of an otherwise "straight" church organ.

Mention may also be made of the "double-touch" device now frequently incorporated in the modern cinematograph or concert-hall organ. Its operation is quite simple and may be explained in a word. A clavier having this device is one of which the keys, when played, fall not only to the standard depth of touch, but also—on extra pressure being applied by the finger—another $\frac{1}{16}''$ or so deeper. The purpose of the second touch is to enable any key to make a second electric contact at the lower level, and so to engage a second circuit when it reaches that point. As a rule this circuit brings into action a powerful solo stop, a coupler or occasionally some "percussion" (*e.g.*, cymbals); but in any case it is plain that a clavier so equipped has the potentialities of two claviers in itself.

Organs designed for secular use are freely equipped with other means of making sounds than pipes. On a theatre instrument one may expect to find chimes, bird-whistle, xylophone, marimba, etc., in addition to drums, cymbal, triangle, castanets and many other "traps," as they are called, for the greater delectation of King Demos. Even in church organs of the United States 8ft. and 4ft. harps to the Choir and cathedral chimes to Great or Solo play an important part, and are by no means deemed out of place; whereas British practice, restrained by more sensitive church traditions, admits in this way nothing more fanciful than a tremulant to the enclosed sections.

Wind Supply.—It but remains to add that wind is supplied to the organ by a form of rotary fan (not unlike a steam turbine), driven by an electric motor. From this fan the wind is conveyed in a zinc duct called a trunk to a junction-box, whence smaller trunks branch out to the reservoirs of each windchest. The dynamo, generating current for the action, may be driven off the main motor by a "whittle-belt" and should be properly over-compounded so as to maintain a steady voltage under varying loads. Gone are the proverbial bellows and still more proverbial "blow-boy," save in remote country districts where there is no electric power; for they have long been ousted by these all-metal machines of greater endurance and fewer vagaries.

Compared to other pneumatic machines, the organ operates on a very light wind pressure. Seldom are even the most powerful reeds voiced on a wind exceeding the weight of 30 inches of water, while a large majority of stops speak on only 4–6 in. pressure.

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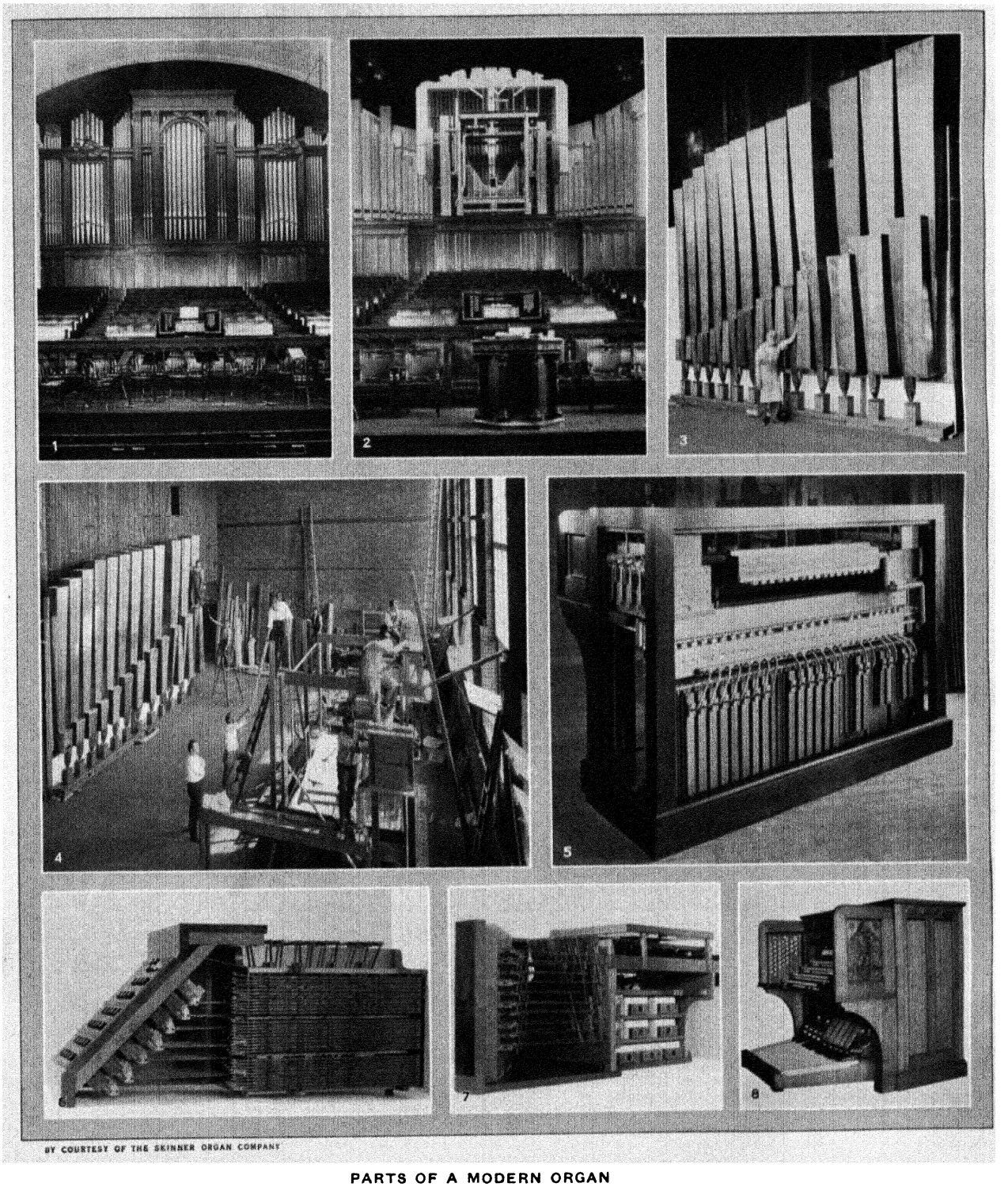


BY COURTESY OF THE SKINNER ORGAN COMPANY

PARTS OF A MODERN ORGAN

1. Large organ at Finney Chapel, Oberlin College, Oberlin, Ohio, showing casework and display pipes. The console is in the foreground
2. Same organ shown in fig. 1, with casework and display pipes removed, showing interior, with manual and pedal pipes and swell boxes
3. Giant pipes known as Bombardes, set up in the factory for voicing and tuning
4. Assembling room showing organs in process of construction with another view of the Bombarde shown in fig. 3
5. Rear view of a console with rear and side panels removed
6. View looking down upon the stop and combination action of a register panel, showing how the movement of the stops is changed from an angle of 45 degrees to a direction parallel to the side of the console. This assembly is arranged to bring the trace rods of all the stops to a common level so that they may be controlled by the combination action which moves them collectively
7. Side view of fig. 6, showing how the various perpendicular groups are brought to a common level
8. View of a standard four manual console, similar to the instrument shown in fig. 1

ORGANIC SENSATIONS, a term for all the bodily sensations except those derived from the skin. In addition to the four special senses, sight, hearing, taste and smell, there is the common sensibility or somaesthesia, which includes cutaneous sensations (*q.v.*) and organic sensations. Organic sensations may be subdivided into kinaesthetic sensations, vestibular or static sensation, and visceral sensations. The deep sensibility that comes from the impulses it is impossible to control the movements accurately.

Kinaesthetic sensation, so named because it mediates the perception of bodily movement as well as the perceptions of weight, resistance and posture, arises in the muscles, tendons and joints, all of which are supplied with sense-organs. Its nervous mechanism has also been called the proprioceptive system, whose function it is to furnish the afferent cues necessary for precise movement. Without these kinaesthetic sensations or proprioceptive nerve-impulses it is impossible to control the movements accurately.

The vestibular or static sense has to do with the maintenance of balance and of bodily position and with the perception of rotation. It arises either in the vestibule or the semi-circular canals of the ear. Ernst Mach's theory, to which recently objection has been raised, relates the perception of rotation to these canals, which seem peculiarly well-adapted by their structure to mediate this perception.

The visceral sensations include the sensory bases for such experiences as hunger, nausea, appetite and sex, if indeed the last two are to be understood in terms of their sensory nature. (*See* VISCERAL SENSATIONS.)

The importance of organic sensations has been emphasized by the James-Lange theory of emotions, which asserts that an emotion differs from other consciousnesses in that it includes the perception of a violent organic reverberation. For example, a fear may be characterized by the kinaesthesis of running away, and the sensations that arise from the dryness of the throat and from the viscera. Against the theory it has been argued that internal state and bodily posture are insufficient completely to account for emotion. *See* EMOTION; JAMES-LANGE THEORY OF EMOTIONS.

(E. G. BOR.)

ORGANO-METALLIC COMPOUNDS are chemical substances containing a metal or metalloid in direct association with one or more hydrocarbon radicals. These compounds never arise by natural processes in the vegetable and animal kingdoms, being produced synthetically by the art of the chemist. They have played an important part in the development of modern chemistry and among them are several substances of great practical utility. Lead tetraethyl (*see* p. 898), a most effective anti-detonant in motor gasolene or petrol, and salvarsan, a specific remedy in syphilis, are two outstanding examples of organo-metallic compounds of proven worth. Included in this group of carbon compounds are the organic derivatives of magnesium known after their discoverer as Grignard reagents (*q.v.*). The application of these reagents in chemical synthesis has proved to be one of the most fruitful and far-reaching improvements in practical organic chemistry since the end of the 19th century.

Brief references to organo-metallic compounds have been given under the headings of certain of the metals and metalloids, and the present article affords a general survey of the whole group. The arrangement adopted below follows the natural sequence of the elements according to the periodic law (*q.v.*).

First Series. *Alkali Metals.*—Although the production of alkyl derivatives of sodium was claimed by Buckton in 1859, the existence and properties of these substances remained doubtful until comparatively recently (W. Schlenk and others, 1913–17). Lithium ethyl, $Li{\cdot}C_2H_5$, is prepared by the action of metallic lithium on mercury diethyl; it crystallizes from benzene or high-boiling petroleum in colourless, six-sided plates melting at 95° C. Lithium methyl, $Li{\cdot}CH_3$, and lithium phenyl, $Li{\cdot}C_6H_5$, are crystalline powders obtained by double decomposition between lithium ethyl and mercury dimethyl and diphenyl respectively (Schlenk and Holtz, 1917). Sodium triphenylmethyl, $Na{\cdot}C(C_6H_5)_3$, a convenient starting point in the preparation of simpler sodium alkyls, is obtained by the action of 1% sodium amalgam on triphenylchloromethane, $(C_6H_5)_3CCl$, dissolved in dry ether in an atmosphere of oxygen-free nitrogen. The product, a brownish-red substance, when allowed to react with mercury dimethyl in inert media, furnishes sodium methyl, $Na{\cdot}CH_3$, as a white powder which burns in air with explosive rapidity. Sodium ethyl, $Na{\cdot}C_2H_5$, sodium *n*-propyl, $Na{\cdot}C_3H_7$, and sodium phenyl, $Na{\cdot}C_6H_5$, are colourless solids having similar properties.

Currency Metals.—Cuprous phenyl, $Cu{\cdot}C_6H_5$, obtained by the interaction of cuprous iodide and magnesium phenyl bromide in ethereal solution, is a white powder decomposing at 80° C into copper and diphenyl. Silver phenyl, $Ag{\cdot}C_6H_5$, an even more unstable substance obtained from phenyl magnesium bromide and silver bromide, is a yellow solid, exploding on rubbing, on gentle warming or on treatment with acids.

An ethereal solution of auric bromide and magnesium ethyl bromide yields on evaporation colourless crystalline diethylauric bromide, $(C_2H_5)_2AuBr$, melting at 58° C and exploding at 70° C. Bromine in chloroform converts this monobromide into the ruby-red ethylauric dibromide, $C_2H_5{\cdot}AuBr_2$ (W. J. Pope and C. S. Gibson, 1907).

Second Series.—The organic derivatives of beryllium are referred to under this metal and the organo-magnesium compounds are described in a special article. (*See* GRIGNARD REAGENTS.) The organo-zinc compounds were discovered by E. Frankland in 1849, and from his study of similar compounds he was led to the conception of chemical valency. In conjunction with Duppa (1863) he applied them in many organic syntheses which were extended by Freund (1861), Butlerow (1867) and others. Zinc dimethyl (b.p. 46° C) and zinc diethyl (b.p. 118° C) are colourless malodorous liquids, spontaneously inflammable in air. They are prepared by distilling the products of the interaction of methyl and ethyl iodides with a zinc copper couple. More recently zinc phenyl bromide, as a crystalline dietherate (Blaise, 1911), and zinc diphenyl (A. Job and R. Reich, 1923) have been obtained by the interaction of magnesium phenyl bromide and anhydrous zinc chloride.

The cadmium dialkyls (dimethyl, diethyl, dipropyl, dibutyl, etc.) are procurable in good yields from anhydrous cadmium bromide and the appropriate magnesium alkyl bromide. Cadmium dimethyl, $Cd(CH_3)_2$ is a colourless liquid boiling at 105° C (E. Krause, 1917). Mercury possesses a remarkable capacity for combination with the carbon of hydrocarbon groups and of organic radicals in general. Sodium amalgam acts directly on ethyl iodide and bromobenzene, giving respectively mercury diethyl, $Hg(C_2H_5)_2$ (b.p. 159° C), and mercury diphenyl, $Hg(C_6H_5)_2$ (m.p. 120° C). With certain reactive substances such as aromatic bases or phenols, mercury derivatives are obtained merely by boiling with mercuric acetate; aniline yields *o*- and *p*-aminophenylmercuriacetates, whereas *m*-toluidine takes up two and even three mercuriacetate residues. Phenol gives rise to *o*- and *p*-hydroxyphenylmercuriacetates and hydroxyphenyl-2:4-dimercuriacetate. In addition to the foregoing processes, organo-mercury compounds are conveniently prepared through the agency of Grignard reagents. Mercury dimethyl, a colourless liquid boiling at 89–92° C, is obtained from magnesium methyl iodide and mercuric chloride, and the homologous mercury dialkyls are prepared similarly.

Third Series.—Aluminium trialkyls and triaryls have been recorded, and the production of these substances is facilitated by the use of Grignard reagents. Magnesium ethyl bromide and anhydrous aluminium chloride interact in dry ether to produce aluminium triethyl etherate, $4Al(C_2H_5)_3{\cdot}3(C_2H_5)_2O$, as a colourless mobile liquid boiling at 112° C/16 mm. It fumes in air, takes fire spontaneously and is decomposed explosively by cold water, (E. Krause and B. Wendt, 1923). Aluminium diethyl iodide (b.p. 118–120° C/4 mm.) and aluminium ethyl diiodide (m.p. 35–37° C; b.p. 158–160° C/4 mm.) were obtained by V. Grignard and R. L. Jenkins (1925) from the liquid product of the interaction of aluminium and ethyl iodide.

Organic derivatives of indium and thallium are obtainable through the Grignard reagents. Thallic bromide, but not thallous bromide, yields both dialkyl and diaryl compounds. Thallic dimethyl bromide, $(CH_3)_2TlBr$, forms silvery-white leaflets (R. J.

Meyer and A. Bertheim, 1904), whereas thallic diphenyl bromide, $(C_6H_5)_2TlBr$, is obtained in colourless transparent microscopic needles (D. Goddard and A. E. Goddard, 1922).

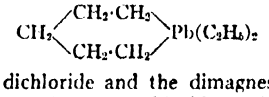
Fourth Series.—Organic derivatives are known of silicon (*q.v.*), germanium (*q.v.*), tin and lead. The commercially important lead tetraethyl, variously known as ethyl, tetraethyl lead, and lead ethide, was formerly obtained by the interaction of Frankland's reagent, zinc diethyl, and lead chloride. It is now manufactured in the U.S.A. by the action of gaseous ethyl chloride under pressure on a powdered alloy of lead and sodium contained in an autoclave with heat control. The liquid lead tetraethyl is drained from the by-product, sodium chloride, and distilled in steam. It is thus obtained as a colourless liquid, stable in air and boiling at 200° C. For use as an antidetonant, lead tetraethyl (54·5%) is mixed with ethylene dibromide (36·4%) and Halowax oil (9·0%) containing a distinctive red aniline dye, and this "ethyl fluid" has a specific gravity of 1·79/20° C.

Lead tetramethyl, obtainable by similar processes to its tetraethyl homologue, is a colourless liquid boiling at 110° C. These two lead tetralkyls and their homologues are obtainable through the appropriate Grignard reagents

$$4R{\cdot}MgBr + 2PbBr_2 = PbR_4 + Pb + 4MgBr_2,$$

but this reaction goes smoothly only in the case of lead tetramethyl, for with the homologous alkyl compounds unsaturated lead trialkyls, PbR_3, are formed as by-products. The four alkyl groups attached to lead can be removed in stages by the action of halogens, and different alkyls can then be substituted for the halogen atom. In this way many mixed lead tetralkyls have been prepared (G. Grüttner and E. Krause, 1917). When prepared from magnesium phenyl bromide, lead tetraphenyl, $Pb(C_6H_5)_4$, is accompanied by lead triphenyl, $Pb(C_6H_5)_3$, and lead tri-*p*-tolyl, $Pb(C_7H_7)_3$, and lead tri-*p*-xylyl, $Pb(C_8H_9)_3$, have also been described (Krause and M. Schmitz, 1919).

Grüttner and Krause have prepared a cyclic lead compound, diethyl*cyclo*plumbipentane,

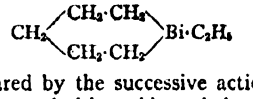


from diethyl lead dichloride and the dimagnesium compound of 1:5–dibromopentane. Stannous chloride and magnesium ethyl bromide give tin diethyl, $Sn(C_2H_5)_2$, as an oxidisable oil insoluble in water (P. Pfeiffer, 1911), whereas tin diphenyl, $Sn(C_6H_5)_2$, a bright yellow powder melting at 130° C to a dark red liquid, is obtained from stannous chloride and magnesium phenyl bromide. When excess of Grignard reagent is used, this diaryl compound loses half its tin and passes into hexaphenyldistannane, $3Sn(C_6H_5)_2 = Sn + (C_6H_5)_3Sn{\cdot}Sn(C_6H_5)_3$, obtained in colourless plates melting at 237° C (E. Krause and R. Becker, 1920). Tin tetramethyl, $Sn(CH_3)_4$, and tin tetraethyl, $Sn(C_2H_5)_2$, boiling at 78° C and 175° C respectively, are prepared in good yields from stannic chloride and the appropriate Grignard reagents; in the latter case triethylstannic chloride, $(C_2H_5)_3SnCl$, is obtained as a by-product.

Magnesium benzyl chloride and stannic chloride give tribenzylstannic chloride, $(C_7H_7)_3SnCl$, (m.p. 143–145° C) and tin tetrabenzyl (tetrabenzylstannane), $Sn(C_7H_7)_4$, (colourless needles, m.p. 42–43° C). The former compound when acted on by iodine furnishes dibenzylstannic chloride $(C_7H_7)_2SnCl_2$ in colourless crystals melting at 163–4° C (Smith and Kipping, 1912).

Fifth Series.—Certain of the more outstanding examples of organic derivatives of arsenic and antimony are described briefly in the articles on these metalloids and further information can be gained from the monographs mentioned below in the bibliography. Both trialkyl- and triaryl-bismuthines have long been known and were formerly prepared by the interaction of alkyl or aryl halides and sodium or potassium bismuthides.

The use of Grignard reagents has considerably enlarged the bismuth series of organic compounds. Diphenyl-α-naphthylbismuthine and tri-α-naphthylbismuthine (melting points 118–119° C and 235° C) have been prepared in this way (F. Challenger, 1914), and a cyclic bismuth compound, ethyl*cyclo*bismuthopentane has been prepared by the successive action on bismuth tribromide of magnesium ethyl bromide and the dimagnesium compound of 1:5–dibromopentane (G. Grüttner and M. Wiernik, 1915); it is a yellow viscous oil boiling at 108–112° C/18–20 mm. with an unpleasant odour and oxidising rapidly in air.



Sixth Series.—Organic derivatives of selenium (*q.v.*) and tellurium (*q.v.*) are mentioned under these headings. A remarkable series of organic chromium compounds has been described by F. Hein (1919–24), who by the action of magnesium phenyl bromide either on chromyl chloride or on anhydrous chromic chloride obtained chromium pentaphenyl bromide, $Cr(C_6H_5)_5Br$, an orange-brown amorphous substance converted by alcoholic potash into chromium pentaphenyl hydroxide,

$$Cr(C_6H_5)_5OH,4H_2O,$$

crystallising in golden-yellow leaflets. This basic hydroxide on treatment with acids loses a phenyl group giving rise to salts of the general type $[Cr(C_6H_5)_4]X$ (where X is the acid radical). Moreover, the mother-liquors from chromium pentaphenyl hydroxide contain chromium triphenyl hydroxide, which gives the corresponding salts $[Cr(C_6H_5)_3]X$. These organic derivatives indicate that chromium has valencies of 6, 5 and 4.

Eighth Series.—Platinic chloride was mixed with dry ether and the syrupy mixture added slowly to magnesium methyl iodide in ether. After adding water and extracting with benzene, the concentrated extract yielded yellow crystals of trimethyl platinic iodide, $(CH_3)_3PtI$, which is converted by moist silver oxide into trimethyl platinic hydroxide, $(CH_3)_3Pt{\cdot}OH$, a colourless base insoluble in water but dissolving in nitric acid to form the readily soluble nitrate, $(CH_3)_3Pt{\cdot}NO_3$. The corresponding chloride, $(CH_3)_3Pt{\cdot}Cl$ crystallises from chloroform in colourless rhombic dodecahedra (W. J. Pope and S. J. Peachy, 1909).

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(G. T. M.)

ORGANON, the name given to Aristotle's logical treatises (Gr. *ὄργανον*, instrument). They are so called because logic is itself neither a speculative science nor a practical art in the ordinary sense, but an aid or instrument to all scientific thought. Francis Bacon gave to his own treatise the name *Novum Organum* in the belief that he had discovered a new inductive logic.

ORCY, a term originally denoting the secret rites or ceremonies connected with the worship of certain deities. The word is derived from Lat. *Orgia*, Gr. *ὄργια*, a post-Homeric word used of the secret rites of Demeter (*q.v.*), at Eleusis, of the Cabeiri, Orpheus and Eumolpus (*qq.v.*), but most commonly of the rites of Dionysus-Bacchus, with their dedications and purifications. The word has been connected with **ἔργω* = *ἔρδω*, *ῥέζω*, in the sense of performing sacred rites; Lat. *operari*, to perform sacrifice. The Dionysiac orgies, which were restricted to women, were celebrated in the winter among the Thracian hills or in spots remote from city life. The women met, generally at night, clad in fawn-skins, with hair dishevelled, swinging the thyrsus and beating the cymbal; they danced and worked themselves up to a state of mad excitement. A bull, the representative of the god, was torn in pieces by them as Dionysus-Zagreus had been torn. The women tore the bull with their teeth, and the eating of the raw flesh was a necessary part of the ritual. The most famous festival of the kind was the *τριετηρίς*, the triennial festival, celebrated on Parnassus by the women of Attica and Phocis. The

celebrants were called Maenads or Bacchae. The wild dances and other "orgiastic" ceremonies have given rise to the use of the word "orgy" for any wild revel or festivity. (*See* DIONYSUS and MYSTERY.)

ORIBI or **OUREBI,** a small South African antelope (*Oribia scoparia*), standing about 24in. at the shoulder, and characterized by a bare glandular spot below the ear, the upright horns of the bucks, which are ringed for a short distance above the face, and the tufted bushy tail. The name is extended to include the other members of the same genus.

ORIEL, in architecture, a projecting bay window carried by corbels or mouldings. It is usually polygonal or semicircular in plan, but at Oxford, in some of the colleges, there are examples which are rectangular and rise through two or three storeys. In Germany it forms a favourite feature, and is sometimes placed at the angle of a building, carried up through two or three floors and covered with a lofty roof. The oriel is also said to have been provided as a recess for an altar in an oratory or small chapel. In the 15th century oriels came into general use, and are frequently found over entrance gateways.

The earliest meaning of the word seems to be a gallery, portico or corridor, and the application of the term to a particular form of window apparently arose from such a window being in an "oriel." In Cornwall "orrel" is still used of a balcony or porch at the head of an outside staircase leading to an upper storey in a fisherman's cottage. The name of Oriel college, Oxford, comes from a tenement known as Seneschal Hall or La Oriole, granted to the college in 1327. (*See* BAY; WINDOW.)

ORIENTAL COOKERY is characterized by the use of many condiments, often making the food very "hot," and by the use of very sweet dishes. In general, the Orient prefers main dishes in which many food materials have been combined into one appetizing whole, and this means cutting into small pieces. Confucius refused to eat food that was not "chopped up properly," and also ruled that there must never be more flesh food than vegetables in the mixture. A Japanese rule calls for the five tastes of sweet, salt, sour, bitter and acrid in each meal, and another for something in each from both sea and mountain. The most widely used meat is lamb or mutton. In China pork is common. The *kebob* of Turkey and India is meat, fish or poultry cut small and strung on a skewer, often with alternating slices of vegetable. It is usually broiled. *Pilaf* or *pilau,* the national dish of Turkey and much eaten in India, is a dish of rice (usually browned in fat before cooking in stock), to which flesh foods or vegetables or both are added, either cooked with the rice or served on it, and the mixture highly seasoned. The Armenian *herissa* and the Arabian *couscous* are similar dishes made with cracked wheat instead of rice. The Turkish *dolma* is a vegetable stuffed with rice and minced meat or olive oil. Vine leaves are also used for this. Birds, domestic and wild, vary the diet. Fish and shellfish furnish more of the flesh food than does meat, being in most places abundant and cheap. All flesh foods and vegetables are preserved by drying as well as in other ways. "Bombay duck" is dried salted fish. Flesh foods eaten in the East not used in the West include buffalo, cat, dog, field rat, snake, lizard, beetle, cockroach, larvae, ant, worm, shark fin and whale, some of these being held to be great delicacies.

For fat, India uses *ghee* (clarified butter), China peanut oil, Turkey and adjacent countries olive oil, and many sesame oil. Eggs are cooked in many ways. Bread is not in as general use as in the Occident, though in Japan it is growing in popularity. The *chapati* of the Indian peasant is a thin wafer made of whole wheat flour, "pan" fried in *ghee.* The main vegetable food of the Orient is rice, which is almost everywhere served with every meal, and is generally cooked in stock. Cracked wheat, barley, buckwheat, sesame and the millets are used in some countries. Noodles are eaten, and Italian pastes, though not native, are now in Eastern markets. Milk is used in Turkey and kindred countries when curdled (*matzoun*) as a beverage and in sauces. Tea is the universal beverage of the Orient, and in some countries coffee is common. Tufkish coffee is made from the following formula: For four small cups, ¾ cup water, 3 teaspoons sugar, 3 teaspoons pulverized coffee. Melt the sugar in the water over the fire, remove from fire, add coffee, stir one minute, return to fire and bring to boiling point three or four times. This is not strained, but sipped from the cup after the coffee has settled to the bottom.

Fruits are usually cooked, except that dates, the staple food of the lands of the Near East, are rarely cooked except in puddings and confections. In China pineapple is often cooked with chicken and other meats. Pastries, sweet with sugar syrup and often with nuts, or a sweet fruit compote, are the usual ending for a Turkish meal. The Chinese and Japanese use sweet cakes, confections and puddings, or cooked or preserved fruits. Salads are much eaten in the Near East, usually of a combination of vegetables and perhaps fruits. Seasonings used in the Orient not common in the Occident include cummin, saffron, coriander seed, tamarind, chilis in variety, curry powder and soy sauce. Vegetable foods form the greater part of the diet.

The most famous dish of India is the curry, in which material cooked with curry powder or in a curry sauce is served in a ring of rice. The epicure insists on curries made from spices ground fresh each day, but curry powder and essence may be made ahead in the home or may be bought bottled. A good formula for curry sauce, hot enough for the average Western taste, but not for that of India, uses 2 tablespoons minced onion, fried a little in ¼ cup butter, 1½ tablespoons curry powder, mixed to a paste with a little of 2 cups of stock or milk, 2 teaspoons curry essence, ¼ teaspoon salt, 1 tablespoon rice flour, 1 cup cocoanut or almond milk (made by soaking an hour in 1 cup milk, ½ cup freshly ground cocoanut or blanched almonds ground fine, and used with or without straining), 1 teaspoon scraped green ginger, 1 teaspoon currant jelly. The meat, fish, shellfish, poultry or vegetables are cooked in the sauce. With a curry is served chutney, a sauce or conserve made of sweet and sour fruits and vegetables, highly spiced.

Chinese and Japanese food are similar, though not the same. Young bamboo sprouts, bean sprouts, water chestnuts, dried mushrooms and *pe-tsai* (Chinese cabbage) are favourite vegetables. The soy bean is used not only in soy sauce, but for the delicate bean curd that adds an agreeable texture and flavour to so many dishes. The famous bird's nests of China are used in dishes with chicken and pigeon as well as for soup. They are a luxury, as are the equally famous ancient eggs. Almonds are used in many combinations. Chop suey is a dish unknown in China. The Japanese serve many foods cooked in deep fat after being dipped in a very delicate batter. In Japan the diner in a restaurant often cooks his own food in an iron skillet set on the dining table.

(I. E. L.)

ORIENTAL SORE, a form of ulcer. (*See* KALA-AZAR.)

ORIENTATION, a term expressing the angular relation of any object to the points of the compass; in architecture, used to express the relation of the main dimensions of a building, with reference to the points of the compass, and especially with reference to the east. In Mesopotamia and Egypt, as well as in primitive Central America, orientation of buildings was common from an early date, with important features, entrances, passages and the like designed to point in the direction of the rising sun. In north Europe the same custom evidently prevailed, as Stonehenge, near Salisbury, England, is carefully orientated. Many Greek temples were also designed to face the rising sun.

In the earliest Christian basilicas at Rome, the apse was placed at the west end, so that the priest who served the altar from behind, facing the congregation, himself faced the east and the rising sun. This orientation has sometimes been traced to the influence of the churches of the Holy Sepulchre at Jerusalem and of the Nativity at Bethlehem. It is more probable, however, that this orientation was due to an underlying tradition whose roots go far back beyond the origin of Christianity.

In St. Sophia, Constantinople, and all the Byzantine churches, the apse was placed at the east end, and the same custom obtains in the early churches in Syria and the Coptic churches in Egypt. During the 6th and 7th centuries this orientation gradually came into use in Italy and the west generally. Orientation of this type, with the apse or altar toward the east, is generally carefully observed in Spain, Germany and England, and

less carefully in France and Italy. It is so common, however, that in an architectural or ecclesiastical description of a church building, the "east end" is always the end with the apse or altar. In Mohammedan mosques the mihrab or prayer niche is so placed that the worshipper looks towards Mecca.

Orientation is an important consideration in the placing of any building, as exposure to the sun, or lack of it, prevailing winds and similar facts in climate must be considered in designing a building for any purpose. Thus in the northern temperate zone, living rooms are usually arranged to get large amounts of south light; studios are arranged with north light, and, in general, buildings like schools, with rooms on both sides of a corridor, are placed, if possible, with the corridor running north and south, so that the rooms on both sides may receive the sun.

ORIENTE or **LA REGION ORIENTALE,** a large undefined territory of Ecuador, comprising all that part of the republic lying east of the Andes. Pop. (1920 estimate), 100,000. The territory was formed in 1884 from the older territories of Napo, Canelos and Zamora, but its boundaries with the neighbouring republics of Colombia and Peru are disputed. The territory is covered with great forests, inhabited by wild Indians, and its climate is hot and exceptionally humid. There are some mission settlements and trading stations in the Andean foothills and on some of the rivers, one of which is Archidona, the nominal capital.

ORIGEN (*c.* 185–*c.* 254), the most distinguished and most influential of all the theologians of the ancient church, with the possible exception of Augustine.

Origen was born, perhaps at Alexandria, of Christian parents in the year 185 or 186. His father Leonidas gave him an excellent education. At a very early age, about the year 200, he listened to the lectures of Pantaenus and Clement in the catechetical school. This school, of which the origin (though assigned to Athenagoras) is unknown, was the first and for a long time the only institution where Christians were instructed simultaneously in the Greek sciences and the doctrines of the holy Scriptures. Asia Minor and the West developed the strict ecclesiastical forms by means of which the church closed her lines against heathenism, and especially against heresy; in Alexandria Christian ideas were handled in a free and speculative fashion and worked out with the help of Greek philosophy. The line between heresy and orthodoxy was less rigidly drawn there than at Ephesus, Lyons, Rome or Carthage.

In the year 202 a persecution arose, in which the father of Origen perished. Origen began about the same time to earn his bread by teaching; and in 203 he was placed, with the sanction of the bishop of Demetrius, at the head of the catechetical school. He regularly attended the lectures of Ammonius Saccas, and made a thorough study of the books of Plato and Numenius, of the Stoics and the Pythagoreans. At the same time he endeavoured to acquire a knowledge of Hebrew, in order to be able to read the Old Testament in the original. His manner of life was ascetic; the sayings of the Sermon on the Mount and the practical maxims of the Stoics were his guiding stars. Four oboli a day, earned by copying manuscripts, sufficed for his bodily sustenance. A rash resolve led him to castrate himself that he might work unhindered in the instruction of women.

He commenced his great work on the textual criticism of the Scriptures; and at the instigation of his friend Ambrosius, who provided him with the necessary amanuenses, he published his commentaries on the Old Testament and his dogmatic investigations. He worked at Alexandria for 28 years (till 231–232). This period, however, was broken by many journeys to Rome, to Arabia, to Antioch, and, in 216, when the imperial executioners were ravaging Alexandria, to Palestine. There the bishops of Jerusalem and Caesarea got him to deliver public lectures in the churches. In the East, especially in Asia Minor, it was still no unusual thing for laymen, with permission of the bishop, to address the people in the church. In Alexandria, however, this custom had been given up, and Demetrius took occasion to express his disapproval and recall Origen to Alexandria.

Probably the bishop was jealous of the high reputation of the teacher; and a coolness arose between them which led, fifteen years later, to an open rupture. On his way to Greece (apparently in the year 230) Origen was ordained a presbyter in Palestine by his friends the bishops. This was undoubtedly an infringement of the rights of the Alexandrian bishop; at the same time it was simply spite on the part of the latter that had kept Origen so long without orders. Demetrius convened a synod, at which it was resolved to banish Origen from Alexandria. A second synod, composed entirely of bishops, determined that Origen must be deprived of his status as a presbyter. This decision seems to have been justified by referring to the self-mutilation of Origen and adducing objectionable doctrines which he was said to have promulgated. No formal excommunication of Origen appears to have been decreed; the sentence of deprivation was approved by most of the churches, in particular by that of Rome. At a later period Origen sought to vindicate his teaching in a letter to the Roman bishop Fabian, but, it would seem, without success.

In these circumstances Origen retired from Alexandria (231–232) to Palestine, where his condemnation had not been acknowledged by the churches. He settled in Caesarea, and established a flourishing school there. Enthusiastic pupils sat at his feet (see the *Panegyric* of Gregory Thaumaturgus), and the methodical instruction which he imparted was famous all over the East. He made frequent journeys. He was for two years together at Caesarea in Cappadocia, where he was overtaken by the Maximinian persecution; here he worked at his recension of the Bible. We find him again in Nicomedia, in Athens, and twice in Arabia. He was called there to combat the unitarian christology of Beryllus, bishop of Bostra, and to clear up certain eschatological questions. As he had formerly had dealings with the house of Alexander Severus, so now he entered into a correspondence with the emperor Philip the Arabian and his wife Severa. But through all situations of his life he preserved his equanimity, his keen interest in science, and his indefatigable zeal for the instruction of others. In the year 250 the Decian persecution broke out, Origen was arrested, imprisoned and maltreated. But he survived these troubles and lived a few years longer in active intercourse with his friends. He died, probably in the year 254 at Tyre.

Writings.—Origen is probably the most prolific author of the ancient church. "Which of us," asks Jerome, "can read all that he has written?" The number of his works was estimated at 6000, but that is certainly an exaggeration. Owing to the increasing unpopularity of Origen in the church, a comparatively small portion of these works have come down to us in the original. We have more in the Latin translation of Rufinus; but this translation is by no means trustworthy, since Rufinus, assuming that Origen's writings had been tampered with by the heretics, considered himself at liberty to omit or amend heterodox statements. Origen's real opinion, however, may frequently be gathered from the *Philocalia*—a sort of anthology from his works prepared by Basil the Great and Gregory Nazianzenus. The fragments in Photius and in the *Apology* of Pamphilus serve for comparison. The writings of Origen consist of letters, and of works in textual criticism, exegesis, apologetics, dogmatic and practical theology.

1. Eusebius (to whom we owe our full knowledge of his life) collected more than a hundred of Origen's letters, arranged them in books, and deposited them in the library at Caesarea (*H.E.* vi. 36). In the church library at Jerusalem (founded by the bishop Alexander) there were also numerous letters of this father (Euseb. *H.E.* vi. 20). But unfortunately they have all been lost except two—one to Julius Africanus and one to Gregory Thaumaturgus. There are, besides, a couple of fragments.

2. Origen's textual studies on the Old Testament were undertaken partly in order to improve the manuscript tradition, and partly for apologetic reasons, to clear up the relation between the LXX and the original Hebrew text. The results of more than twenty years' labour were set forth in his *Hexapla* and *Tetrapla*, in which he placed the Hebrew text side by side with the various Greek versions, examined their mutual relations in detail, and tried to find the basis for a more reliable text of the LXX. The *Hexapla* was probably never fully written out, but excerpts were made from it by various scholars at Caesarea in the 4th century; and thus large sections of it have been saved. He worked at the text of the New Testament, although he produced no recension.

3. The exegetical labours of Origen extend over the whole of the Old and New Testaments. They are divided into *Scholia* (σημειώσεις, short annotations, mostly grammatical), *Homilies* (edifying expositions grounded on exegesis), and *Commentaries* (τόμοι). In the Greek original only a very small portion has been preserved; in Latin translations, however, a good deal. The most important parts are the homilies on Jeremiah, the books of Moses, Joshua and Luke, and the commentaries on Matthew, John and Romans. With grammatical precision, antiquarian learning and critical discernment Origen combines the allegorical method of interpretation—the logical corollary of his conception of the inspiration of the Scriptures. He distinguishes a threefold sense of scripture, a grammatico-historical, a moral and a pneumatic—the last being the proper and highest sense. He thus set up a formal theory of allegorical exegesis, not quite extinct in the churches even yet, and in his own system of fundamental importance.

4. The principal apologetic work of Origen is his book κατὰ Κέλσου (eight books), written at Caesarea in the time of Philip the Arabian. It has been completely preserved in the original. This work is invaluable as a source for the history and situation of the church in the 2nd century; for it contains nearly the whole of the famous work of Celsus (Λόγος ἀληθής) against Christianity. What makes Origen's answer so instructive is that it shows how close an affinity existed between Celsus and himself in their fundamental philosophical and theological presuppositions. The real state of the case is certainly unsuspected by Origen himself; but many of his opponent's arguments he is unable to meet except by a speculative reconstruction of the church doctrine in question. Origen's apologetic is most effective when he appeals to the spirit and power of Christianity. In details his argument is not free from sophistical subterfuges and superficial reasonings.

5. Of the dogmatic writings we possess only one in its integrity, and that only in the translation of Rufinus, Περὶ ἀρχῶν (On the Fundamental Doctrines). This work, which was composed before 228, is the first attempt at a dogmatic at once scientific and accommodated to the needs of the church. The material is drawn from Scripture, but in such a way that the propositions of the *regula fidei* are respected. This material is then formed into a system by all the resources of the intellect and of speculation. Origen thus solved, after his own fashion, a problem which his predecessor Clement had not even ventured to grapple with. The first three books treat of God, the world, the fall of spirits, anthropology and ethics. "Each of these three books really embraces, although not in a strictly comprehensive way, the whole scheme of the Christian view of the world, from different points of view, and with different contents." The fourth book explains the divinity of the Scriptures, and deduces rules for their interpretation. It ought properly to stand as first book at the beginning. The ten books of *Stromata* (in which Origen compared the teaching of the Christians with that of the philosophers, and corroborated all the Christian dogmas from Plato, Aristotle, Numenius and Cornutus) have perished, with the exception of fragments; so have the tractates on the resurrection and freewill.

6. Of practical theological works we have still the Προτρεπτικὸς εἰς μαρτύριον and the Σύνταγμα περὶ εὐχῆς. For a knowledge of Origen's Christian estimate of life and his relation to the faith of the church these two treatises are of great importance. The first was written during the persecution of Maximinus Thrax, and was dedicated to his friends Ambrosius and Protoctetus. The other also dates from the Caesarean period; it mentions many interesting details, and concludes with a fine exposition of the Lord's Prayer.

7. In his own lifetime Origen had to complain of falsifications of his works and forgeries under his name. Many pieces still in existence are wrongly ascribed to him; yet it is doubtful whether a single one of them was composed on purpose to deceive. The most noteworthy are the *Dialogues* of a certain Adamantius "de recta in Deum fide," which seem to have been erroneously attributed to Origen so early as the 4th century.

Outline of Origen's View of the Universe and of Life.—The system of Origen was formulated in opposition to the Greek philosophers on the one hand, and the Christian Gnostics on the other[1]. But the science of faith, as expounded by him, bears unmistakably the stamp both of Neo-Platonism and of Gnosticism. As a theologian, in fact, Origen is not merely an orthodox traditionalist and believing exegete, but a speculative philosopher of Neo-Platonic tendencies. He is, moreover, a judicious critic. The union of these four elements gives character to his theology, and in a certain degree to all subsequent theology. It is this combination which has determined the peculiar and varying relations in which theology and the faith of the church have stood to each other since the time of Origen. That relation depends on the predominance of one or other of the four factors embraced in his theology.

As an orthodox traditionalist Origen holds that Christianity is a practical and religious saving principle, that it has unfolded itself in an historical series of revealing facts, that the church has accurately embodied the substance of her faith in the *regula fidei*, and that simple faith is sufficient for the renewal and salvation of man. As a philosophical idealist, however, he transmutes the whole contents of the faith of the church into ideas which bear the mark of Neo-Platonism, and were accordingly recognized by the later Neo-Platonists as Hellenic[2]. In Origen, however, the mystic and ecstatic element is held in abeyance. The ethico-religious ideal is the sorrowless condition, the state of superiority to all evils, the state of order and of rest. In this condition man enters into likeness to God and blessedness; and it is reached through contemplative isolation and self-knowledge, which is divine wisdom.

As a means to the realization of this ideal, Origen introduces the whole ethics of Stoicism. But the link that connects him with churchly realism, as well as with the Neo-Platonic mysticism, is the conviction that complete and certain knowledge rests wholly on divine revelation, *i.e.*, on oracles. Consequently his theology is cosmological speculation and ethical reflection based on the sacred Scriptures. The Scriptures, however, are treated by Origen on the basis of a matured theory of inspiration in such a way that all their facts appear as the vehicles of ideas, and have their highest value only in this aspect. That is to say, his gnosis neutralizes all that is empirical and historical, if not always as to its actuality, at least absolutely in respect of its value. The most convincing proof of this is that Origen (1) takes the idea of the immutability of God as the regulating idea of his system, and (2) deprives the historical "Word made flesh" of all significance for the true Gnostic. To him Christ appears simply as the Logos who is with the Father from eternity, and works from all eternity, to whom alone the instructed Christian directs his thoughts, requiring nothing more than a perfect—*i.e.*, divine—teacher. In such propositions historical Christianity is stripped off as a mere husk. The objects of religious knowledge are beyond the plane of history, or rather belong to a supra-mundane history.

On this view contact with the faith of the church could only be maintained by distinguishing an exoteric and an esoteric form of Christianity. This distinction was already current in the catechetical school of Alexandria, but Origen gave it its boldest expression, and justified it on the ground of the incapacity of the Christian masses to grasp the deeper sense of Scripture, or unravel the difficulties of exegesis. On the other hand, in dealing with the problem of bringing his heterodox system into conformity with the *regula fidei* he evinced a high degree of technical skill. An external conformity was possible, inasmuch as speculation, proceeding from the higher to the lower, could keep by the stages of the *regula fidei*, which had been developed into a history of salvation. The system itself aims in principle at being thoroughly monistic; but, since matter, although created by God out of nothing, was regarded merely as the sphere in which souls are punished and purified, the system is pervaded by a strongly dualistic element. The immutability of God requires the eternity of the Logos and of the world. At this point Origen succeeded in avoiding the heretical Gnostic idea of God by assigning to the Godhead the attributes of goodness and righteousness. The pre-

[1] The opposition to the unitarians within the church must also be kept in mind.

[2] Porphyry says of Origen, κατὰ τὰ περὶ πραγμάτων καὶ τοῦ θείου δόξας Ἀλλ' Ἑλληνίζων (Euseb. *H.E.* vi. 19).

existence of souls is another inference from the immutability of God, although Origen also deduced it from the nature of the soul, which as a spiritual potency must be eternal. From this follows the necessity for the created spirit, after apostasy, error and sin, to return always to its origin in God.

The actual sinfulness of all men Origen was able to explain by the theological hypothesis of pre-existence and the premundane fall of each individual soul. He holds that freedom is the inalienable prerogative of the finite spirit; and this is the second point that distinguishes his theology from the heretical Gnosticism. The system unfolds itself like a drama, of which the successive stages are as follows: the transcendental fall, the creation of the material world, inaugurating the history of punishment and redemption, the clothing of fallen souls in flesh, the dominion of sin, evil and the demons on earth, the appearing of the Logos, His union with a pure human soul, His esoteric preaching of salvation, and His death in the flesh, then the imparting of the Spirit, and the ultimate restoration of all things. The doctrine of the restoration appeared necessary because the spirit, in spite of its inherent freedom, cannot lose its true nature, and because the final purposes of God cannot be foiled. The end, however, is only relative, for spirits are continually falling, and God remains through eternity the creator of the world. Moreover the end is not conceived as a transfiguration of the world, but as a liberation of the spirit from its unnatural union with the sensual.

The old Christian eschatology is set aside; no one has dealt such deadly blows to Chiliasm and Christian apocalypticism as Origen. It need hardly be said that he spiritualized the church doctrine of the resurrection of the flesh. But, while in all these doctrines he appears in the character of a Platonic philosopher, traces of rational criticism are not wanting. Where his fundamental conception admits of it, he tries to solve historical problems by historical methods. Even in the christology, where he is treating of the historical Christ, he entertains critical considerations; hence it is not altogether without reason that in after times he was suspected of "Ebionitic" views of the Person of Christ.

Although the theology of Origen exerted a considerable influence as a whole in the two following centuries, it certainly lost nothing by the circumstance that several important propositions were capable of being torn from their original setting and placed in new connections. It is in fact one of the peculiarities of this theology, which professed to be at once churchly and philosophical, that most of its formulae could be interpreted and appreciated *in utramque partem*. By arbitrary divisions and rearrangements the doctrinal statements of this "science of faith" could be made to serve the most diverse dogmatic tendencies. This is seen especially in the doctrine of the Logos. On the basis of his idea of God Origen was obliged to insist in the strongest manner on the personality, the eternity (eternal generation) and the essential divinity of the Logos[1]. On the other hand, when he turned to consider the origin of the Logos he did not hesitate to speak of Him as a κτίσμα, and to include Him amongst the rest of God's spiritual creatures. A κτίσμα, which is at the same time ὁμοούσιον τῷ Θεῷ, was no contradiction to him, simply because he held the immutability, the pure knowledge and the blessedness which constituted the divine nature to be communicable attributes.

In later times both the orthodox and the Arians appealed to his teaching, both with a certain plausibility; but the inference of Arius, that an imparted divinity must be divinity in the second degree, Origen did not draw. With respect to other doctrines also, such as those of the Holy Spirit and the incarnation of Christ, etc., Origen prepared the way for the later dogmas. The technical terms round which such bitter controversies raged in the 4th and 5th centuries are often found in Origen lying peacefully side by side. But this is just where his epoch-making importance lies, that all the later parties in the church learned from him. And this is true not only of the dogmatic parties; solitary monks and ambitious priests, hard-headed critical exegetes, allegorists, mystics, all found something congenial in his writings. The only man who tried to shake off the theological influence of Origen was Marcellus of Ancyra, who produced no lasting effect on theology.

The attacks on Origen, which had begun in his lifetime, did not cease for centuries, and only subsided during the time of the fierce Arian controversy. It was not so much the relation between *pistis* and *gnosis*—faith and knowledge—as defined by Origen that gave offence, but rather isolated propositions, such as his doctrines of the pre-existence of souls, of the soul and body of Christ, of the resurrection of the flesh, of the final restoration, and of the plurality of worlds. Even in the 3rd century Origen's view of the Trinity and of the Person of Christ was called in question, and that from various points of view. It was not till the 5th century, however, that objections of this kind became frequent. In the 4th century Pamphilus, Eusebius of Caesarea, Athanasius, the Cappadocians, Didymus and Rufinus were on the side of Origen against the attacks of Methodius and many others. But, when the zeal of Epiphanius was kindled against him, when Jerome, alarmed about his own reputation, and in defiance of his past attitude, turned against his once honoured teacher, and Theophilus, patriarch of Alexandria, found it prudent, for political reasons to condemn Origen—then his authority received a shock from which it never recovered.

There were, doubtless, in the 5th century church historians and theologians who still spoke of him with reverence, but such men became fewer and fewer. In the West Vincent of Lerins held up Origen as a warning example (*Commonit.* 23), showing how even the most learned and most eminent of church teachers might become a misleading light. In the East the exegetical school of Antioch had an aversion to Origen; the Alexandrians had utterly repudiated him. Nevertheless his writings were much read, especially in Palestine. The monophysite monks appealed to his authority, but could not prevent Justinian and the fifth oecumenical council at Constantinople (553) from anathematizing his teaching.

BIBLIOGRAPHY.—Next to the works of Origen (*see* Redepenning, "Des Hieronymus wiederaufgefundenes Verzeichnis der Schriften des Origens," in *Zeit. f. d. hist. Theol.* [1851], pp. 66 *seq.*) the most important sources are: Gregory Thaumat., *Panegyricus in Orig.*; Eusebius, *H.E.* vi.; Epiphanius, *Haer.* 64; the works of Methodius, the Cappadocians, Jerome (see *De vir. ill.* 54, 61) and Rufinus; Vincent. Lerin. *Commonit.* 23; Palladius, *Hist. Laus.* 147; Justinian, *Ep. ad Mennam* (Mansi, ix. p. 487 *seq.*); Photius, *Biblioth.* 118, etc. The best of the older editions is that of Delarue (1733–59, 4 vols. fol.; pub. by Migne in *Patrol. Gr.* vols. xi.–xvii.). A critical edition is being brought out by the Preussische Akademie der Wissenschaften; it is not yet completed. Amongst the older works on Origen those of Huetius (printed in Delarue, vol. iv.) are the best; but Tillemont, Fabricius, Walch (*Historie d. Ketzereien*, vii. pp. 362–760) and Schröckh also deserve to be mentioned. In recent times the doctrine of Origen has been expounded in the great works on church history by Baur, Dorner, Böhringer, Neander, Möller (*Geschichte der Kosmologie in der griechischen Kirche*) and Kahnis (*Die Lehre vom h. Geist*, vol. i.); compare with these the works on the history of philosophy by Ritter, Erdmann, Ueberweg and Zeller. Of monographs, the best and most complete is Redepenning, *Origenes, eine Darstellung seines Lebens und seiner Lehre* (2 vols., 1841, 1846). Compare Thomasius, *Orig.* (1837); Krüger, "Über das Verhältnis des Orig. zu Ammonius Sakkas," in the *Ztschr. f. hist. Theol.* (1843), i. p. 46 *seq.*; Fischer, *Comment. de Orig. theologia et cosmologia* (1846); Ramers, *Orig. Lehre von der Auferstehung des Fleisches* (1851); Knittel, "Orig. Lehre von der Menschwerdung," in the *Theol. Quartalschr.* (1872); Schultz, "Christologie des Orig.," in the *Jahrb. f. protest. Theol.* (1875); Mehlhorn, "Die Lehre von der menschlichen Freiheit nach Orig.," in *Zeitschr. f. Kirchengesch.* vol. ii. (1878); Freppel, *Origène*, vol. i., 2nd ed. (Paris, 1875). A full list of the later bibliography will be found in Bardenhewer's *Geschichte der altkirchen litteratur* (2nd ed. 2 vols., 1914) and de Faye *Origène*, vol. i. (1923). (A. HA.)

ORIGINAL PACKAGE, a legal term in America, meaning the package in which goods, intended for inter-State commerce, are actually transported wholesale. The term is used chiefly in determining the boundary between Federal and State jurisdiction in the regulation of commerce, and derives special significance by reason of the conflict between the powers of Congress to regulate commerce and the police legislation of the States with respect to commodities considered injurious to public health and morals.

By the Federal Constitution Congress is vested with the power "to regulate commerce with foreign nations and among the several States, and with the Indian tribes," and each State is forbidden, without the consent of Congress, to "lay any imposts or duties on imports or exports, except what may be absolutely necessary

[1] "Communis substantiae est filio cum patre; ἀπόρροια enim ὁμοούσιος videtur, i.e., unius substantiae cum illo corpore ex quo est ἀπόρροια."

for executing its inspection laws," and the basis of the law on the subject of "original package" was laid when, in 1827, Chief Justice Marshall interpreted these clauses in his decision of the case of *Brown* v. *Maryland* (12 Wheaton 419), which tested the constitutionality of an act of the legislature of Maryland requiring a licence from importers of foreign goods by bale or package and from persons selling the same by wholesale, bale, package, hogshead, barrel or tierce. After pronouncing such a licence to be in effect a tax, the chief justice observed that so long as the thing imported remained "the property of the importer, in his warehouse, in the original form or package in which it was imported," a tax upon it was too plainly a duty on imports to escape the prohibition of the Constitution.

Later decisions agree that the right to import commodities or to ship them from one State to another carries with it the right to sell them, and have established the boundary line between Federal and State control of both foreign imports and inter-State shipments at a sale in the original package (*Waring* v. *Mobile*, 8 Wall. 110) or at the breaking of the original package before sale for other purposes than inspection (*May* v. *New Orleans*, 178 U.S. 498). A State or a municipality may, however, tax while in their original packages any commodities which have been shipped in from another State, provided there be no discrimination against such commodities.

The term occasioned considerable confusion prior to the adoption of the 18th (prohibition) amendment to the Constitution in 1919. The Supreme Court in Jan. 1847, in the licence cases, upheld the constitutionality of Massachusetts, New Hampshire and Rhode Island laws requiring licences for the sale of intoxicating liquors, the liquor having been shipped in the inter-State commerce (5 Howard 504). The justices based their decisions on different opinions and did not even agree that the power of Congress to regulate inter-State commerce included the power to authorize a sale after shipment. The Supreme Court held in *Leisy* v. *Hardin*, in 1889, where a keg of beer sold in Iowa, a prohibition State, had been shipped from Illinois by order of an agent of an Illinois firm, that so long as it was sold in the original package, it remained a matter for Federal regulation only (135 U.S. 100). This overruled in part the doctrine in the licence cases. Congress passed in 1890 the Wilson Act, which provided that where intoxicants were shipped into a State or Territory, they were subject to the police laws of such State or Territory. Even with this act, however, a State was not permitted to interfere with an inter-State shipment of liquor direct to the consumer. The Webb Act, passed by Congress in 1913, did prohibit the shipment of liquor into any State in violation of its police laws.

What constitutes an original package was the principal question in the case of *Schollenberger* v. *Pennsylvania* (171 U.S. 1), the court deciding that the State of Pennsylvania could not prohibit the sale of oleomargarine by retail when it had been shipped from Rhode Island in packages containing only ten pounds each, and the original package doctrine has been sharply criticized because of the difficulty in determining what constitutes an original package, as well as because of the conflict between the doctrine and the police powers of the several States.

See J. B. Uhle, "The Law Governing an Original Package," in *The American Law Register*, vol. xxix. (Philadelphia, 1890); Shackelford Miller, "The Latest Phase of the Original Package Doctrine," and M. M. Townley, "What is the Original Package Doctrine?" both in *The American Law Review*, vol. xxxv. (St. Louis, 1901); also F. H. Cooke, *The Commerce Clause of the Federal Constitution* (1908).

ORIHUELA, a town and episcopal see of eastern Spain, in the province of Alicante; 13 m. N.E. of Murcia and about 15 m. from the Mediterranean Sea, on the Murcia-Elche railway. Pop. (1920) 37,180. Orihuela is situated in a beautiful and exceedingly fertile *huerta*, on both sides of the river Segura, which divides the city into two parts, Roig and San Augusto, and is spanned by two bridges. Orihuela was captured by the Moors in 713, and retaken by James I. of Aragon, for his father-in-law Alphonso of Castile, in 1265. It was sacked during the disturbances at the beginning of the reign of Charles V. (1520), and again in the War of Succession (1706). Local annals specially mention the plague of 1648, the flood of 1651 and the earthquake of 1829. The university of Orihuela, founded in 1568 by the archbishop of Valencia, was closed in 1835. The trade in fruit, cereals, oil and wine is considerable. There are also tanneries, dye and silk works, linen and woollen fabrics, leather and starch.

ORILLIA, a town and port of entry of Simcoe county, Ontario, Canada, situated 84 m. N. of Toronto, on Lake Couchiching and on the Canadian National and Canadian Pacific railways. Pop. (1921) 8,774. It is a favourite summer resort, and has an extensive trade in lumber and farm produce. It contains an asylum, saw and grist mills and iron foundries.

ORINOCO, a river and river system of northern South America. Its basin embraces about one-half of the eastern plains of Colombia and nearly all of Venezuela south and east of the Andes; it ranks third in area among the South American river basins. The main river is about 1,500 m. long from its source in the Sierra Parima on the Venezuela-Brazil boundary to the Atlantic ocean, and, except for a stretch of about 200 m. between the mouths of the Guaviare and Meta rivers, where it forms a part of the Venezuela-Colombia boundary, it is in Venezuela. At about 150 m. from its source it bifurcates into the Casiquiare canal to the Río Negro of the Amazon system, affording a through water way to the Amazon basin. Three major rapids and numerous minor ones obstruct the upper river. At the mouth of the Apure the Orinoco is 2 m. wide in the dry season and often 7 m. wide in time of floods, and narrows to 800 ft. at the city of Ciudad Bolívar. Large steamers can navigate as far as the Cariben rapids, 700 m. from the ocean and only 6 m. from the mouth of the Meta. At the Cariben rapids the difference between high and low water averages 32 ft., while at the Angostura, at Ciudad Bolívar, the average rise is 50 ft. and has been known to reach 60.

The Orinoco enters the ocean by a delta of approximately 700 sq.m. of islands and swamps covered with dense vegetation and so little above sea-level that they are periodically flooded. The Boca Grande at the mouth of the Corosimi river (the southernmost channel of the delta) is the deepest outlet; but the Caño Macareo, one of the outlets of the Vagre river (the westernmost channel of the delta), is usually taken by steamers because it is the most direct navigable route to the Gulf of Paria.

Ordaz, whose expedition (1531–32) entered the Orinoco by the Boca de Navíos and, with much loss of life, ascended to the mouth of the Meta, was the first to explore any part of the river, although Columbus, while exploring the Gulf of Paria in 1498, noticed the freshness of its waters without investigating their source, and Ojeda, following closely the track of Columbus in 1499, probably passed in sight of one or more of the mouths of the river. There have since been many expeditions and surveys.

Except for a few outliers which form isolated hills north of the lower river, the Orinoco is the dividing-line between the *llanos* and the highlands of Venezuelan Guiana. The tributaries from the Guiana highlands are little known. They all have their sources in the divide which carries the Venezuela-Brazil boundary. The largest, the Ventuari, joins the Orinoco about 90 m. above the mouth of the Guaviare. The Caura, the next large stream to the east, is much obstructed with falls and rapids, while the lower Caroni is more or less navigable for some 400 miles. The *llanos* are divided into a broad, well-watered western section and a narrower and much drier eastern section. North of the upper Guaviare and its tributaries the western section rises gently from an elevation of about 130 ft. at the mouth of the Apure to about 700 ft. at the border of the Andes. Its principal rivers have their sources in innumerable mountain torrents that rise in the eastern ranges of the Eastern Cordillera of Colombia. From the Guaviare north to 6° 30′ N. lat. these streams are fed so abundantly by the condensation of moisture from the north-east trade winds, that they have headed far back toward the high savannas of the Eastern Cordillera.

The most important tributaries of the Orinoco in this section are the Apure, Arauca, Meta and Guaviare. The Apure was, until recently, formed by the junction of the Uribante and Sarare, but the latter has now dammed its lower channel and flows to the Arauca, leaving the Uribante, an important stream with 16 large

affluents, and the Nula, formerly a tributary of the Sarare, as the chief sources of the Apure. The Apure is about 650 m. long from the Uribante-Nula junction. It is in large part navigable for large craft but is obstructed by rapids about 100 m. from its mouth. The northern tributaries drain the eastern and southern slopes of the Venezuelan Andes. Of these the Portuguesa, which the cattle route from San Fernando to Puerto Cabello follows, and a few others, are navigable for short distances. The Arauca parallels the Apure on the south. When in flood, the additional water now brought to the Arauca by the Sarare causes it to overflow and send part of its surplus water by several *caños* to the Capanaparo, a tributary which joins the Orinoco about 18 m. S. of the mouth of the Arauca.

The main stream of the Guaviare, southernmost of the great western tributaries of the Orinoco, is known as the Guayabero from its source to the mouth of the Ariari, a large tributary from the north-west. It marks in a general way the dividing line between the low savannas of the north and the higher and more varied topography of the south. The main stream and many of its tributaries after leaving the piedmont cut their way through four distinct zones: (1) a dissected sandstone plateau, the crests of which rise 1,500 ft. above the *llanos;* (2) a zone east of the escarpment of the plateau of sandstone remnants separated by clayey depressions; (3) a crystalline peneplain where the granites and gneisses are mostly covered with lateritic clays; and (4) a low plain on which stand isolated massifs of the dome-like form characteristic of crystalline mountains in wet tropical climates. The Ariari tributary is navigable for large barges for a considerable distance. About 300 m. of the Guayabero-Guaviare are said to be navigable but narrows and rapids which mark the passage of the river from one zone to another offer serious obstacles.

(R. R. P.)

ORIOLE, the name applied in Europe to the members of the family *Oriolidae*. The golden oriole (*Oriolus oriolus*) is an occasional spring visitor to the British Islands, but has rarely bred there. On the continent of Europe it is a well-known bird; its range in summer extends east to Irkutsk, while in winter it is found in Natal and Damaraland. In India it is replaced by an allied form, *O. kundoo*, the mango-bird, and both in Asia and Africa are several other species, some of which have a black head, or even a glowing crimson, instead of the ordinary yellow colouring, while others exhibit the dingy type of plumage seen in the female of the more normal form. Among these last are the species of the group, *Mimeta*, belonging to the Australian region, which mimic friar-birds (*see* A. R. Wallace, *Malay Archipelago;* HONEY-EATER). Another genus which has been referred to the *Oriolidae* is *Sphecotheres*, peculiar to the Australian region, and distinguishable by a bare space round the eye. Orioles are shy and restless birds, frequenting gardens and woods, and living on insects and fruit. The nest is pocket-shaped, of bark, grass, and fibres, and the eggs are white or salmon-coloured with dark spots. The name is applied in America to the *Icteridae* family.

ORION (or OARION), in Greek mythology, son of Hyrieus or Poseidon, a mighty hunter of great beauty and gigantic strength. He is also sometimes represented as sprung from the earth. He was beloved of Eos, the dawn-goddess, who carried him off to Delos; but Artemis slew him with her arrows (*Odyssey*, v. 121). According to other accounts which attribute Orion's death to Artemis, the goddess herself loved him and was deceived by the angry Apollo into shooting him by mistake; or he paid the penalty of offering violence to her, or of challenging her to a contest of quoit-throwing (Apollodorus i. 4; Horace, *Odes*, iii. 4, 71). In the lower world his shade is seen by Odysseus driving the wild beasts before him as he had done on earth (*Odyssey*, xi. 572). After his death he was changed into the constellation which is called by his name. It took the form of a warrior, wearing a girdle of three stars and a lion's skin, and carrying a club and a sword. When it rose early it was a sign of summer; when late, of winter and stormy weather; when it rose about midnight it heralded the season of vintage.

See Küentzle's article in Roscher's *Lexikon;* Preller-Robert, *Griechische Mythologie* (1894), pp. 448–454.

Orion is one of the most conspicuous constellations, containing many bright stars. Of these Betelgeuse is easily distinguished by its yellowish-red colour in contrast to all the other important stars of the constellation which are white B-type stars. Betelgeuse is an irregular variable sometimes above and sometimes below the first magnitude. It was the first star for which the apparent diameter was measured by Michelson's interferometer method (1920). Rigel at the opposite corner of the quadrilateral is rather brighter; and the third brightest star is Bellatrix. The Orion nebula can be seen with the naked eye just below the belt; faint extensions of it have been photographed filling practically the whole constellation. The multiple star θ Orionis is near the centre of the nebula. There is no doubt that the principal stars of the constellation form a single system, and are involved in the nebulosity whose luminescence is stimulated by their intense radiation rich in light of short wave-length. The distance of the nebula is estimated at 180 parsecs.

ORION and **ORUS,** the names of several Greek grammarians, frequently confused. The following are the most important. (1) Orion of Thebes in Egypt (5th century A.D.), the teacher of Proclus the neo-Platonist and of Eudocia, the wife of the younger Theodosius. He taught at Alexandria, Caesarea in Cappadocia and Byzantium. He was the author of a partly extant etymological Lexicon (ed. F. W. Sturz, 1820), largely used by the compilers of the *Etymologicum Magnum,* the *Etymologicum Gudianum* and other similar works; a collection of maxims in three books, addressed to Eudocia, also ascribed to him by Suidas, still exists in a Warsaw ms. (2) Orus of Miletus, who, according to Ritschl, flourished not later than the 2nd century A.D., and was a contemporary of Herodian and a little junior to Phrynichus. His chief works were treatises on orthography; on Atticisms; on the names of nations.

See F. Ritschl, *De Oro et Orione Commentatio* (1834); R. Reitzenstein, *Geschichte der griechischen Etymologika* (1897); and article "Orion" in Smith's *Dictionary of Greek and Roman Biography.*

ORISKANY (ō-rĭs'ką-nĭ), a village of Oneida county, New York, U.S.A., about 7 m. N.W. of Utica. Pop. (1925) 1,177. Oriskany is served by the New York Central railway. In a ravine, about 2 m. west of Oriskany, was fought on Aug. 6, 1777 the battle of Oriskany, an important minor engagement of the American Revolution. On Aug. 4, Gen. Nicholas Herkimer had gathered about 800 militiamen at Ft. Dayton (on the site of the present Herkimer, N.Y.) for the relief of Ft. Schuyler (*see* ROME, N.Y.) then besieged by British and Indians under Col. Barry St. Leger and Joseph Brant. On the 6th Gen. Herkimer's force, on its march to Ft. Schuyler, was ambushed by a force of British under Sir John Johnson and Indians under Joseph Brant in the ravine above mentioned. The rear portion of Herkimer's troops escaped from the trap, but were pursued by the Indians, and many of them were overtaken and killed. Between the remainder and the British and Indians there was a desperate hand-to-hand conflict, interrupted by a violent thunderstorm, with no quarter shown by either side. On hearing the firing near Ft. Schuyler (incidental to a sortie by Lt.-Col. Marinus Willett) the British withdrew, after about 200 Americans had been killed and as many more taken prisoners, the loss of the British in killed being about the same. Gen. Herkimer, though his leg had been broken by a shot at the beginning of the action, continued to direct the fighting on the American side, but died on Aug. 16, as a result of the clumsy amputation of his leg. The battle, though indecisive, had an important influence in preventing St. Leger from affecting a junction with Gen. Burgoyne. The battlefield is marked by a monument erected in 1884. The sesquicentennial of the battle of Oriskany and Ft. Stanwix was celebrated on Aug. 6, 1927, by a pageant. The Oneida Historical Society then presented to the State the battle monument and about 5 ac. of land to be maintained as a State park.

See *Orderly Book of Sir John Johnson during the Oriskany Campaign* (Albany, 1882), with notes by W. L. Stone and J. W. De Peyster; *Publications* of the Oneida Historical Society, vol. i. (Utica, N.Y., 1877); and Phoebe S. Cowen, *The Herkimers and Schuylers* (Albany, 1903).

ORISSA, a tract of India, in the province of Bihar and Orissa, consisting of a British division and 24 feudatory states. The

historical capital of Cuttack is the headquarters; and Puri, with its temple of Jagannath, is world-famous. Orissa is inhabited by a distinctive race, the Oriyas, with a separate language, Oriya. The language is archaic in form and vocabulary, and the written character has been determined by an archaic writing material. This, till little over a century ago, consisted of strips of palm leaves on which the scribes wrote with an iron stylus. The country was long isolated from the rest of India. In 1899 it was brought into communication with Bengal and Madras by means of the railway.

The DIVISION OF ORISSA consists of five districts, viz., Cuttack, Puri and Balasore, which constitute the delta of the Mahanadi, Brahmani and Baitarani, and the inland districts of Sambalpur and Angul. Total area 13,736 sq.m.; pop. (1921) 4,968,873. Of these Sambalpur was a state which lapsed to the British government in 1849 on the death of the chief without heirs, and in accordance with his own wishes. Part of Angul was another small state which was confiscated in 1847 on account of the Raja's misrule and disloyalty. The other part, the Khondmals, was notorious for the human sacrifices offered by the aboriginal Khonds; it was nominally under the Raja of Baud and was annexed in 1855. The other three districts have a distinct history. They were under Hindu kings till their conquest by the Mohammedans in the 16th century and developed a civilization and culture of their own. Splendid memorials of the art attained between the 8th and 13th centuries are found in the temples at Bhubaneswar, Konarak and Puri, which are distinguished for grandeur of design, fine elaboration of details and beautiful stone carving. The Orissan style of architecture of which they are specimens, has been described by Fergusson as "one of the most complete and interesting styles of Indian architecture." Orissa remained under the rule of Mohammedan deputy governors, subject to the nawab of Bengal, with their capital at Cuttack, till 1751. It was then ceded by Ali Vardi Khan to the Marathas and for nearly half a century was subject to their tyranny and oppression. It was invaded and conquered by the British in 1803 during the second Maratha war.

In 1866 it suffered from an appalling famine, followed by destructive floods, during which a million persons are estimated to have perished, largely owing to the isolation of Orissa, for the unbridged roads were impassable in the rains, and supplies brought by sea could not be landed on its surf-beaten coast. The danger of the recurrence of such a famine has been averted by the Orissa canal system and the railway, as well as by the increased prosperity of the people. The occurrence of floods still occasionally causes distress. The beds of the deltaic rivers have been raised by the volumes of silt brought down and their outlets are obstructed by shoals and sand bars. Consequently, when high floods occur they are not discharged by the natural channels and are liable to burst the embankments and inundate the low-lying country on either side. Orissa differs from Bihar in having temporary settlements of land revenue: the "permanent settlement" of Bengal had been made ten years before it came under British rule. The last settlement was made in 1900, for 30 years.

The FEUDATORY STATES OF ORISSA occupy the hills between the British districts on the south-east, and the Central Provinces on the west, and Chota Nagpur on the north. Area, 28,046 sq.m.; pop. (1921) 3,807,172. The States may be classed in five groups, according to situation, viz., (1) to the north-east Keonjhar, Mayurbhanj and Nilgiri; (2) to the north-west, Bonai and Gangpur; (3) to the west, Bamra, Kalahandi, Patna, Rairakhol and Sonpur; (4) the central States of Athmallik, Baud, Pal Lahara and Talcher; (5) to the south-east, Athgarh, Baramba, Daspalla, Dhenkanal, Hindor, Khondpara, Narsinghpur, Nayagarh, Ranpur and Tigiria. Bamra, Kalahandi, Patna, Rairakhol and Sonpur were formerly attached to the Central Provinces, and Bonai and Gangpur to Chota Nagpur. The other 17 states, which used to be called the Tributary Mahals, or Garhjats, were ceded to the British by the Marathas after the conquest of Orissa in 1803. A political officer assists the Chiefs in the administration, general supervision being exercised by the governor of Behar and Orissa as agent of the governor-general.

ORISTANO, a town and archiepiscopal see of Sardinia, 23 ft. above sea-level, about 3 m. from the eastern shore of a gulf on the west coast, to which it gives its name, and 59 m. N. by W. of Cagliari by rail. Pop. (1921) 10,151. The town has remains of the walls (1290), and two gates, the Porta Manna, with a lofty square tower (Torre S. Cristoforo) and the Porta a Mare. The low houses are largely constructed of sun-dried bricks. Two miles south of Oristano is the village of S. Giusta, with a beautiful Romanesque church of the Pisan period dedicated to this saint, containing several antique columns. The lagoons on the coast are full of fish, but are a cause of malaria. In the environs garden produce is grown; good wine (*vernaccia*) is made, and ordinary pottery. It is also a centre of the cattle trade. A mile south of the mouth of the river Tirso is the landing-place for shipping. The large orange groves of Milis lie 13 m. N. of Oristano at the base of Monte Ferru. The inhabitants of Milis manufacture reed baskets and mats, which they sell throughout Sardinia.

Oristano occupies the site of the Roman Othoca, the point at which the inland road and the coast road from Carales to Turris Libisonis bifurcated. The mediaeval town (1070) was the seat onwards of the *giudici* (judges) of Arborea, one of the four divisions of the island. Almost the last of these judges was Eleonora (1347–1403); after her death Oristano became the seat of a marquisate, which was suppressed in 1478.

ORIZABA (Indian name *Ahuializ-apan,* pleasant waters), a city of Mexico in the State of Vera Cruz, 82 m. by rail W.S.W. of the port of Vera Cruz. Pop. (1920) 41,684 including a large percentage of Indians and half-breeds. The Mexican railway affords frequent communication with the City of Mexico and Vera Cruz, and a short line (4½ m.) connects with Ingemo, an industrial village and a branch line connects with the Tehuantepec National. Orizaba stands in a fertile, well-watered and richly wooded valley of the Sierra Madre Oriental, 4,025 ft. above sea-level, and about 18 m. S. of the snow-crowned volcano that bears its name. It has a mild, humid and healthful climate. The public edifices include the parish church of San Miguel, a chamber of commerce, a handsome theatre and some hospitals. The city is the centre of a rich agricultural region which produces sugar, rum, tobacco and Indian corn. In colonial times, when tobacco was one of the crown monopolies, Orizaba was one of the districts officially licensed to produce it. It is also a manufacturing centre of importance, having good water power from the Rio Blanco and producing cotton and woollen fabrics. Its cotton factories are among the largest in the republic. The forests in the vicinity are noted for orchids and ferns. An Indian town called *Ahuializapan,* subject to Aztec rule, stood here when Cortes arrived on the coast. The Spanish town that succeeded it did not receive its charter until 1774. In 1862 it was the headquarters of the French.

ORIZABA, in Aztec, *Citlaltepetl,* "star mountain," an extinct or dormant volcano, on the boundary between the Mexican states of Puebla and Vera Cruz and very nearly on the 19th parallel. It rises from the south-eastern margin of the great Mexican plateau to an elevation of 18,314ft., according to Scovell and Bunsen's measurements in 1891–92, or 18,250 and 18,209ft. according to other authorities, and 18,701 (5,700 metres) by the Comisión Geográfica Exploradora. It is the highest peak in Mexico and the second highest in North America. Its upper timber line is about 13,500ft. above sea-level, and Hans Gadow found patches of apparently permanent snow at an elevation of 14,400ft. on its south-east side in 1902. The first ascent of Orizaba was made by Reynolds and Maynard in 1848. Its last eruptive period was 1545–66, and the volcano is now considered to be extinct.

ORKHON INSCRIPTIONS, ancient Turkish inscriptions of the 8th century A.D., discovered near the river Orkhon to the South of Lake Baikal in 1889. They are written in an alphabet derived from an Aramaic source and recount the history of the northern branch of the Turks or Tu-kiue of Chinese historians. *See* TURKS.

ORKNEY, EARL OF, a Scottish title held at different periods by various families, including its present possessors the Fitzmaurices. The Orkney islands (*q.v.*) were ruled by jarls or earls under the supremacy of the kings of Norway from very early times to about 1360, many of these jarls being also earls of Caith-

ness under the supremacy of the Scottish kings. Perhaps the most prominent of them were a certain Paul (d. 1099) who assisted the Norwegian king, Harald III. Haardraada, when he invaded England in 1066; and his grandson Paul the Silent, who built, at least in part, the cathedral of St. Magnus at Kirkwall. They were related to the royal families of Scotland and Norway.

In its more modern sense the earldom dates from about 1380, and the first family to hold it was that of Sinclair, Sir Henry Sinclair (d. *c.* 1400) of Roslin, near Edinburgh, being recognized as earl by the king of Norway. He ruled the islands almost like a king, and employed in his service the Venetian travellers Nicolo and Antonio Zeno. His son Henry (d. 1418) was admiral of Scotland and was taken prisoner by the English in 1406, together with Prince James, afterwards King James I.; his grandson William, the 3rd earl (*c.* 1404–80), was chancellor of Scotland and took some part in public affairs. In 1455 William was created earl of Caithness, and in 1470 he resigned his earldom of Orkney to James III. of Scotland, who had just acquired the sovereignty of these islands through his marriage with Margaret, daughter of Christian I., king of Denmark and Norway. In 1567 Queen Mary's lover, James Hepburn, earl of Bothwell, was created duke of Orkney, and in 1581 her half-brother Robert Stewart (d. 1592), an illegitimate son of James V., was made earl of Orkney. Robert, who was abbot of Holyrood, joined the party of the reformers and was afterwards one of the principal enemies of the regent Morton. His son Patrick acted in a very arbitrary manner in the Orkneys, where he set the royal authority at defiance; in 1609 he was seized and imprisoned, and, after his bastard son Robert had suffered death for heading a rebellion, he himself was executed in Feb. 1614, when his honours and estates were forfeited.

In 1696 Lord George Hamilton was created earl of Orkney. He married Elizabeth Villiers, and was succeeded by his daughter Anne (d. 1756), the wife of William O'Brien, 4th earl of Inchiquin. Anne's daughter Mary (*c.* 1721–91) and her granddaughter Mary (1755–1831) were both countesses in their own right, the younger Mary married Thomas Fitzmaurice (1742–93), son of John Petty, earl of Shelburne, and was succeeded in the title by her grandson, Thomas John Hamilton Fitzmaurice (1803–77), whose descendants still hold the earldom.

See *Records of the Earls of Orkney, 1299–1664*, ed. by J. S. Clouston (1914).

ORKNEY ISLANDS, group forming a county off the north coast of Scotland. The islands are separated from the mainland by the Pentland firth, which is 6¼ m. wide between Brough Ness in the island of South Ronaldshay and Duncansbay Head in Caithness-shire. The group consists of 67 islands (not including rocky islets) of which 29 are inhabited, four of them only with lighthouse attendants. They measure 50 m. from north-east to south-west, and 29 m. from east to west, and cover 240,847 acres. Excepting on the west coasts of the larger islands, which present rugged cliff scenery, the group lies somewhat low and is of bleak aspect, owing to the absence of trees. The islands are built up wholly of Old Red Sandstone. The Old Man of Hoy is a fine stack of rock standing detached from the north-west cliffs. The only other islands containing heights of any importance are Pomona, with Ward hill (880 ft.), and Wideford (740 ft.) and Rousay. Erratics of distant origin (*e.g.*, from Moray firth) give evidence of glacial action. Nearly all of the islands possess lakes, the largest being Loch Harray and Loch Stenness in Pomona. The rivers are merely streams. Excepting on the west fronts of Pomona, Hoy and Rousay, the coast-line of the islands is deeply indented, and the islands themselves are divided from each other by straits, generally called *sounds* or *firths*, though off the north-east of Hoy is *Bring Deeps*, south of Pomona is Scapa *Flow* and to the south-west of Eday is the *Fall* of Warness. The topographical names are Norse, and the common terminal of the names of the islands, *a* or *ay*, is the Norse *ey*, meaning "island." The islets are usually called *holms* and the isolated rocks *skerries*. The tidal currents, or *roost* (as some of them are called locally, from the Icelandic), off many of the isles run very fast and whirlpools are frequent.

History.—The Orkneys were the *Orcades* of classical writers, and the word is probably derived from the Norse *Orkn*, seal, and *ey*, island. Evidences of prehistoric occupation include numerous weems or underground houses, chambered mounds, barrows or burial mounds, brochs or round towers, and stone circles and standing stones. Three of the most famous are the corbelled tomb at Maeshowe, and the circles of standing stones at Brogar and Stennis with an early village discovered in 1928. If, as seems likely, the Dalriadic Scots towards the beginning of the 6th century established a footing in the islands, their success was short-lived, and the native inhabitants regained power and kept it until dispossessed by the Norsemen in the 9th century. The Celtic missionaries, companions of St. Columba, followed about 565. As the Norse pirates made raids on Norway from the islands, as well as on Scotland, Harold Haarfager ("Fair Hair") subdued the rovers in 875 and added the Orkneys and Shetlands to Norway. They remained under the rule of Norse earls until 1231, when the line of the earls became extinct. In that year the earldom of Caithness was granted to Magnus, second son of the earl of Angus, whom the king of Norway apparently confirmed in the title. In 1468 the Orkneys and Shetlands were pledged by Christian I. of Denmark for the payment of the dowry of his daughter Margaret, betrothed to James III. of Scotland, and as the money was never paid, their connection with the crown of Scotland has been perpetual. In 1471 William, earl of Orkney, exchanged his earldom for lands in Fife, and the islands were annexed to the Scottish crown. In 1581 Lord Robert Stewart, natural son of James V., was created earl of Orkney, but in 1615 the earldom was again annexed to the crown. The islands were the *rendezvous* of Montrose's expedition in 1650 which culminated in his imprisonment and death. In 1707 the islands were granted to the earl of Morton in mortgage, but in 1766 his estates were sold to Sir Lawrence Dundas, ancestor of the earls of Zetland.

In early times both the archbishop of Hamburg and the archbishop of York disputed with the Norwegians ecclesiastical jurisdiction over the Orkneys; but ultimately the Norwegian bishops, the first of whom was William the Old, consecrated in 1102, continued the canonical succession. The see, left vacant on several occasions, was finally abolished in 1697, although many of the clergy refused to conform. The Norse tongue, at last extinguished by the constant influx of settlers from Scotland, lingered until the end of the 18th century. When the islands were given as security for the princess's dowry, there seems reason to believe that it was intended to redeem the pledge, because it was then stipulated that the Norse system of government and the law of St. Olaf should continue to be observed in Orkney and Shetland. Thus the *udal* succession and mode of land tenure (or, that is, absolute freehold as distinguished from feudal tenure) still obtain to some extent, and the remaining *udallers* hold their lands and pass them on without written title.

Agriculture and Industries.—The soil generally is a sandy loam or a strong but friable clay, and very fertile. Less than half the total area is under cultivation, but farming is now up to the general Scottish standard. The crofters' houses have been rebuilt of stone and lime, and are superior to those in most parts of the Highlands. The holdings run small, less than one-fifth being over 50 acres. The grain crops are oats and barley, while the favoured root crops are turnips (much the most extensively grown) and potatoes. Numbers of cattle and sheep are reared on the fine pasture of the islands; pigs are also kept on several of the islands, and the horses—as a rule hardy, active and small, though larger than the famous Shetland ponies—are very numerous. The woollen, linen, straw-plaiting and kelp industries have all successively failed, though the last named has been recently revived. Sandstone is quarried on several islands, and distilleries are found in Pomona (near Kirkwall and Stromness). About half the population is engaged in agriculture. Apart from this, the principal industry is fishing. For several centuries the Dutch practically monopolized the herring fishery, but when their supremacy was destroyed by the salt duty, the fisheries were almost totally neglected. The industry, however, is now of considerable importance, particularly the herring fishery, followed by the cod, ling and lobster fisheries. There is a regular communi-

cation by steamer between Stromness and Kirkwall, and Thurso, Wick, Aberdeen and Leith, and also between Kirkwall and Lerwick and other points of the Shetlands.

Population and Administration.—The population was 24,111 in 1921, including 61 persons who spoke Gaelic and English, but none who spoke Gaelic only. Orkney unites with Shetland to send one member to parliament. Kirkwall, the county town, is the only royal burgh. Orkney forms a sheriffdom with Shetland and Caithness, and is under the school-board jurisdiction.

The Inhabited Islands.—From south to north, the islands (population in brackets) include Sule Skerry (lighthouse, 3), Pentland Skerries (lighthouse, 9), Swona (26), South Ronaldshay (1,545), Hoy (964). On Hoxa Head, is a *broch*, or round tower, and the island contains, besides, examples of Picts' houses and standing stones. The famous Dwarfie Stone, an enormous block of sandstone with rooms hollowed out in it, lies in a valley near Ward Hill. Flotta (349), east of Hoy, was the home for a long time of the Scandinavian compiler of the *Codex Flotticensis*, which furnished Thormodr Torfaeus (1636–1719), the Icelandic antiquary, with many of the facts for his *History of Norway*. Pharay (60) also lies east of Hoy. Burray (518) is famous for the *broch* from which the island takes its name (Borgarey, Norse, "island of the broch"). The tower stands on the north-western shore, is 15 ft. high, has walls from 15 to 20 ft. thick, built of layers of flat stones without cement or mortar, and an interior diameter of 40 feet. Between Hoy and Pomona are Hunda (3), Cava (15), and Graemsay (147). The isle, surrounded by shoals, has two lighthouses. The cliffs of Copinshay (4) are a favourite haunt of sea-birds. Half a mile to the north-east is the great rock which, from a fancied resemblance to a horse rearing its head from the sea, is called the Horse of Copinshay.

Pomona (*q.v.*) is the principal island and is known as Mainland. Shapinshay (618) was the birthplace of William Irving, father of Washington Irving. It possesses several examples of Pictish and Scandinavian antiquities and Balfour Castle, built in 1848. Gairsay (28) was the home of Sweyn Asleifson, the rover. At Lamb Head is a *broch* and Pictish pier, and on Odin Bay, is a round pit in the rocks called the Vat of Kirbuster. Papa Stronsay (30) commemorates the Celtic *papae*, or missionaries, who preached before the arrival of the Northmen. The adjacent Veira or Wire has a population of 54; Egilshay (103) is the island on which St. Magnus was murdered by his cousin Hacco in 1115. It derives its name (*ecclesia*) from the little church of St. Magnus, now in ruins. The round tower resembles similar ones found beside Irish churches of the 7th and 8th centuries and has walls 3 ft. thick. Eday (474) contains weems, mounds and standing stones. Carrick village was named after the earl of Carrick. It was off this island that John Gow, the pirate, was taken in 1725. Stronsay (1033) and Rousay (488) are other large islands.

Sanday (1403), one of the largest northern islands, has an area of 19 sq.m. It produces potatoes and grain, and has harbours at Otterswick and Kettletoft. The antiquities include a *broch* in Elsness. Pharay (47). Westray (1507), has a harbour at Pier-o'-wall. Noltland castle was proposed as the refuge of Queen Mary after her flight from Loch Leven. It was at one time the property of Sir Gilbert Balfour, the master of Queen Mary's household. At the westerly point, there is the Stack of Noup. Gentleman's Cave afforded shelter to five followers of Prince Charles Edward during the winter of 1745–46. Papa Westray (247) and North Ronaldshay (349) are the most northerly islands. The latter is only reached from Sanday over a dangerous firth 2½ m. wide. The monumental stone with Ogham inscription, discovered in the *broch* of Burrian, must date from the days of the early Christian missionaries.

ORLANDO, VITTORIO EMANUELE (1860–), Italian politician and jurist, was born at Palermo on March 19, 1860. Becoming a barrister and a law professor, he was first elected deputy for Partinico in Sicily in 1898. He was minister of education in the Giolitti-Tittoni Cabinet of 1903–05, and of justice in the Giolitti Cabinet of 1907–09, and again under Salandra in November 1914. Although a Giolittian at heart, he was in favour of Italian intervention in the World War. On the resignation of the Salandra Cabinet in June 1916 he remained in office under Boselli as minister of the interior, and when the latter resigned Orlando was entrusted with the formation of a new Cabinet. After the Armistice he went to Paris as president of the Italian peace delegation. When President Wilson launched his appeal on Fiume to the Italian people over the heads of their delegates, he returned to Rome, where he was triumphantly received, but after his return to Paris without the guarantees he was supposed to have secured, and without obtaining any satisfactory solution of the Adriatic problem, the chamber voted against him and he resigned on June 19, 1919.

On Dec. 2, 1919, he was elected president of the chamber. He at first supported Fascism and the Mussolini government, and was re-elected deputy in 1924 on the government list; but after the Matteotti affair he withdrew his support, without, however, abandoning the chamber. At the municipal elections of Palermo in August 1925 he mobilised all his adherents in favour of the anti-Fascist list but upon the subsequent triumph of the Fascists Orlando retired from Parliament.

See L. Hautecoeur, *L'Italie sous le ministère Orlando, 1917–19* (1919); R. Lansing, *The Big Four* (1922).

ORLANDO, a city of Florida, U.S.A., the county seat of Orange county; 125 m. S. of Jacksonville, on Federal highways 92 and 441 and served by the Atlantic Coast Line and the Seaboard Air Line railways. Pop. 22,255 in 1925 (State census), of whom 6,462 were negroes; estimated locally at 35,500 in 1928. The region is devoted to citrus fruits, is dotted with lakes (over 1,000 in the county), and is a centre for tourists. At Winter Park, 4 m. N.E., is Rollins college (1885), beautifully situated on Lake Virginia. Orlando, founded in 1843, was incorporated in 1875.

ORLÉANAIS, formerly a French province, comprised the country around Orleans, the *pagus Aurelianensis*; it lay on both banks of the Loire, and for ecclesiastical purposes formed the diocese of Orleans. It had formed part of the territory possessed by the ancestors of Hugh Capet and long remained an important part of the royal demesne. In 1344 Philip VI. gave it with the title of Duke to Philip (d. 1375), one of his younger sons.

See A. Thomas, *Les États provinciaux de la France centrale* (1879).

ORLEANISTS, a French political party which arose out of the Revolution. It took its name from the Orleans branch of the house of Bourbon, the descendants of Philippe, duke of Orleans, younger brother of Louis XIV., who were its chiefs. Its aim was to reconcile the monarchical principle with the "rights of man," as proclaimed by the Constituent Assembly in 1789. The Orleans princes were traditionally marked out as the leaders in such a policy. Enormously rich, within measurable distance of the succession to the throne, but cut off by the jealousy of the crown from all share in public affairs, they had long been the centres of opposition to the encroachment of the royal power. Louis, duke of Orleans, had headed the protest of the princes against the policy of Maupeou in suppressing the *parlement* of Paris; his son later earned the style of Philippe Égalité by adopting—with ulterior objects—extreme revolutionary views (*see* ORLEANS, LOUIS PHILIPPE J., duke of); and Égalité's son, Louis Philippe (afterwards king of the French) fought, as duc de Chartres, at Jemappes, under the republican tricolour. The generation of Orleanists, the immediate supporters of Philippe Égalité, were swamped in the turmoil of the Revolution. But they came naturally to the front when another revolution overthrew the restored legitimate monarchy of Louis XVIII. and Charles X. During the Restoration, 1815–30, everything tended to identify the Liberals with the Orleanists. It is true that Louis XVIII. had been induced to grant (*octroyer*) a constitutional charter; but he and his successor claimed to rule by divine right and to confer liberties upon their subjects of their own will. The difference between the Legitimists, and the Orleanists, was thus fundamental. So was that between the Orleanists and the Bonapartists; for the former aimed at securing political liberty, in addition to equality before the law and in social life, while the latter aimed at subjection to a military despotism.

The revolution of 1830 brought the Orleanists into power, and

they marked the profound change made in the character of the government by styling Louis Philippe not "king of France and Navarre by the grace of God," but "king of the French by the grace of God and the will of the people." The Orleanists were led by men eminent in letters and in practical affairs—Guizot, Thiers, the Broglies, the banker Laffitte, and many others—and the 18 years of their rule were, on the whole, profitable to France. That they ended in another "general overturn" in 1848 was due mainly to the fact that the Orleanist conception of what was meant by the word "people" led the Government to offend the deeply-rooted love of the French for equality. On the model of the English constitution they instituted a *pays légal* of about a quarter of a million of voters by whom all the rest of the country was to be "virtually represented." But the nation outside of the *pays légal* soon discovered that it was being governed by a privileged class, less offensive perhaps, but also less brilliant, than the aristocracy of the old monarchy.

The revolution of 1848 swept the Orleanists from power for ever. They continued indeed throughout the Second Republic and the Empire (1848–70) to enjoy a marked prestige, due to the wealth and capacity of some of their members, their influence in the French Academy and the ability of their organs in the press. But their weakness was demonstrated when the Second Empire was swept away by the German War of 1870–71. The country, in its disgust at the Bonapartists and its fear of the Republicans, chose a great many royalists to represent it in the assembly which met in Bordeaux on Feb. 12, 1872. In this body the Orleanists again exercised a kind of leadership by virtue of individual capacity, but they were counterbalanced by the Legitimists. They defeated Thiers on May 24, 1873, as punishment for his dexterous imposition of the Republic on the unwilling majority of the assembly. Their real occupation was to endeavour to bring about a fusion between themselves and the Legitimists. As far back as 1850 Guizot had proposed, or had thought of proposing, such a fusion, but it was on the condition that the comte de Chambord would resign his divine pretentions. The fusion arranged in 1873 was on quite another footing. After much exchange of notes and many agitated conferences, the comte de Paris, the representative of the Orleanists, sought an interview with the comte de Chambord at Frohsdorff, and obtained it by giving a written engagement that he came not only to pay his respects to the head of his house, but also to "accept his principle." Orleanists have declared that the engagement was given, with mental reservations; but the country believed that the liberal royalists had been absorbed in the divine right royalists, and returned republicans at by-elections till it transformed the Assembly. The Orleanist princes had still a part to play, particularly when the death of the comte de Chambord in 1883 left them heads of the house of France, but the Orleanist party ceased to exist as an independent political organization.

BIBLIOGRAPHY.—The Orleanists are necessarily more or less dealt with in all histories of France since 1789, and in most political memoirs, but their principles can be learnt and their fortunes followed from the following: A. Sorel, *L'Europe et la révolution française* (1885–1904); F. Guizot, *Histoire parlementaire de la France* (1819–48), and *Mémoires pour servir à l'histoire de mon temps* (1858–67); P. de la Gorce, *Histoire du second empire* (1894–1904); and G. Hanotaux, *Histoire de la fondation de la 3ème République* (1925). For the attitude of the Orleans princes towards the crown under the old régime, *see* Amédée Britsch, *La Jeunesse de Philippe Égalité* (1927).

ORLEANS, DUKES OF. The title of duke of Orleans was first created by King Philip VI. in favour of his son Philip, who died without legitimate issue in 1375. The second duke of Orleans, created in 1392, was Louis, a younger son of Charles V., whose heir was his son, the poet Charles of Orleans. Charles's son Louis, the succeeding duke, became king of France as Louis XII. in 1498, when the duchy of Orleans was united with the royal domain. In 1626 Louis XIII. created his brother, Jean Baptiste Gaston (d. 1660), duke of Orleans, and the title was revived in 1661 by Louis XIV. in favour of his brother Philip. Descendants of this duke have retained the title until the present day, one of them becoming king of France as Louis Philippe in 1830. Two distinguished families are descended from the first house of Orleans: the counts of Angoulême, who were descended from John, a son of Duke Louis I., and who furnished France with a king in the person of Francis I.; and the counts and dukes of Longueville, whose founder was John, count of Dunois, the bastard of Orleans, a natural son of the same duke. In addition to the dukes of Orleans the most important members of this family are: Anne Marie Louise, duchess of Montpensier; Francis, prince of Joinville; Louis Philippe Albert, count of Paris; and the traveller Prince Henry of Orleans. *See* table BOURBON.

ORLEANS, CHARLES, DUKE OF (1391–1465), commonly called Charles d'Orléans, French poet, was the eldest son of Louis, duke of Orleans (brother of Charles VI. of France), and of Valentina Visconti, daughter of Gian Galeazzo, duke of Milan. He was born on May 26, 1391. He married (June 29, 1406), Isabella, his cousin, widow of Richard II. of England. She died three years later. He was already duke of Orleans, for Louis had been assassinated by the Burgundians two years before (1407). He was now the most important person in France, except the dukes of Burgundy and Brittany, the king being a cipher. He was, however, only nominally one of the leaders of the civil war; the real guidance of his party resting with Bernard VII., the great count of Armagnac, whose daughter, Bonne, he married, or at least formally espoused, in 1410. Five years of confused negotiations, plots and fightings passed before the English invasion and the battle of Agincourt, where Charles was joint commander-in-chief. He was taken prisoner and carried to England, where he remained for a full quarter of a century. He hunted and hawked and enjoyed society amply, though the very dignities which secured him these privileges made his ransom great, and his release difficult to arrange. Above all, he had leisure, however, for literary work which consisted of short poems in the artificial metres, then fashionable in France. Besides these a number of English poems have been attributed to him, but without certainty. For practical purposes his work consists of some hundreds of short French poems, a few in various metres, but the majority either ballades or rondels. Charles d'Orléans is the last representative of the poetry of the middle ages, in which the form was almost everything, and the personality of the poet, save in rare instances, nothing. He has the urbanity of the 18th century without its vicious and prosaic frivolity. His best-known rondels —those on Spring, on the Harbingers of Summer, and others— rank second to nothing of their kind.

The agreement for his release from captivity was concluded on July 2, 1440. He was actually released on Nov. 3, and then married Mary of Cleves, who brought him a considerable dowry to assist the payment of his ransom. After his return to France he maintained at Blois a miniature court, at which the best-known French men-of-letters at the time—Villon, Olivier de la Marche, Chastelain, Jean Meschinot and others—were residents or visitors or correspondents. His son, afterwards Louis XII., was born in 1462. Charles died on Jan. 4, 1465, at Amboise.

The best edition of Charles d'Orléans's poems, with a brief but sufficient account of his life, is that of C. d Héricault in the *Nouvelle collection Jannet* (Paris, 1874). For the English poems *see* the edition by Watson Taylor for the Roxburghe Club (1827). *See* also C. Bruneau, *Charles d'Orléans et la poésie aristocratique* (Lyons, 1924).

ORLEANS, FERDINAND PHILIP LOUIS CHARLES HENRY, DUKE OF (1810–1842), born at Palermo on Sept. 3, 1810, was the son of Louis Philippe, duke of Orleans, afterwards king of France, and Marie Amélie, princess of the Two Sicilies. Under the Restoration he bore the title of duke of Chartres, and studied classics in Paris at the Collège Henri IV. At the outbreak of the Revolution, which in 1830 set his father on the throne, he was colonel of a regiment of Hussars. He assumed the title of duke of Orleans, and was sent by the king to put down the riots at Lyons (1831), and then to the siege of Antwerp (1832). He was appointed lieutenant-general, and made several campaigns in Algeria (1835, 1839, 1840). On his return to France he organized the *chasseurs d'Orléans*. He died after an accident at Neuilly, near Paris, on July 13, 1842.

The duke of Orleans had married (May 30, 1837) Helène Louise Elisabeth of Mecklenburg-Schwerin, and had by her two sons, the count of Paris and the duke of Chartres. On Feb. 24, 1848, after the abdication of Louis Philippe, the duchess of

Orleans went to the Chamber of Deputies in the Palais Bourbon in the hope of having her eldest son proclaimed and of obtaining the regency; the attitude of the populace forced her to take refuge in England, and she died at Richmond on May 18, 1858.

ORLEANS, HENRI, PRINCE OF (1867–1901), eldest son of Robert, duke of Chartres, was born at Ham, near Richmond, Surrey, on Oct. 16, 1867. In 1889, at the instance of his father, he undertook, in company with MM. Bonvalot and Dedecken, a journey through Siberia to Siam. They crossed the mountain range of Tibet, and the fruits of their observations, submitted to the Geographical Society of Paris and later incorporated in *De Paris au Tonkin à travers le Tibet inconnu* (1892), brought them conjointly the gold medal of that society. In 1892 the prince made a short journey in East Africa, and shortly afterwards visited Madagascar, proceeding thence to Tongking. From there he set out for Assam, and found the sources of the Irrawaddy, which secured the medal of the Geographical Society of Paris and the cross of the Legion of Honour. In 1897 he revisited Abyssinia, and political differences arising from this trip led to a duel with the comte de Turin, in which both combatants were wounded. While on a trip to Assam he died at Saigon on Aug. 9, 1901.

ORLEANS, HENRIETTA, DUCHESS OF (1644–1670), third daughter of the English king, Charles I., and his queen, Henrietta Maria, was born during the Civil War at Exeter on June 16, 1644. A few days after her birth her mother left England, and she lived at Exeter under the care of Lady Dalkeith (afterwards countess of Morton) until the surrender of the city to the parliamentarians, when she was taken to Oatlands in Surrey. In July 1646 she rejoined her mother in Paris, where her girlhood was spent and where she was educated as a Roman Catholic. Henrietta was mentioned as a possible bride for Louis XIV., but she was betrothed to his only brother Philip. After the restoration of her brother Charles II., she returned to England with her mother, but a few months later she was again in Paris, where she was married to Philip, now duke of Orleans, on March 30, 1661. The duchess was very popular at the court of Louis XIV., and was on good terms with the Grand Monarch, but she was soon estranged from her husband, and her conduct was very imprudent. In 1670, at the instigation of Louis, but without Philip's consent, she visited England and obtained the signature of Charles II.'s ministers to the treaty of Dover. Shortly after returning to France, Henrietta died at St. Cloud on June 30, 1670, and it was asserted that she had been poisoned by order of her husband. She left two daughters, Marie Louise, wife of Charles II. of Spain, and Anne Marie, wife of Victor Amadeus II. of Savoy.

ORLEANS, JEAN BAPTISTE GASTON, DUKE OF (1608–1660), third son of the French king Henry IV., and his wife Marie de Medici, was born at Fontainebleau on April 25, 1608. Known at first as the duke of Anjou, he was created duke of Orleans in 1626, and was nominally in command of the army which besieged La Rochelle in 1628. On several occasions he was obliged to leave France for conspiring against the government of his mother, of Cardinal Richelieu, and of Louis XIII. Orleans stirred up Cinq-Mars to attempt Richelieu's murder, and then deserted him. In 1643, on the death of Louis XIII., Gaston became lieutenant-general of the kingdom, and fought against Spain on the northern frontiers of France; but during the wars of the Fronde he passed from one party to the other. Exiled by Mazarin in 1652 he remained in Blois until his death on Feb. 2, 1660. Gaston's first wife was Marie (d. 1627), daughter and heiress of Henri de Bourbon, duc de Montpensier (d. 1608), and his second wife Marguerite (d. 1672), sister of Charles III., duke of Lorraine. By Marie he left a daughter, ANNE MARIE, duchesse de Montpensier (*q.v.*); and by Marguerite he left three daughters, Marguerite Louise (1645–1721), wife of Cosimo III., grand duke of Tuscany; Elizabeth (1646–1696), wife of Louis Joseph, duke of Guise; and Françoise Madeleine (1648–1664), wife of Charles Emmanuel II., duke of Savoy.

ORLEANS, LOUIS, DUKE OF (1372–1407), younger son of the French king, Charles V., was born on March 13, 1372. Having been made count of Valois and of Beaumont-sur-Oise, and then duke of Touraine, he received the duchy of Orleans from his brother Charles VI. in 1392. In 1389 he married Valentina (d. 1408), daughter of Gian Galeazzo Visconti, duke of Milan, who brought the county of Asti to her husband and her claim upon Milan, which she transmitted to her descendants, and which furnished Louis XII. and Francis I. with a pretext for interference in northern Italy. When Charles VI. became insane in 1392, Orleans opposed his uncle Philip II., duke of Burgundy, who was conducting the government; and this quarrel was the dominating factor in the affairs of France. Continued after Philip's death in 1404 with his son and successor, John the Fearless, it culminated in the murder of Orleans by one of John's partisans on Nov. 23, 1407. He had eight children by Valentina Visconti, including his successor, Charles of Orleans the poet, and one of his natural sons was the famous bastard of Orleans, John, count of Dunois.

See E. Jarry, *La Vie politique de Louis d'Orléans* (1889).

ORLEANS, LOUIS, DUKE OF (1703–1752), only son of Duke Philip II., the regent Orleans, was born at Versailles on Aug. 4, 1703. He took very little part in the politics of the time, although he was conspicuous for his hostility to Cardinal Dubois in 1723. In 1730 Cardinal Fleury secured his dismissal from the position of colonel-general of the infantry. He retired and spent his time mainly in translating the Psalms and the epistles of St. Paul. Having succeeded his father as duke of Orleans in 1723, he died in the abbey of St. Geneviève at Paris on Feb. 4, 1752. His wife Augusta (d. 1726), daughter of Louis William, margrave of Baden, bore him one son, Louis Philippe, who succeeded him.

ORLEANS, LOUIS PHILIPPE, DUKE OF (1725–1785), son of Louis, duke of Orleans, was born at Versailles on May 12, 1725, and was known as the duke of Chartres until his father's death in 1752. He served with the French armies in the campaigns of 1742, 1743 and 1744, and at the battle of Fontenoy in 1745, retiring to Bagnolet in 1757, and occupying his time with theatrical performances. He died at St. Assise on Nov. 18, 1785. The duke married Louise Henriette de Bourbon-Conti, who bore him a son Philip (Égalité), duke of Orleans, and a daughter, who married the last duke of Bourbon. His second wife, Madame de Montesson, whom he married secretly in 1773, was an authoress of some repute. He had two natural sons, the abbot of St. Far and the abbot of St. Albin.

See *L'Automne d'un prince*, a collection of letters from the duke to his second wife, ed. J. Hermand (1910).

ORLEANS, LOUIS PHILIPPE JOSEPH, DUKE OF (1747–1793), called PHILIPPE ÉGALITÉ, son of Louis Philippe, duke of Orleans, and of Louise Henriette of Bourbon-Conti, was born at St. Cloud on April 13, 1747. Having borne the title of duke of Montpensier until his grandfather's death in 1752, he became duke of Chartres, and in 1769 married Louise Marie Adelaide de Bourbon-Penthièvre, daughter and heiress of the duke of Penthièvre, grand admiral of France. Her wealth made him the richest man in France, and he determined to play a part equal to that of his great-grandfather, the regent, whom he resembled in character and debauchery. As duke of Chartres he opposed the plans of Maupeou in 1771, and was exiled to his country estate of Villers-Cotterets (Aisne). When Louis XVI. came to the throne in 1774 Chartres still found himself looked on coldly at court. In 1778 he served in the squadron of D'Orvilliers, but the Queen obtained his removal from the navy and he was given the honorary post of colonel-general of hussars. He then abandoned himself to pleasure; he often visited London, becoming an intimate friend of the prince of Wales (afterwards George IV.). He made himself very popular in Paris by his gifts to the poor in time of famine, and by throwing open the gardens of the Palais Royal to the people. Before the meeting of the notables in 1787 he had succeeded his father as duke of Orleans, and advertised his liberalism so boldly that he was believed to be aiming at becoming constitutional king of France. In November he was again exiled to Villers-Cotterets. He was elected to the States-General and led the minority of 47 noblemen who seceded from their own estate (June 1789) and joined the Tiers État. The part he played during the summer of 1789 is one of the most debated points in the history of the Revolution. The court accused him

of being at the bottom of every popular movement, and saw the "gold of Orleans" as the cause of the Reveillon riot and the taking of the Bastille. The best testimony for his behaviour during this summer is that of an English lady, Mrs. Grace Dalrymple Elliott, who shared his affections with the comtesse de Buffon; her statement shows that at the time of the riot of July 12 he was on a fishing excursion, and was rudely treated by the king on the next day when going to offer him his services. La Fayette persuaded the king to send the duke to England on a mission and he remained in England from Oct. 1789 to July 1790. On July 7, he took his seat in the Assembly, and on Oct. 2, both he and Mirabeau were declared by the Assembly entirely free of any complicity in the events of October. He now tried to avoid politics, but the court suspected him, and his friends talked about his being king. He made no attempt to get himself made king, regent or lieutenant-general of the kingdom at the time of the flight to Varennes in June 1791, but again tried in vain to make his peace with the court in Jan. 1792. In the summer of that year he was present for a short time with the army of the north, but had returned to Paris before Aug. 10. After that day he ran great risks in saving fugitives; in particular, he saved the life of the count of Champcenetz, the governor of the Tuileries, his personal enemy, at the request of Mrs. Elliott. After accepting the title of Citoyen Égalité, conferred on him by the commune of Paris, he was elected 20th and last deputy for Paris to the Convention. In that body he sat as quietly as in the National Assembly, but at the king's trial he had to speak, and then only to give his vote for the death of Louis. Nevertheless when the news of the desertion of his eldest son, the duke of Chartres with Dumouriez became known in Paris all the Bourbons remaining in France, including Égalité, were arrested April 5. He remained in prison until October, when the Reign of Terror began, and was decreed "of accusation" on Oct. 3. He was tried on Nov. 6, and guillotined on the same day. Personally Orleans possessed the charming manners of a polished grand seigneur; he was debauched and cynical, but never rude or cruel, full of gentle consideration for all about him but selfish in his pursuit of pleasure.

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ORLEANS, LOUIS PHILIPPE ROBERT, DUKE OF (1869–1926), eldest son of the comte de Paris, was born at York House, Twickenham, on Feb. 6, 1869. The law of exile against the French princes having been abrogated in 1871, he returned to France and was educated at Eu and at the Collège Stanislas, Paris. On the death of the comte de Chambord, the comte de Paris became head of the Bourbons; and in 1886 he and his son were exiled from France by the new law of 1886. He then passed through the Royal Military College, Sandhurst, and received a commission in the 4th battalion of the 60th Rifles, then quartered in India. In January 1888 the duke joined his regiment for a few months. On attaining his majority, he went to Paris (February 7, 1890), and, proceeding to the *mairie*, expressed his desire, as a Frenchman, to perform his military service. He was arrested in conformity with the law of 1886, tried, and sentenced to two years' imprisonment; but he was liberated by President Carnot after a few months' nominal incarceration (June 4), and conducted to the Swiss frontier. This escapade won for him the title of "Le Premier Conscrit de France." After the comte de Paris's funeral (September 12, 1894) the duke received his adherents in London, and was accepted as the head of his house. On Nov. 5, 1896, he married the archduchess Maria Dorothea Amalia of Austria; there was no issue of the marriage. The duke of Orleans was interested in exploration, and published *Une croisière au Spitzberg* (1905). He died on March 28, 1926.

ORLEANS, PHILIP I., DUKE OF (1640–1701), son of the French king Louis XIII., was born at St. Germain-en-Laye on Sept. 21, 1640. In 1661 he was created duke of Orleans, and married Henrietta, sister of Charles II. of England; but the marriage was not happy, and the death of the duchess in 1670 was attributed to poison. Later he married Charlotte Elizabeth, daughter of Charles Louis, elector palatine of the Rhine. Having fought with distinction in Flanders in 1667, Orleans returned to military life in 1672, and in 1677 gained a great victory at Cassel and took St. Omer. Louis XIV., it was said, was jealous of his brother's success; Orleans never commanded an army again. He died at St. Cloud on June 8, 1701, leaving a son, Philip, the regent Orleans, and two daughters: Anne Marie (1669–1728), wife of Victor Amadeus II., duke of Savoy; and Elizabeth Charlotte (1676–1744), wife of Leopold, duke of Lorraine. His eldest daughter, Marie Louise (1662–1689), wife of Charles II. of Spain, died before her father.

ORLEANS, PHILIP II., DUKE OF (1674–1723), regent of France, son of Philip I., duke of Orleans, and his second wife, the princess palatine, was born on Aug. 2, 1674, and fought at the siege of Mons in 1691. His marriage with Mlle. de Blois, the legitimized daughter of Louis XIV., won him the favour of the king. He fought at Steinkerk, Neerwinden and Namur (1692–1695). During the next few years he studied natural science. He was next given a command in Italy (1706) and in Spain (1707–1708) where he gained some important successes, but his suspected desire to succeed Philip V. on the throne of Spain gained him Louis XIV.'s disfavour. In his will, however, he appointed him president of the council of regency of the young King Louis XV. (1715). After the death of the king, Orleans had the will annulled by the parlement, and himself invested with absolute power. At first he made a good use of this, counselling economy, decreasing taxation, disbanding 25,000 soldiers and restoring liberty to the persecuted Jansenists. But the inquisitorial measures which he had begun against the financiers led to disturbances. He also countenanced the risky operations of the banker John Law (1717), whose bankruptcy led to a disastrous crisis.

A conspiracy under the inspiration of Cardinal Alberoni, first minister of Spain, to transfer the regency from Orleans to Philip V. of Spain was discovered and defeated in 1718. Dubois, formerly tutor to the duke of Orleans and now his all-powerful minister, caused war to be declared against Spain, with the support of the emperor, and of England and Holland (Quadruple Alliance). Philip V. made peace with the regent in 1720.

On the majority of the king (Feb. 15, 1723), the duke of Orleans resigned the supreme power; but he became first minister to the king, and remained in office till his death on Dec. 23, 1723. The regent had great qualities, both brilliant and solid, but his dissolute manners found only too many imitators, and the regency was one of the most corrupt periods in French history.

See J. B. H. R. Capefigue, *Histoire de Philippe d'Orléans, régent de* France (2 vols., 1838); A. Baudrillart, *Philippe V. et la cour de France*, vol. ii. (1890); and L. Wiesener, *Le régent, l'abbé Dubois et les Anglais* (3 vols., 1891–99).

ORLEANS (ORLEANS), a city of France, the chief town of Loiret, on the Loire, 77 m. S.S.W. of Paris by rail. Pop. (1926) 62,862. Les Aubrais, a mile to the north, is one of the chief railway junctions in the country. An early trading post among the Gauls, Orleans was known as *Genabum* by the Romans, and led the revolt against Julius Caesar in 52 B.C. In the 5th century it had taken the name *Aurelianum* from either Marcus Aurelius or Aurelian. It was vainly besieged in 451 by Attila, and by Odoacer in 471, but Clovis took it in 498 and held there in 511 the first ecclesiastical council assembled in France. It then became the capital of a separate kingdom, but was united with that of Paris in 613. In the 10th century the town was given in fief to the counts of Paris, who in 987 ousted the Carolingians. Philip, fifth son of Philip VI., was the first duke of Orleans. After the assassination of his successor Louis the people of Orleans sided with the Armagnacs, and thus brought upon themselves the attacks of the Burgundians and the English. Joan of Arc relieved the city in 1429. In 1562 it became the headquarters of Louis I. of Bourbon, prince of Condé, the Protestant commander-in-chief. In 1563 Francis, duke of Guise, laid siege to it, but was assassinated. Orleans was surrendered to the king, who raised the fortifications. It was held by the Huguenots from 1567 to 1568. The St. Bartholomew massacre there in 1572 lasted a week. It

was given as a *lieu de sûreté* to the League under Henry III., but surrendered to Henry IV. in person in 1594. The town is surrounded by boulevards, and is connected with the suburb of St. Marceau by an 18th century stone bridge of nine arches. The river is canalized on the right, and serves as a continuation of the Orleans Canal.

In the Place du Martroi is a statue of Joan of Arc. A simple cross marks the site, on the left bank of the Loire, of the *Fort des Tourelles,* captured by Joan of Arc in 1429. The cathedral of Ste. Croix, begun in 1287, was burned by the Huguenots in 1567 before its completion. Henry IV., in 1601, laid the first stone, the building of which continued until 1829. The church of St. Aignan mutilated by the Protestants consists of a transept and choir of the second half of the 15th century; it contains in a gilded and carved wooden shrine the remains of its patron saint. St. Euverte, dedicated to one of the oldest bishops of Orleans (d. 391), is an early Gothic building dating from the 13th, completely restored in the 15th century. The church of St. Paul (15th and 16th century) has an isolated tower, and Notre-Dame de Recouvrance was rebuilt between 1517 and 1519 in the Renaissance style and dedicated to the memory of the deliverance of the city. The *hôtel de ville,* built under Francis I. and Henry II. and restored in the 19th century, was formerly the residence of the governors of Orléans, and was occupied by the kings and queens of France from Francis II. to Henry IV. The public library comprises among its manuscripts a number dating from the 7th century. The *salle des fêtes,* formerly the corn-market, stands within a vast cloister formed by 15th-century arcades, once belonging to the old cemetery. Among old houses are that of Agnes Sorel (15th and 16th centuries), containing objects relating to Joan of Arc, that of Francis I., of the first half of the 16th century, that occupied by Joan of Arc during the siege of 1429, and that known as the house of Diane de Poitiers (16th century), which contains the historical museum. The anniversary of the raising of the siege in 1429 by Joan of Arc is celebrated yearly. Orleans is the seat of a bishopric under the archbishop of Paris, a prefect, a court of appeal, and a court of assizes and headquarters of the V. army corps.

The more important industries are the manufacture of tobacco (by the state), blankets, pins, vinegar, machinery, agricultural implements, hosiery, tools and ironware, and the preparation of preserved vegetables. Wine, wool, grain and live stock are commercial staples, round which there are important nurseries.

ORLEANS CAMPAIGN OF 1870

Orleans was the pivot of the second phase of the Franco-German War, called the "People's War," when the new armies began their attempt to relieve Paris. After the fall of the empire, the Government of National Defence, deciding to remain in Paris, delegated three of its members, Crémieux, Glais-Bizoin and Fourichon, proceeded to the provinces to hasten the levy of troops. General de la Motte-Rouge was appointed to command the "territorial division of Tours." From many scattered units, most of them ill equipped, he formed the XV. corps. The Germans, however, were only able to spare the I. Bavarian corps and three cavalry divisions (2nd, 4th and 6th), the investment of Paris and Metz occupying their forces. On October 5 the German 4th cavalry division was forced to retire before a French detachment under Reyau. Von der Tann, commanding the I. Bavarian corps, was reinforced by the 22nd infantry and 2nd and 6th cavalry divisions. Reyau was attacked at Artenay on October 10 and was thrown back in disorder, Orleans being captured in the evening of the following day, whereupon the French fell back on Sologne. Meanwhile Gambetta, Minister of Defence, arriving at Tours by balloon from Paris, assumed virtual control on Oct. 11, being aided by de Freycinet, the Deputy Minister. He forthwith appointed General d'Aurelle de Paladines in place of La Motte-Rouge. The change gave impetus to the training and re-organization of the troops and by October 23 a further force was concentrated at Blois, which formed the XVI. corps.

After the withdrawal of the 22nd infantry division from Von der Tann, its commander, General Wittich advanced to Châteaudun which he captured on October 18. He now made for Chartres, which also fell into his hands. The resistance he had met with led the Germans to believe in the existence of a new army as the French who defended them did not belong to either the XV. or XVI. corps. The "Army of the West," as they called this phantom force, originated from the defenders of Chateaudun and Chartres and was never formed into a fighting unit.

The French command decided to advance against the Germans massed around Orleans whom it mistakenly estimated at 60,000 men, whereas they barely numbered 26,000. As a mystification empty trains were run to Le Mans to confirm the Germans in their belief in the existence of an army west of Paris. But the contemplated offensive was postponed owing to bad weather and the discouraging news of Bazaine's capitulation with his 150,000 troops at Metz.

Moltke directed the II. Army, released from the siege of Metz, towards Bourges, sending it by Chalon-sur-Saône, while he formed a new detachment under the Grand Duke of Mecklenburg-Schwerin consisting of the I. Bavarian army corps, 17th and 22nd infantry and 2nd, 3rd and 4th cavalry divisions. This force was to concentrate between Chateaudun and Chartres.

The French advance began auspiciously, the German cavalry retiring before them on November 8. The following day, moving across the country in battle formation, the French attacked Von der Tann who was drawn up at Coulmiers, forcing him to retreat unpursued. The 2,500 Germans guarding Orleans thereupon evacuated the city and joined Von der Tann at Angerville.

Meanwhile, the Grand Duke with his detachment had not encountered any strong hostile forces and by November 19 Moltke began to believe that after all the French must still be concentrated in the neighbourhood of Orleans to the number of 150,000 men. He fully realised the gravity of the situation—the expected sortie from Paris coupled with the advance of the Army of the Loire. The king of Prussia was prepared, as he said to Waldersee at Versailles, to raise the siege of Paris if the II. Army sustained a defeat.

The members of the Government in Paris urged Trochu, the Governor, to attempt a sortie towards Fontainebleau, thereby joining hands with the army of the Loire. The sortie was to begin November 29, but the balloon carrying the message to Gambetta alighted in Norway, which caused a delay. D'Aurelle still remained on the defensive near Orleans though pressed by Freycinet to advance.

The battle of Beaune-la-Rolande took place on November 28, General Crouzat's XX. corps attacking the German X. corps between Turanville and Beaune-la-Rolande, while Billot's XVIII. corps pushed back the Prussian left. In the afternoon Crouzat was himself assailed in the rear from Pithiviers by a cavalry and infantry division, Billot also falling back. After further operations in which the French sustained defeat, the Germans moved towards Orleans on December 3 in a scythe-like line of battle 40 miles long. Serious resistance was only encountered at Chilleurs. Orleans was entered on Dec. 4th. (*See* further FRANCO-GERMAN WAR.)

ORLEY, BERNARD VAN (*c.* 1490–1540), Flemish painter, son of the painter, Valentyn van Orley, was born at Brussels about 1490. The date of his birth is estimated from his portrait by Dürer painted in 1521, now in the Dresden gallery. It represents an attractive and intelligent man of about 30. In 1515 he was employed by Margaret of Austria, then regent of the Netherlands, and three years later he was appointed her court painter. He died in 1540. His earliest important work is the altarpiece of S.S. Thomas and Matthias, of which the centrepiece is at Vienna and the wings at Brussels painted about 1512. The style of the picture seems to be inspired by the school of Autrey. From 1516–22 Bernard van Orley imitated Mabuse—to this period belongs the "Madonna" in the Wied Collection and the "Holy Family" in the Louvre. In the "Holy Family" in the Prado (1522) the influence of Mabuse has given way to that of Raphael. In the altarpiece representing the "Patience of Job," (1521) now in the Brussels gallery, we find the two influences combined. The artist had many opportunities to see designs by Raphael whose tapestry cartoons were in Brussels for many years. Important works of his later period are the "Hanneton

Family" altarpiece in the Brussels gallery; the "Last Judgment" (1525) at Antwerp; and the "Crucifixion" at Rotterdam. He painted several portraits; the one of Dr. Georg Zelk in the Brussels gallery is the only one which is signed and dated (1519). Van Orley was a designer of tapestries; for instance, "Hunts of Maximilian," in the Louvre, and "Victory of Pavia" at Naples.

See M. Friedlander, *Annual of Prussian Museums* (1908–09).

ORLOV, ALEXIS FEDOROVICH, PRINCE (1787–1862), Russian statesman, grandson of Count Theodore Grigorievich Orlov, took part in all the Napoleonic wars from 1805 to the capture of Paris. For his services as commander of the cavalry regiment of the Life Guards on the occasion of the rebellion of 1825 he was created a count, and in the Turkish War of 1828–29 rose to the rank of lieutenant-general. Orlov was the Russian plenipotentiary at the Peace of Adrianople, and in 1833 was appointed Russian ambassador at Constantinople, holding at the same time the post of commander-in-chief of the Black Sea Fleet. He was one of the most trusted agents of Nicholas I., whom in 1837 he accompanied on his foreign tour. In 1854 he was sent to Vienna to bring Austria over to the side of Russia, but without success. In 1856 he was one of the plenipotentiaries who concluded the Peace of Paris, and was rewarded with the dignity of prince, and the presidency of the imperial council of state and of the council of ministers. In 1857 he presided over the commission formed to consider the question of the emancipation of the serfs, to which he was altogether hostile.

ORLOV, ALEXIS GRIGORIEVICH, COUNT (1737–1808), brother of Gregory, Count Orlov (*q.v.*), was remarkable for his athletic strength and dexterity. In the revolution of 1762 he played an even more important part than his brother. He conveyed Peter III. to the château of Ropsha and is said to have murdered him there. In 1770 he was appointed commander-in-chief of the fleet sent against the Turks, whose far superior navy he annihilated at Cheshme (July 5, 1770), a victory which led to the conquest of the Greek archipelago. He devoted himself to horse-breeding, and produced the finest race of horses then known by crossing Arab and Frisian, and Arab and English studs. In the war with Napoleon during 1806–07 Orlov commanded the militia of the fifth district, which was placed on a war footing almost entirely at his own expense. He left an estate worth five millions of roubles and 30,000 serfs.

See article, "The Associates of Catherine II.," No. 2, in *Russkaya Starina* (Rus.) (St. Petersburg, 1873).

ORLOV, GREGORY (GRIGORII) **GRIGORIEVICH,** COUNT (1734–1783), Russian statesman, was the son of Gregory Orlov, governor of Great Novgorod. While serving in the capital as an artillery officer he caught the fancy of Catherine II., and was the leader of the conspiracy which resulted in the dethronement and death of Peter III. (1762). Catherine made him a count and adjutant-general, director-general of engineers and general-in-chief. At one time the empress thought of marrying her favourite, but the plan was frustrated by Nikita Panin. Orlov's influence became paramount after the discovery of the Khitrovo plot to murder the whole Orlov family. Gregory Orlov entered with enthusiasm, both from patriotic and from economic motives, into the question of the improvement of the condition of the serfs and their partial emancipation. He was their advocate in the great commission of 1767. One of the earliest propagandists of the Slavophil idea of the emancipation of the Christians from the Turkish yoke, he was sent as first Russian plenipotentiary to the peace-congress of Focsani (1771), but he failed in his mission, owing partly to the obstinacy of the Turks, and partly (according to Panin) to his own insolence. He was superseded in the empress's favour by Vasil'chikov.

See A. P. Barsukov, *Narratives from Russian History in the 18th Century* (Rus.) (St. Petersburg, 1885).

ORLOV, NIKOLAI ALEKSYEEVICH, PRINCE (1827–1885), entered the diplomatic service, and represented Russia successively at Brussels (1860–1870), Paris (1870–1882) and Berlin (1882–1885). As a publicist he stood in the forefront of reform. His articles on corporal punishment, which appeared in the *Russkaya Starina* in 1881, brought about its abolition. He also advocated tolerance towards the dissenters. He wrote a *Sketch of Three Weeks' Campaign in 1806* (St. Petersburg, 1856).

ORLOV, THEODORE (FEDOR) **GRIGORIEVICH,** COUNT (1741–1790), Russian general, participated with his elder brothers, Gregory (*q.v.*) and Alexis (*q.v.*), in the *coup d'état* of 1762, after which he was appointed chief procurator of the senate. His naval exploits in the first Turkish War were commemorated by a triumphal column, crowned with naval trophies, erected at Tsarskoe Selo. He retired in 1775.

ORM or **ORMIN,** the author of an English book, called by himself *Ormulum* ("because Orm made it"), consisting of metrical homilies on the gospels read at mass. The unique ms., now in the Bodleian library, is certainly Orm's autograph, and contains abundant corrections by his own hand. On palaeographical grounds it is referred to about A.D. 1200, and this date is supported by the linguistic evidence. The dialect is midland, with some northern features. The orthography of the *Ormulum* is the most valuable existing source of information on the development of sound in Middle English. On the whole, the language of the *Ormulum* seems to point to north Lincolnshire as the author's native district. There are reasons for thinking that Orm and the Walter to whom it is dedicated may have been inmates of the Augustinian priory of Elsham, near the Humber, which was established about the middle of the 12th century by Walter de Amundeville.

The *Ormulum* is written in lines alternately of eight and seven syllables, without either rhyme or alliteration. The rhythm may be seen from the opening couplet:

Nu, broþerr Wallter, broþerr min
Affterr þe flæshess kinde.

The extant portion of the work, not including the dedication and introduction, consists of about 20,000 lines. But the table of contents refers to 242 homilies, of which only 31 are preserved; and as the dedication implies that the book had been completed, and that it included homilies on the gospels for nearly all the year, it would seem that the huge fragment which we possess is not much more than one-eighth of this extraordinary monument of pious industry.

The *Ormulum* was edited for the first time by R. M. White in 1852. A revised edition, by R. Holt, was published in 1878. Many important corrections of the text were given by E. Kölbing in the first volume of *Englische Studien*. With reference to the three forms of the letter *g*, *see* A. S. Napier, *Notes on the Orthography of the Ormulum*, printed with *A History of the Holy Rood Tree* (Early English Text Society, 1894).

ORME, ROBERT (1728–1801), English historian of India, was born at Anjengo on the Malabar coast on Dec. 25, 1728, the son of a surgeon in the Company's service. Educated at Harrow, he was appointed to a writership in Bengal in 1743. He returned to England in 1753 in the same ship with Clive, with whom he formed a close friendship. From 1754 to 1758 he was a member of council at Madras. His great work was *A History of the Military Transactions of the British Nation in Indostan from 1745* (3 vols., 1763–78). This was followed by a volume of *Historical Fragments* (1781), dealing with an earlier period. In 1769 he was appointed historiographer to the East India Company. He died at Ealing on Jan. 13, 1801. His valuable collections of mss. are in the India Office library. Not a few of the most picturesque passages in Macaulay's Essay on Clive are borrowed from Orme.

ORMER, the name given in the Channel Isles and on the coasts of France to *Haliotis tuberculata*, a gastropod mollusc. It has a shell with a widely open aperture, more or less resembling a human ear in outline. The animal lives beneath stones and rocks close to the low-water mark of spring tides. For a sedentary organism it can move remarkably fast, and observers have commented on its strength and agility. The ormer is an article of human food in the Channel Isles and elsewhere (*see* ABALONE). The States of Guernsey introduced legislation in 1926 for its protection.

See T. A. Stephenson (1924), *Journ. Marine Biol. Assocn.*, xiii. No. 2, p. 480.

ORMEROD, ELEANOR A. (1828–1901), English entomologist, the daughter of George Ormerod, F.R.S., author of *The History of Cheshire*, was born at Sedbury Park, Gloucestershire,

on May 11, 1828. The opportunity afforded for entomological study by the large estate upon which she grew up and the interest she took in agriculture soon made her an authority upon this subject. In 1868, she aided the Royal Horticultural Society in forming a collection of insect pests of the farm for practical purposes, and was awarded the Flora medal of the society. In 1877 she issued a pamphlet, *Notes for Observations on Injurious Insects,* which was distributed among persons interested in this line of inquiry, who readily sent in the results of their researches, and was thus the beginning of the well-known *Annual Series of Reports on Injurious Insects and Farm Pests.* In 1881 Miss Ormerod published a special report upon the "turnip-fly," and she was consulting entomologist to the Royal Agricultural Society from 1882 to 1892. For several years she was lecturer on scientific entomology at the Royal Agricultural college, Cirencester. Eleanor Ormerod died at St. Albans on July 19, 1901.

Her works include: *The Cobden Journals; Manual of Injurious Insects; Handbook of Insects Injurious to Orchard and Bush Fruits;* and her *Autobiography and Correspondence* (1904). *See* also: *Canadian Entomologist,* vol. 33, 1901; *Royal Agric. Soc. Journ.* vol. 62, 1901.

ORMOC, a municipality (with administration centre and 16 *barrios* or districts), of the island and province of Leyte, Philippine islands, on the west coast about 35 m. S.W. of Tacloban, the provincial capital. Pop. (1918), 38,174, of whom 20 were whites. Ormoc is in a great abacá-producing region and is open to coastwise trade, its commerce being especially with Cebu. In 1918, it had 343 household industry establishments, with outputs valued at 96,400 pesos. Of its 12 schools, 11 were public. The language spoken is a dialect of Bisayan.

ORMOLU, an alloy of copper and zinc, sometimes with an addition of tin. The name is also used to describe gilded brass or copper. The tint of ormolu approximates closely to that of gold; it is heightened by a wash of gold lacquer, by immersion in dilute sulphuric acid or by burnishing. The principal use of ormolu is for the mountings of furniture. With it the great French *ébénistes* of the 18th century obtained results which, in the most finished examples, are almost as fine as jewellers' work. The mounts were usually cast and then chiselled with extraordinary skill and delicacy. (*See* also SILVERSMITHS' AND GOLDSMITHS' WORK.)

ORMOND, a town of Volusia county, Florida, U.S.A., on the Halifax river (an arm of the Atlantic ocean extending along the east coast for 25 m.) just N. of Daytona Beach. It is on Federal highway 1 (which between Ormond and Jacksonville runs over the old King's road, built by the English 1763–83) and is served by the Florida East Coast railway. The resident population was 1,852 in 1925 (State census), of whom 1,052 were negroes. It is a winter resort with large hotels and beautiful residences. The hard, compact Ormond-Daytona beach (200 ft. wide and 20 m. long) is the scene of many automobile races and speed tests. Ormond was incorporated in 1880.

ORMONDE, EARL AND MARQUESS OF, titles still held by the famous Irish family of Butler (*q.v.*), the name being taken from a district now part of co. Tipperary. In 1328 James Butler (*c.* 1305–37), a son of Edmund Butler, was created earl of Ormonde, one reason for his elevation being that his wife Eleanor Bohun was a granddaughter of Edward I. His son James, the 2nd earl (1331–82), was four times governor of Ireland; the latter's grandson James, the 4th earl (d. 1452), held the same position several times, and won repute not only as a soldier, but as a scholar. His son, James, the 5th earl (1420–*c.* 1461), was created an English peer as earl of Wiltshire in 1449. He was lord high treasurer of England in 1455 and again in 1459, and was taken prisoner by the Yorkists after the battle of Towton in 1461. He and his two brothers were then attainted, and he died without issue, the exact date of his death being unknown. The attainder was repealed in the Irish parliament in 1476, when his brother Sir John Butler (*c.* 1422–78), who had been pardoned by Edward IV. a few years previously, became 6th earl of Ormonde. John, who was a fine linguist, served Edward IV. as ambassador to many European princes. His brother Thomas, the 7th earl (*c.* 1424–1515), a courtier and an English baron under Richard III. and Henry VII., was ambassador to France and to Burgundy; he left no sons, and on his death in August 1515 his earldom reverted to the crown.

Margaret, a daughter of this earl, married Sir William Boleyn of Blickling, and their son Sir Thomas Boleyn (1477–1539) was created earl of Ormonde and of Wiltshire in 1529. He arranged the preliminaries for the Field of the Cloth of Gold; he was lord privy seal from 1530 to 1536, and served the king in many other ways. He was the father of Anne Boleyn.

Meanwhile in 1515 the title of earl of Ormonde had been assumed by Sir Piers Butler (*c.* 1467–1539), a cousin of the 7th earl. He was lord deputy, and later lord treasurer of Ireland, and in 1528 he surrendered his claim to the earldom of Ormonde and was created earl of Ossory. Then in 1538 he was made earl of Ormonde, this being a new creation; however, he counts as the 8th earl of the Butler family. In 1550 his second son Richard (d. 1571) was created Viscount Mountgarret, a title still held by the Butlers. The 8th earl's son, James, the 9th earl (*c.* 1490–1546), lord high treasurer of Ireland, was created Viscount Thurles in 1536. In 1544 an act of parliament confirmed him in the possession of his earldom, which, for practical purposes, was declared to be the creation of 1328, and not of 1538.

Thomas, the 10th earl (1532–1614), a son of the 9th earl, was lord high treasurer of Ireland. He was a Protestant, and threw his great influence on the side of the English queen and her ministers in their efforts to crush the Irish rebels, but he was perhaps more anxious to prosecute a fierce feud with his hereditary foe, the earl of Desmond, this struggle between the two factions desolating Munster for many years. His successor was his nephew Walter (1569–1633), who was imprisoned from 1617 to 1625 for refusing to surrender the Ormonde estates to his cousin Elizabeth, the wife of Sir R. Preston and the only daughter of the 10th earl. He was deprived of the palatine rights in the county of Tipperary, which had belonged to his ancestors for 400 years, but he recovered many of the family estates after his release from prison in 1625.

Walter's grandson, James, the 12th earl, was created marquess of Ormonde in 1642 and duke of Ormonde in 1661 (*see* below); his son was Thomas Butler, earl of Ossory (*q.v.*), and his grandson was James Butler, 2nd duke of Ormonde (*see* below).

When Charles Butler, earl of Arran (1671–1758), the brother and successor of the 2nd duke, died in December 1758, the dukedom and marquessate became extinct, but the earldom was claimed by a kinsman, John Butler (d. 1766). John's cousin, Walter (1703–83), inherited this claim, and Walter's son, John (1740–95), obtained a confirmation of it from the Irish House of Lords in 1791. He is reckoned as the 17th earl. His son Walter, the 18th earl (1770–1820), was created marquess of Ormonde in 1816, a title which became extinct on his death, but was revived in favour of his brother James (1774–1838) in 1825, and was retained by his descendants.

See J. H. Round on "The Earldoms of Ormonde" in Joseph Foster's *Collectanea Genealogica* (1881–83).

ORMONDE, JAMES BUTLER, 1ST DUKE OF (1610–1688), Irish statesman and soldier, eldest son of Thomas Butler, Viscount Thurles, and of Elizabeth, daughter of Sir John Poyntz, and grandson of Walter, 11th earl of Ormonde (*see* above), was born in London on Oct. 19, 1610. On the death of his father by drowning in 1619, the boy was made a royal ward by James I., removed from his Roman Catholic tutor, and placed in the household of Abbot, archbishop of Canterbury, with whom he stayed until 1625, residing afterwards in Ireland with his grandfather. In 1629, by his marriage with his cousin, the Lady Elizabeth Preston, daughter and heiress of Richard, earl of Desmond, he put an end to the long-standing quarrel between the families and united their estates. He succeeded his grandfather in 1632.

His active career began in 1633 with the arrival of Strafford, whom he supported consistently. In 1640 during Strafford's absence he was made commander-in-chief of the forces, and in August he was appointed lieutenant-general. On the outbreak of the rebellion in 1641 he rendered great service in the expedition to Naas, and in the march into the Pale in 1642, though much hampered by the lords justices, who were jealous of his power and

recalled him after he had succeeded in relieving Drogheda. On April 15, 1642, he gained the battle of Kilrush against Lord Mountgarret. He was created a marquess, and lieutenant-general with a commission direct from the king. He won the battle of New Ross (March 18, 1643) against Thomas Preston, afterwards Viscount Tara. In September, the civil war in England having meanwhile broken out, Ormonde, in view of the successes of the rebels and the uncertain loyalty of the Scots in Ulster, concluded (Sept. 15) with the latter, in opposition to the lords justices, the "cessation" by which the greater part of Ireland was given up into the hands of the Catholic Confederation, leaving only small districts on the east coast and round Cork, together with certain fortresses in the north and west then actually in their possession, to the English commanders. He subsequently, by the king's orders, despatched a body of troops into England (shortly afterwards routed by Fairfax at Nantwich) and was appointed in January 1644 lord lieutenant, with orders to keep the Scotch army occupied.

In the midst of all the plots and struggles of Scots, Old Irish, Catholic Irish of English race, and Protestants, and in spite of the intrigues of the pope's nuncio, as well as of attempts by the parliament's commissioners to ruin his power, Ormonde showed the greatest firmness and ability. He assisted Antrim in his unsuccessful expedition into Scotland. On March 28, 1646, he concluded a treaty with the Irish which granted religious concessions and removed various grievances. Meanwhile the difficulties of his position had been greatly increased by Glamorgan's treaty (Aug. 25, 1645) with the Roman Catholics, and it became clear that he could not long hope to hold Dublin against the Irish rebels. He thereupon applied to the English parliament, signed a treaty on June 19, 1647, gave Dublin into their hands upon terms, and sailed for England at the beginning of August. He attended Charles during August and October at Hampton Court, but subsequently, in March 1648, in order to avoid arrest by the parliament, he joined the queen and prince of Wales at Paris. In September of the same year, he returned to Ireland to endeavour to unite all parties for the king. On Jan. 17, 1649 he concluded a peace with the rebels on the basis of the free exercise of their religion; on the execution of the king he proclaimed Charles II. and was created a knight of the Garter in September. On the conquest of the island by Cromwell he returned to France in December 1650.

Ormonde accompanied Charles to Aix and Cologne when expelled from France by Mazarin's treaty with Cromwell in 1655. In 1658 he went disguised, and at great risk, upon a secret mission into England. He attended the king at Fuenterrabia in 1659 and had an interview with Mazarin; and was actively engaged in the secret transactions immediately preceding the Restoration. On the return of the king he was at once appointed a commissioner for the treasury and the navy, and received other important places, together with an English peerage, and (1661) the dukedom of Ormonde in the Irish peerage. On Nov. 4, 1661 he once more received the lord lieutenantship of Ireland. The act of Explanation (on land settlement) was passed through the Irish parliament by Ormonde in 1665. His heart was in his government, and he vehemently opposed the bill prohibiting the importation of Irish cattle which struck so fatal a blow at Irish trade; and retaliated by prohibiting the import into Ireland of Scottish commodities, and obtained leave to trade with foreign countries. He encouraged Irish manufactures and learning to the utmost, and it was to his efforts that the Irish college of Physicians owes its incorporation.

Faced by the loss of royal favour, Ormonde declared "However ill I may stand at court I am resolved to lye well in the chronicle." His irresponsible government was no doubt open to criticism. He had billeted soldiers on civilians, and had executed martial law. The impeachment, however, threatened by Buckingham in 1667 and 1668 fell through. Nevertheless by 1669 constant importunity had had its usual effect upon Charles, and in March Ormonde was dismissed. That year, he was however, elected chancellor of Oxford university. On Dec. 6, 1670 an attempt was made to assassinate the duke by Thomas Blood. He was dragged out of his coach, and taken on horseback along Piccadilly with the intention of hanging him at Tyburn. Ormonde, however, succeeded in overcoming the horseman to whom he was bound, and his servants coming up, he escaped. The king pardoned Blood, and even treated him with favour after his apprehension while endeavouring to steal the crown jewels.

In 1671 Ormonde successfully opposed Richard Talbot's attempt to upset the act of Settlement. In 1667 he was restored to favour and reappointed to the lord lieutenancy. On his arrival in Ireland he placed the revenue and the army upon a proper footing. In 1682 Charles summoned Ormonde to court. On Nov. 9, 1683 an English dukedom was conferred upon him, and in June 1684 he returned to Ireland; but he was recalled in October in consequence of fresh intrigues. Before, however, he could give up his government to Rochester, Charles II. died; and Ormonde's last act as lord lieutenant was to proclaim James II. in Dublin. Subsequently he lived at Cornbury in Oxfordshire. He refused the king his support over the Indulgence but James held him in respect. He died on July 21, 1688, and was buried in Westminster abbey.

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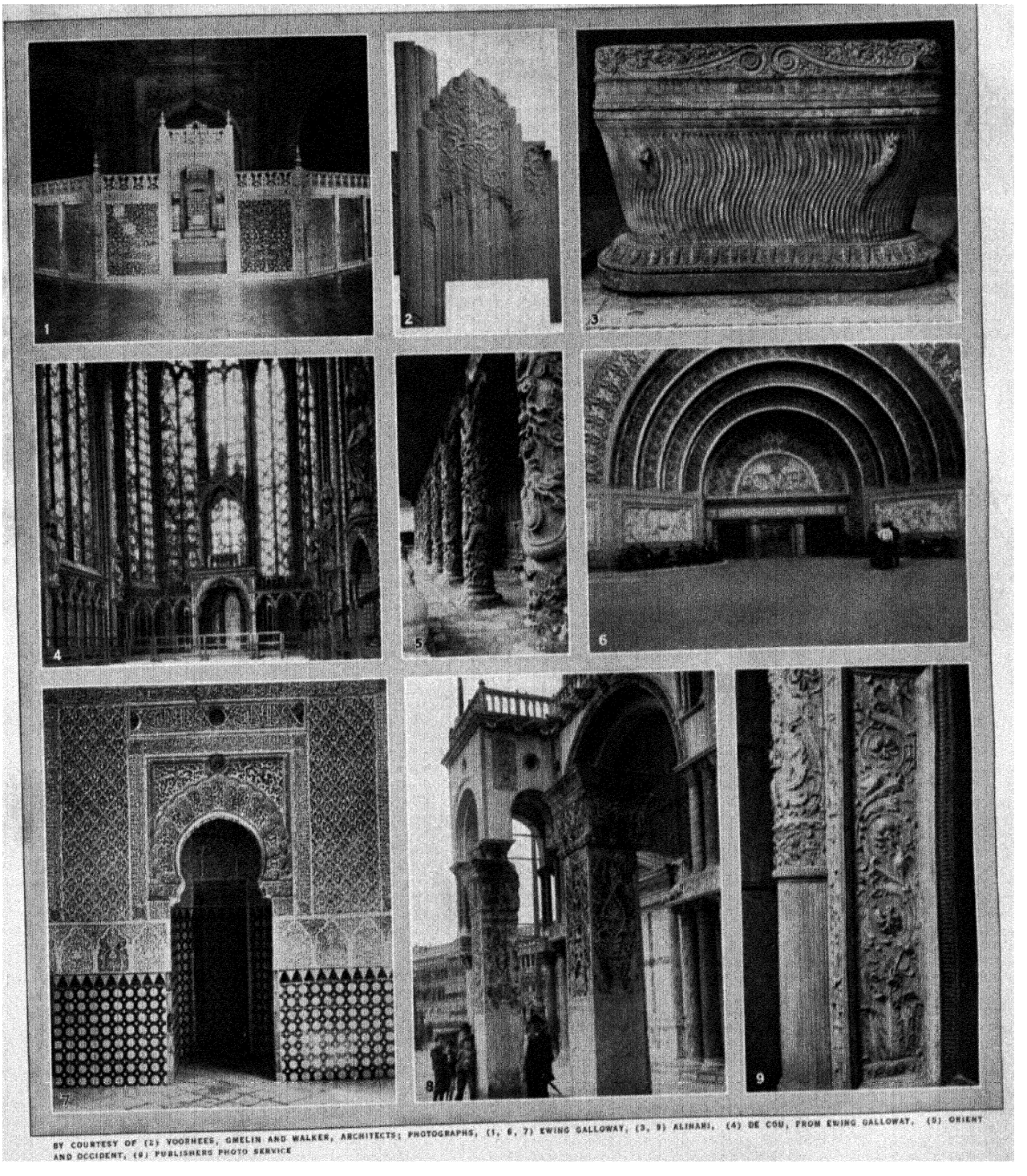
ORMONDE, JAMES BUTLER, 2ND DUKE OF (1665–1745), Irish statesman and soldier, son of Thomas, earl of Ossory, and grandson of the 1st duke, was born in Dublin on April 29, 1665, and was educated in France and afterwards at Christ Church, Oxford. He commanded a regiment of horse in William's army at the battle of the Boyne. In 1691 he served on the continent under William, and after the accession of Anne he was placed in command of the land forces co-operating with Sir George Rooke in Spain. He succeeded Rochester as viceroy of Ireland in 1703, a post which he held till 1707.

On the dismissal of the duke of Marlborough in 1711, Ormonde was appointed captain-general in his place, and allowed himself to be made the tool of the Tory ministry, whose policy was to carry on the war in the Netherlands while giving secret orders to Ormonde to take no active part in supporting their allies under Prince Eugene. Though he had supported the revolution of 1688, Ormonde was traditionally a Tory, and Lord Bolingbroke was his political leader. During the last years of Queen Anne he almost certainly had Jacobite leanings, and corresponded with the duke of Berwick. He joined Bolingbroke and Oxford, however, in signing the proclamation of King George I., by whom he was nevertheless deprived of the captain-generalship. In June 1715 he was impeached, and fled to France, where he for some time resided with Bolingbroke, and in 1716 his immense estates were confiscated to the crown by act of parliament, though by a subsequent act his brother, Charles Butler, earl of Arran, was enabled to repurchase them. After taking part in the Jacobite invasion in 1715, Ormonde settled in Spain, where he was in favour at court and enjoyed a pension from the crown. He died on Nov. 16, 1745, and was buried in Westminster abbey.

See Thomas Carte, *Hist. of the Life of James, Duke of Ormonde* (6 vols., Oxford, 1851), which contains much information respecting the life of the second duke; Earl Stanhope, *Hist. of England, comprising the Reign of Queen Anne until the Peace of Utrecht* (1870); F. W. Wyon, *Hist. of Great Britain during the Reign of Queen Anne* (2 vols., 1876); William Coxe, *Memoirs of Marlborough* (3 vols., new edition, 1847).

ORMSKIRK, a market town, urban district, Ormskirk parliamentary division, Lancashire, England, 11 m. N.E. of Liverpool by the L.M.S. railway. Pop. (1921) 7,405. The name and church existed in the time of Richard I., when the priory of Burscough was founded, whose prior obtained from Edward I. a royal char-



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ORNAMENTAL DETAIL IN ARCHITECTURE

1. Taj Mahal, Agra, India; alabaster screen inlaid with precious stones enclosing the tombs of Shah Jahan and his empress, Mumtaz Mahal, for whom Jahan built (c. A.D. 1631) the Taj Mahal. 2. Models of ornament for the Telephone Building, Washington, D.C., an illustration of modern vertical design. 3. Sarcophagus from the tomb of Caecilia Metella, Augustan era; now in the court of the Farnese Palace, Rome. 4. Interior of *La Sainte-Chapelle*, Paris, built 1246–58 by Louis IX. (Saint Louis). (See *Gothic Architecture*, Plate I.). 5. Pillars of the Confucius Temple at Chü Fu, Shantung Province (Yüan dynasty, 1280–1368), with the Chinese dragon and other forms in high relief. 6. Entrance to the Transportation Building, Chicago World's Fair, 1893. Louis Sullivan, architect. 7. The Alhambra, Granada, Spain, 13th and 14th centuries; *mihrab* or prayer niche in the private mosque, adorned with lace-like carvings in stone of Arabic inscriptions, delicate arabesques, and geometric designs; and with horseshoe and lobar arch forms and coloured tiles, characteristic of Moorish art in Spain. 8. St. Mark's, Venice. Two isolated marble columns, near the arcades of the south side, brought in the 18th century, from St. Jean d'Acre, Palestine, by Tiepolo. 5th century, Hellenistic style. 9. Detail of a marble altar, by Benedetto da Rovezzano (1476–1556), in the Church of the Holy Trinity (Santa Trinità), Florence

ter for a market at the manor of Ormskirk. On the dissolution of the monasteries the manor was granted to the earl of Derby.

The church of SS. Peter and Paul is a spacious building in various styles, principally Perpendicular. It possesses two western towers, the one square and embattled, the other octagonal and bearing a short spire. There are various Norman fragments, including a fine early window in the chancel. To the south-east of the church, is the Derby chapel, the property of the earls of Derby, whose vault is contained within. A grammar school was founded about 1614. Rope and twine making, iron-founding and brewing are carried on. The town has long been famous for its gingerbread, and is the centre of an important potato-growing district.

ORNAMENT, ARCHITECTURAL. In decorative art ornament is that element which supplies beauty in detail by the addition of anything which gives an aesthetic pleasure.

In all beginnings of primitive culture man shows a marked tendency to decorate his utensils, fabrics and ceramics with some sort of ornament. These early designs, consisting largely of overlapping stitches, lines, triangles, dots, zigzags, spirals and crosses, are purely linear even when colour is used to heighten the effectiveness of the designs. All have very similar motifs, and crude as this early ornament is, it still persists as a basis for much of the so-called abstract ornament in use to-day. These forms may be due to a lack of handicraft ability. For whether or not these early designs in the cultural growth of a people are representative of natural objects—the scales of fishes, the feather patterns of birds, plants and things of common everyday experience—the technical difficulties in the way of making free designs in the art of basketry, weaving or pottery tend to make the designs geometric in character. It is also possible that such designs may have lost their pure form through the tendency to standardize that comes of the endless copying by craftsmen of different degrees of skill. It is evident to the casual observer that more culture is necessary to produce free designs than is the case with the use and development of geometric art, because of the greater technical difficulties, and that naturalistic ornament while deriving its sources from nature tends to become abstract owing to the conventionalization of the motifs employed. At the same time, the abstract ornament tends to revert back to the natural as it takes on complexity.

The theory of the evolution of the natural to the geometric, while not accepted by all the authorities on primitive art, has, if the psychology of the designer or artist is taken into consideration, much to commend it. A conventionalization of design takes place without fail in any art due to the very great difficulty in inventing new motifs and to the natural inclination of the average craftsman to be content with imitation, and finally the design motifs conventionalize in primitive art because of a special symbolic meaning associated with the religion and customs of the tribe and so become difficult to change. In fact, it is this very conventionalization of ornament for all uses, for whatever reason, that formalizes into the standards which we call styles. Historically, these styles mark the evolution of ornamental design and are definitely related to the customs and civilization of the people who produced them. Furthermore, a style is known not by its beginnings but by its decadence, and is named not by its creator but by historians.

Influences.—All ornament is affected very strongly by the philosophy and thought of the time in which it is designed. It is interesting in that respect that primitive art fundamentally shows a clear desire on the part of the group design to express a complete and definite sense of fulfilment, a straightforward expression of a thing or things of the present only. Each unit or repeat in primitive design is wholly complete in itself and only establishes its relation as part of the whole through a very simple rhythm of the necessary repetition. And while it is true that primitive design may be very elaborate it is rarely complex but rather indicates a desire for richness. The slight degree of complexity that is gained is by the use of different primary colours added to the same linear motif or by increasing the number of rows of different patterns, each simple in itself.

Historically, all ornament has passed through this primitive stage to a period of larger viewpoint, when the artist becomes more interested in a sense of a lack of completeness and the design motifs gather or lose a quality of freshness and time appreciation in ratio to the existence or lack of that sense. For example, architectural ornament of the nature of the chevron, the dentil, the egg and dart, and the bead and reel, are primitive forms, each complete in itself, in which as a repetition the timebeat, the interval and the rhythm are uniform and are therefore rigid and mechanical, easily comprehended, and lacking in time appreciation; whereas such motifs as the arabesque, the vine and flamboyant tracery are without that limited sense of completeness, and in so far as the rhythm interacts with the interval and against the timebeat, they lose the quality of the mechanical and become more enduring in interest. (*See* GREEK ARCHITECTURE and ROMAN ARCHITECTURE.)

Appreciation of any art presupposes sufficient leisure for its enjoyment, so that in designing ornament it would seem necessary to consider a time element as well as whether or not it is proper both as to position and technical fitness. This time element engenders space elements by means of which appreciation must be led from one detail to another, and as all ornament is static in nature it should include, therefore, within the design a stimulus toward, and an opportunity for, fresh viewpoints, and so encourage a more continuous period of appreciation. It is the thought or emotion behind the ornament that lives, while its surface aspects, because of the always evident desire to change, must become out-moded in time.

As all ornament is designed to form a pattern, whether it is composed of repeat units or as a general composition, the rhythms and interrelations of the structural background on which the ornamental detail is composed are as important as the primary functions of the design itself. It is this structure which gives coherence, unity and the sense of space and time to the ornamental design. In the consideration that all ornament must bear the repetition of being seen not only once but many times, the longer the element of time appreciation that is consciously set up within the design the more enduring in interest it will become. Yet it must not be so extended and involved as to be incomprehensible upon close inspection. It seems evident that a design whose rhythmic quality is purely mechanical, even though colour is used to superimpose an additional rhythm, must fail in possessing a sustained interest. The design motif fulfills its sole purpose when it creates a longer time interest in the object ornamented through its added beauty. This growth in time interest in appreciation of ornament is closely allied with the same growth in the complexity of the manners and philosophy of the people who are creating or modifying the ornamental design. A very clear conception of this interrelation of thought and design can be obtained from the study of the differences in growth of oriental and occidental ornamental motifs; the differences remain even when there are signs of influence of one thought upon the other, or through the gradual change from simplicity to complexity which is evident in the difference between the early ornament and thought of the Gothic period (*see* GOTHIC ARCHITECTURE) and its later development. And while it is evident that the technical ability of the craftsman has contributed a great deal as to whether the design motifs are simple or complex—for instance, compare the wood carving of the Jacobean craftsmen with the work of Grinling Gibbons and the later English wood carvers—it would seem that the technical skill had but kept pace with the civilization with which it is associated, for as a civilization advances it is apparent that ornamental design becomes more complex rather than less, that the design motifs become fuller in nature, richer in detail and more nearly perfect in technique.

Materials.—It is generally thought that the treatment of ornament is definitely limited by and related to processes and materials, although throughout the history of ornament motifs and technique have been freely translated from one material to another without loss of harmony. The architectural motifs, for example, both structural and ornamental have always been used as pure ornament in the furniture and accessories of the same style. Ornamental design in which the design is not inherently manufactured

can be considered apart from the material it embellishes. The material of which the structure is built limits only the coarseness or fineness of the technique of the detail employed, although, for example, most stones or woods may be carved crudely or delicately according to the effect desired by the designer, the scale desired, or the technical ability of the craftsman. This being so, the actual design motif may be thought of for its effect as such and is only limited in its possibilities by the thought and ability of the creator who might use it to obtain a difference in texture as a help in making a transition between two materials, or to create the pattern interest that comes from employing detail. In its relations to the material employed, it may be either structurally inherent or applied. Structural ornament is either integral, that is part of the structure as in weaving or where a structural member is changed for added grace, or as in veneers where the inherent pattern of wood or marble is used; whereas applied ornament may have little or no relation to the structure other than being placed upon it, and as its name implies is added later for pure embellishment.

Modern Tendency.—The ornament of the present, because of the almost immediate world-wide communication of ideas, is breaking away from the local or national boundaries and is becoming more universal in its characteristics. This will not necessarily lead to a tighter standardization because the means by which design is produced has undergone a great change. Since ornament has always had a very definite relation to the tools and technical ability of the period in which it is produced, it would seem natural that ornament, which is becoming more and more dependent upon the machine for its production and upon designers of greater perceptibility, will become less standardized because of the ease with which the tools are changed and improved, and as the self-consciousness of the designer in designing for the machine becomes less as the communities become more completely industrialized. This loss in standardization will tend to give a sense of greater freshness and creativeness in design and will give, because of the freedom in execution, a maximum individuality to the work of the designer.

For a complete list of the various architectural subjects treated in this work *see* ARCHITECTURAL ARTICLES.

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ORNAMENTS, PRIMITIVE. The term "ornament" is strictly applied to objects worn from a sense of aesthetic value and intrinsic beauty either in gratification of the personal taste of the wearer, or in accord with fashion. But it can also be applied to objects which are worn for other reasons, such as the various objects worn for magico-religious reasons, as indications of social distinction and status, for the purpose of protection, as amulets and charms, or even as curatives. As Professor Radcliffe Brown points out, the desire for protection and the desire for display "are very intimately related and are really both involved in every kind of ornament. All ornament in some way marks the relation of the individual to the society." (*Andaman Islanders*, p. 319.) Classes of ornaments in primitive society mark distinctions of sex and social status, the unmarried having ornaments peculiar to their status which differ conspicuously from those allowed to or required of married people. Articles worn as dress, that is, either for protection against climatic conditions, or from modesty may become ornaments if an element of aesthetic appreciation helps to determine individual choice or fashionable vogue. Decorations may be worked on or fashioned to plain materials to make the whole ornamental. In communities of a more permanent order, ornament and embellishment, external and internal, is applied to architecture in personal rivalry or in token of social status. To religious zeal is due the wealth of ornament often found in the Men's House—the centre of the communal life, the repository of the cult objects of the community, the origin of the temple.

The objects worn as ornaments are sometimes of a considerable degree of elaboration. Wings of butterflies, gorgeous tropical beetles, seeds, berries, flowers, variegated leaves, bright stones, all sorts of natural products are employed. The manufacture of ornaments as prescribed by the social order is an occupation of importance. Thus, "The Akamba wear a great number of ornaments (*mapa*) of various kinds, especially metal ones, but they never overload their bodies with them on ordinary occasions. On account of the composition and choice of colours these ornaments are attractive even to European ideas of beauty, and the fine execution of the work must arouse admiration." (G. Lindblom, *Akamba*, 1920, p. 375.) Nature provides the materials and the models. The sense of colour is expressed by using different coloured earths, the quest for which is a stimulus towards economic development. Conventionalization, vulgarization, degradation and imperfect, unintelligent, imitations are notable in primitive art but at one and the same time in one community there may be artists of very different capacities.

ORNE, a department of the north-west of France, about half of which formerly belonged to the province of Normandy and the rest to the duchy of Alençon and to Perche. Pop. (1926) 277,637. Area, 2,371 sq.m. West of the Orne and the railway from Argentan to Alençon lie primitive rocks connected with those of Brittany; to the east begin the Jurassic and Cretaceous formations of Normandy. The district of the newer rocks is rich agriculturally, that of the older rocks poor, but the whole department is relatively high land, by far the greater portion being over the 600 ft. contour (highest point, forest of Écouves, 1,368 ft.). It forms a centre whence rivers diverge in all directions, traversing deeply-cut and picturesque valleys, in many cases well-wooded with fine oaks.

Horse-breeding is very important in the rural districts; there are three breeds—those of Perche, Le Merlerault and Brittany. The great government stud of Le Pin-au-Haras (established in 1714), with its school of horse-breeding, is situated between Le Merlerault and Argentan. A large number of lean cattle are bought in the neighbouring departments to be fattened; the farms near Vimoutiers, on the borders of Calvados, produce the famous Camembert cheese, and others excellent butter. The bee industry is very flourishing. Oats, wheat, barley and buckwheat are the chief cereals, and fodder in great quantity and variety, potatoes and some hemp are grown. The variety of production is due to the great natural diversity of the soils. Small farms are the rule, and the fields are surrounded by hedges relieved by pollarded trees. Along the roads or in the enclosures are numerous pear and apple trees, the latter yielding cider, part of which is manufactured into brandy. Orne has iron mines and freestone quarries; a kind of smoky quartz known as Alençon diamond is found. The hot springs of Bagnoles, which contain salt, sulphur and arsenic, are famous. In the forest of Bellême is the chalybeate spring of La Hesse, which was used by the Romans.

Cotton and linen weaving, notably at Flers (*q.v.*) and La Ferté-Macé (pop. 3,775), forms the staple industry of Orne. Alençon and Vimoutiers make linen and canvas. Vimoutiers has bleacheries, which, with dye-works, are found in the textile centres. At Alençon only a little of the lace which takes its name from the town is still made. There are foundries and wire-works in the department, and articles in copper, zinc and lead are manufactured. Pins, needles, wire and hardware are produced at Laigle (pop. 4,624), and hardware also at Tinchebray. There are glass-works, papermills, tanneries (the waters of the Orne being reputed to give a special quality to the leather), and glove-works. Coal, raw cotton, metals and machinery are imported. The exports include woven and metal manufacture, live stock and farm produce.

The department is served by the Ouest-Etat railway. There are two arrondissements, with Alençon, the capital, and Argentan, as their chief towns, 36 cantons and 513 communes. The department forms the diocese of Sées (province of Rouen) and part of

the *académie* (educational division) of Caen, and the region of the IV. army corps; its court of appeal is at Caen.

ORNITHOLOGY is the science of birds. We begin with the records of birds made by Aurignacian man during the last glacial epoch of the Ice age in France and Spain—paintings on the walls of caves, or figures or incisions carved on bits of horn, bone or stone. The birds that have been identified thus far from this remote Palaeolithic art include the crane, duck, goose, grouse, owl, partridge and swan. In the more recent Neolithic period, outlines of birds are more common, so that in the cave at Tajo Segura, in the province of Cadiz, southern Spain, Col. Willoughby Verner has found figures of 12 species of birds, the great bustard, crane, duck, goose, raven, spoonbill, flamingo, purple gallinule, glossy ibis, stork, eagle and marsh harrier. To these archaeologists assign an antiquity of 6–8,000 years. The Palaeolithic designs are much older.

From a painting and a statuette of the common fowl from Egypt, made about 4400 B.C., it is believed that this bird was even then kept in captivity, while knowledge of the domesticated pigeon in the same country, according to Canon Tristram, goes back to the 5th dynasty, about 3500 B.C. Record of the use of pigeons as carriers of messages is found a little later. In a tomb of the 4th dynasty of about 3700 B.C., at Meidoum, in Egypt, Mariette discovered a fresco showing red-breasted and white-fronted geese, whose painted colours are said to be exactly like those seen in the two species to-day.

Early Writings.—There are many incidental references to birds in the Bible, those in the Old Testament being of considerable antiquity. The writings of Aristotle (384–322 B.C.), though they do not attempt to give a connected account, include statements (according to Sundevall) that concern about 170 species of birds. He obtained part of his information from still earlier writers whose works are lost. Pliny the elder (d. A.D. 79), in his *Historia Naturalis*, devoted Book X. to birds, taking much from Aristotle. Aelian (d. about A.D. 140) made various notes on birds, compiled in part from older authors.

Early Saxon poets mention the gannet and several other birds of uncertain identity in songs current during the 6th and 7th centuries, and during the latter came the first records of falconry, apparently introduced by the Saxons into Britain. About the middle of the 8th century the *Epistolae Sancti Bonifacie* informs us that Boniface, archbishop of Mons in Belgium, presented to Ethelbert, king of Kent, a hawk and two falcons. In the laws of Howel, king of Cambria, supposedly in the 10th century, there is statement of the hunting of the pheasant, and allusion to hawking. Incidental references to hunting with hawks are found in accounts of the activities of Athelstan, and of Edward the Confessor. Aelfric's *Vocabulary*, a list of words prepared in the 10th century, possibly for educational use, and another of somewhat later date, contain names of more than 100 birds, while in the *Colloquy of Aelfric*, a series of dialogues between a master and his pupils, are references to hunting with and training of hawks. In the writings and manuscripts of the 12th and 13th centuries are many references to hawking, descriptions of decoys in which ducks were captured alive, records of heronries, and an account of a great flight of crossbills into England in the year 1251.

Following the invention of printing, William Turner published in 1544 a commentary on the birds of Aristotle and Pliny, prepared in accordance with treatment that was the forerunner of modern methods. This was followed in 1555 by Conrad Gesner's *Historia Animalium*, whose third book dealt with birds and contained many original observations, as the author travelled extensively and recorded his impressions first-hand. Pierre Belon, whose *Histoire de la Nature des Oyseaux* appeared also in 1555, had considerable knowledge of the anatomy of birds, and seems to have been the first to correlate the various parts of the avian skeleton with those of man's.

In the joint observations of Francis Willughby and John Ray, published by the latter in 1676, after the death of Willughby, there is found a division of all known birds into two great groups of "land-fowl" and "water-fowl," an arbitrary classification that has been current to the present generation, though now superseded by a more modern grouping based on structural characters.

Linnaeus, the founder of the modern system of scientific names used in systematic zoology, began publication of his *Systema Naturae* in 1735. His attempt was to be terse and concise, and in 1758, in the 10th edition of his work, he proposed that each species be designated by two names, the first of generic significance applying in most cases to a number of somewhat similar allied forms, and the second specific in nature and used in connection with the genus name for the species in question alone. (*See* ZOOLOGICAL NOMENCLATURE.) In recent years, sub-species, or geographic races, are designated by a third Latin term or subspecific name.

Natural history collections made in connection with the many exploring expeditions of the late 18th and early 19th centuries brought to Europe, particularly to England and France, many specimens of birds that greatly broadened knowledge of the ornithology of the world. In early explorations paintings or drawings were made of birds, or specimens were preserved in spirits, or sometimes dried as mummies. At the beginning of the 19th century, as travellers increased and interest in natural objects expanded, methods of preparing skins of birds were evolved that led finally to the making of what are known as scientific specimens, where the skin, with the feathers intact, is removed from the bird, leaving only the bones of the skull, wings, feet and base of the tail. The inner surface of the skin is poisoned, usually with arsenic, filled with cotton, tow or other light vegetable substance, and dried after being wrapped or otherwise arranged so that it resembles a dead bird. By means of such preparations it is possible to assemble collections of birds that may be preserved indefinitely for continued study and examination. The growth of such collections and their expansion into museums, where birds were mounted in natural positions, changed completely the style and method of published treatises dealing with ornithology. To this time these had been mainly accounts and descriptions written from hearsay or memory, and involving constant repetition of the writings of previous authors. Such accounts were now in large measure supplanted by detailed statements regarding specimens secured during voyages, or monographs that brought together all available knowledge concerning genera, families, or larger groups of birds. The art of illustration was amplified, and many works contained series of coloured representations that delineated the bird under discussion more definitely than words. Among early writers of such illustrated works or monographs may be mentioned Daubenton, whose *Planches Enluminées* contained 1,008 plates mainly on birds, Le Vaillant who published on hornbills, cotingas, birds of paradise, and many others; Vieillot, who produced an array of volumes that dealt with the majority of the known birds of the world; and Temminck, who wrote on the pigeons and gallinaceous birds.

Audubon's *Birds of America*, in 4 vols. of elephant folio size, containing 435 plates, was published in London between 1827 and 1838, and was followed by his *Ornithological Biography*, in which, with the aid of William MacGillivray, he gave accounts of the habits of North American birds. The writings of John Gould, which began in 1832, covered descriptions and beautiful paintings in colour of birds of all parts of the world and included in all more than 40 folio volumes illustrated by upwards of 3,000 plates.

Modern Contributions.—After the middle of the 19th century ornithological publications increased to a point where it is impossible in brief space to enumerate them. In 1874 there appeared the first of the great series of volumes comprising the *Catalogue of Birds in the British Museum*, begun by R. Bowdler Sharpe, and completed in 27 vols. in 1898 with the assistance of a number of other writers. This, with Sharpe's *Handlist of the Birds of the World*, in 5 vols. (1899 to 1909), has had profound influence.

In America increase of knowledge in ornithology subsequent to Audubon and Wilson (who was a contemporary of Audubon in the study of American birds and published an excellent and painstaking account of them) came rapidly with the appointment of Spencer Fullerton Baird as assistant-secretary of the Smithsonian institution. Baird's early years in this new position

were coincident with the initiation of the great exploratory surveys, including the Hayden surveys and the survey of the 40th parallel of latitude, undertaken by the Government to develop the western part of the United States. Baird established the U.S. National Museum as a depository for specimens of all kinds belonging to the American Government, and arranged to send naturalists with the different survey parties, with the result that large collections, particularly of birds and mammals, came to Washington, furnishing the material for many important reports.

At the same time Baird initiated the preparation of a complete review of the birds of America, a project that he had perforce to turn over finally to Robert Ridgway because of increasing administrative duties. The final result has been the publication by the U.S. National Museum since 1901 of 8 vols. under the title, *Birds of North and Middle America*. Two more volumes are expected to bring this work to completion.

Ornithological Societies.—As ornithologists increased in number desire for discussion of their problems grew, to take shape finally in serials devoted to birds alone. Among the early periodicals that continue to-day there may be mentioned especially the *Journal für Ornithologie* begun in 1853, the *Ibis*, founded by the British Ornithologists' Union in 1859, and the *Auk*, originated by the American Ornithologists' Union in 1883. The last mentioned is a direct continuation of the *Bulletin* of the Nuttall Ornithological Club, established by that organization in April 1876. The Zoological Society of London, especially in its earlier years, has had a profound influence on the development of ornithology through the labours of its prosectors, particularly A. H. Garrod, W. A. Forbes and Frank E. Beddard, and through its publications, especially the *Proceedings* of the Zoological Society of London, and its precursor the *Proceedings* of the Committee of Science and Correspondence of the Zoological Society (1830, etc.).

Today, there is an ornithological or similar society in most of the principal countries of the world. At the present time there are more than 30 periodicals devoted to various phases of bird study alone. Of these the most important to the ornithologist has been the *Zoological Record*, published annually since 1864 by the Zoological Society of London. The section devoted to *Aves* now annually contains reference to more than 1,000 separate papers.

Bird Protection.—Another phase of ornithological interest that has obtained extended popular support in the past two decades is that of the protection of useful or harmless birds. (*See* BIRDS, PROTECTION OF; BIRD SANCTUARIES.) Legislation intended to restrict the killing of ducks, grouse and other birds considered as game, began in very early times, indication of recognition of the propriety of such action being found in the Old Testament (Deuteronomy, xxii., 6–7) where there is a prohibition against the killing of a bird on the nest.

In the laws of the Welsh king, Howel of Cambria, about the 10th century A.D., there are definitions of the various kinds of hunts, including the hunting of the pheasant. Such penalties as the loss of both eyes were provided by William, duke of Normandy, for peasants who had the temerity to kill game reserved for the nobility. Game protection was thus one of the early tenets of Anglo-Saxon law, and so came early to the New World, particularly to the United States, though, unfortunately, it has not been possible to show clearly the need for rigid protective measures until the destruction of game had greatly reduced valuable species of birds. In America protective measures to conserve valuable birds antedate the coming of the Caucasian, however, since the Inca rulers recognizing the value of the sea birds of the coasts of Peru as producers of fertilizers, forbade anyone under penalty of death to enter or disturb their rookeries during the breeding season. For many years in America legislation for the protection of game-birds was considered a local matter and was applied by States or territories individually. It has become recognized recently that this procedure, through lack of uniformity, did not give proper protection to ducks, geese and other migratory game-birds, which has led finally to assumption by the Federal Government of control over non-sedentary species, and a covenant with Canada known as the Migratory Bird treaty, arranged in 1916, which provides uniform regulations for the two countries concerned. The success of this measure has been so pronounced that it has attracted wide attention and will lead to similar measures between other nations.

As human interest in birds spread, there has arisen considerable feeling against the killing of small birds for food or game. It was realized that insectivorous birds were of benefit to man through their assistance in keeping down the abundance of insects injurious to agriculture, to which was coupled the aesthetic appeal of birds in general, through their beauty of form, colour and note, to the sympathetic and understanding mind. Use of the feathers of birds in decorative dress has been the custom from remote times, a custom that at the close of the last century culminated in a fashion that required the placing of stuffed skins or parts of skins of birds in more or less grotesque attitudes upon women's hats. The resultant demand for feathers led to the destruction of birds by the hundred thousand. Plume-hunting became a lucrative business, and led to search for strange and beautiful feathers throughout the world. Terns, gulls, herons, birds of paradise, hummingbirds, to say nothing of countless familiar song-birds, were slaughtered to supply an unthinking and somewhat senseless desire for decoration, a course that led to great diminution in numbers in many species of birds. The destruction wrought was especially rapid in species that breed in colonies. Herons, terns and grebes, brought together by the paramount instinct for reproduction, were held by their eggs or young to a limited area, and so were easy to kill in large numbers. As this killing entailed the loss of eggs and the starvation of young, these species suffered to such an extent that some almost disappeared as living forms. As understanding of the results of such brutal methods arose, there resulted a revulsion against this fashion which led to the formation of such bird-protective organizations as the Audubon Society that have brought forcibly to public attention the evils of plume-hunting. This has resulted in a partial change in fashion, and in legislation against plume importation and traffic. It is now generally recognized in England and the United States that bird protection is meritorious, a sentiment spreading rapidly to other countries so that international conventions have been held to promote it.

In connection with protective measures it is realized that the Caucasian race in its present civilization has modified natural environments to such an extent that many avian inhabitants of our earth are being crowded out of existence. To procure the continuance of interesting forms, some for their economic worth and some for their aesthetic interest, reservations or sanctuaries have been formed which birds may frequent without molestation. In Europe such preserves were made primarily to protect upland game birds, and are thrown open to hunting at the proper season. In the United States reservations have been established to cover areas where herons, terns, or similar birds nest and consist of low coastal islands, or swamp and marsh lands of little monetary value. Both types of sanctuary are now found in many countries.

The result of such protection, enforced in most instances by paid wardens, has been to increase the numbers of many birds. The egret and snowy heron, at one time reduced from a vast multitude whose breeding colonies were so populous that, from a distance, they appeared like vast white blankets, to a condition where it was unusual to see a single individual, have become again common in extensive areas. Terns have returned to colonies that were deserted for years, and the pelican maintains its numbers in spite of much unthinking persecution.

In the United States there are at the present time 76 bird reservations under jurisdiction of the Department of Agriculture, ranging in size from a few acres to several hundred square miles, while light-house reservations, national parks, and similar tracts under supervision of other governmental departments have also been designated as bird preserves. In addition, various States are now developing the idea of game sanctuaries which are also refuges for birds. Pennsylvania, at the present time, has 88 sanctuaries of this kind, including nearly 73,000 acres. Private sanctuaries also are multiplying and afford much protection; many have been established as local enterprises by cities, towns, or by groups of private individuals.

Economic Studies.—Early information on the economic value of birds was based largely on field observation of living birds and many of the data obtained were erroneous. The method should be checked by the stomach examination, as developed largely by the Bureau of Biological Survey, of the U.S. Department of Agriculture. In this a series of stomachs of any given species of bird is secured, so far as practicable, at intervals throughout the year, under as many varying conditions of life as possible. These contents are examined under a microscope with low magnification, and the different kinds of insects, seeds, bones or other materials sorted. There is thus afforded a picture of the actual food preferences of the species concerned and the status of the bird is decided on this basis as useful or harmful. These data have been of great use in arranging protection for species that assist in the war on insects injurious to crops, or that are proved to be harmless, since such information offers a certain check against observations on living birds in the field. (*See* publications of the Biological Survey [*q.v.*] of the U.S. Department of Agriculture.) With few exceptions, the destruction of birds as a means of protecting crops, has been found to be an unsound policy.

Aviculture.—Aviculture (*see* AVIARY), or the keeping of birds alive, goes back to a remote period, of unknown date, when primitive man brought young birds of various kinds to his rude domicile, partly through curiosity and partly to use as food. Parrots are mentioned by Ctesias, a Greek writer, a century before the time of Aristotle, as birds that spoke the language of man, and that a little later the Romans are known to have kept them in ornate, silver-wired cages of tortoise-shell and ivory.

The domestication of falcons for hunting is recorded in Persia as early as 1700 B.C., and is said to have antedated that period in China. Falconry (*q.v.*) is believed to have spread to Europe as early as three centuries before the Christian era. In America the Pueblo Indians of New Mexico and Arizona held the turkey (*Meleagris gallopavo*) in captivity at least 1,000 years ago, and probably at a much earlier period, not for use as food, but for the feathers, which were plucked from the living bird and burned in prayer offerings to propitiate Deity. The accumulations of turkey bones in a number of pueblo ruins indicate the numbers maintained.

The original canary (*Serinus serinus canarius*) is believed to have come from the Canary islands, but in its original grey, olive-green and yellowish plumage, with sides and flanks streaked with dusky, is so similar to the serin finch (*Serinus serinus serinus*) of southern Europe that it is probable that both these closely-related geographic races have furnished the stock from which have come our modern birds. Canaries were known in a domesticated state at the close of the 14th century, though they seem at that time to have been rare, as Gesner, in 1555, mentions that he had never seen one. Variation in colour among them began early, as partly yellow canaries were known at Nuremberg in 1614, and in 1677 pure yellow canaries as well as white ones were recorded at Augsburg. There are now at least 14 distinct strains and numerous varieties. Modern interest in canaries is shown by the fact that from 1905 to 1914 more than 3,250,000 were imported into the United States, mainly from Germany and England. There are many societies of canary breeders and several journals that deal their needs.

The keeping in captivity of exotic birds of all kinds originally was the field of zoological gardens, but has engaged the attention of many individuals, and in the past 25 years has gained greatly in vogue, particularly in western Europe and in the United States. Aviaries have been brought to a high state of perfection, and the requirements of many delicate species of birds studied with the utmost care to permit success in their breeding and rearing in confinement, the highest goal of achievement of the bird fancier. Among journals dealing with the pursuit is the *Avicultural Magazine*.

TYPES OF LIVING BIRDS

Mammals have specialised for life on land (as the deer and mouse), in water (as the whale), in the air (as the bat), for night life (as the lemur), and in the earth (as the mole). But birds specialise for existence or progression through the air. Though it is common for birds to nest in holes or tunnels in the earth, which, in many cases, are excavated specially for this purpose, no bird has been able to adapt itself to continuous life underground, probably because its covering of feathers is not designed to withstand the constant abrasion that would take place in burrowing. Also, though many birds frequent the water, none are so wholly adapted to life beneath the surface as the whales. The bird thus has failed to utilize completely the ecological environments that have been available for it—a manifestation of its inferior adaptability compared to the mammal.

Birds adapted to a terrestrial existence are found in many widely separated groups, as for example ostriches, bustards, plovers, larks and pipits. Most of these adopt a terrestrial habit to secure food and safety from enemies. They run about on the earth, and though the greater number retain power for flight, often trust to their legs to avoid or escape ordinary pursuit. Most of them show greatest variety in regions of extensive plains, prairies or broad, open downs. The wholly terrestrial forms that have entirely lost the power of flight are comparatively few, and (so far as Continental areas are concerned) are birds of considerable size and strength. Among living forms they include the ostriches of Africa, which extend into Eurasia as far as southern Persia, the cassowaries of New Guinea and adjacent areas, the emus of Australia, the kiwis of New Zealand and the rheas of South America. These birds, though united by certain peculiarities, differ widely from one another, and seem to represent ancient types of bird that were formerly more abundant, as a number of fossil forms are known. It will be noted that large flightless birds exist in modern times in all of the continents except North America, where they have not been represented since the Eocene.

The kiwis (*Apteryx*) of New Zealand, the queerest and most unbirdlike of living birds, are nocturnal and have different habits from the other species mentioned. They have long bills with the nostrils at the extreme tip, and move about by using the bill to test the ground before them as a blind man uses a cane, noting their surroundings partly by touch and partly by smell. On casual examination they seem to have no wings, but on investigation the wing is found concealed beneath the feathers, a tiny structure, a little more than 3 in. long when fully extended, and entirely without flying function, as the bird is heavier than an ordinary fowl. The cassowaries, like the kiwis, inhabit forest areas, but are far less peculiar. The wings are small, with heavy, naked quills nearly concealed beneath the long, hair-like feathers, and there is a curious casque on the head. It is said that the bird uses both casque and wing-quills to fend off entangling vines in travelling through the jungle.

Ostriches and rheas have larger wings and may extend them while running, but are wholly without power of flight. In all these birds the body is heavy and the legs are large and strong. With those fleetest in running there is a tendency to reduction in the number of toes, so that the rhea has three and the ostrich only two. That these birds have come from flying ancestors is apparently indicated by the wing, which, while small and weak, has the bones formed as in flying species. All the species discussed have the external surface of the breast bone smooth without the great keel so characteristic of the flying birds, there being no necessity for such attachment, as in flightless birds the muscles usually concerned in flying have little development.

There is another type of terrestrial bird that has developed more recently than those just discussed, found mainly on oceanic islands. This includes various species of flightless rails, and some other birds that have lived under conditions in which they had no enemies from whom it has been necessary to escape by flying, so that through disuse the power of flight has been lessened until, finally, the birds are not able to rise from the ground, though the wing retains the same form encountered in flying birds and the breast bone still has a keel, though this may be greatly reduced in size. The weka rails of New Zealand are the most striking living examples of this group; they are nearly as large as a fowl, and run with great ease and rapidity. Some other flightless rails are much smaller, for example the Laysan

rail (*Porzanula palmeri*), of Laysan island in the Hawaiian islands, which is not much larger than a newly-hatched chicken. In running fast this bird extends its wings and flaps them rapidly, but is unable to rise from the ground. Many other insular birds show a tendency to degeneration of the wing but can still fly.

Among birds adapted to life in the water the penguins are pre-eminent. These include about 17 species found in southern seas, ranging in size from the great emperor penguin (*Aptenodytes forsteri*), which is 48 in. long and weighs up to 78 lb., to the little blue penguin (*Eudyptula minor*) of New Zealand and the Chatham islands, which is only 16 in. in length. Penguins have thick, heavy bodies, more or less elongated, and are covered uniformly with dense, short feathers, without the bare spaces or apteria that in other birds divide the feather-growths into distinct tracts. The wing is a short, broad paddle, without developed quills, the feathers being close-set and stiff, almost like the scales of a reptile. In the water the penguin rests comparatively low. Beneath the surface it progresses literally by flying, the flattened wings driving the bird through its aquatic medium swiftly and gracefully, while the feet are extended behind and serve as a rudder. Penguins have possessed their present type of body since early Tertiary times; but they came originally from a flying stock.

Other types of birds developed for life in the water include loons or divers and grebes, whose progress beneath the surface is accomplished, usually, by the use of the broad feet alone, the wings being held close to the sides, except when the birds are frightened or under other unusual circumstances. The downy young dive, by use of both wings and feet, indicating that flying under water is a primitive method. The many species of auks and guillemots use the wings beneath the surface as in the air above. The cormorant and the snake-bird progress by use of feet alone. Mergansers, scaups, redheads, pochards and golden-eyes among ducks dive regularly with the feet alone, while in the same group old squaws, scoters and eiders as regularly use both wings and feet beneath the surface. The curious diving petrels (*Pelecanoides*) of the southern hemisphere fly swiftly beneath the water, and may burst out through the surface in full flight.

Birds adapted for life at night are fairly numerous, and are typified especially by members of the nightjar and owl families, though specialized forms occur among a number of other families. Most nocturnal birds have large eyes that usually reflect light with a prominent reddish colour so that the eyes of many nightjars glow like dull coals of fire by the reflected light of an electric torch, and may be seen for a considerable distance. One of the American night-hawks (*Chordeiles acutipennis*) is an exception, as the eye is said to shine with a pale green hue. Most nocturnal birds actually see at night by a specialized eye adapted to collect the faintest rays of light. Only the kiwis (*Apteryx*) among habitually nocturnal species appear wholly blind.

GEOGRAPHIC DISTRIBUTION

The laws governing geographic distribution (*see* DISTRIBUTION OF ANIMALS; ZOOLOGICAL DISTRIBUTION), through which each faunal area has its own peculiar forms, apply to birds as to all other animals, in spite of the easy method of travel possible for the bird. Very few birds are cosmopolitan. As an example may be mentioned the sanderling (*Crocethia alba*) that at some season may be found along water almost anywhere on the Earth, but that nests only in the Arctic regions, passing southward in migration throughout the world, to return in spring to its breeding area. The barn owl (*Tyto*), resident through wide areas in the temperate and tropical regions of the earth so that it reaches all the continents, has reacted to its environment in such a way that 25 geographic forms, some sufficiently distinct to be called species, are now recognized. In contrast to this, many species are confined within very narrow limits, as the very distinct Laysan teal (*Anas laysanensis*), found only about the shores of one small lagoon in Laysan islands in the Hawaiian Bird Reservation, where it has a range of only about 1 sq. mile.

Every continent has its peculiar forms of life, so that the earth's surface has been divided into great regions, each characterized by certain groups or by the lack of some found elsewhere. According to a usually accepted classification, these are given the following names: Nearctic region, for North America south to include the Mexican tableland; Neotropical region, for southern Mexico, Central and South America, and the West Indies; Palaearctic region for Europe, Algeria and Morocco, and Asia north of the Himalayas and the Gobi desert; Ethiopian region, for the remainder of Africa; Oriental region, for India, Indo-China, China, the Philippine islands, and the East Indian islands to, and including, Bali; Australian region, for Australia, and the Pacific islands south of the Tropic of Cancer; and New Zealand region, for New Zealand. The life of the northern hemisphere is so evidently allied that what are here designated Nearctic and Palaearctic regions are frequently united under the term Holarctic, a vast area that extends throughout the entire north temperate and Arctic area.

These great regions, which cover continents, are divided into life-zones, where temperature and certain other general conditions control the distribution of species within narrower limits. The life-zones are more sharply delimited in temperate regions than in tropical and sub-tropical areas, and to some extent are more easily distinguished in the northern hemisphere than in the southern. They change with difference in altitude on the slopes of mountains, as they do with difference in latitude in travelling north or south, and are most easily perceived on the slopes of steep mountains, where the successive zonal bands may be compared without great difficulty. Life-zones to the present time have been most intensively studied in North America. By the student the life-zone is further divided into faunas, where conditions imposed by rainfall, geological formation and similar factors produce sections characterized by aggregations of species or sub-species.

Birds, in general, have attained a vast distribution over the surface of the globe because of their ability in flight and their specialization for life on both land and water. As a result of this versatility and adaptability some form of bird is found at some season everywhere over the world, except perhaps in the centre of the great unexplored Antarctic continent. Broad areas of the sea, away from the great ocean currents that flow like rivers through this aquatic medium, may appear birdless for days and weeks, but are crossed at certain seasons by some of the petrels in their wanderings. The seas and lands within the Arctic Circle are visited by many birds, some of which, as the raven and snow bunting, nest far north in Greenland, and some, as ducks and gulls, in summer traverse the solitudes of the north polar sea.

As individuals, birds may be tremendously abundant in temperate regions, but it is within the Tropics that the greatest variety of forms occur within small limits. The largest aggregations are found in regions of diversified topography, where the life-zones change within a comparatively few miles from tropical to alpine. The greatest number of forms at present recorded from a limited area is that reported by Dr. Frank M. Chapman from Ecuador, where within approximately 75,000 sq.m., an area less in extent than Great Britain, there are at present known 1,508 forms of birds, and it is said that this list is far from complete.

THE AVIAN LIFE-CYCLE

The circle of annual activities of any bird, in general, includes a period for nesting, the rearing of the young to maturity, and a subsequent resting time when a moult occurs to renew the covering of feathers. With many birds there is included in this programme a migration or journey to some other region, and a subsequent return to the native area at the coming of a new breeding period. The cycle of activities thus corresponds to the seasonal round of the year, as the necessities of the bird are influenced by climatic conditions, which change from month to month, except in limited areas in the Tropics, and even there the life of birds is influenced to a greater extent than might be imagined through the incidence of wet or dry seasons.

REPRODUCTION

With the approach of the breeding season there is instituted at once a conflict, active or passive, as the case may be, between males of the same kind for a breeding area in which, later, the

nest will be located. (*See* also BIRD, *Reproductive Habits.*) Each male selects some section suited to nesting needs and remains within or near it until a mate appears, if he is not already mated, and protects this tract against encroachment by others that may be considered rivals. In the case of gregarious species, like the sooty tern (*Sterna fuscata*) that nests in great colonies on islands in the sea, the nesting territory for each pair may be only a yard square, or even less, being a space in which the egg may be located, so that the incubating bird and her mate, on guard beside her, cannot quite reach the adjacent pair with whom, and with any others that intrude, they spar and fight on the slightest provocation. The male red-winged blackbird (*Agelaius phoeniceus*) of North America, also gregarious, selects an area of marsh or swamp, with his neighbours situated at a distance of a few feet or a few yards, and remains on guard, forbidding entrance of another male in that limited space. Solitary species hold larger areas, so that a red-eyed vireo (*Vireo virescens*) may hold a clump of three or four trees, or a blackbird (*Turdus merula*) may pre-empt a small section, including thickets, trees and open ground. Possession of such a breeding ground at the beginning of the nesting season is a paramount passion with each male, and to retain possession he will battle fiercely, even until death, with any others of his kind that may attempt definitely to locate within what have been selected as his limits. Under this urge, sanguinary combats are not unusual among species whose individuals live for the rest of the year wholly at peace with their kind.

Mating.—At the mating season the male bird resorts to a variety of artifices to attract attention on the part of the female, and to arouse her interest to the end that a nest be established. (*See* also COURTSHIP OF ANIMALS; SELECTION, SEXUAL; BIRD, *Reproductive Habits.*) Among perching birds this is first indicated by song (*q.v.*), by which the male not only gives expression to the pleasant sensations of merely living, but also, when established on his breeding ground, gives notice to rivals of his presence as a guard over his territory and notice to females that he is in search of a mate. The song may range from the polished effort of an expert, like many thrushes, the nightingale, or the mocking-bird, to sounds that, to some human ears, may be merely disagreeable noise, as the chatter of the house sparrow, or the strange music of the plant-cutter of South America (*Phytotoma rutila*), whose song is a curious squeaking that resembles exactly the rubbing produced by tree-limbs touching in the wind. The rhea booms, the hawk screams and the owl hoots, each producing music in the estimation of others of its kind.

Actual mating may be accompanied by a great variety of strange and unusual actions which the male alone, both sexes, or more rarely the female alone, may undertake (*see* COURTSHIP OF ANIMALS). The male ruffed grouse (*Bonasa umbellus*), of North America, selects a stand on some sheltered log or stump, to which he resorts each day to "drum," a resonant love-call for which he draws himself fully erect and begins a steady beat of his short, stiffly-feathered wings. The action of these against the air between wing and body is so strong and abrupt that a dull thumping sound is produced, at first slowly, and then with increasing rapidity, until the sound comes as a steady, pulsating roar. The display of the peacock, in which the long, ornamented upper tail-coverts (mistaken by many for the tail, which is short, stiff and dull in colour, entirely concealed beneath the longer feathers) are erected and fully spread, to be shaken finally with a dry rattle as the male faces the apparently indifferent female, is another well-known example of activity on the part of the male alone.

The great crested grebe has been found by Julian Huxley to have a complicated courtship-display in which both sexes participate. A pair approach, facing one another with head wagging from side to side, then raise one wing and preen the feathers beneath, an action varied in many ways to culminate finally in a weird "dance" in which the pair rise erect, treading water, and remain bolt upright with breasts nearly touching for a brief space. In some species of albatross mutual courtship-displays have progressed to a point where they have far exceeded mere mating antics, and have become social customs that continue through a period of months, beginning with the arrival of the birds on the breeding grounds, and continuing until the young are grown. In the Laysan albatross (*Diomedea immutabilis*) of the Leeward islands of Hawaii, the display begins with two birds approaching with quick bows, shaking their heads rapidly from side to side, raising the wing to preen the feathers beneath, and finally throwing the head and neck fully erect, with the bill pointing perpendicularly to the sky, while both birds emit a hollow groan. This action is of daily occurrence when the birds are on land, from October to May, and is participated in by mates or neighbours. It has thus developed into an interesting racial custom.

As an example of the third type of display there may be mentioned the courtship of the phalaropes, in which the female has brighter plumage than the male, and takes much of the initiative. In Wilson's phalarope (*Phalaropus tricolor*) both birds bow and nod, but in the culmination of this action the male flees with one, or sometimes two, females in close pursuit.

The site for the nest that is to contain the eggs is sometimes chosen by the female, sometimes indicated by the male, though the female may exhibit certain supposed prerogatives of her sex in such matters by modifying considerably the original plans proposed by her mate. The male house sparrow (*Passer domesticus*) selects some hollow suitable for a nest, and rests beside the entrance, calling and chattering until a female comes to inspect the premises. If these appear suitable, nest-construction may proceed. With birds that nest in trees or bushes, or on the ground, where there is greater latitude of site, various locations may be examined before definite selection is made, both male and female apparently exhibiting directive impulse in choice. When suitable sites are numerous it is probable that final selection comes frequently through the chance that directs the placing of the first nesting-material when the courtship shall have proceeded to the point of actual nest construction. In some instances, where numerous sites all exactly alike are available, as where barn swallows (*Hirundo*) make their nests of mud on the rafters of a building, there is often confusion, so that birds may carry pellets of mud to a dozen rafters until, finally, one of the several foundations assumes more importance in their eyes than the others and a nest is brought to completion. In such species as the ruby-throated hummingbird (*Archilochus colubris*) and prairie-hen (*Tympanuchus americanus*), where mating takes place at a point away from the nest and the male does not visit the nest-site, selection of a suitable spot rests entirely with the female.

With most birds mating is temporary, and may be for the period of a single brood, or, where two or more families are reared, for one nesting season. Some interesting information has been secured recently on this subject through marking birds with numbered bands which serve to distinguish such individuals from others of their kind. Experiments made by S. P. Baldwin on the house wren (*Troglodytes aëdon*) in Ohio have been particularly instructive. In these studies one male house wren was found mated with three different birds in three successive years, and this same individual mated with two different mates for first and second broods during one season. Another wren mated with one companion for one brood, and in the following year took a new mate, with which it was found in the year succeeding. This shifting in the mating relation is not due to the death of one of the birds.

Though the majority of birds associate in pairs only during the nesting season there are some exceptions to this. The white-breasted nuthatch (*Sitta carolinensis*) of North America is found so invariably in pairs that when one appears alone the assumption is that something has killed its mate. Cardinal grosbeaks (*Cardinalis cardinalis*) also are usually found in pairs throughout the year. It is commonly stated that some birds, as eagles, mate for life, but this remains to be definitely proven.

Polygamy is practised by numbers of birds, particularly among the pheasant-like species. The males of the capercaillie (*Tetrao urogallus*), black grouse (*Lyrurus tetrix*) and wild turkey (*Meleagris gallopavo*) regularly take several mates, though the bobwhite (*Colinus virginianus*), a related species, is monogamous. Polyandry has been alleged for a number of species but needs verification as to regular occurrence since one of the forms concerned, the cowbird (*Molothrus ater*), where the female has been said to

mate with several males, has recently been found to pair as regularly as is normal in small birds.

Nests.—The nests of birds (*see* NESTS) exhibit a wide range in form and many have wonderful features.

The skimmer (*Rynchops nigra*) and the least tern (*Sterna antillarum*) excavate a slight hollow in sand or gravel to contain the eggs. The American avocet (*Recurvirostra americana*) may line a slight depression near the water's edge with a few bits of weed stem, and there deposit its four eggs. Subsequently, should the waters increase in freshet the avocet hustles about gathering grass, bits of wood, feathers, small bones and weeds to raise its treasures above the flood, so that where necessity arose, these birds have been known to erect piles of rubbish a foot in height. If the waters subsequently subside these elevated nests become conspicuous structures, but are not removed.

Some ground-nesting birds regularly conceal their eggs in holes. The Manx shearwater (*Puffinus puffinus*) digs burrows in loose soil, and makes its nest at the end of the tunnel. There may be variation in method in one species, however, as the wedge-tailed shearwater (*Puffinus pacificus*) of the Pacific islands ordinarily excavates a hole for nesting, but on rocky islands, where there is little soil, may deposit its egg on the ground, under bushes, or even in the open. The little auk or dovekie (*Alle alle*) searches out a crevice or shelter beneath boulders, often on talus slopes where rock fragments are piled in great confusion. The belted kingfisher (*Streptoceryle alcyon*) digs a tunnel on the face of a steep bank and lays its eggs at the end, gradually building up a mass of fish bones from regurgitated pellets for a nest.

Concealment is sought also by some tree-nesting birds. The scops owl (*Otus scops*) of Europe, and the screech owl (*Otus asio*) of North America, seek hollows in trees, where the eggs are placed without nest lining of any kind. Woodpeckers excavate special chambers in the trunks of trees, placing their eggs on an accumulation of chips at the bottom. Though dead trunks are usually chosen, the yellow-bellied woodpecker (*Sphyrapicus varius*) frequently drills its home in a living hardwood tree, and the Porto Rican woodpecker (*Melanerpes portoricensis*) may nest in a living palm trunk.

Nests of many herons, *e.g.*, the night-heron (*Nycticorax nycticorax*), are placed in trees, and are flat structures of twigs and sticks that form a mere platform, so loosely built that the eggs may often be seen from below. Among larger nests there is every variation from this type to that of the osprey (*Pandion haliaëtus*) to which material may be added year after year until the mass is 8 or 10 ft. in diameter and makes a cartload in bulk.

Among smaller birds, the tree nest is usually a simple cup that has a foundation of rough material on which the nest proper of finer material rests; the lining is made of soft substances, as rootlets or plant downs. The blackbird (*Turdus merula*) and the American robin (*Turdus migratorius*) line their nests with cups of mud, within which are placed soft grasses. Many birds place nests of grasses and rootlets under herbage or in thickets on the ground. For protection, many tree-nesting birds build homes with arched tops that wholly conceal the eggs. There is a great group of birds in South America, the so-called tracheophones, many of whose species have this habit. Conspicuous among them in the Argentine is the leñatero, or firewood-gatherer (*Anumbius anumbi*), that gathers a quantity of thorny twigs to form a spherical mass, within which is placed the nest proper, reached by a runway, the whole so firmly constructed that the eggs inside may be reached only with difficulty. These nests are durable and last for several years, until the materials composing them decay. The oven-birds (*Furnarius*) in this group construct rounded masses of mud, with an entrance at one side, the walls being an inch or more in thickness, and so built that they will withstand the beating of heavy rains without damage.

Many of the troupial family (*Icteridae*) make purse-like nests that are suspended in the tops of trees. The nest of the oropendola (*Gymnostinops montezuma*) of Central America may be 5 ft. in length, suspended by the upper end, below which is located the entrance which leads through a long, constricted neck to the expanded lower part, where the nest proper is placed. The oropendola nests in colonies, but nests of the orioles, as the Baltimore oriole (*Icterus galbula*) which also constructs a purse-shaped nest from 8 to 10 in. in length, are found alone. The nests of the social weaver-finches of southern Africa are among the most remarkable structures known in the bird world. These birds are gregarious and, in company, accumulate masses of grass in trees to form a roof, under which each pair of birds has its separate cubicle, lined warmly with feathers. From 20 to 300 pairs may inhabit a single structure, which grows in size as it is inhabited year after year, until it may contain several wagon-loads of material.

Among other curious nests there may be mentioned those of the edible-nest swiftlets of the Indian, Australian, and South Pacific areas, that are cupped platforms, composed of a coagulated mucus secreted by the mouth-glands of the birds, placed on the walls of caves. These are gathered commercially and form the basis for a soup highly prized by the Chinese. The American chimney swift (*Chaetura pelagica*) makes a nest of twigs, cemented together by mucus from the mouth, to make a tiny basket. In early times these nests were placed on the inside of hollow tree-trunks, but with the advent of the Caucasian race and the building of houses, hollow trees have been forsaken for chimneys.

Nest-building with most birds seems to be usually the duty of the female. The male may assist by bringing material and may lay it on the nest, but it is mainly arranged by the female. In many species the entire work devolves upon the female.

EGGS

In birds, as in all other vertebrates, the gonads are paired organs on the dorsal wall of the body-cavity. In most birds the right ovary disappears early in life, leaving only the left to grow and mature. This rule, though usual, is not invariable, since in many hawks, particularly the harriers (*Circus*), and the small bird-eating forms (*Accipiter*) usually, but not invariably, we find both ovaries present and functional. The ovum, or yolk, in birds is a relatively enormous cell which passes from the ovary into the mouth of a convoluted tube, the oviduct. As the yolk moves down the oviduct it receives first a deposit of gelatinous albumen, the "white," next a membranous sheath, and then is enclosed in a hard, calcareous shell, and is deposited as an egg (*q.v.*).

Eggs are ordinarily oval in shape, though this is not invariable, as the eggs of swifts are usually elliptical, and those of owls are nearly round. Eggs of birds that breed on rock ledges without constructing nests are much pointed, which allows them to roll about in a relatively small circle and so lessens the danger of a fall over the edge. Eggs of many shore-birds, which are relatively large in relation to the size of the birds, are also strongly pointed, which permits them to pack closely with the pointed ends toward the centre, thus bringing the whole into a compass that permits the parent to cover them.

Eggs of owls, kingfishers and woodpeckers, which are laid usually in holes or cavities (though some owls occupy open nests) are white, and whitish eggs are found in grebes, albatrosses and petrels. Most eggs have, however, a coloured shell, or spots and blotches of colour spread over a lighter background. Where there is a pattern of markings present there is usually a wreath of heavy colour about the large end of the eggs. Herons' eggs are pale blue or bluish-green, and plain green or blue eggs are found in various perching birds. The tinamous of the New World, a primitive group, have very striking eggs, with smooth and highly polished shells, varying from green or pink to deep brown, their lustre suggesting porcelain.

The egg-shells are penetrated by pores which usually cannot be seen, except under a lens, but that in some eggs, as those of the ostrich, are easily visible to the unaided eye. Evaporation takes place through these openings, so that the egg loses steadily in weight during the incubation period.

The number of eggs produced annually varies widely in different groups, being adjusted to the requirements of each species, to enable maintenance of its normal numbers. The migratory species that covers a considerable range encounters more dangers than one that is sedentary and, therefore, must produce more of its kind

This statement, however, has many exceptions. Migratory wild ducks lay from five to 12 eggs, while the bobwhite, which is sedentary, may have as many as 21, though usually not more than a dozen. Among small birds, on the average more eggs are deposited annually by the migratory species of the temperate zones than by the sedentary forms of the Tropics. On the other hand, the non-migratory titmice and wrens lay many more eggs than the migratory warblers (*Sylviidae*). Most perching birds of temperate regions have from three to five eggs, rarely six, in a setting, but may nest two or three times each season. Most sandpipers deposit four eggs, though in some the number is reduced to three. Many gulls, hummingbirds, loons, and some species of pigeons have two eggs regularly. Other kinds of pigeons, with auks, petrels and albatrosses, lay but one egg. Boobies lay two eggs, but never seem to rear more than one young.

Adjustment of birds to their environment as regards the number of eggs deposited, to ensure continuance of each species, was made before the rise of man, who has been an active factor in the life of the earth for a relatively brief period compared to other animals. In some cases, where man has kept in check enemies of birds, these species have increased. In other instances, where man has been an active enemy, he has brought about reduction in numbers or actual extermination, because the birds concerned had become adjusted to a certain annual drain on their numbers from natural enemies and were unable to change to counteract added destruction by man. The great auk laid only one egg, and as it nested in colonies was quickly exterminated. The passenger pigeon of North America, which existed in colonial days in innumerable hosts, also produced but one young each season, which did not enable it to withstand the drain of hunting, so that it has become extinct. Usually, only those birds which rear a number of young each year can be maintained as game, and these must have protective regulation to enable them to hold their own.

Incubation.—After the egg is deposited it requires a certain definite temperature to develop to the point of hatching. This is normally accomplished by incubation on the part of one of the parents, usually the female, a period during which the bird remains closely on the nest, except for brief intervals required for a hasty search for food. The eggs are warmed by being brought into close contact with the breast and abdomen of the brooding bird, there being usually a sloughing of down and other feathers over a part of this area, to permit close contact between the skin and the eggs, and at the same time an increase in the blood supply to the skin, to bring a more even heat to bear. The actual degree of heat required to develop the embryo in the egg is known for only a few forms of birds. In the case of the domestic fowl the average incubation temperature is about 103° F. In charts published by Baldwin and Kendeigh, showing by use of a thermo-couple fluctuating temperature in the nest of a house-wren (*Troglodytes aëdon*), the incubating temperature is shown to vary from 39° to 41° C, or 102° to 106° F, the average being about 104° F.

Though, ordinarily, care of the eggs involves their being heated from the body of the incubating bird, in species that nest in the open, in warm climates, where the sun is torrid, brooding may be required to shade the eggs from too powerful sun-rays. The body of the bird here acts as a shelter and an equalizer of heat.

Though incubation falls ordinarily to the lot of the female, there are many species in which both sexes alternate in this duty. This is true in the ostrich, various auklets, herons, grebes, petrels, etc. The male rose-breasted grosbeak (*Zamelodia ludoviciana*) broods devotedly, though in this case his action would seem disadvantageous, as his plumage is strikingly variegated with black and white, and the rose-red spot on his breast often shows above the rim of the nest, while his mate is inconspicuous in a brown, streaked dress. In the phalaropes, the bustard-quails (*Turnix*), the emu and the rhea the male alone incubates, the female taking no part in this duty. It is believed that this also obtains in other shore-birds.

The megapodes or mound-builders (*Megapodidae*), found from the Nicobars and Philippine islands to Australia, carry on no incubation whatever. For example, the scrub-fowl (*Megapodius duperryi*), of Northern Territory and Queensland in Australia, scrapes together a mound of sand and earth, to which a small amount of vegetation is added, during the wet season. The mound may be used for a number of consecutive seasons; and mounds 14 ft. in height and 35 ft. in diameter have been discovered. The eggs of one pair of birds are buried in the top of such a mound, and, through heat generated by decomposition of the included vegetation, are maintained at an even temperature of 95° F. The Mallee fowl (*Leipoa ocellata*) of Australia constructs a much smaller nest by scraping out a hole in the ground 2 ft. wide and 1 ft. deep, with the excavated earth piled up around the opening, so that the whole resembles the crater of a volcano in miniature. The cavity is filled with leaves, twigs and vegetable debris, scraped up by use of wings and feet for yards around. This is left uncovered for four or five months until it is soaked by rains, when decomposition changes it into a hot-bed. A central chamber is excavated in the top at the proper time, and the debris taken out, mixed with sand and returned. In a few days another excavation is made, and an egg placed within it, so that it stands with the small end down. On warm days when the sun shines the birds make a cavity in the top of the mound to catch the rays of warmth. In damp, rainy weather the conical peak of the mound is covered with sticks and rubbish that assist in turning water that might penetrate to the eggs. The temperature about the eggs is maintained from 90° to 97° F until they are hatched. During dry seasons, when there is no moisture to promote the necessary decomposition of vegetable material to produce heat, the birds are said not to breed. On the other hand recent researches show that in some species at least there is no generation of heat by decomposition within the nests, and the comparatively low temperature necessary for development is maintained by oxidations within the egg itself. The nesting activities of these curious birds are strongly reminiscent of the breeding-habits of the reptilian group, from which the class of birds as a whole is descended.

The period of incubation varies greatly in different groups, in general, being longer in large birds. The period may be shortened slightly by slight increase in incubation temperature or prolonged somewhat by irregular attention on the part of the parent. The incubation period of the emu is said to range from 56 to 63 days, that of the ostrich is reported as 42 days, the domestic mallard requires four weeks, and the domestic fowl three weeks. Most small perching birds require from 12 to 14 days, with magpies and jays running from 16 to 18 days. The shortest incubation period known is that of the American cowbird (*Molothrus ater*), whose eggs hatch after 10½ days' incubation.

In the gallinaceous birds, *e.g.*, the domestic fowl, and many other species, the nest is used merely to house and incubate the eggs and the young, which are born covered with down, and follow the mother in search of food as soon as their plumage is dry. In some mound birds the young are hatched with developed wing-quills, so that they are able to fly within half-an-hour of hatching. In most tree-nesting species the young undergo a shorter period of development in the egg, and consequently must remain in the nest under close parental care for a period after hatching. The nest is thus a home during early juvenile development. Food is sought by the parents and brought to the young, and what guard may be possible is maintained against destructive enemies. In hole-nesting species like the hoopoes and woodpeckers there is indifference to nest sanitation, as immunity against dangerous bacteria that multiply actively when heat and moisture are available has apparently been developed. Such nests become extremely foul as the period of occupancy progresses. Hawks, herons and numerous others, even when very young, instinctively void their excrement beyond the nest, so that such unsanitary condition is obviated. In most of the smaller perching birds the excrement of the young is of such a consistency that it maintains a globular form and is removed from the nest by the parent. In a few finches, as the American goldfinch and crossbills, the excreta are voided by the young about the margin of the nest and are not removed.

In most birds the young remain with the parents for a time after leaving the nest, and gradually become self-reliant, so that they procure their own food. At this stage family parties usually

separate as the young drift away from their parents, or the adults tire of importunate begging for food on the part of progeny able to procure their own sustenance, and so either drive the young away or themselves leave. When the young learn early to search for food they may remain in bands with their parents.

Parasitism.—breeding parasitism is found in several groups of birds in which no nest is built, the eggs being deposited with those of other birds and left entirely to the foster-parent for care. The European cuckoo (*Cuculus canorus*) has long been known to have such habits. The female places a single egg in the nest of some bird, usually a species of small size, ordinarily choosing a nest in which the eggs are fresh, and removing one of the rightful set when leaving her own (*see* CUCKOO.) Although about 100 species of birds have been recorded as parasitized, ordinarily each female cuckoo places her eggs in the nests of one particular species of bird. Each female cuckoo is supposed to lay from five to 16 eggs during the season. There is argument as to whether the cuckoo deposits her egg directly in the nest of the fosterer or whether she extrudes the egg elsewhere and carries it in her throat to the nest chosen. The former is certainly the more usual. An egg of the foster-parent is almost invariably removed and eaten by the cuckoo after she has deposited her own. The process of placing the egg requires only a few seconds, and then the bird leaves at once, which renders definite observation difficult. The young cuckoo's back is hypersensitive to touch, has a spasmodic reaction when it comes in contact with objects other than the nest; aided by a curious depression on the back, the parasite casts out the rightful young, or the eggs until finally it occupies the nest alone.

Similar parasitic habits are known for a number of other cuckoos in other parts of the world. Stuart Baker, in discussing parasitism in Indian cuckoos, shows that a number are parasitic on one species or group of species of birds, and that the cuckoo's egg is specialized to resemble the foster-parent's rather closely. In some cases one cuckoo may have widely different eggs in different parts of its range, as the hawk-cuckoo (*Hierococcyx sparveroides*), which, when it parasitizes the streaked spider-hunter (*Arachnothera magna*), lays a dark olive-brown egg like that of the bird parasitized, but that elsewhere foists on the laughing thrushes or allied species a bright blue egg like that of its dupes.

Some of the American cowbirds are also parasitic. The common North American cowbird (*Molothrus ater*) has developed no particular resemblance in egg colour to the egg of the fosterer, except that many of its dupes lay spotted eggs like its own. In South America the bay-winged cowbird (*Molothrus badius*) cares for its own eggs in a normal manner, but is parasitized by a related species, the screaming cowbird (*Molothrus rufo-axillaris*), which uses this species alone as foster parent. Parasitism is also known in the rice-grackles (*Cassidix orizivora*) which lay in the nests of related oriole-like birds. Certain species of weaver-birds (*Ploceidae*) and the honey-guides (*Indicatoridae*) of Africa also parasitize other birds. The origin of such habits is obscure.

POST-BREEDING LIFE

The period of reproduction is the most active part of the annual life-cycle of the bird, from a biological standpoint, as it brings in play-instincts and activities different and more complex than those apparent during the remainder of the year. Reproductive activity reaches its climax with the maturity of the young. With these on the wing the individual pair have done their utmost in the perpetuation of their kind, and there ensue a number of months of more restful life, with search for food and escape from enemies as the principal activities. For many species there is immediately a period of moult to renew the feathers, a period during which birds are quiet and sluggish, often seeking haunts where they will be disturbed as little as possible. With the drain on vitality brought by feather-production at an end, there comes a time of greater activity, when old and young seem to attain greater vitality.

Moult.—The close of the breeding season finds adult birds with worn feathers, so that most species immediately undergo a moult, during which the old feathers are dropped and new ones are grown. The process is one that, in totality, requires more than a month to complete and progresses in regular routine, varying in sequence over the body in the different orders. In most species the feathers of the wing are shed and renewed one or two at a time, so that the bird still retains the power of flight. Ducks, geese, flamingos, cranes, rails and grebes drop all the wing- and tail-feathers in a very short time, so that they become flightless for several weeks until new feathers are grown. Penguins shed their feathers in patches, almost as a lizard drops its old skin. The epidermis of the tarsus and feet is sloughed during the moult, and any ornamental coverings of the beak are dropped at the same time.

Young birds have a first plumage, grown during their period of development, that is replaced by a post-juvenile dress of feathers that comes when they are fully grown and able to care for themselves. In most, the flight-feathers remain until the following year, but in some, as the house sparrow (*Passer domesticus*), the wing- and tail-quills are also completely renewed at this first moult.

In most adult birds the moult comes immediately after the close of the breeding season, and in temperate regions occurs in late summer. The birds are thus again in full dress when the time for migration arrives, or, if resident, by the approach of cold weather. Swallows, many shorebirds, and hawks moult during the winter, the two former groups undergoing this process in the winter home after migration.

Most birds have one complete moult annually, which takes place as indicated, at the close of the breeding season. In many, particularly among the perching birds there is another moult, partial or complete, through which the bird acquires nuptial plumes. In the bobolink (*Dolichonyx orizivorus*) and the whinchat (*Saxicola rubetra*), for example, the body plumage is completely changed in late winter and early spring. Many of the sparrow family, as the cirl bunting (*Emberiza cirlus*) and the Harris's sparrow (*Zonotrichia querula*), have a partial moult of the feathers about the head that produces bright plumes for the breeding dress.

Change in colour is not necessarily accompanied by moult, as often the tip of a feather may be one colour and the middle portion another. In the throat of the male house sparrow, for example, in autumn and early winter the black throat is obscured by greyish feather tips. As spring arrives the grey tips wear away, so that the black is fully revealed. The most striking change of this type is found in the snow bunting (*Plectrophenax nivalis*), which is white or light brown above in autumn and winter, but through sloughing of the feather tips becomes entirely black on the back in spring.

MIGRATION

Aristotle (384–322 B.C.), the first to discourse connectedly on migration (*q.v.*), tells in his writings that the crane flies from the steppes of Scythia to the marshlands at the source of the Nile, south of Egypt. He noted migration also in the swan, land-rail, lesser goose, quail, rock-dove and turtle-dove, though he reports that of the last three a few may linger through the winter in protected localities. The cuckoo disappeared with the rising of the dog-star in July. Pliny, in his *Natural History*, repeats much that had been said by Aristotle, adding that the European blackbird, starlings and thrushes pass to neighbouring countries, while storks and cranes travel to a great distance. There are scattered references to migration in the writings of the middle ages, Olaus Magnus, in 1555, speaking of the migrations of swallows, and Francis Willughby, in 1768, mentioning various migratory birds. In the succeeding century Gilbert White, Thomas Pennant and George Edwards kept regular records of the arrival and departure of birds. Interest in the subject was considerable by the opening of the 19th century, and from that time forward the number of observers and the mass of published information on migration has increased yearly.

Superstitious Beliefs.—Though the migrations of larger birds were understood, as these travelled openly across the spring and autumn skies, the movement of smaller species, that appeared or disappeared under cover of night, so that they were present one day and gone the next, or vice versa, were present suddenly after an absence of several months, was the basis of considerable superstitious belief. It was thought that the smaller species were too weak to travel far, so that, in 1740, J. G. Gmelin was told by

the Tatars of Krasnojarsk that each crane carried a corn-crake on its back in its journeys. In southern Europe the peasantry believe to-day that small birds congregate on the shores of the Mediterranean, and as opportunity offers flutter on the backs of storks and cranes who carry them across to Africa.

Somewhat more unusual is a belief promulgated in an anonymous tract published in London in 1703 "By a person of Learning and Piety," entitled in part "An Essay Towards the Probable Solution of this Question. Whence come the Stork and the Turtle, the Crane, and the Swallow, when they Know and Observe the Appointed Time of their Coming." The author announces a belief that migratory birds travel to the moon, where they pass the winter, the journey in either direction requiring 60 days to compass, during which the author (who, according to Hugh Gladstone, was Charles Moreton, a minister who in late life removed to New England), informs us that they required no food, as they travelled in a rarefied ether.

Another superstition centring around migration has been the supposed hibernation on the part of some birds, a belief that dates back to early times and has been prevalent both in Europe and America. Aristotle attributed hibernation to the swallow and various other birds, saying that some individuals became torpid, and so passed the winter in the shelter of caves or hollow trees in a state of suspended animation. In later years hibernation was used mainly to explain the disappearance of swifts, swallows and the sora rail. Many and detailed have been the arguments over this matter, and over 200 papers have been written dealing with supposed cases of hibernation. It was related that the sora rail abounded in its favourite marshes, until, overnight, the birds turned into frogs, or sank in the mud, to remain until the following spring. Naturalists with great detail described how swallows gathered on reeds growing in water until their combined weights bent down these slender supports and the birds were submerged in the water. Those to whom this theory did not appeal stated that swallows and swifts hibernated in hollow trees and clefts in rocks, and the finding of birds in such situations in winter was described in great detail in a number of instances, all, however, under some misunderstanding of the circumstances. In short, though hibernation, or its correlate aestivation, is common among mammals, reptiles, amphibians, and even in fishes, it has never been proved among birds. The frequent coupling of this superstition with swallows may be explained, perhaps, by the fact that these birds in autumn regularly roost at night in marshes, and that during storms many perish to fall into the water and sink into the mud, never, however, to revive.

Among other superstitious beliefs mention may be made also of a transmutation theory prevalent among early writers, who supposed that at the approach of winter a bird might be transformed into another species, to remain thus until spring, when it resumed its proper form. Apparently this was first suggested by Aristotle, who held that the redbreast or robin (of Europe) changed to the redstart. The confusion resulted, apparently, from similarity of form and difference of plumage in two related species, where one disappeared in southward migration about the time that another arrived from northern regions, thus lending colour to a transmutation argument.

Theories of Origin.—An explanation of migrational movement has been that of seasonal change in food supply. According to this belief, with the approach of winter in areas remote from the Equator, there is failure of the food supply that causes birds to travel, and as the food supplies remain more constant toward the Tropics, birds move in that direction. When, with the approach of spring, the instinct for reproduction becomes paramount, as the food supplies of the broad equatorial area are not sufficient to support the great host of young birds that will appear, the adults move out again to their summer homes in temperate or boreal regions, where they rear their families. It may be argued against this that the tropical belt supports the migratory hosts when they have become grown, so that it would seem that these same individuals might obtain sustenance there while in younger stages.

An allied theory contends that migration is controlled by cold, from which birds retreat in autumn. Under this hypothesis some have held that birds originated in the north, were driven south by the advance of ice in the Pleistocene, and have returned to the north with the coming of milder climate. Each year now they retreat before the breath of approaching winter, while each spring a love of birthplace calls them to their natal homes. It must be noted that many birds retreat south early in the season, long before there is climatic necessity for their movement. This, with similar facts, has given rise to the theory that all species of birds have had their origin in the south, and through a natural struggle among individuals have spread to the north, especially for the period when each pair must be bound to a restricted territory for its breeding ground.

A somewhat different theory is that of phototropism, which holds that birds move toward the region of greatest light, this bringing a natural ebb and flow of bird life with the changing seasons as the sun moves north and south across the Equator. It is true that the course of migration, in general, follows the advance and retreat of the sun, but it would seem that it is the changing season and not the change in intensity in light itself that affects our bird-life. Through phototropism we may not, for example, explain the migrations of nightjars, which are nocturnal, and which, therefore, find in darkness the period of their activity. Such birds should find their optimum conditions of life in the equatorial regions, where the hours of the day are divided between daylight and darkness. The nightjar and whippoorwill, to give two well known examples, travel north to breed, and in June in their northern ranges have their hours of activity greatly curtailed through the lengthened period of daylight. A recent theory, supported by some experimental evidence, asserts that the onset of migration is physiologically controlled by the relative length of day and night, as is known to be the case with the flowering of plants.

The main difficulty with these and a number of other theories that have been promulgated in connection with migration is that they attempt to explain this great and impelling semi-annual movement by some single factor. When we consider that the known history of the bird in its evolutionary development, from present knowledge goes back through an enormous stretch of time, so vast that it may be noted in figures but is beyond human comprehension, to the fossil species known as *Archaeopteryx* and *Archaeornis* of the Jurassic period, it must be recognized that our present day species have had their instincts and habits moulded by many factors, so that it seems reasonable to consider that such a widespread phenomenon as migration may be due to a complex association of a number of powerful causes, some of which may have affected one species and some another, but no one of which may serve to explain the entire phenomenon as it exists at present.

We may believe, therefore, that the underlying basis of migration is founded on a combination of a number of causes, and we may look upon the present migratory instinct as an outgrowth of all the complex circumstances that have affected birds during their entire evolution, though it seems evident that the actual routes followed by migratory birds, at least in the northern hemisphere, have been shaped during the climatic changes of the Pleistocene.

During breeding-period the bird is restricted closely to the region in which the nest is located, and though some young are free to move about when recently hatched, the parents are, as a rule, confined to one neighbourhood until their offspring may be old enough to require no further care. This close confinement is seen easily in the smaller perching birds that are held within a very limited range until the young are finally on the wing. When the young are grown the adults may linger to rear other broods, but the young, driven often by antagonism of erstwhile attentive parents, wander away, borne by their newly-developed wings, and though they may not go far, do not usually remain for long in the immediate vicinity of the nest. This is one type of wandering in its simplest form. Somewhat more complex is the condition found in some parts of Australia, where prolonged droughts occur during which water evaporates, vegetation is not developed and the majority of birds disappear. With the incidence of rains the country again becomes green and birds return. Though both kinds of movement that have been described may appear as vagrancy, yet such impulses need only to become synchronized with seasonal

climatic change to become true migration.

Tropical regions offer interesting data in this connection, as though hundreds of birds found in these areas are strictly sedentary, yet there are some that shift about with changing conditions. Climatic variation within the Tropics is confined mainly to a cycle, in which periods of relatively little precipitation alternate with those of heavy rains. There is thus a seasonal shift that is influenced by changes in the vegetation. Some species of tree or vine come into flower or fruit and immediately there appear tanagers, honey-eaters and other birds hitherto absent to live upon the newly-available food.

It is idle to suppose all birds have arisen within either tropical or temperate areas. Birds, as a group, have been in existence for many million years, and during all that period there has been constant unceasing competition between individuals. In virile species individuals have been produced in abundance, and many have necessarily been forced out into new range. Some have reacted to new conditions, or have become modified through some inherent quality, so that they have been changed so greatly that they have finally become species apart from the parent stock, and have thus set up their own *loci* for subsequent radiation. The complexity of overlapping ranges under such conditions is easily apparent.

HOW MIGRATION PROCEEDS

Some students have indicated that the spring and fall migrations correspond to advance to the breeding station and subsequent retreat therefrom, and indicate correctly that the stimulus for this may be a hormone arising from physiological change in the gonads. This, however, is merely an activating principle for migration as it exists at the moment, and may not be considered the cause through which migration itself has originated.

Briefly, migration may be defined as advance and retreat, with fluctuation in conditions favourable to each species separately, which, as each form has its own reaction to its environment, has originated from varying causes. The origin of the present day regular, seasonal movements is thus complex.

Methods of Migration.—Migration may take place by day or by night, according to the species. Geese, ducks, cranes and pelicans crossing the sky, flying abreast or in angular formation, are accepted as portents of changing season throughout the world. Though seen regularly by day, these birds may also migrate by night, as we frequently hear the calls of geese and swans coming from darkened skies during the height of their movements. The smaller birds travel mainly by night, and descend on us in hordes, so that frequently we go out in early morning to find fields and hedgerows crowded with songsters that were absent the previous evening. During the proper season, when a full moon rides the sky in evening, it is possible to detect the forms of these nocturnal travellers silhouetted against the illuminated disk of light as they pass far above the earth, and occasionally to recognize a feathered friend by some peculiarity of form or wing movement. Many such observations have been made through large telescopes, and birds may be seen occasionally against the moon through ordinary field-glasses. It is probable that timid wrens, warblers and sparrows, that live ordinarily under shelter, feel greater safety in prolonged flights under the protecting cover of darkness. Kingbirds, robins, bluebirds, bluejays and many others however regularly fly by day.

The matter of procurement of food is probably a greater factor than timidity in inducing nocturnal flight. Digestion in birds is rapid, so that food must be obtained at regular intervals to maintain the activity especially characteristic of smaller species, whose tiny bodies have necessarily smaller reserves of energy than their larger brethren. Stomachs of small birds killed at night by striking lights or other obstructions are nearly always entirely empty, which, though an entirely natural thing, in some cases has given rise to belief that the individuals in question were in the throes of starvation. If tiny migrants flew long distances by day they would arrive at some distant destination with empty stomachs and depleted energies, perhaps almost exhausted, and because of darkness would not be able to procure food until the following morning. Such circumstances would lead to delay in further flights through need for recuperation or, if accompanied by cold or storm, might prove fatal because of the lowered vitality. By arrival at daybreak it is possible for migrants to rest for a time and then search for food, and so to recuperate that they may continue the following evening if desired. At the same time there is often detected among these smaller species an indication of continuation of migratory flight by day, as in feeding they often tend to move in the general direction towards which the seasonal flight trends.

It was thought formerly that migrants flew at great altitudes above the earth, there being a somewhat hazy notion that rarefied atmosphere in some uncertain way facilitated flight. Modern observations from aeroplanes show, however, that this belief is unfounded, and that the bulk of migrant birds travel at less than 3,000 ft. above the earth. It is unusual to meet with birds above 5,000 ft., though exceptionally aviators have recorded shore-birds at 10,000 and 12,000 feet. In many instances birds pass at very moderate altitudes, particularly above the sea, where they may barely clear the waves. At night, the calls of migrants may be often heard, apparently only short distances above the trees.

There has been much discussion of the method by which birds direct their courses in flights to distant lands, without arrival at definite explanation. Memory of routes previously travelled, some magnetic sense, courses laid by the positions of the heavenly bodies, as a mariner directs his navigation, the direction of regular winds, telepathy, television and hereditary memory have all had their champions. It may be said that there appears great probability that young birds of the season, on occasion, migrate southward without the guidance of others that have previously made the journey, that sea-birds return across apparently trackless oceans to remote islands where they nest, and that birds have returned to their breeding stations when removed forcibly to waters that they do not ordinarily frequent. This may, perhaps, be explained in the somewhat general terms, by supposition, that the birds are directed by some special sense of direction, but must be regarded at present as something of which there is no definite explanation.

One of the most interesting facts connected with migration is the almost unfailing regularity that accompanies the movements of birds in the temperate regions. Through records kept over a long period of years, the average dates of arrival in spring of the common birds are now known, and it is found that they appear with almost uncanny regularity, often on the average day and always within a range of a few days earlier or later. Among small birds the seed-eaters generally migrate earlier in spring and later in autumn than insect-eaters, as they find their food with greater readiness. The first arrivals in spring or fall are usually few, and it may be days or weeks before the mass of individuals appear.

The length of the journeys made by individual birds varies greatly. Inhabitants of high mountains, in a flight of a mile or two, descend to some warm valley, where they may spend the winter in comfort, or the migration flight may entail a movement to a great distance, as from central Europe to southern Africa. The Arctic tern is supposed to have the longest migration route known, as it nests in the far north and spends the northern winter near the shores of the Antarctic continent, with 11,000 m. in an air-line separating its northern and southern homes. Incidentally, this tern probably enjoys longer hours of daylight than any other living creature, since it lives under the midnight sun in both northern and southern hemispheres, and only in its travels through the equatorial belt does it meet extended periods of darkness. There are numerous shore-birds, such as the American golden plover, that nest in the Arctic and spend the northern winter on the plains of Argentina. Many birds nest in Canada or in the northern United States and winter in the Gulf States, Mexico, Central America, the West Indies, or northern South America. Likewise, many pass from northern Europe to Africa, some going as far as Cape Colony.

There is almost infinite variety in the migration routes and travels of the many forms of birds, yet in each continent it is found that there is a tendency to converge in great lanes of migration that carry the bulk of individuals, though random birds may cross anywhere in the intervening area. The flight-lines often fol-

low river valleys or coast-lines, which seem to afford assistance in directing the flight. The observer interested in bird life who is located on one of these great air-roads is fortunate.

Through prolonged journeys birds encounter constant perils and dangers, so that many are destroyed. Storms, unfamiliar coverts, with consequent exposure to the attacks of enemies, and wandering from the direct course in crossing broad reaches of water annually exact a toll of unknown thousands of individuals, as has been indicated in a previous section. To enable maintenance of their proper number migratory species, therefore, are required to produce a sufficient number of young to permit this toll, and at the same time leave a pair to continue the species at the next breeding season. On the average, the migratory species of the north and south temperate zones produce from three to six eggs in each nesting, four or five being the rule, with from one to three families each season, while the more strictly resident form of the Tropics may produce only two or three eggs and have only one nesting annually. In spite of apparent prolificness the more northern species do not increase inordinately. The song sparrow family, in August, at the close of the breeding season, if there has been no mortality, may have ten or 14 individuals, depending upon whether two or three broods have been reared, yet by next spring does not show any appreciable increase in abundance; so that there has been a tremendous wastage in individual life during the migrations and the intervening winter.

In final consideration, it may be said that residents in Europe and North America are often prone to consider migration as something peculiar to birds breeding in the northern hemisphere. It must be noted, however, that in South America, southern Africa, and Australia there are native species that, at the approach of the southern winter, travel north toward the Equator, to return at the proper season to their breeding-grounds.

BIRD BANDING

Until the beginning of the present century the study of migration was carried on by mass-observation, under which records were kept of the first appearance for each species and of its subsequent fluctuations in abundance, the value of the records depending to a certain degree upon the skill and experience of the observer. Much valuable data has thus been assembled, and this method of study is still highly useful. In recent years there have been developed methods in marking individual birds with numbered bands that have added greatly to knowledge of migration, since by this means it is possible to single out the individual bird from the great army of his fellows, and to learn something of the separate flights that make up this mass movement.

Sporadic attempts to mark wild birds so that they might be identified began more than 125 years ago, and have ranged from little bells, bits of coloured yarn, marks made with indelible inks or paints on some of the feathers, plain rings of wire or other material, or strips of metal on which were marked scriptural quotations, to the modern scheme of bands of aluminium marked with a serial number and the name and address of the person or organization responsible for them.

The earliest definite record for a banded bird, according to F. C. Lincoln, is that of a heron (*Ardea cinerea*), captured in Germany in 1710, with metal rings on the leg, one of which had been placed on the bird in Turkey several years before. Sporadic efforts to mark birds have been made at irregular intervals, but nothing of real importance was attempted until 1899, when C. C. Mortensen, of Viborg, Denmark, began systematically to band storks, ducks, starlings and birds of prey. The results obtained were so valuable that soon others took up this study, with the result that at the beginning of the World War approximately 20 distinct banding projects had been initiated in Europe.

In America the first birds ringed seemed to have been some common phoebes (*Sayornis phoebe*), marked by Audubon, when in the nest, with silver wires around the leg, some of them returning the following year to breed in the locality where they had been born. After several persons in America had arranged schemes for the marking of birds the American Bird Banding Association was organized, in 1909, through the efforts of Dr. L. J. Cole, and continued until 1920, when its activities were taken over as part of the work of the Bureau of Biological Survey, U.S. Department of Agriculture. Under Government auspices the work has been expanded through a co-operative scheme until now more than 1,500 persons are engaged in banding birds in the United States and Canada, and to 1928 approximately 350,000 birds had been banded. Early work was concerned with the marking of young birds before they were able to fly, or the casual capture of adult individuals. In recent years this has changed to the banding, principally, of adults captured by a variety of ingenious traps, and then marked and released. Banding in the United States has progressed to a point where there have been organized four regional societies concerned with it. Though hundreds of birds that have been marked are not subsequently detected, enough are recovered to render the work profitable to a high degree. Among ordinary birds from one to four in every hundred banded are later retaken, while among ducks, which are hunted as game, the recovery runs from 12 to 20 in each hundred, a remarkable number. Through the trapping method it often happens that banded birds are retaken and released uninjured, sometimes on several occasions.

Through banding, it has been found that some birds have winter homes as definitely defined as those inhabited in summer. As a case in point, there may be mentioned the white-throated sparrow (*Zonotrichia albicollis*), which nests in the northern section of eastern North America, from Massachusetts and Wyoming north to Labrador and Great Bear lake, and winters in the central and southern States. A bird of this species banded by S. P. Baldwin, near Thomasville, Georgia, on March 5, 1916, was retaken within a few yards of the original spot on March 7 and 19, 1917, on several occasions between February 25 and March 22, 1920, and on March 27, 1921, indicating a remarkable regularity in return to one spot. Wild ducks banded by the writer at the northern end of Great Salt lake, in Utah, were killed subsequently in California, Mexico, Texas, Oklahoma, Missouri, Nebraska and Saskatchewan, revealing a tremendous spread in flight, and, with other similar data, giving information of great importance in game conservation. A black-headed gull (*Larus ridibundus*), banded at Rossitten, Germany, was taken subsequently at Bridgetown, Barbados, and another from the same point crossed to Vera Cruz, Mexico. A common tern, marked at Eastern Egg Rock, on the coast of Maine, was found dead four years later at the mouth of the Niger. A lapwing (*Vanellus vanellus*) banded in Cumberland, England, was taken in Newfoundland. Such examples of trans-oceanic migration will increase as the work progresses.

SONGS AND CALLS

The voice in mammals, including man, is produced in the voice-box, or larynx, in the upper part of the throat. The bird possesses a similar larynx; but its sounds and notes are formed in another voice-box, the syrinx, at the lower end of the windpipe, where it divides to send a bronchial tube to either lung. The syrinx is composed of firm walls derived from the rings of the trachea, or in part from the bronchi, and has within delicate membranes whose tension is controlled by slender muscles. Air expelled forcibly over these membranes produces sound which may be of many kinds, according to the species concerned. The adult turkey vulture (*Cathartes aura*), and the brown pelican (*Pelecanus occidentalis*), have as their only note a sighing aspiration made by expelling the air unmodulated, though their young utter harsh calls in some variety, either in begging for food or in attempting to repel possible enemies. The voiceless condition in the adult is unusual. The rhea sends forth a booming call, ventriloquial in effect, that carries for long distances, the wedge-tailed shearwater utters a series of indescribable groans and shrieks, which combine with those of thousands of its kind to produce a vast volume of sound, the gull or tern calls in constant iteration with a note of harshest sound. In the highest order of birds, among the oscines or song-birds, song has reached high development, and in many follows lines of human music sufficiently to give deep aesthetic pleasure. The male mockingbird (*Mimus polyglottos*) of America, is stirred by spring to a period of vocal utterance that includes a varied repertoire of utterances peculiar to his

own expression, as well as notes borrowed from tuneful neighbours. In the height of the breeding season his efforts continue day and night in apparently ceaseless expression of virile energy. The nightingale (*Luscinia megarhyncha*) of Europe, a dweller of tangled copses, would be overlooked by many were it not for his impassioned outburst of song (which, contrary to popular belief, may be heard at all hours of day and night). The two just mentioned, with the addition of the hermit thrush and the skylark, are the songsters of greatest renown among English-speaking peoples.

A number of bird-songs, even where they have variety of note, are frequently unpleasant to some human ears. Many complain of the doleful cadence of the cooing of mourning doves (*Zenaidura macroura*), or are unpleasantly affected by the harsh chatter of the house sparrow. The song of the plant-cutter (*Phytotoma rutila*) of Argentina exactly resembles the creaking of two tree-limbs rubbing against one another in the wind. The song of the Henslow's sparrow (*Passerherbulus henslowii*) is a low double note barely audible at a hundred yards.

The song impulse is so predominant at the height of its period that it is given expression on the slightest disturbance. Birds awakened at night frequently sing for an instant as clearly as during the day, and song also may be used to express emotions of fear and anger.

Though modulated speech for the expression of abstract ideas may be peculiar to man, there is no question but that birds possess a rudimentary language in the sense that they use their calls to communicate with one another. A low call on the part of a parrot or paroquet at detection of a sound or sight that may denote danger will instantly cause the entire group of its companions to become motionless, or send them in screaming confusion into the air. The mother pheasant warns her young, who immediately hide and cannot be found. The rooster, by rapid repetition of a certain note, calls the members of his harem to some supply of food. There are also cries of anger, and others that may be interpreted as conversational, that enable species of social habit to keep in touch with one another. Bird-calls are often intelligible to other creatures, as the alarm-call of a jay or plover will often startle deer or other game.

There are a number of birds that possess a strong imitative faculty which, in domesticated individuals, may be adapted to the mimicry of human sounds. Canaries and other finches may be taught to whistle a few notes of musical airs. The Amazon parrots are particularly adept at mimicry of the human voice, and similar ability is found in some macaws, paroquets and other parrots. Crows, jays and magpies also may learn to repeat a few words, as may starlings and mynahs. According to a widely current superstition the tongues of the latter birds must be split to enable them to articulate human speech, a belief for which there is no valid basis, whatever, and which, when practised, imposes a needless cruelty. This curious belief may be based on the fact that the tongue of crows and jays is naturally somewhat split.

FLIGHT

The wing-membranes of the ancient reptilian pterosaur (*see* PTERODACTYL) were supported by elongated finger-bones, as are the wings of bats (though differently), but birds have developed another mechanism for flying, as the fore-limb, including the hand, has long feathers projecting from its posterior margin that are extended to form a supporting surface, by which flight is accomplished (*see* also BIRD). The hand is stiffened, being flexible only at the wrist, the number of hand and finger-bones is reduced, and those that remain are partly fused together. The wing thus developed folds against the sides, so that it causes no embarrassment when the bird is at rest or is walking or climbing, but at the same time may be extended instantly should need or desire for flight arise. It appears thus perfectly adapted for its purpose and in utility (though not in speed) eclipses the aeroplanes of man.

Methods in Flight.—Avian flight is accomplished, except when soaring, by strokes of the wings, which may be slow or fast according to circumstances or the custom of the bird. A certain momentum must be acquired before the bird actually moves through the air. From a level surface this is ordinarily accomplished by an initial spring, through which the flexed legs throw the body as though from a catapult. From an elevation, as from a cliff or the limb of a tree, a fall of a few inches or a few feet may occur before the bird is under way. Albatross take off from land facing the wind, running a few steps forward with beating wings and then spreading their pinions, to rise and sail gracefully away. Some aquatic birds with small wings and heavy bodies, as coots, diving ducks, grebes and loons rush across the water surface with beating wings and alternately striking feet until they acquire sufficient momentum to carry them into the air. Surface-feeding ducks, on the contrary, spring directly into the air with one tremendous impulse that gives such impetus that they fly without appreciable pause. Grebes rise with difficulty except from the water. From a smooth, hard surface they can sometimes take off in flight, but in herbage they are unable to rise, as the slightest obstructions break their momentum.

There is a considerable group of birds that in their active moments are so constantly in the air that they may almost be termed aerial creatures. The swallows are an excellent example of these as they secure their entire supply of food in the air, and for hours on end circle and swing with tirelessly moving wings, only perching when their appetite is satisfied, for the purpose of rest at night, or at their nests.

Aerial existence of a stronger, more placid type, is exemplified by the great vultures and the larger hawks that circle and turn on broadly extended wings above the earth, frequently at great heights. Such birds may soar for hours with only an occasional stroke of the wings, as they use the force of rising or laterally moving air-currents to maintain themselves, the only motion being a constant slight adjustment of the angle of the wings, particularly at the tips, and of the tail to secure the proper amount of upward thrust to enable them to maintain the desired altitude and at the same time move ahead. The turkey vulture (*Cathartes aura*), which uses a soaring flight constantly for its progress through the air, is seldom abroad on foggy days when the air is still, but on such occasions remains quietly in its roosts. Many other birds soar merely for the pleasure that this occasions. Pelicans, cormorants, storks, and screamers, to mention only a few, are seen wheeling for hours so high above the earth that they appear as mere specks in the sky, though these birds search for food near, or on the surface of, water or the ground. Soaring flight of a different kind is seen where gulls glide beside or over a vessel, holding steady position in one place for minutes at a time without movement of the wings. This again is occasioned by steady air-currents that are deflected from the surfaces of the boat at a constant angle.

Hawks and the other soaring birds that have been mentioned that perform their flights relatively high in the air have wings wide in proportion to their length. Albatrosses and other seabirds that travel habitually near the surface of the water have long, narrow wings that when fully extended are more or less of equal width throughout their length, and so are somewhat similar in shape to the wings of a monoplane. These birds progress by utilization of air-currents induced by wind, and are most common in pelagic regions where there are regular winds, and are rare in regions of calm. Their flight is quick and subject to sudden turns, so that the method of progression differs somewhat from the smooth, spiraling turns that mark the soaring of hawks and vultures. As the larger petrel-like birds follow in the wake of ships they bank and turn rapidly with stiffly-extended wings, frequently swinging so that the plane of the wings for a brief space is at right angles to the line of the horizon. It is common to see shearwaters caught in the trough of a wave fly rapidly to the crest and then scale with set wings down the succeeding moving slope of water.

Birds like magpies and ducks, that habitually fly long distances, travel with a steady beat of the wings that carries them in a smooth, direct line. Inhabitants of thickets and hedgerows, as sparrows and wrens, progress with a tilting flight in which the short, rounded wings move rapidly for a few quick strokes, and

then pause for a very brief instant, so that the flight is rapidly tilting, or irregular in a vertical plane. Another group of birds, as many woodpeckers, fly in long undulations with a regular rise, during which the wings are stroked rapidly, and a slow descent, during which they are closed and the bird progresses through a combination of its previous momentum and the pull of gravity.

Such ground-haunting birds as the grouse and quails regularly walk or run, and use their wings extensively only to carry them from danger. In these the wings move rapidly, so that flight is swift and is accompanied by a roaring sound. The rapid movement is maintained for a comparatively short distance when the bird drops to the ground to hide in cover. Flight at high speed is thus maintained for only a brief space. The tinamous (*Tinamidae*) of South America, birds of grouse-like appearance related to the rheas, like grouse, fly only when pressed. They rise violently and drive rapidly away for fair distances, but are reluctant to rise again, and when forced to fly a second or third time do so with some difficulty. They are so seldom in the air that in violent winds they cannot easily control their direction, and often alight so clumsily that they fall.

Ground-inhabiting birds that reside on islands where they have no regular persistent enemies, have little incentive to flight, with the result that wings become shortened and their movement weakened. In many instances, particularly among rails, this has resulted in species in which the power of flight is completely lost, and the wings, though they may beat rapidly as the bird runs, cannot raise it from the ground. In some species now living loss of power of flight is now taking place. The Laysan teal (*Anas laysanensis*) is now in this process, so that, though an initial flight of about 100 yd. may be made, the birds are then exhausted and may sometimes be caught by hand.

Speed of Flight.—The speed that birds attain in flight, until comparatively recent years, has been a matter of uncertainty, in many cases subject to gross exaggeration. Most of these may be traced to Gätke, who in his otherwise admirable studies of migration on the island of Heligoland became seized with the hypothesis that birds perform most of their migration-flight during the course of a single night. On this theory, he placed the migratory speed of the northern blue-throat at 180 to 240 m. per hour, the hooded crow at 108 m., and plovers and related species at 240 m. per hour, or 4 m. per minute. He believed that these tremendous speeds were possible through flight at great altitudes, even to 40,000 ft. above the earth, where he supposed that the thin air offered little resistance. These statements, which have been widely quoted, are wholly erroneous.

Reliable data on the rate of flight have accumulated slowly during the past 15 years. The writer has secured some information on the subject by timing birds flying parallel to roads by means of the speedometer of an automobile, and in such diverse forms as herons, hawks, horned larks, ravens and shrikes has found the usual flight to vary from 22 to 28 m. per hour. Another observer has found the Arkansas kingbird and scissor-tailed flycatcher flying at only 10 to 17 m. per hour. Gladstone gives similar records for the willow warbler as 23½ m. per hour, the pied wagtail as 25, the European blackbird as over 22, the missel thrush as 23, and the cuckoo as 23 m. per hour.

Meinertzhagen has recently given very definite data on the speed of flight in birds from observations made by theodolites designed to estimate the speed of aeroplanes at anti-aircraft stations, by stop watches along measured courses, and by observations from travelling aeroplanes. From his records it appears that members of the crow family may travel from 31 to 45 m. per hour, the smaller perching birds, as larks, pipits and buntings from 20 to 37 m. per hour, starlings from 38 to 49 m., geese from 42 to 55 m., ducks 44 to 59 m., falcons 40 to 48 m. and sand grouse 43 to 47. The fastest flying birds known are found in the family of swifts (*Micropodidae*). One species (apparently the common swift of Eurasia), observed from an aeroplane in Mesopotamia, circled easily about a plane when this was flying at 68 m. per hour. From this and other observations it appears that ordinary swifts fly regularly at 70 m., and may accelerate this to 100 m. per hour for necessity or pleasure.

FOOD

During their long period of evolution, birds have become adapted to all foods available to their methods of feeding. Geese graze on tender herbage as readily as cattle, rheas and ostriches select a miscellaneous vegetable diet, the plant-cutter (*Phytotoma*) eats buds, berries and other vegetable matter, the palm-chat of Haiti (*Dulus dominicus*) frequently consumes blossoms, the sage-hen (*Centrocercus urophasianus*) delights in the bitter twigs and leaves of sage (*Artemisia*), ducks are fond of succulent roots, tubers and leaves of aquatic plants, and many other birds have similar propensities for plant-stems or leaves. Fruits are taken by many birds, while the number of birds that depend upon starchy seeds for the major part of their diet is myriad, and includes a great variety of species. The finches with their strong bills crack off the investing hulls of large seeds and consume only the starchy interior. Small hard seeds, as those of lambs-quarter (*Chenopodium*), are swallowed entire and are ground up by sand and bits of gravel swallowed for the purpose. Grackles (*Quiscalus*) by means of a keeled process on the palate, cut around the shells of acorns until they crack in two and the meat is exposed. Jays hold nuts between the toes and break them open by strong blows of the beak. Some woodpeckers force acorns into crevices in trees, where they are held until they may be broken open. The mallard and wood-duck swallow acorns and even entire nuts of the hickory, which have a shell so thick that it requires a strong blow of a hammer to break them, and grind them up in their gizzards. Seeds form a standard autumn and winter food when other sustenance is lacking, and are produced in tremendous quantity. From the stomach and gullet of one mallard duck there have been taken 102,400 seeds of the water primrose (*Jussiena leptocarpa*).

Birds that feed on insect-life abound, and include a large proportion of the smaller species. Vireos, warblers and kinglets search actively for insects among leaves and twigs, picking off their prey at rest or flying out a few inches after some escaping titbit. Flycatchers (*Tyrannidae*) watch from commanding perches and fly out to snap up passing insects on the wing, or occasionally to pick them from the ground. Nuthatches and creepers search over the bark of trees for insects, spiders or eggs hidden in the crevices, and woodpeckers chisel out coleopterous grubs from their hidden tunnels in wood. Usually these are found in decaying trunks, but occasionally some of the stronger woodpeckers will cut in through 1 in. of hard wood to secure a grub. The flicker (*Colaptes*) feeds much on the ground on ants, which it secures by its long tongue as the insects run about their hills. More than 6,000 ants have been taken from the stomach of one flicker. Swifts, swallows and nightjars feed exclusively on the wing, securing flying insects in their capacious mouths. In the stomach of one nighthawk there have been found 50 species of flying insects comprising several thousand individuals. Cuckoos consume large numbers of hairy caterpillars, from which the stomach becomes so filled with hairs stuck in the lining that its inner surface appears covered with short, stiff fur. Hummingbirds live on the nectar of flowers and tiny flies, Hymenoptera, beetles and spiders that find a home in blossoms or in the bark of trees.

Grebes, divers, herons, mergansers, cormorants and pelicans feed on fish of various kinds, most often on species not especially desirable from a human standpoint. Albatrosses and shearwaters take quantities of squid, and the smaller petrels seem to secure the miscellaneous array of smaller marine creatures known collectively as plankton (*q.v.*). Hawks and owls feed extensively on small mammals and other birds. Some eat frogs, snakes and large insects, as well as crayfish. Larger owls may capture and consume smaller ones, and partly-grown brown pelicans, when ravenous with hunger, may seize and swallow a small member of the colony, that has just been fed. The flesh of dead animals, even in the form of putrid carrion, is sought by vultures that eat with impunity where death from poison from bacillary action would be the fate of another creature.

Though most birds seek their food day by day and so live an existence that involves continual search for sustenance, a few species form food-stores against a time of scarcity. Most

remarkable among these is a group of North American woodpeckers (*Balanosphyra formicivora*), that drill holes in the trunks of trees, in which they fit acorns, and so preserve a part of the acorn harvest for subsequent consumption. The birds work assiduously, as 13,200 acorns have been estimated as the store on one large tree-trunk, with an average density of 60 to the square foot. That the instinct for storage sometimes goes astray is shown when the carefully-drilled holes are filled with pebbles instead of nuts. The red-headed woodpecker (*Melanerpes erythrocephalus*) fills cavities with quantities of acorns or other small nuts, over which it piles bits of bark to conceal them. Many shrikes (*Lanius*), when food is abundant, frequently impale the bodies of grasshoppers, birds, mice or other prey on thorns, to return to them later if needed.

Hawks and owls swallow their prey entire or in large fragments, digest out all nutritive matter and form the bones, fur, scales, feathers or chitin into pellets, which are subsequently regurgitated, leaving the stomach empty to receive another meal. Albatrosses eject pellets composed of the beaks of squids, flycatchers masses of insect chitin, and even hummingbirds may throw up tiny pellets made up of the indigestible portions of their insect food. Birds with strong, muscular gizzards, that feed on seeds, swallow sand or gravel that serves as millstones to triturate into digestible starch meal the seeds they have eaten.

The Brahmans maintain towers where food for birds is placed, and where birds may nest. In Japanese temples shelves are built where swallows may erect their homes. Indians in the eastern United States placed hollow gourds on bare stubs of trees to provide nesting cavities for the purple martin (*Progne subis*), a species of swallow, a practice that was adopted by early colonists from Europe, and that is followed to-day in country districts in the southern States. From these somewhat rude foundations there have developed complicated procedures for the attraction of birds about human homes. The martin-gourd has been transformed into ornate martin-houses containing many compartments, each of a size to house a pair of birds, and boxes or houses have been designed for many other hole-nesting birds. Though in use in many places, particularly in Germany, at an earlier date, it is since the beginning of the present century that methods for the attraction of birds have received widespread attention. In the United States and Europe single-compartment houses (nesting-boxes) are set up for wrens, bluebirds, tits, woodpeckers and similar birds, and where favourably located are occupied without the slightest hesitation. These bird-houses are of many types, and so many are used that commercial companies have been formed for their manufacture.

Large pieces of suet tied to the trunks or limbs of trees, where birds may feed without fear of capture from cats, draw woodpeckers, nuthatches and titmice. A shelf built on an outside window ledge will draw many birds where they may be seen to the best advantage. Sunflower and canary seed, wheat, chickfeed, moderately fine-ground corn, nut meats and crumbs of bread are all relished by feathered neighbours. A mixture of suet and nut meats, preferably peanuts, ground medium fine in a food grinder, is especially relished by titmice and jays. Birds come to such feeding stands throughout the year.

ORIGIN AND EVOLUTION

Bizarre as the idea may seem at first, birds are more closely allied to reptiles (*q.v.*) than to any other living group of vertebrates. The bird, while similar to the reptile in much of its structure, in its superior mental capacity, and concomitant adaptations that this has permitted, has far outstripped its lowly cousins, and so has flourished and multiplied while its cold-blooded relatives with decreasing numbers have fallen behind in the race of life. From one viewpoint we may look upon the bird as the attempt of the reptilian groups to retain the dominance of the earth that was theirs during the Mesozoic era, a design that was frustrated by the development of mammals.

The earliest birds known were contemporaneous with dinosaurs (*q.v.*), to which, structurally, they seem to have close affinity, particularly to the hollow-boned, agile, bird-like groups. As these creatures existed at a time when primitive birds were also known search must be carried farther into the ages for a generalized reptilian group from which both birds and dinosaurs may have sprung. This, apparently, is found in the fossil reptiles known as the Pseudosuchians, of early Triassic times; though according to some the original ancestor of the bird-like creatures should be sought in still older ages in the Permian.

Fossil Birds.—The bones of birds are so poorly preserved in the fossil state that there is record now of only about 750 fossil forms, including some of questionable identity. The earliest fossils known are *Archaeopteryx* (*q.v.*) and *Archaeornis* of the Jurassic beds of Bavaria, creatures with toothed jaws, very long, bony tails with feathers projecting along the sides, and free fingers, that in spite of their reptilian form, were birds, as they were covered with feathers and were able to fly. In the Cretaceous period two types of birds, both possessing teeth, are known from nearly complete skeletons, *Hesperornis* and its allies, diver-like species that lived in water and seemed to have had no wings, and *Ichthyornis* which was aerial and may have had the habits of a gull (*see* ODONTORNITHES). These four are the most peculiar fossil birds known at present, since others, while often strange, are allied more or less closely to modern families.

At the beginning of the Tertiary period the types of birds found were suggestive, in form, of existing birds, though in the Eocene some were highly peculiar, and most seem to pertain to extinct families. In the Miocene there occur a number of birds very closely similar to those existing to-day, and in the Pleistocene are found bones of numerous birds still in existence, in addition to many that differed from modern forms.

The progress of the avian group since the coming of the Pleistocene ice seems to have been one of extermination rather than of consistent evolutionary progress, as peculiar types seem to have been exterminated in numbers during the Pleistocene, and there is no indication that others have developed to take their places except for the minor characters that distinguish sub-species or poorly-marked species. The story of fossil birds is far from complete, and much work remains to be done on many of those at present discovered, to establish their relationship.

SYSTEMATIC CLASSIFICATION

It is difficult to arrive at an exact figure for the number of kinds of birds now known, but at a conservative estimate it is believed this may reach 25,000 distinct forms.

The primary group or class, Aves, is one of the great divisions of the vertebrates and is equal in rank to the fishes, amphibians, reptiles and mammals. This class is divided into two sub-classes, the first, the Archaeornithes, containing the most primitive birds which are very close to reptiles, and the second, the Neornithes, all other known birds. The Neornithes are divided again into three major divisions or super-orders, the Odontognathae, containing forms with teeth, the Palaeognathae, for the ostrich-like birds and their allies, which have a primitive arrangement of the bones of the palate, and the Neognathae, including the remaining species with a more specialized modern type of palatal structure. These super-orders are divided again into orders, sub-orders, superfamilies and families. An arrangement embodying modern ideas of classification follows:

Class Aves.
- Sub-class ARCHAEORNITHES
  - Order Archaeopterygiformes
    - Family Archaeopterygidae, *Archaeopteryx, Archaeornis* (fossil)
- Sub-class NEORNITHES
  - Super-order Odontognathae, toothed bird
    - Order Hesperornithiformes
      - Family Hesperornithidae, *Hesperornis, Hargeria* (fossil)
      - " Enaliornithidae, *Enaliornis* (fossil) [position provisional]
    - Order Ichthyornithiformes
      - Family Ichthyornithidae, *Ichthyornis* (fossil)
  - Super-order Palaeognathae
    - Order Struthioniformes
      - Family Struthionidae, Ostriches (Old World)
    - Order Rheiformes
      - Family Rheidae, Rheas (South America)

Order Casuariiformes
Family Casuariidae, Cassowaries (Australian region)
„ Dromiceidae, Emus (Australian region)
„ Dromornithidae, *Dromornis* (fossil)
Order Dinornithiformes
Family Dinornithidae, Moas (extinct, New Zealand)
Order Aepyornithiformes
Family Aepyornithidae, *Aepyornis* (extinct, Madagascar)
Order Apterygiformes
Family Apterygidae, Kiwis (New Zealand)
Order Tinamiformes
Family Tinamidae, Tinamous (S. Central America)
Super-order Neognathae
Order Sphenisciformes
Family Spheniscidae, Penguins (Southern hemisphere)
„ Cladornithidae, *Cladornis* (fossil)
Order Gaviiformes
Family Gaviidae, Loons and divers (Arctic & North temperate)
Order Colymbiformes
Family Colymbidae, Grebes (Cosmopolitan)
Order Procellariiformes
Family Diomedeidae, Albatrosses (Tropics, sub-Tropics & Antarctic)
Family Procellariidae, Shearwaters, Fulmars (Cosmopolitan)
Family Hydrobatidae, Small Petrels (Cosmopolitan)
„ Pelecanoididae, Diving Petrels (Cosmopolitan)
Order Pelecaniformes
Sub-order Phaëthontes
Family Phaëthontidae, Tropic-birds (tropical)
Sub-order Pelecani
Super-family Pelecanides
Family Pelecanidae, Pelicans (Tropics, sub-Tropics and warm temperate)
Family Cyphornithidae, *Cyphornis*, *Palaeochenoides* (fossil)
Super-family Sulides
Family Pelagornithidae, *Pelagornis* (fossil)
„ Sulidae, Boobies, Gannets (Cosmopolitan)
„ Phalacrocoracidae, Cormorants (Cosmopolitan)
„ Anhingidae, Snake-Birds or darters (Tropics and sub-Tropics)
Sub-order Fregates
Family Fregatidae, Man-o'war Birds (Tropics and sub-Tropics)
Sub-order Odontopteryges
Family Odontopterygidae, *Odontopteryx* (fossil)
Order Ciconiiformes
Sub-order Ardeae
Family Ardeidae, Herons, Bitterns (Cosmopolitan)
„ Cochleariidae, Boat-billed Herons (S. America)
Sub-order Balaenicipites
Family Balaenicipitidae, Shoe-bills (Africa)
Sub-order Ciconiae
Super-family Scopides
Family Scopidae, Hammerheads (Africa)
Super-family Ciconiides
Family Ciconiidae, Storks, Jabirus (Cosmopolitan)
Super-family Threskiornithides
Family Threskiornithidae, Ibises, Spoonbills (Cosmopolitan)
Sub-order Phoenicopteri
Family Phoenicopteridae, Flamingos (temperate & tropical regions)
Order Anseriformes
Sub-order Anhimae
Family Anhimidae, Screamers (South America)
Sub-order Anseres
Family Anatidae, Ducks, Geese, Swans (Cosmopolitan)
Order Falconiformes
Sub-order Cathartae
Family Cathartidae, New World Vultures (America)
„ Teratornithidae, *Teratornis* (fossil)
Sub-order Falcones
Family Sagittariidae, Secretary-birds (Africa)
„ Accipitridae, Hawks, Old World Vultures, Harriers, Ospreys (Cosmopolitan)
Family Falconidae, Falcons, Caracaras (Cosmopolitan)
Order Galliformes
Sub-order Galli
Super-family Cracides
Family Megapodidae, Megapodes (Australian region)
„ Cracidae, Curassows, Guans, Chachalacas (Central & South America)
Super-family Phasianides
Family Tetraonidae, Grouse (Cosmopolitan)
Family Perdicidae, Quails (Old World)
„ Phasianidae, Pheasants, Peacocks, Common Fowl (Old World)
Family Numididae, Guinea-fowl (Africa)
„ Meleagridae, Turkeys (America)
Sub-order Opisthocomi
Family Opisthocomidae, Hoatzins (South America)
Order Gruiformes
Sub-order Mesoenatides
Family Mesoenatidae, Roatelos, Monias (Madagascar)
Sub-order Turnices
Family Turnicidae, Bustard-Quails (Old World)
„ Pedionomidae, Collared Hemipodes (Old World)
Sub-order Grues
Super-family Gruides
Family Gruidae, Cranes (Cosmopolitan except South America)
Family Aramidae, Limpkins (America)
„ Psophiidae, Trumpeters (South America)
Super-family Rallides
Family Rallidae, Rails, Coots, Gallinules (Cosmopolitan)
Sub-order Heliornithes
Family Heliornithidae, Sun-Grebes or fin-foots (Old World and South America)
Sub-order Rhynocheti
Family Rhynochetidae, Kagus (New Caledonia)
Sub-order Eurypygae
Family Eurypygidae, Sun-Bitterns (Central and South America)
Sub-order Phororhaci
Family Phororhacidae, *Phororhacos* (fossil)
Sub-order Cariamae
Family Hermosiornidae, *Hermosiornis* (fossil)
„ Cariamidae, Cariamas (South America)
Sub-order Otides
Family Otididae, Bustards (Old World)
Order Diatrymiformes
Family Diatrymidae, *Diatryma* (fossil)
Order Charadriiformes
Sub-order Charadrii
Super-family Jacanides
Family Jacanidae, Jaçanas (Tropics)
Super-family Charadriides
Family Haematopodidae, Oyster-catchers (Cosmopolitan)
Family Charadriidae, Plovers, Lapwings, Turnstones, Surf-birds (Cosmopolitan)
Family Scolopacidae, Snipe, Woodcock, Sandpipers (Cosmopolitan)
Family Recurvirostridae, Avocets, Stilts (Cosmopolitan)
Family Presbyornithidae, *Presbyornis* (fossil)
„ Phalaropodidae, Phalaropes (Northern hemisphere)
Super-family Dromades
Family Dromadidae, Crab-plovers (India, Arabia and East Africa)
Super-family Oedicnemides
Family Oedicnemidae, Thick-knees (Cosmopolitan)
Super-family Glareolides
Family Glareolidae, Pratincoles, Coursers (Old World)
Super-family Thinocorides
Family Thinocoridae, Seed-snipe (Tropics)
Super-family Chionides
Family Chionidae, Sheath-bills (Southern hemisphere)
Sub-order Lari
Family Stercorariidae, Skuas, Jaegers (Cosmopolitan)
„ Laridae, Gulls, Terns (Cosmopolitan)
„ Rynchopidae, Skimmers (America, Africa and South Asia)
Sub-order Alcae
Family Alcidae, Auks, Auklets, Murres, Guillemots (North temperate and Arctic)
Order Columbiformes
Sub-order Pterocletes
Family Pteroclidae, Sand-Grouse (Old World)
Sub-order Columbae
Family Raphidae, Dodo, Solitaire (Mauritius, Réunion, Rodriguez)
Family Columbidae, Pigeons, Doves (Cosmopolitan)
Order Cuculiformes
Sub-order Musophagi
Family Musophagidae, Plantain-eaters (Africa)
Sub-order Cuculi
Family Cuculidae, Cuckoos, Road-runners, Anis (Cosmopolitan)

Order Psittaciformes
Family Loriidae, Lories (Australian region)
„ Psittacidae, Parrots, Macaws (Tropics & sub-Tropics)
Order Strigiformes
Family Tytonidae, Barn-owls (Cosmopolitan)
„ Strigidae, Owls (Cosmopolitan)
Order Caprimulgiformes
Sub-order Steatornithes
Family Steatornithidae, Oil-birds (South America)
Sub-order Caprimulgi
Family Podargidae, Frogmouths (India and Australia)
„ Nyctibiidae, Potoos (Old World Tropics)
„ Aegothelidae, Owlet-Frogmouths (Old World Tropics)
Family Caprimulgidae, Nightjars, Night-hawks, Whip-poorwills (Cosmopolitan, except east Pacific)
Order Micropodiformes
Sub-order Micropodii
Family Micropodidae, Swifts (Cosmopolitan)
„ Macropterygidae, Crested Swifts (Asia)
Sub-order Trochili
Family Trochilidae, Hummingbirds (America)
Order Coliiformes
Family Coliidae, Colies (Africa)
Order Trogoniformes
Family Trogonidae, Trogons (Tropics)
Order Coraciiformes
Sub-order Alcedines
Super-family Alcedinides
Family Alcedinidae, Kingfishers (Cosmopolitan)
Super-family Todides
Family Todidae, Todies (West Indies)
Super-family Momotides
Family Momotidae, Motmots (Central and South America)
Sub-order Meropes
Family Meropidae, Bee-eaters (Old World)
Sub-order Coracii
Family Coraciidae, Rollers (Old World)
„ Leptosomatidae, Ground-rollers (Madagascar)
„ Upupidae, Hoopoes (Old World)
„ Phoeniculidae, Wood-hoopoes (Africa)
Sub-order Bucerotes
Family Bucerotidae, Hornbills (Old World Tropics)
Order Piciformes
Sub-order Galbulae
Super-family Galbulides
Family Galbulidae, Jacamars (Central and South America)
Family Bucconidae, Puff-birds (Central & South America)
Super-family Capitonides
Family Capitonidae, Barbets (Tropics)
„ Indicatoridae, Honey-guides (Old World)
Super-family Rhamphastides
Family Rhamphastidae, Toucans (Central and South America)
Sub-order Pici
Family Picidae, Woodpeckers, Piculets (Cosmopolitan, except Madagascar and Australia)
Order Passeriformes
Sub-order Eurylaimi
Family Eurylaimidae, Broadbills (Indo-Malaya)
Sub-order Tyranni
Super-family Furnariides
Family Dendrocolaptidae, Wood-hewers (South America)
Family Furnariidae, Ovenbirds (America)
„ Formicariidae, Ant-thrushes (Central and South America)
Family Conopophagidae, Ant-pipits (South America)
„ Rhinocryptidae, Tapaculos (Central and South America)
Super-family Tyrannides
Family Cotingidae, Cotingas (America)
„ Pipridae, Manakins (Central and South America)
Family Tyrannidae, New World Flycatchers (America)
„ Oxyruncidae, Sharp-bills (Central and South America)
Family Phytotomidae, Plant-cutters (South America)
„ Pittidae, Pittas (Old World Tropics)
„ Xenicidae, New Zealand Wrens (New Zealand)
„ Philepittidae, Asities or Wattled Ant-thrushes (Madagascar)
Sub-order Menurae
Family Menuridae, Lyre-birds (Australia)
„ Atrichornithidae, Scrub-birds (Australia)
Sub-order Oscines
Family Alaudidae, Larks (Cosmopolitan, one genus in America)
Family Palaeospizidae, *Palaeospiza* (fossil)
„ Hirundinidae, Swallows, Martins (Cosmopolitan)
Family Campephagidae, Cuckoo-shrikes (Old World)
„ Dicruridae, Drongos (Old World Tropics)
„ Oriolidae, Old World Orioles (Old World)
„ Corvidae, Crows, Magpies, Jays (Cosmopolitan)
Family Ptilinorhynchidae, Bower-birds (Australian region)
Family Paradiseidae, Birds of Paradise (Australian region)
Family Paridae, Titmice (Europe, Asia, Africa, North America)
Family Sittidae, Nuthatches (Northern hemisphere, Australia, Madagascar)
Family Hypositttidae, Coral-billed Nuthatches (Madagascar)
Family Certhiidae, Creepers (Europe, Asia, North America, Australia)
Family Chamaeidae, Wren-tits (Oregon and California)
„ Timeliidae, Babbling Thrushes (Old World)
„ Pycnonotidae, Bulbuls (Old World)
„ Cinclidae, Dippers (Northern hemisphere)
„ Troglodytidae, Wrens (Cosmopolitan, except Africa and Australia)
Family Mimidae, Thrashers, Mockingbirds (America)
„ Turdidae, Thrushes (Cosmopolitan)
„ Zeledoniidae, Wren-thrushes (Central America)
„ Paramythiidae, *Paramythia* (New Guinea)
„ Sylviidae, Old World Warblers (Old World)
„ Regulidae, Kinglets, Gold-crests (Northern hemisphere)
Family Muscicapidae, Old World Flycatchers (Old World)
Family Motacillidae, Wagtails, Pipits (Cosmopolitan)
„ Enicuridae, Fork-tails (Indo-Malaya)
„ Bombycillidae, Waxwings (mainly northern hemisphere)
Family Ptilogonatidae, Silky Flycatchers (Tropical America)
Family Dulidae, Palm-chats (West Indies)
„ Artamidae, Wood-swallows (Africa, India, Australia)
Family Vangidae, Vanga Shrikes (Madagascar)
„ Laniidae, Shrikes (Cosmopolitan except South America)
Family Prionopidae, Wood-shrikes (Old World Tropics)
Family Aërocharidae, Helmet-birds (Madagascar)
„ Cyclarhidae, Pepper-shrikes (Central and South America)
Family Vireolaniidae, Shrike-vireos (Central and Northern South America)
Family Sturnidae, Starlings (Old World)
„ Graculidae, Glossy Starlings (Old World)
„ Meliphagidae, Honey-eaters (Australian region)
„ Nectariniidae, Sun-birds (Africa, Asia, Australia)
Family Dicaeidae, Flower-peckers (West Africa, Indo-Malaya, Australia)
Family Zosteropidae, White-eyes (Africa, Asia, Australasia)
Family Vireonidae, Vireos (America)
„ Coerebidae, Honey-creepers (Tropical America)
Family Drepanididae, Hawaiian Honey-creepers (Hawaiian Islands)
Family Mniotiltidae, Wood Warblers (America)
„ Ploceidae, Weaver-finches (Africa, South Asia, Australia)
Family Icteridae, New World Blackbirds, Troupials (America)
Family Procniatidae, Swallow-Tanagers (America)
„ Thraupidae, Tanagers (America)
Family Catamblyrhynchidae, Plush-capped Finches (Northern Andes)
Family Fringillidae, Grosbeaks, Finches, Buntings (Cosmopolitan)

[Fossil Families of uncertain Systematic position]
Enaliornithidae, *Enaliornis*
Gastornithidae, *Gastornis*
Opisthodactylidae, *Opisthodactylus*

See BIRD, BIRD SANCTUARIES, PROTECTION OF BIRDS, NATURE RESERVES, VERTEBRATE EMBRYOLOGY, VERTEBRATA, REPTILES.

BIBLIOGRAPHY.—The literature of ornithology is extensive and important, and works on birds appear in increasing numbers annually. The following list of books is intended merely to indicate a few useful works for consultation from which general information may be obtained, and which will assist the student by references to other works. The titles are grouped for convenience under several headings.

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ECONOMIC ORNITHOLOGY

The method of analysing the food of birds has been described. An instance may be added. The skylark requires about 6 lb. of food per year; in other words 10,000 larks would require about 27 tons of food in a year. Knowing the percentages of food eaten by this species, it is possible to analyse this figure. Of the total bulk of food consumed in a year 35·5% consists of injurious insects, 3·5% of neutral insects, 2·5% of beneficial insects, 9·5% of grain, 1% of leaves, 2% of earthworms, 1% of slugs, 1·5% of miscellaneous animal matter, and 43·5% of weed seeds. In other words, the lark benefits the farmer in regard to 36·5% of its food eaten, is neutral in respect of 50·5%, and injurious only in respect of 13%. If the debit and credit account is further examined it shows on the former side a loss of 2½ tons of cereals, and on the latter something like 30,000,000 injurious insects and 30,000 slugs. Such a plague of insects left to themselves would have destroyed many more tons of cereals, root crops, etc. Thus the farmer is undoubtedly the gainer from the activities of this bird by an enormous tonnage of produce.

Some species of wild birds are injurious because they are too numerous, and as a result there are too many birds feeding upon the same kind of food in a given area, in consequence of which certain species supplement their diet by feeding upon cultivated crops. No better instance of this can be found than the European house sparrow. It has been estimated that in Great Britain alone the losses due to this species reach the incredible figure of £8,000,000 a year. Wherever it has been introduced it has increased and spread with startling rapidity, and proved an enemy to the cultivator.

The contention that insectivorous birds do more harm than good by attacking beneficial insects and parasitized caterpillars does not appear to be well founded. Similarly those species which feed largely upon the seeds of weeds have been regarded as beneficial, but it is now known that many of these species act as distributors of the seeds.

The Feeding of Nestlings.—During the first few days of life nestlings consume daily considerably more than their own weight of food and add 20 to 50% to their weight. From sunrise to sunset feeding continues, 200 to 300 visits being paid to the nest by the parent birds. With the exception of doves and pigeons, and aquatic and raptorial species, the food brought to the young consists of caterpillars, soft-bodied insects, spiders, worms and slugs. Moreover, during the whole of the nesting period the parent birds are feeding upon food similar to that fed to the young. "Few people," states H. C. Bryant, "have any realization of the great quantities consumed by birds. For instance, if we consider that there is an average of one meadow lark to every two acres of available land for cultivation (11,000,000ac.) in the Sacramento and San Joaquin valleys, and that each pair of birds raises an average of four young, each one of which averages one ounce in weight while in the nest, and consumes half of its own weight of food each day, it takes over 343½ tons of insect food each day to feed the young birds in the great valleys alone."

It is difficult to bring home to the mind by an expression of figures the millions of caterpillars, grubs, flies, beetles, etc., that birds consume. Careful investigations have shown that the British song thrush during the breeding season, April to June, consumes on an average 10,080 caterpillars, flies, grubs, etc., per month; assuming that there are 100,000 of these birds in the British Isles, they would account for 3,024,000,000 insects, etc., weighing upwards of 520 tons. Such a number are capable of destroying in three months upwards of 65,000 tons of produce, and assuming that this was worth £5 per ton, the activities of the thrushes would result in a saving of £325,000. Other species are equally beneficial, so that these figures might be multiplied by 20 or 30, thus showing a saving of produce every spring approaching ten millions sterling.

COMMERCIAL USES

Game.—Commercially, birds are utilized in various ways. Some are used as food, others are valued for their plumage and others for their guano.

Most game-birds are beneficial to agriculture. While accurate statistics are difficult to obtain, there is a larger consumption of such birds to-day than ever, and most nations have enacted special laws for their preservation. When and where such laws do not exist the danger of extermination is very great. In practically all cases the preservation of game-birds has, economically, proved of great value.

Eggs.—The eggs of various species of wild birds are highly esteemed as food, and large quantities are annually gathered, but

here again there is the same tendency toward extermination unless the gatherings are limited, or close seasons instituted.

Feathers.—The feathers of birds are commercially of considerable value apart altogether from the demand of the millinery trade. There is a large trade carried on for upholstery purposes in which the feathers of gulls, guillemots, puffins, ducks and the domestic fowl are utilized. The soft feathers or down of the eider-duck are preferred to all others owing to their superior warmth, lightness and elasticity. Large quantities are imported from Iceland, Greenland and the Faeroe islands. The great mercantile value of the plumes of the ostrich has led to the establishment of ostrich farms, which yield considerable profits.

What is known as the plumage trade, *i.e.*, the trade in birds' feathers for millinery purposes, has, quite apart from many very repulsive aspects, led to more wanton destruction of certain species of birds than all other causes combined. The almost complete extinction of the egrets in the United States and the appalling destruction of birds of paradise, gulls, terns, grebes, tanagers, orioles, bluebirds and numerous other small birds is a blot on present-day civilization. Restrictive measures have been, or are being, taken in many countries.

Guano.—Prior to the introduction of artificial manures, guano from the various islands of the Pacific ocean was greatly sought after. Although utilized by the Peruvians over three centuries ago, it was not until the middle of the 19th century that it assumed any importance as an article of commerce. So great was the demand that the better qualities were soon exhausted, and the poorer ones proved unprofitable when compared with the better artificial fertilizers. Small quantities are still collected. Schemes for protection and conservation of the birds and their product have, however, now been introduced.

Legislation.—In the absence, until recent years, of really comprehensive and reliable statistics with reference to the precise economic status of the different species of wild birds, it is not surprising that the various acts and orders relating to the preservation or destruction of wild birds have proved largely abortive. Many of these have been ill-considered and often hastily prepared, others have been largely selfish in nature, while the advocates of uniform protection have indirectly contributed to the wanton destruction of many useful birds. What would be the probable ultimate effect of such legislation was never seriously considered at the time.

In some countries the principles on which legislation has been based are, that all wild birds are the property of the State, hence that without permission no one has a right to destroy them; the State has the right to impose restrictions and birds may be captured, killed, possessed, etc., only under such conditions as the State enacts; in a like manner landowners can only kill or capture as a privilege and according as the law specifically grants.

International co-operation in Europe as regards the protection of wild birds has proved difficult, so many and diverse are the interests of the different countries. Valuable work has, however, been done by the International Ornithological Congresses and other organizations. An international committee was founded in London in 1922, and the International Treaty of 1916 between Great Britain and the United States of America for the protection of migratory birds constitutes one of the most important and far-reaching measures in the history of wild bird protection.

The immediate need of the present is for (1) wide and comprehensive measures that will ensure protection to all non-injurious and beneficial wild birds, and provide adequate repressive measures for those species which have, or do, become too numerous and destructive: (2) the establishment of an ornithological bureau, which would have full control of all matters relating to wild birds, including game-birds. Such an organization should be the sole authority for framing new laws or making special local orders, and for granting licences to persons to collect birds or their eggs for scientific or other purposes, or to destroy birds which the bureau considers to be injurious. Such a bureau would of course be in close touch with other similar bodies, so that international action could be taken where desirable. (*See* EGG; FEATHER.)

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ORNITHOPTER, a flying machine with flapping wings operated either mechanically or manually. The type is of historic interest only, and represents man's attempt to imitate the flight of birds. Its failure may be ascribed mainly to two causes. With all that high speed photography can tell us, with all our knowledge of aerodynamics, and despite our achievement of flight in aeroplanes, we know little in detail of the mechanism of bird flight. Earlier generations, with none of these advantages, could discover little by watching the flight of live birds and examining their dead bodies. The inadequacy of human muscular power was not realized, nor yet the fact that the muscles which operate a bird's wings comprise about one sixth of its total weight.

The ornithopter presents mechanical problems of great difficulty, and even if these could be solved satisfactorily it could be only at the expense of a large increase of weight. With most birds, flapping is a means of propulsion rather than of generation of a lifting force, except at the moments of arising and alighting. The loss in the propulsive mechanism of an aeroplane (the air-screw), which amounts to some 25% of the power of the engine, might conceivably be appreciably reduced by some means of combining the functions of lifting and propelling in one surface—the wings. But from general experience rotational motion is much more easily and efficiently obtained from a mechanism than is an oscillating motion. (*See* HELICOPTER; GYROPLANE; FLIGHT; FLYING.) (W. S. F.)

ORODES (also called HYRŌDES, Pers. *Hurauda*), the name of two Parthian kings.

1. ORODES I., son of Phraates III., whom he murdered in 57 B.C., assisted by his brother Mithradates III. This Mithradates was made king of Media, but soon afterwards was expelled by Orodes and fled into Syria. Thence he invaded the Parthian kingdom, but having reigned for a short time (55) was besieged by Surenas, general of Orodes, in Seleucia, and after a prolonged resistance was captured and slain. Meanwhile Crassus had begun his attempt to conquer the east, but he was defeated and killed in 53 at Carrhae by Surenas, while Orodes himself invaded Armenia and forced King Artavasdes, the son of Tigranes, to abandon the Romans. By the victory of Carrhae the countries east of the Euphrates were secured to the Parthians. In the next year they invaded Syria, but with little success, for Surenas, whose achievements had made him too dangerous, was killed by Orodes (Plut. *Crass.* 33), and Pacorus, the young son of the king, was defeated by C. Cassius in 51. During the civil war the Parthians sided first with Pompey and then with Brutus and Cassius, but took no action until 40 B.C., when Pacorus, assisted by the Roman deserter Labienus, conquered a great part of Syria and Asia Minor, but was defeated and killed by Ventidius in 38. (*See* PACORUS.) The old king, Orodes, who was deeply afflicted by the death of his gallant son, appointed his son Phraates IV. successor, but was soon afterwards killed by him (37 B.C.; Dio. Cass. 49.23; Justin 42.4; Plut. *Crassus*, 33). Plutarch relates that Orodes understood Greek very well; after the death of Crassus the *Bacchae* of Euripides were represented at his court (Plut. *Crass.* 33).

2. ORODES II., raised to the throne by the magnates after the death of Phraates V. about A.D. 5, was killed after a short reign on account of his cruelty (Joseph. *Ant.* xviii. 2, 4). (ED. M.)

ORONTES, the ancient name of the chief river of Syria, also called Draco, Typhon, Axius, the last name being probably the name whence has sprung the modern name El-'Āsī (rebel). Taking its rise on the east side of the Beka', it flows northwards expanding into the lake of Homs, and in the plain of Antioch, it is joined by two tributaries, the Afrīn and Kara-su. It reaches the

sea near the small port of Suedia (Seleucia Pieriae). In its 170m. course it is mainly unnavigable and of small value for irrigation. Its valley, however, has served as a highway for armies and trade between Egypt and Palestine, and Asia Minor.

OROPUS, a Greek seaport, on the Euripus, in the district *Peraïkè*, opposite Eretria. A border city between Boeotia and Attica, it was a continual cause of dispute; but falling finally to Athens, it was always an Attic town under the Roman empire. The harbour, called Delphinium, was about a mile N. of the city at the mouth of the Asopus. Oropo village occupies the ancient site. The oracle of Amphiaraus, in the territory of Oropus, 12 stadia from the city, has been excavated by the Greek Archaeological Society; it contained a temple, a sacred spring, into which coins were thrown by worshippers, altars, porticoes, and a small theatre, of which the proscenium is well preserved. The oracle was consulted by sleeping on the skin of a slaughtered ram within the sanctuary.

OROSIUS, PAULUS (*fl.* 415), historian and theologian, was born in Spain (possibly at Braga in Galicia) towards the close of the 4th century. Having entered the Christian priesthood, he naturally took an interest in the Priscillianist controversy then going on in his native country, and it may have been in connection with this that he went to consult Augustine at Hippo in 413 or 414. After staying for some time in Africa as the disciple of Augustine, he was sent by him in 415 to Palestine with a letter of introduction to Jerome, then at Bethlehem. The ostensible purpose of his mission (apart, of course, from those of pilgrimage and perhaps relic-hunting) was that he might gain further instruction from Jerome on the points raised by the Priscillianists and Origenists; but in reality, it would seem, his business was to stir up and assist Jerome and others against Pelagius, who, since the synod of Carthage in 411, had been living in Palestine, and finding some acceptance there. The result of his arrival was that John, bishop of Jerusalem, was induced to summon at his capital in June 415 a synod at which Orosius communicated the decisions of Carthage and read such of Augustine's writings against Pelagius as had at that time appeared.

Success, however, was scarcely to be hoped for amongst Orientals who did not understand Latin, and whose sense of reverence was unshocked by the question of Pelagius, *et quis est mihi Augustinus?* All that Orosius succeeded in obtaining was John's consent to send letters and deputies to Innocent of Rome; and, after having waited long enough to learn the unfavourable decision of the synod of Diospolis or Lydda in December of the same year, he returned to north Africa, where he is believed to have died.

The earliest work of Orosius, *Consultatio sive commonitorium ad Augustinum de errore Priscillianistarum et Origenistarum*, explains its object by its title; it was written soon after his arrival in Africa, and is usually printed in the works of Augustine along with the reply of the latter, *Contra Priscillianistas et Origenistas liber ad Orosium*. His next treatise, *Liber apologeticus de arbitrii libertate*, was written during his stay in Palestine, and in connection with the controversy which engaged him there. It is a keen but not always fair criticism of the Pelagian position from that of Augustine. The *Historiae adversum Paganos* was undertaken at the suggestion of Augustine, to whom it is dedicated. The *Hormesta, Ormesta*, or *Ormista*, as it was called, speedily attained a wide popularity.

Nearly two hundred mss. of the Historiae have survived. A free abridged translation by King Alfred is still extant (Old English text, with original in Latin, edited by H. Sweet, 1883). The *editio princeps* of the original appeared at Augsburg (1471); that of Haverkamp (Leiden, 1738 and 1767) has now been superseded by C. Zangemeister, who has edited the *Hist.* and also the *Lib. apol.* in vol. v. of the *Corp. scr. eccl. Lat.* (Vienna, 1882), as well as an edit. min. (Leipzig, Teubner, 1889). The "sources" made use of by Orosius have been investigated by T. de Mörner (*De Orosii vita ejusque hist. libr. vii. adversus Paganos*, 1844); besides the Old and New Testaments, he appears to have consulted Caesar, Livy, Justin, Tacitus, Suetonius, Florus and a cosmography, attaching also great value to Jerome's translation of the *Chronicles* of Eusebius.

ORPEN, SIR WILLIAM NEWENHAM MONTAGUE (1878–), British painter, was born at Stillorgan, co. Dublin, on Nov. 27, 1878, and studied at the Dublin Metropolitan school of Art and at the Slade school, London. He was elected A.R.A. in 1910 and R.A. in 1919. He first exhibited at the New English Art club, of which he became a member in 1900, his early work being marked by preoccupation with spacing and silhouette and the use of quiet harmonies of grey and brown, with a note of vivid red or blue. He soon turned to the use of bright colour and the study of light, seen in a series of brilliant portrait interiors such as the "Hon. Percy Wyndham" (1907), "Myself and Venus" (1910, now in Pittsburgh gallery, U.S.A.). About this time he became well known for his vigorously characterised portraits. During the World War Orpen received an appointment as official artist and in 1918 an exhibition of his war pictures was held in London. Many of these are now in the Imperial War museum. He was created K.B.E. in 1918. He wrote *An Onlooker in France* (1921) and *Stories of Old Ireland and Myself* (1924).

ORPHAN, the term used of one who has lost both parents by death, sometimes of one who has lost father or mother only. In Law an orphan is such a person who is under age. By the custom of the city of London, the lord mayor and aldermen, in the Court of Orphans, have the guardianship of the children still under age of deceased freemen.

In the United States the guardianship of orphans and the administration of their estates is administered by probate, surrogate, county or orphans' courts, the name varying in the different states. The courts appoint a guardian, "next friend," curator or tutor, according to circumstances, to care for the orphan and manage his property. A guardian's powers and privileges are usually limited by statute and by the rulings of the court to which he must report at required intervals.

ORPHEUS. The legendary founder of the cult known as Orphism, ὁ Ὀρφικὸς βίος. The derivation of the name is uncertain, possibly from the same root as ὀρφνή, signifying darkness. What original figure, human or divine, lies behind the legend, is unknown; it seems possible, however, that Orpheus is the name or title of Thraco-Phrygian priest-kings, who may have been regarded as incarnating the god Dionysus (*q.v.*) or some similar deity, and were perhaps killed by the worshippers of the god after a period of years, or when they grew old (*see* Frazer, *Golden Bough*, 3rd ed. vi. 90).

Legend.—Orpheus was the son, in most accounts, of the Thracian king Oeagrus (sometimes of Apollo), and a Muse, generally Calliope, sometimes Polyhymnia. He took part in the Argonautic expedition (*see* ARGONAUTS), and there was an Orphic version of that exploit, preserved in a late form in the Orphic *Argonautica*. The best-known episode of his career is that of his marriage. His wife Eurydice was bitten by a serpent (while fleeing from Aristaeus, according to Virgil, *Georg.*, iv., 457; this detail is not found earlier, but the story itself is old and widespread; *see* Rose in *Aberystwyth Studies*, iv. p. 21). Orpheus, inconsolable at her death, went down to Hades to get her back. The infernal deities, softened by his music, allowed her to return, on condition that she should walk behind Orpheus and he should not look back. He broke this condition, and she became a ghost once more (Plato, *Sympos.* 179 D., seems to allude to a slightly different account). He now refused to have anything more to do with women, and consequently the Thracian women, during a Dionysiac orgy, set upon him and tore him to pieces. His head floated down the Hebrus and finally came ashore on Lesbos, where there was apparently an oracular shrine of Orpheus. The legend may be founded on the practice of the *omophagia* (*see* DIONYSUS).

Orpheus is represented as a musician so marvellous that the wild beasts, and even trees and rivers, came to listen to him. He is also represented as a seer, a founder of mystic rites, particularly Dionysiac, a magician, and later as an astrologer also. Sometimes his adventures tend to be assimilated to the stock incidents in the career of a philosopher, for he is represented as travelling in search of knowledge (as Plato, for example, is said to have visited Egypt). Several writers speak of him as a sort of missionary of civilization (*e.g.*, Aristophanes, *Frogs*, 1032, Horace *A.P.*, 391). He is also the reputed author of a number of books, some dating from the time of Peisistratus of Athens (*cf.* ONOMACRITUS).

The Orphic Doctrines and "Life".—There was no Orphic Church but there existed a number of *thiasoi* (conventicles) of initiates into the Orphic mysteries, all having a similar doctrine and rules of life, but lacking any sort of central organization and probably having no common standard of orthodoxy. Orphic initiators (*ὀρφεοτελεσταί*) were numerous, and are spoken of with the utmost contempt by Plato and others. We hear of Orphism from about the 6th century on, and the doctrine, which seems to have grown out of a combination of the Thraco-Phrygian worship of Dionysus with certain religious speculations characteristic of that age, and probably resulting from the contact of Greece with the East, was in outline as follows. When Zagreus was devoured by the Titans (*see* DIONYSUS) and they were consumed by the thunderbolt, man sprung from their ashes. Hence man is partly divine (Zagreus), partly desperately wicked (the Titans). It is his chief end to get rid of the latter element, which is accomplished by a life of ritual and moral purity during the soul's incarnation in a series of bodies. When completely purified, it will be freed from the "circle of birth or becoming" (*κύκλος τῆς γενέσεως*) and be made fully divine. The rules of purity included abstinence from animal food of all kinds, avoidance of polluting actions, such as contact with death or birth, wearing of white garments and other ascetic practices. There were mysteries of some kind, at which we may conjecture that the death of Zagreus was enacted (*see* MYSTERY), also various Dionysiac practices, such as the *omophagia*. In some cases, at least, the Orphic dead were provided with extracts from the sacred writings of their sect, inscribed on gold tablets, containing directions for their conduct in the underworld. Several of these have been recovered (*see* next paragraph). The influence of Orphism on Pythagoreanism was very great, so much so that it is often impossible to separate the two, although one was primarily a religion, the other a system of philosophy.

Orphic Literature.—A great number of books existing in antiquity were ascribed to Orpheus, or his son Musaeus. This literature was well known to Pindar and Euripides, and exercised great influence, directly or through Pythagoreanism, on Plato, and probably on Socrates also (*see* A. E. Taylor, *Varia Socratica*). It is now lost save for (1) the gold tablets already mentioned, which clearly contain extracts from a poem dealing with the underworld, (2) a collection of hymns of late date, (3) *Lithica* (on the virtues of minerals) and the *Argonautica*, also late. There are, however, numerous quotations in writers of various dates, which together make up a large collection of fragments, some early and undoubtedly genuine Orphic, others much later, including palpable forgeries, showing Jewish and other foreign influence. A principal source for these is the controversialists, Christian and pagan, of the 3rd and 4th centuries A.D. Among editions may be mentioned E. Abel, *Orphica* (1885); O. Kern, *Orphicorum fragmenta* (1922). The former contains the hymns, *Lithica* and *Argonautica*.

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On the representations of Orpheus in heathen and Christian art (in which he is finally transformed into the Good Shepherd with his sheep), *see* A. Baumeister, *Denkmäler des classischen Altertums*, ii. p. 1,120; P. Knapp, *Über Orpheusdarstellungen* (Tübingen, 1895); F. X. Kraus, *Realencyklopädie des christlichen Alterthums*, ii., (1886); J. A. Martigny, *Dictionnaire des antiquités chrétiennes* (1889); A. Heussner, *Die altchristlichen Orpheusdarstellungen* (Leipzig, 1893); R. Eisler, *Vorträge der Bibliothek Warburg 1922–23, ii. Teil*, (1925); and the articles in Roscher's and Daremberg and Saglio's Lexicons.

The story of Orpheus, as was to be expected of a legend told both by Ovid and Boethius, retained its popularity throughout the middle ages and was transformed into the likeness of a northern fairy tale. In English mediaeval literature it appears in three somewhat different versions: *Sir Orpheo*, a "lay of Brittany" printed from the Harleian ms. in J. Ritson's *Ancient English Metrical Romances*, vol. ii. (1802); *Orpheo and Heurodis* from the Auchinleck ms. in David Laing's *Select Remains of the Ancient Popular Poetry of Scotland* (new ed. 1885); and *Kyng Orfew* from the Ashmolean ms. in J. O. Halliwell's *Illustrations of Fairy Mythology* (Shakespeare Soc., 1842). The poems show traces of French influence.

ORPIMENT, a native arsenic trisulphide, As_2S_3. The pigment is artificially prepared under the name "king's yellow" and varies in colour from yellow to red according to the particle size. Owing to its poisonous nature and lack of permanence, it is no longer used as an artist's colour but is employed to some extent in pigmenting rubber. *See* PAINTS, CHEMISTRY OF; REALGAR.

ORPINGTON, a residential town of Kent, England, 13¾ m. S.E. of London, and 2½ m. S. by E. of Chislehurst, on the S.R. Pop. (1921) 7,047. The church is Early English. An old mansion called the Priory dates in part from 1393. In 1873 John Ruskin set up at Orpington a private publishing house for his works, in the hands of his friend George Allen. Fruit and hops are extensively grown in the neighbourhood. A line of populous villages extends between Orpington and Bexley—St. Mary Cray, St. Paul's Cray, Foots Cray (an urban district), and North Cray.

ORRERY[1], CHARLES BOYLE, 4th EARL OF (1676–1731), British author, soldier and statesman, the second son of Roger, 2nd earl, born at Chelsea, was educated at Christ Church, Oxford. He translated Plutarch's life of Lysander, and published an edition of the epistles of Phalaris, which engaged him in the famous controversy with Bentley. Orrery was imprisoned for a short time in 1721 on suspicion of being concerned in Layer's Jacobite plot. He died on Aug. 28, 1731. Among the works of Roger, earl of Orrery, will be found a comedy, entitled *As you find it*, written by Charles Boyle.

ORRERY, ROGER BOYLE, 1ST EARL OF (1621–79), British soldier, statesman and dramatist, 3rd surviving son of Richard Boyle, 1st earl of Cork, was born on April 25, 1621, created baron of Broghill on Feb. 28, 1627, and educated at Trinity college, Dublin, and, according to Wood, also at Oxford. He travelled in France and Italy, and coming home took part in the expedition against the Scots. He returned to Ireland on the outbreak of the rebellion in 1641 and fought with his brothers at the battle of Liscarrol in September 1642. On the resignation of the marquis of Ormonde, Lord Broghill consented to serve under the parliamentary commissioners till the execution of the king, when he retired from public life. He was engaged in royalist schemes, however, when Cromwell visited him, and, explaining that he knew all about his activities, offered him a chance of clearing himself by serving the Commonwealth in Ireland. He accepted, and served Cromwell faithfully throughout the Irish campaign.

Orrery was returned to Cromwell's parliaments of 1654 and 1656 as member for the county of Cork, and also in the latter assembly for Edinburgh, for which he elected to sit. He served that year as lord president of the council in Scotland; and when he returned to England he was included in the inner cabinet of Cromwell's council, and was nominated in 1657 a member of the new House of Lords. On Cromwell's death he gave his support to Richard; but as he saw no possibility of maintaining the government he left for Ireland, where by resuming his command in Munster he secured the island for Charles and anticipated Monk's overtures by inviting him to land at Cork. He sat for Arundel in the Convention and in the parliament of 1661, and at the Restoration was taken into great favour. On Sept. 5, 1660, he was created earl of Orrery. The same year he was appointed a lord justice of Ireland and drew up the act of Settlement. He continued to exercise his office as lord-president of Munster till 1668, when he resigned it on account of disputes with the duke of Ormonde, the lord-lieutenant. On Nov. 25 he was impeached by the House of Commons for "raising of money by his own authority upon his majesty's subjects," but the proceedings were interrupted by the prorogation of parliament and were not afterwards renewed. He died on Oct. 26, 1679.

In addition to Lord Orrery's achievements as a statesman and admin-

[1]The orrery, an astronomical instrument—consisting of an apparatus which illustrates the motions of the solar system by means of the revolution of balls moved by wheelwork—invented, or at least constructed, by Graham, was named after the earl.

istrator, he gained some reputation as a writer and a dramatist. He was the author of *An Answer to a Scandalous Letter . . . A Full Discovery of the Treachery of the Irish Rebels* (1662), printed with the letter itself in his *State Letters* (1742), another answer to the same letter entitled *Irish Colours Displayed . . .* being also ascribed to him; *Parthenissa*, a novel (1654); *English Adventures by a Person of Honour* (1676), whence Otway drew his tragedy of the *Orphan; Treatise of the Art of War* (1677), a work of considerable historical value; poems, of little interest, including verses *On His Majesty's Happy Restoration* (unprinted), *On the Death of Abraham Cowley* (1677), *The Dream* (unprinted), *Poems on most of the Festivals of the Church* (1681); plays in verse, of some literary but no dramatic merit, of which *Henry V.* (1664), *Mustapha* (1665), *Tryphon* (acted 1668), *The Black Prince* (1669), *Herod the Great* (published 1694), and *Altemira* (1702) were tragedies, and *Guzman* (1669) and *Mr. Anthony* comedies. A collected edition was published in 1737, to which was added the comedy *As you find it. The General* is also attributed to him.

AUTHORITIES.—*State Letters of Roger Boyle, 1st Earl of Orrery*, ed. with his life by Th. Morrice (1742); *Add. mss.* (Brit. Mus.) 25,287 (letter-book when governor of Munster), and 32,095 *sqq.* 109–188 (letters); article in the *Dict. of Nat. Biog.* and authorities there collected; Wood's *Athenae Oxonienses*, iii. 1200; *Biographia Britannica* (Kippis); *Orrery Papers*, ed. by Lady Cork and Orrery (1903) (Preface); *Contemporary Hist. of Affairs in Ireland*, ed. by John T. Gilbert (1879–80); *Cal. of State Pap., Irish and Domestic.*

ORRIS-ROOT (apparently a corruption of "iris root"), the rhizomes or underground stems of three species of *Iris*, *I. germanica*, *I. florentina* and *I. pallida*, closely allied plants growing in subtropical and temperate latitudes, but principally identified with north Italy. The three plants are indiscriminately cultivated in the neighbourhood of Florence as an agricultural product under the name of "ghiaggiuolo." The rhizomes are in August dug up and freed of the rootlets and brown outer bark; they are then dried and packed in casks for sale. In drying they acquire a delicate but distinct odour of violets. It is principally powdered for use in dentifrices and other scented dry preparations.

ORSHA (Polish, Orsza), a town of the White Russian S.S.R., in 54° 34′ N., 30° 20′ E., on the Dnieper river, and at a junction on the Moscow-Warsaw railway. Pop. (1926) 21,311. It is an entrepôt for grain and timber and has iron works and a brewery. An electric plant was under construction in 1928. It is mentioned in the annals in 1067 as Rsha and was captured by the Lithuanians in the 13th century. A Polish Jesuit college was founded here in 1604. During the 16th and 17th centuries it was several times besieged by the Russians, and finally annexed 1772. Near it is the Jewish town of Dubrovno, which joined in the 1905 revolution and from which a band of Jewish youths set out for Orsha to defend the Jews against a pogrom, but perished in the attempt.

ORSINI, the name of a Roman princely family of great antiquity. According to tradition the popes Paul I. (757) and Eugenius II. (824) were of the Orsini family, but the probable founder of the house was a certain Ursus (the Bear), about whom very little is known, and the first authentic Orsini pope was Giacinto Orsini, son of Petrus Bobo, who assumed the name of Celestin III. (1191). The latter endowed his nephews with church lands and founded the fortunes of the family, which alone of the Guelph houses was able to confront the Ghibelline Colonna. "Orsini for the church" was their war-cry in opposition to "Colonna for the people." In the 13th century the "Sons of the Bear" were already powerful and rich, and under Innocent III. they waged incessant war against other families, including that of the pope himself (Conti). In 1241 Matteo Orsini was elected senator of Rome, and sided with Pope Gregory IX. against the Colonna and the Emperor Frederick II., saving Rome for the Guelphic cause. In 1266 the family acquired Marino, and in 1277 Giovanni Orsini was elected pope as Nicholas III.

When Boniface VIII. proclaimed a crusade against the Colonna in 1297, the Orsini played a conspicuous part in the expedition and captured Nepi, which the pope granted them as a fief. On the death of Benedict XI. (1304) fierce civil warfare broke out in Rome and the Campagna for the election of his successor, and Cardinal Napoleone Orsini appears as the leader of the French faction at the conclave. The Campagna was laid waste by the feuds of the Orsini, the Colonna and the Caetani. At this time the Orsini held the castle of S. Angelo, and a number of palaces on the Monte Giordano, which formed a fortified and walled quarter. In 1332, during the absence of the popes at Avignon, the feuds between Orsini and Colonna, in which even Giovanni Orsini, although cardinal legate, took part, reduced Rome to a state of complete anarchy. The Orsini were again at war with the Colonna at the time of Rienzi. In 1435 Francesco Orsini was appointed prefect of Rome, and created duke of Gravina by Pope Eugenius IV. In 1484 war between the Orsini and the Colonna broke out once more, the former supporting the pope (Sixtus IV.). Virginio Orsini led his faction against the rival house's strongholds, which were stormed, the Colonna being defeated.

The Orsini fortunes waxed and waned many times, and their property was often confiscated, but they always remained a powerful family and gave many soldiers, statesmen and prelates to the church. The title of prince of Solofra was conferred on them in 1620, and that of prince of the Holy Roman empire in 1629. In 1724 Vincenzo Maria Orsini was elected pope (Benedict XIII.) and gave his family the title of Roman princes.

See F. Sansovino, *Storia di casa Orsina* (Venice, 1565); F. Gregorovius, *Geschichte der Stadt Rom* (Stuttgart, 1872); A. von Reumont, *Geschichte der Stadt Rom* (1868); *Almanach de Gotha.*

ORSINI, FELICE (1819–1858), Italian revolutionist, was born at Meldola in Romagna. He joined the Giovane Italia, a society founded by Giuseppe Mazzini. Implicated together with his father in revolutionary plots, he was arrested in 1844 and condemned to imprisonment for life. The new pope, Pius IX., released him, and he led a company of young Romagnols in the first war of Italian independence (1848). He was elected member of the Roman constituent assembly in 1849, and after the fall of the republic he conspired against the papal autocracy once more in the interest of the Mazzinian party. Mazzini sent him on a secret mission to Hungary, but he was arrested in 1854 and imprisoned at Mantua, escaping a few months later. His account of his prison experiences, *Austrian Dungeons in Italy* (1857), led to a rupture between him and Mazzini.

He then formed a plot to assassinate Napoleon III., whom he regarded as the principal obstacle to Italian independence. On the evening of Jan. 14, 1858, while the emperor and empress were on their way to the theatre, Orsini and his accomplices threw three bombs at the imperial carriage. The intended victims were unhurt, but several other persons were killed or wounded. Orsini was arrested; on Feb. 11, he wrote a letter to Napoleon, exhorting him to take up the cause of Italian freedom. He addressed another letter to the youth of Italy, stigmatizing political assassination. He was executed on March 13, 1858. Of his accomplices Pieri also was executed, Rudio was condemned to death but obtained a commutation of sentence, and Gomez was condemned to hard labour for life. Orsini's attempt terrified Napoleon, who may have been so induced to take up Italy's cause.

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ORTA, LAKE OF, in north Italy, west of Lago Maggiore. Its southern end is about 22 m. by rail N.W. of Novara on the main Turin-Milan line, while its north end is about 4 m. by rail S. of the Gravellona-Toce railway station. It has an area of about 6½ sq.m., it is about 8 m. in length, its greatest depth is 469 ft., and the surface is 951 ft. above sea-level, while its width varies from ½ to 1¼ m. The island of San Giulio (just west of the village of Orta) has a picturesque church. The chief place is Orta, on a peninsula projecting from the east shore of the lake, while Omegna is at its northern extremity. The lake is the remnant of a larger sheet of water by which the waters of the Toce flowed south towards Novara. As the glaciers retreated the waters flowing from them sank, and were gradually diverted into Lago Maggiore. This explains why no considerable stream feeds the Lake of Orta, while at its north end the Nigoglia torrent flows out of it, ultimately joining Lago Maggiore.

ORTELIUS (WORTELS), **ABRAHAM** (1527–1598), next to Mercator the greatest geographer of his age, was born at Antwerp on April 14, 1527, and died in the same city on July 4, 1598. He

was of German origin, his family coming from Augsburg. He travelled extensively in western Europe. Beginning as a map-engraver, he became a merchant, and most of his journeys before 1560 were for commercial purposes. In 1560, however, when travelling with Gerhard Kremer (*see* MERCATOR, GERHARDUS), he became interested in scientific geography and began to prepare that atlas or *Theatre of the World* by which he became famous. In 1564 he completed a *mappemonde*, which afterwards appeared in the *Theatrum*. In 1570 (May 20) was issued, by Gilles Coppens de Diest at Antwerp, Ortelius' *Theatrum Orbis Terrarum*, the "first modern atlas" (of 53 maps). Many editions, Flemish, Latin and German, appeared in his lifetime. Most of the maps were admittedly reproductions (a list of 87 authors is given by Ortelius himself), and many discrepancies of delineation or nomenclature occur; but, taken as a whole, this atlas with its accompanying text was a monument of rare erudition and industry. In 1573 Ortelius published 17 supplementary maps under the title of *Additamentum Theatri Orbis Terrarum*.

In 1575 Ortelius was appointed geographer to the king of Spain, Philip II., on the recommendation of Arius Montanus, who vouched for his orthodoxy (his family, as early as 1535, had fallen under suspicion of Protestantism). Other important works are: *Synonymia geographica* (1578); *Nomenclator Ptolemaicus* (1584); his *Parergon* (a series of maps illustrating ancient history, sacred and secular), and his *Itinerarium per nonnullas Galliae Belgicae partes*, a record of a journey in Belgium and the Rhineland made in 1575; an edition of Caesar (*C. I. Caesaris omnia quae extant*, Leyden, Raphelingen, 1593), and the *Aurei saeculi imago, sive Germanorum veterum vita* (Philippe Galle, Antwerp, 1596). He also aided Welser in his edition of the Peutinger Table in 1598. His death and burial (in St. Michael's Abbey church) in 1598 were marked by public mourning.

See Emmanuel van Meteren, *Historia Belgica* (Amsterdam, 1670); General Wauwermans, *Histoire de l'école cartographique belge et anversoise* (Antwerp, 1895), and article "Ortelius" in *Biographie nationale* (Belgian), vol. xvi. (Brussels, 1901); J. H. Hessels, *Abrahami Ortelii epistulae* (Cambridge, England, 1887); Max Rooses, *Ortelius et Plantin* (1880); Génard, "Généalogie d'Ortelius," in the *Bulletin de la Soc. roy. de Géog. d'Anvers* (1880 and 1881).

ORTHEZ, a town of S.W. France, department of Basses-Pyrénées, 25 m. N.W. of Pau on the Southern railway. Pop. (1926) 4,097.

At the end of the 12th century Orthez passed from the viscounts of Dax to the viscounts of Béarn, who resided there in the 13th century. Jeanne d'Albret founded a Calvinist university in the town and Theodore Beza taught there for some time. An envoy sent in 1569 by Charles IX. to revive the Catholic faith was besieged in Orthez which was taken by the Protestant captain, Gabriel, count of Montgomery. In 1684 Nicholas Foucault, intendant under Louis XIV., was more successful, as the inhabitants, ostensibly at least, renounced Protestantism, which however is still strong there. It stands on the right bank of the Gave de Pau here crossed by a 14th century bridge with four arches and surmounted by a central tower. The Tour de Moncade, a pentagonal tower of the 13th century, was once the keep of a castle of the viscounts of Béarn, and is now used as a meteorological observatory. The work of spinning and weaving cotton, especially of the fabric called *toile de Béarn*, the manufacture of paper and of leather, and the preparation of hams known as *jambons de Bayonne* and of other delicacies are carried on.

ORTHOCLASE, an important rock-forming mineral belonging to the felspar group (*see* FELSPAR). (Gr. ὀρθός, "right," and κλᾶν, "to break.") The mineral, so named by A. Breithaupt in 1823 in allusion to the right-angled intercleavage angle, has the composition $KAlSi_3O_8$ but commonly contains significant proportions of the corresponding $NaAlSi_3O_8$ compound in solid solution.

Included under orthoclase are the varieties known as adularia and sanidine, the former occurring in druses in granites and crystalline schists, the latter as glassy crystals enclosed in lavas and dike rocks. The apparent symmetry of orthoclase is that of a monoclinic crystal with the two prominent cleavages 001 and 010 at right angles. The crystals show considerable variety of habit, prismatic, as in adularia, elongated along the edge 001 : 010 as in crystals from the Baveno granite quarries, and tabular on the clinopinacoid as in sanidine. The simple Carlsbad type of twinning is exceedingly common.

Orthoclase melts incongruently at 1,170° C with formation of leucite (*q.v.*). As a primary mineral it is an essential constituent of many acidic igneous rocks, in granites, porphyries, syenites and trachytes, while the variety sanidine is practically wholly limited to surface lavas and associated dike rocks. It is common as a constituent of thermally altered argillaceous sediments but its place in the crystalline schists is usually taken by microcline (*q.v.*).

(C. E. T.)

ORTHODONTIA, a special department of dentistry concerned with the prevention and correction of irregular and of malposed teeth. Orthodontic treatment is usually effected by means of the spring force of delicate wires attached to the teeth. The earliest attempt in the literature at systematic treatment of orthodontia was by Fauchard in 1728. In 1836 Kniesel published a special work on the subject. Between these two it was variously treated by several writers in the field of mechanical dentistry (Bunon 1742; Burdot 1757; Fox 1803; Delebarre 1806). At the beginning of the 20th century in America orthodontia emerged from the general field of mechanical dentistry as a recognized specialty. Its advent was heralded by the appearance of many "systems of regulating." These "systems" were marketable combinations of mechanical appliances designed to effect various movements of the teeth, and were identified by the names of their inventors (Angle, Case, Jackson *et al*). While this period of the exploitation of apparatus undoubtedly was a great stimulus to the development of technique, the literature which it evoked took the form of personal opinion rather than the presentation of scientific evidence. Expert technicians soon demonstrated the limitations of the mechanical conception of the subject whereupon interest centred in its biological aspect. Since then the results of treatment have been more satisfactory. Great advances have been made in America where specialization is more common while the conservative influence of the dental profession in Great Britain and European countries has acted as a stabilizing force in its growth. The condition of irregular and malposed teeth, *i.e.*, malocclusion, may be caused by bad diet in both its chemical and physical aspects (Howe, McCollum, Mellanby). Habits of infancy and childhood as thumb-sucking, tongue-biting and mouth-breathing, and mutilations from trauma and disease are also important causes. In fact any abnormal function in or about the mouth when persisted in may result in irregular and malposed teeth.

(A. L. J.)

ORTHODOX EASTERN CHURCH (frequently spoken of as "the Greek Church," and described officially as "The Holy Orthodox Catholic Apostolic Eastern Church"), the historical representative of the churches of the ancient East. It consists of (*a*) those churches which accepted all the decrees of the first seven general councils, and have remained in full communion with one another, (*b*) such churches as derived their origin from these by missionary activity, or by abscission without loss of communion.

Origins of the Greek or Eastern Church.—Christianity arose in the East, and Greek was the language of the Scriptures and early services of the church, but when Latin Christianity established itself in Europe and Africa, and when the old Roman empire fell in two, and the eastern half became separate in government, interests and ideas from the western, the term Greek or Eastern Church acquired gradually a fixed meaning. It denoted the church which included the patriarchates of Antioch, Alexandria, Jerusalem and Constantinople, and their dependencies. The ecclesiastical division of the early church, at least within the empire, was based upon the civil. Constantine introduced a new partition of the empire into dioceses, and the church adopted a similar division. The bishop of the chief city in each diocese naturally rose to a pre-eminence, and was commonly called *exarch*—a title borrowed from the civil jurisdiction. In process of time the common title *patriarch* was restricted to the most eminent of these exarchs, and councils decided who were worthy of the dignity. The council of Nicaea recognized three patriarchs—the bishops of Rome, Alexandria and Antioch. To these were after-

wards added the bishops of Constantinople and Jerusalem.

When the empire was divided, there was one patriarch in the West, the bishop of Rome, while in the East there were at first two, then four and latterly five. This geographical fact has had a great deal to do in determining the character of the Eastern Church. It is not a despotic monarchy governed from one centre and by a monarch in whom plenitude of power resides. It is an oligarchy of patriarchs. It is based, of course, on the great body of bishops; but episcopal rule, through the various grades of metropolitan, primate, exarch, attains to sovereignty only in the five patriarchal thrones. Each patriarch is, within his diocese, what the Gallican theory makes the pope in the universal church. He is supreme, and not amenable to any of his brother patriarchs, but is within the jurisdiction of an oecumenical synod. The schismatic churches of the East have always reproduced the ecclesiastical polity of the church from which they seceded.

The Greek Church, like the Roman, soon spread far beyond the imperial dioceses which at first fixed its boundaries, but it was far less successful than the Roman in preserving its conquests for Christianity. This was due in the main to the differing quality of the forces by which the area covered by the two churches was respectively invaded. Greek Christianity became the religion of the Slavs as Latin Christianity became that of the Germans; but the Orthodox Church never conquered her conquerors.

The great dogmatic work of the Eastern Church was the definition of that portion of the creed of Christendom which concerns *theology proper*—the doctrines of the essential nature of the Godhead, and the doctrine of the Godhead in relation with manhood in the incarnation, while it fell to the Western Church to define *anthropology*, or the doctrine of man's nature and needs.

All the churches of the East, schismatic as well as orthodox, accept unreservedly the decrees of the first two councils. The schismatic churches protest against the additions made to the creeds of Nicaea and Constantinople by succeeding councils. The Niceao-Constantinopolitan creed declared that Christ was *consubstantial* (ὁμοούσιος) with the Father, and that He *had become man* (ἐνανθρωπήσας). Disputes arose when theologians tried to explain the latter phrase. These differences took two separate and extreme types, the one of which forcibly separated the two natures so as to deny anything like a real union, while the other insisted upon a mixture of the two, or an absorption of the human in the divine. The former was the creed of Chaldaea and the latter the creed of Egypt; Chaldaea was the home of Nestorianism, Egypt the land of Monophysitism. The Nestorians accept the decisions of the first two councils, and reject the decrees of all the rest as unwarranted alterations of the creed of Nicaea. The Monophysites accept the first three councils, but reject the decree of Chalcedon and all that come after it. They gave rise to numerous sects and to at least three separate national churches,—the Jacobites of Syria, the Copts of Egypt, and the Abyssinian church, which are treated under separate headings. (*See* also NICAEA [COUNCIL OF]; CHALCEDON [COUNCIL OF]; NESTORIUS; NESTORIANS; MONOPHYSITES.)

CONFLICT WITH ROME

The relation of the Byzantine Church to the Roman may be described as one of growing estrangement from the 5th to the 11th century, and a series of abortive attempts at reconciliation since the latter date. The estrangement and final rupture may be traced to the increasing claims of the Roman bishops and to Western innovations in practice and in the doctrine of the Holy Spirit, accompanied by an alteration of creed. In the early church three bishops stood forth prominently, principally from the political eminence of the cities in which they ruled —the bishops of Rome. Alexandria and Antioch. The transfer of the seat of empire from Rome to Constantinople gave the bishops of Rome a possible rival in the patriarch of Constantinople, but the absence of an overawing court and of meddling statesmen did more than recoup the loss to the head of the Roman Church. The theological calmness of the West, amid the violent theological disputes which troubled the Eastern patriarchates, and the statesmanlike wisdom of Rome's greater bishops, combined to give a unique position to the pope, which councils in vain strove to shake, and which in time of difficulty the Eastern patriarchs were fain to acknowledge and make use of, however they might protest against it and the conclusions deduced from it.

But this pre-eminence, or rather the Roman idea of what was involved in it, was never acknowledged in the East; to press it upon the Eastern patriarchs was to prepare the way for separation, to insist upon it in times of irritation was to cause a schism. The theological genius of the East was different from that of the West. The Eastern theology had its roots in Greek philosophy, while a great deal of Western theology was based on Roman law. (*See* Stanley's *Eastern Church*, ch. i.) This gave rise to misunderstandings, and at last led to two widely separate ways of regarding and defining one important doctrine—the procession of the Holy Spirit from the Father or from the Father and the Son. Political jealousies and interests intensified the disputes, and at last, after many premonitory symptoms, the final break came in 1054, when Pope Leo IX. smote Michael Cerularius and the whole of the Eastern Church with an excommunication. There had been mutual excommunications before, but they had not resulted in permanent schisms. Now, however, the separation was final, and the ostensible cause of its finality was the introduction by the Latins of two words *Filioque* into the creed. (After the words "and in the Holy Ghost" of the Apostles' Creed the Constantinopolitan creed added "who proceedeth from the Father." The Roman Church, without the sanction of an oecumenical council and without consulting the Easterns, added "and the Son." The addition was first made at Toledo [589] in opposition to Arianism. The Easterns also resented the Roman enforcement of clerical celibacy, the limitation of the right of confirmation to the bishop and the use of unleavened bread in the Eucharist.) It is this addition which was and which still remains the permanent cause of separation.

Doctrines and Creeds.—The Eastern Church has no creeds in the modern Western use of the word, no *normative* summaries of what must be believed. It has preserved the older idea that a creed is an adoring confession of the church engaged in worship; and, when occasion called for more, the belief of the church was expressed more by way of public testimony than in symbolical books. Still the doctrines of the church can be gathered from these confessions of faith. The Eastern creeds may thus be roughly placed in two classes—the oecumenical creeds of the early undivided church, and later testimonies defining the position of the Orthodox Church of the East with regard to the belief of the Roman Catholic and of Protestant Churches. These testimonies were called forth mainly by the protest of Greek theologians against Jesuitism on the one hand, and against the reforming tendencies of the patriarch Cyril Lucaris (*q.v.*) on the other. The Orthodox Greek Church adopts the doctrinal decisions of the seven oecumenical councils, together with the canons of the Concilium Quinisextum or second Trullan council (692); and they further hold that all these definitions and canons are simply explanations and enforcements of the Nicaeo-Constantinopolitan creed and the decrees of the first council of Nicaea. The first four councils settled the orthodox faith on the doctrines of the Trinity and of the Incarnation; the fifth supplemented the decisions of the first four. The sixth declared against Monothelitism; the seventh sanctioned the worship (δουλεία, not ἀληθινὴ λατρεία) of images; the council held in the Trullus (a saloon in the palace at Constantinople) supplemented by canons of discipline the doctrinal decrees of the fifth and sixth councils.

The most important doctrinal testimonies of the Eastern church are (1) the Orthodox confession of catechism of Peter Mogilas, confirmed by the Eastern patriarchs and by the synod of Jerusalem (1643), and (2) the decree of the synod of Jerusalem or the confession of Dositheus (1672). Besides these, the catechisms of the Russian Church should be consulted, especially the catechism of Philaret, which since 1839 has been used in all the churches and schools in Russia.

The Church of Christ is the fellowship of ALL THOSE WHO ACCEPT AND PROFESS ALL THE ARTICLES TRANSMITTED BY THE APOSTLES AND APPROVED BY GENERAL SYNODS. *Without this visible Church there is no salvation.* It is under the abiding influence of

the Holy Ghost, and *therefore cannot err in matters of faith.* Specially appointed persons are necessary in the service of the Church, *and they form a threefold order, distinct jure divino from other Christians, of Bishops, Priests and Deacons.* THE FOUR PATRIARCHS, OF EQUAL DIGNITY, HAVE THE HIGHEST RANK AMONG THE BISHOPS, AND THE BISHOPS *united in a General Council represent the Church and infallibly decide,* under the guidance of the Holy Ghost, all matters of faith and ecclesiastical life. All ministers of Christ must be regularly called and appointed to their office, and are consecrated *by the sacrament of orders. Bishops must be unmarried,* and PRIESTS AND DEACONS MUST NOT CONTRACT A SECOND MARRIAGE. To all priests in common belongs, besides the preaching of the word, the administration of the SIX SACRAMENTS—BAPTISM, CONFIRMATION, PENANCE, EUCHARIST, MATRIMONY, UNCTION OF THE SICK. The *bishops* alone can administer the *sacrament* of orders.

Ecclesiastical ceremonies are part of the divine service; most of them have apostolic origin; and those connected with the sacrament must not be omitted by priests under pain of mortal sin. (This summary has been taken with Corrections from G. B. Winer, *Comparative Darstellung des Lehrbegriffs der verschiedenen Kirchenparteien,* Eng. trans. 1873. Small capitals denote differences from Roman Catholic, italics differences from Protestant doctrine.)

Liturgy and Worship.—The ancient liturgies of the Eastern Church were very numerous but a strong desire for uniformity led to the almost exclusive use of the liturgy of Jerusalem or of St. James in the East. It is used in two forms, a shorter revised by Chrysostom, and a longer called the liturgy of St. Basil. This liturgy and the service generally are either in Old Greek or in Old Slavonic, and frequent disputes have arisen in particular districts about the language to be employed. Both sacred languages differ from the language of the people, but it cannot be said that in the Eastern Church worship is conducted in an unknown tongue—"the actual difference," says Neale, "may be about that between Chaucer's English and our own." There are eleven chief service books, and no such compendium as the Roman breviary. Fasting is frequent and severe. Besides Wednesdays and Fridays, there are four fasting seasons, Lent, Pentecost to SS. Peter and Paul, August 1–15 preceding the Feast of the Sleep of the Theotokos, and the six weeks before Christmas. Indulgences are not recognized; an intermediate and purificatory state of the dead is held but not systematized into a doctrine of purgatory. The Virgin receives homage, but the dogma of her Immaculate Conception is not admitted. While ikons are found in the churches, there is no "graven image" apart from the crucifix.

Monasticism is, as it has always been, an important feature in the Eastern Church. An Orthodox monastery is perhaps the most perfect extant relic of the 4th century. The simple idea that possesses the monks is that of fleeing the world; they have no distinctions of orders, and though they follow the rule of St. Basil object to being called Basilians. A few monasteries (Mt. Sinai and some on Lebanon) follow the rule of St. Anthony. K. Lake in *Early Days of Monasticism on Mount Athos* (1909) traces the development through three well-defined stages in the 9th and 10th centuries—(*a*) the hermit period, (*b*) the loose organization of hermits in lauras, (*c*) the stricter rule of the monastery, with definite buildings and fixed rules under an ἡγούμενος or abbot. (*See* ABBEY, MONASTICISM, and related articles.)

The Branches of the Church.—In addition to the ancient churches which have separated themselves from the Orthodox faith, many have ceased to have an independent existence, owing either to the conquests of Islam or to their absorption by other churches. In the early years of the present century the Orthodox Eastern Church consisted of 12 mutually independent churches (or 13 if we reckon the Bulgarian Church), using their own language in divine service (or some ancient form of it, as in Russia) and varying not a little in points of detail, but standing in full communion with one another, and united as equals in what has been described as one great ecclesiastical federation. However, in using such language it must be remembered that we are not dealing with bodies which were originally separated from one another and have now entered into fellowship, but with bodies which have grown naturally from a single origin and have not become estranged. The most ancient of these divisions depend on the jurisdiction of the four patriarchates. (1) The ancient *Patriarchate of Constantinople* included the imperial dioceses of Pontus, Asia, Thrace and Eastern Illyricum—*i.e.,* speaking roughly, the greater part of Asia Minor, European Turkey, and Greece, with a small portion of Austria. The Oecumenical Patriarch, as he has been called since early in the 6th century, is the most exalted ecclesiastic of the Eastern churches, and his influence reaches far outside the lands of the patriarchate. His jurisdiction extends over the dominions of the Sultan in Turkey, together with Asia Minor and the Turkish islands of the Aegean; there are 82 metropolitans under him, and the "monastic republic" of Mount Athos. He has great privileges and responsibilities as the recognized head of the Greek community in Turkey, and enjoys also many personal honours which have survived from the days of the Eastern emperors. In ecclesiastical affairs the patriarch acts with two governing bodies—(*a*) a permanent Holy Synod (Ἱερὰ Σύνοδος τῆς Ἐκκλησίας Κωνσταντινουπόλεως) consisting of 12 metropolitans, six of whom are re-elected every year from the whole number of metropolitans, arranged in three classes according to a fixed cycle; (*b*) the Permanent National Mixed Council (Διαρκὲς Ἐθνικὸν Μικτὸν Συμβούλιον), a remarkable assembly, which is at once the source of great power by introducing a strong lay element into the administration, and of a certain amount of weakness by its liability to sudden changes of popular feeling. Its members are chosen by an electoral body appointed for the purpose. The election of the patriarch himself is to a considerable extent popular. (2) The *Patriarchate of Alexandria,* consisting of Egypt and its dependencies, was at one time the most powerful, as it was the most centralized, of all; but the secession of the greater part of his church to Monophysitism (COPTIC CHURCH), and the Mohammedan conquest of Egypt, have left him but the shadow of his former greatness. (3) The *Patriarchate of Antioch* has undergone most changes in extent of jurisdiction, arising from the transfer of sees to Jerusalem, from the progress of the schismatic churches of the East and from the conquests of the Mohammedans. The patriarch retains little of his old importance. His jurisdiction includes Cilicia, Syria (except Palestine) and Mesopotamia. (4) The *Patriarchate of Jerusalem* was constituted at the council of Chalcedon in 451, with jurisdiction over Palestine. The inroads of the Saracens reduced its importance, which afterwards depended chiefly on the position and associations of Jerusalem.

In addition to the four patriarchates, the Orthodox Eastern Church, until 1914, consisted of nine national branches or divisions: the ancient Church of Cyprus (*see* CYPRUS, CHURCH OF); the Church of Mount Sinai, consisting of little more than the famous monastery of St. Catherine; the Eastern Orthodox Church in Austria-Hungary, which consisted of the Serbs of Hungary and Croatia, the Rumanians of Transylvania, the Ruthenians of Bukovina, and the Serbs of Bosnia-Herzegovina; and the respective national churches of Russia, Greece, Bulgaria, Rumania, Serbia, and Montenegro.

POSITION AT THE OUTBREAK OF WORLD WAR

Russia, with Georgia, is reckoned to have had nearly 100,000,000 Slavonic Orthodox. Georgia, an exarchate once independent, was gradually being Russianised; the exarch was a Russian and an *ex officio* member of the Russian Holy Synod since 1801, while his suffragan bishops were Georgians. The effects of Tsarism on the Russian Church have been described by a learned observer as not good (Agéyev, *The Christian East,* 1920). "Under the guise of protecting the Church, the state in reality had enslaved it." The Church was in a state of paralysis, and the Russian educated classes were estranged from it.

The Orthodox Church in Turkey (Greek), under the Ecumenical Patriarch, Archbishop of Constantinople—often erroneously in the West called the Patriarch of Constantinople—is believed to have numbered 2,500,000 in Europe—counting in those transferred to the kingdom of Hellas in 1912—and 2,000,000

in Asia Minor and the islands. In Greece proper, where the autocephalous position of the Church was recognised by the Ecumenical Patriarch in 1850, there were about 2,000,000 orthodox (*ib.*).

In the Austro-Hungarian Empire there were several orthodox Churches, chiefly Slavonic, with some 3,000,000 souls: the Karlowitz Serbian Church; those of Dalmatia and Cattaro, joined to the Ruthenian Bukowina, though far distant from it; of Bosnia and Hercegovina; of Transylvania; and a certain number of orthodox scattered in various districts. The Bulgarian Church was made autocephalous by the Sultan in 1876, when the Bulgarian exarch resided in Constantinople; but the Ecumenical Patriarch did not recognise its independence. It numbered about 4,000,000.

In Rumania the old Church of Okhrida was suppressed in 1767 and the Orthodox then became subject to the Ecumenical Patriarch till recent times. They numbered about 4,500,000. The same state of things obtained in Serbia (1,500,000), where the old Church of Ipek was suppressed in 1766.

The little Church of Montenegro (about 200,000 souls) was made independent in 1766 and governed by a metropolitan who had one suffragan bishop. (Note that in some of the separated Churches of the East the metropolitans have no suffragans.) In addition there were the Orthodox in the patriarchate of Antioch, that of Jerusalem, that of Alexandria, Cyprus, autocephalous since 431, and the monastery of Mount Sinai, autocephalous since 1575, the archbishop of which usually resides in Egypt.

POSITION AFTER THE WAR

The alterations in the boundaries of the various states have necessarily had a great effect on the Church. But a much greater effect has been produced by the internal convulsions in Russia and Turkey.

Russia has lost Poland and the Baltic provinces; but this has not affected the Orthodox Church to a very great extent, as the bulk of the population was of other faiths. Poland has still 3 million Orthodox; Lithuania has 23,000 Orthodox and 35,000 "Old Believers"; Czechoslovakia has very few Orthodox, most of the population being Roman Catholics or Uniats.

In Russia proper and in Georgia the effect has been most disastrous. At first the revolution promised well for the Orthodox. A Holy Synod of 12 bishops and a council of bishops, priests and laymen were established in 1917; the office of Chief Procurator—a layman who had represented the Tsar, and who wielded very great powers—was abolished; the patriarchate, discontinued by Peter the Great since 1700, was revived (Nov. 1, 1917) in the person of Tikhon, Patriarch of Moscow and all Russia, who was enthroned on Dec. 4, 1917. But the Bolshevist régime dashed all the hopes of the Church. The new rulers set themselves to oppose Christianity in all its forms.

All teaching of religion in public schools was forbidden; parents were not allowed to teach their children religion; only candidates for the priesthood, if over 18 years of age, might learn theology. No minister of religion could enjoy full civil rights. No religious association could hold property, and all property of existing religious associations was confiscated to the State, which might at its pleasure lend buildings for religious worship. Monasteries were to be converted to useful purposes. Most of the bishops who have not escaped from Russia and have not been put to death have been interned in or about Moscow, or in monasteries in the far north. And the only organization that has been found possible is a synod of 15 Russian bishops which holds its sessions outside Russia, at Belgrade. The patriarch Tikhon died in 1925, and a makeshift for the patriarchate has been devised in the shape of a locum tenens. The passive resistance of the Russian peasantry has been the great obstacle to the Government's endeavour to suppress Christianity, and the so-called reformed Russian Church, a body encouraged by the Soviet power, has so far been a failure for the same reason. In Georgia, the Church is in as great confusion as in Russia; since the first revolution the tendency has been towards independence in ecclesiastical matters. (The translation of an official summary of Soviet legislation against religion is given in the *Church Times*, Oct. 30, 1925; *see* also Nov. 20, 1925.)

Post-War Turkey, with its curtailed frontiers, has as its aim the creation of an entirely Muslim State; and among other things the Turkish Government desires the abolition of the Oecumenical Patriarchate. But the European Powers, while restoring Constantinople to Turkey, prevented this, and at Lausanne the Turkish delegates made a formal declaration of their Government that the Patriarchate would be allowed to continue. Yet, as far as Turkey is concerned, the Patriarchate is little more than "the shadow of a shade." By the Treaty of Lausanne all Greek Orthodox residents in Constantinople before Oct. 30, 1918, are exempt from expulsion. All other Greeks in Turkey, however, are liable to expulsion, and those in Asia Minor have been settled in the new Greece and elsewhere, in many cases in change for Muslims. Only Turkish subjects can be metropolitans in Turkey, and therefore the episcopate has to be recruited from the comparatively few Greek residents in Constantinople. Outside modern Turkey the Oecumenical Patriarch, not the Metropolitan of Athens, has jurisdiction in Macedonia, Western Thrace, Epirus, Crete and the Aegean Islands, and this is an exception to the rule about ecclesiastical independence mentioned above. (*See* an informative series of four articles on *The Orthodox Churches*, by Dr. Greig, Bishop of Gibraltar in *Theology*, 10–11, March, April, July, Aug., 1925.)

Yugoslavia, called in the Treaties the Serb-Croat-Slovene State, is now re-organizing its Church, which includes the former Serbian Church, the Karlowitz Serbian Church, that of Dalmatia and Cattaro, that of Bosnia and Hercegovina (these three formerly in Austro-Hungary) and Montenegro. During the World War many Serbians were in England; over 600 refugees, young ordinands, were there instructed and prepared for the Orthodox priesthood under Serbian priests. (*The Christian East*, 48 f, 51 f, 54.) Many others were in France, engaged in secular pursuits, and in other countries. This will be a convenient place to remark on the changed ecclesiastical conditions in both Yugoslavia and Rumania. Before the War Rumania and Serbia were inhabited practically by Orthodox alone. But the enlarged boundaries have brought in many Roman Catholics and Lutherans, and this has complicated the problem of national religions. The former idea of one country, one church, has to be given up, and religion and politics cannot have the same close connection that they had before. Moreover, the greatest hindrance to the reorganization of the Orthodox Church in the Balkans and in Rumania is the exaggerated national feeling and jealousy of each country against the others. This jealousy is much more felt between the different branches of Orthodoxy than between them and the Roman Catholics or Lutherans. (Greig in *Theology*, ii., 8, 66.)

To the former Rumanian Church, with its two metropolitans, is now added the Transylvanian Church (formerly in Hungary), with its metropolitan at Hermannstadt, and suffragan bishops at Arad and Kazansebes; and also the Churches of Bukowina and Bessarabia.

The old metropolitanate of Athens has not been greatly affected. For Macedonia, etc., *see* above; but it is hard to see how the Oecumenical Patriarch in Constantinople can under the changed conditions exercise an effective supervision over these districts. Salonika has now become once more a Christian city, and the mosques which had originally been Christian churches have now been restored to Orthodox worship.

Bulgaria has lost the Aegean coast to Greece, and part of the Dobruja to Rumania. Otherwise the Church has not been much affected. It has, by the official census of 1920, about 4,000,000 members, almost all of Bulgarian nationality, out of a total population of nearly 5,000,000, of whom about 700,000 are Muslims, chiefly Turks.

Among the smaller communities in Asia and Africa which were once under Turkish rule, the Orthodox patriarchate of Jerusalem, now under British mandate, consists of about 30,000 Arab and Greek Christians and a few Russians: the chief obstacles to progress are the jealousies between Arabs and Greeks, and the financial difficulties of the monasteries. The Orthodox patriarchate of Antioch, now under French mandate, suffers from the same difficulties as that of Jerusalem. It has some 300,000 members. The

Orthodox ("Melkite") Patriarch of Alexandria has only a small following of about 100,000, as has been the case since the Monophysite schism in the 5th century. Under him is the Archbishop of Nubia. The autocephalous Churches of Cyprus (with about 200,000 Orthodox) and Mount Sinai have not been greatly affected by the War.

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ORTHOGENESIS, a zoological term introduced by Eimer to express the view that the variations from the normal form of an animal species, on the occurrence of which evolution depends, do not arise at hazard but have a definite direction in all closely allied species; and that these variations may be repeated over a long series of generations, always in the same direction. The cause of these definite variations is left uncertain but is supposed to lie within the animal and not in its environment. Thus evolution would follow a direct course, which need have no positive adaptive significance. This view was founded on a study of the patterns of butterfly wings.

The phylogenies built up by palaeontologists, as E. D. Cope was the first to observe, do show that evolution has generally proceeded in definite directions, each member of a series differing from its predecessor in the same ways as its successor differs from it. In most cases the changes take place in such a way that greater mechanical efficiency is secured, and they can thus, theoretically, be accounted for by natural selection, exercised by a constant or auto-orthogenetic environment. In some cases however the changes may proceed in a definite direction despite very great changes in habits and habitat amongst the animals.

The essential point, that variation is not indefinite in direction, has been established for those heritable variations known as mutations by the observation that definite mutants appear time after time at a definite rate amongst the members of a species bred under controlled conditions; and that identical mutants occur in allied species and genera. The implication of these facts is that the mechanism which determines the course of development of the fertilized egg, and is hence responsible for heredity, is capable of modification only in certain definite ways, and that this mechanism is of essentially the same structure in allied animals. This view is in harmony with the fact, observed by palaeontologists, that closely allied stocks (phyla or lineages) exposed to similar conditions pursue parallel evolutionary courses. It is not inconsistent with the view that the evolution, at least of certain structures, may follow a definite trend independently of its environment. *See* EVOLUTION. (D. M. S. W.)

ORTHOPAEDIC SURGERY. In this branch of surgery, which deals with the rectification of congenital and acquired deformities, particularly those of the limbs, great advances have been achieved during recent years as a consequence of the exceptional opportunities of study and practice afforded during the Great War. Thus the treatment of fractures during the early part of the War was attended not only by unnecessary deformity, but also by a high mortality, and remained unsatisfactory until special hospitals were started, manned by teams of expert surgeons. In compound fractures of the femur an initial mortality of 80% was ultimately reduced to 25%. This dramatic change was accomplished by immediate reduction and fixation of the fracture, by segregation and by continuity of treatment. Knowledge thus gained has formed the basis of the efforts to place the organisation and teaching of fractures upon a different basis with a view to minimising the disabilities of industrial accidents. Reform lies in the simplification of apparatus, and in an intensive education in their application, in segregation of fractures in special wards and in appointing surgeons with special qualifications to teach the student.

Improved Technique.—Among certain reconstructive operations in the case of which a greatly improved technique has resulted may be mentioned repair of injuries to the peripheral nerves, tendon transplantations, bone grafting and bone infections. The enormous number of complete nerve lacerations enabled a finished operative technique to be built up, which was largely wanting previously. Many misconceptions were also corrected, such as the worthlessness of complete transplants of nervous or other tissue to bridge gaps in peripheral nerves, and the doubtful value of lateral nerve anastomosis. In cases of irreparable destruction to nerves, healthy muscles were transposed to take the place of paralysed ones. These operations proved singularly successful where large tracts of the musculospiral nerve were irreparably damaged.

Certain flexor muscles of the forearm were attached in such a way that extension of the wrist and fingers became assured. Bone graft surgery likewise received a great impetus and has since been extended. This has led to considerable research on the viability of transplanted tissue, and in the case of the bone it is held that the transplant is a scaffold along which the fresh bonelaying cells creep from the embracing bone and deposit new bone, the scaffolding itself being ultimately removed by absorption. The treatment of virulent infections has been similarly developed. The Carrel-Dakin method has permanently established itself as well as the procedure of laying open infected bone cavities so that the soft tissues fall in easily to obliterate the gap when the infection is at an end.

Care of Cripples.—The most notable recent advance in orthopaedic surgery in Great Britain has been in the organization for the care and cure of cripples. This has consisted in the establishment of well-equipped open-air hospitals in various parts of the country, known as hospital schools, fully staffed by surgeons specially trained to deal with deformities of every kind. These schools provide treatment and education for the cripple, and are associated with what are known as after-care clinics situated in small towns covering an area of from 40 to 50 m. distant from the hospital in every direction. These after-care clinics are visited by the hospital staff at stated times, and are attended by out-patients who have been inmates of the hospital school, and by cases from the district, who are often seen at a sufficiently early date to prevent deformities from arising. These hospitals and clinics are run in close association and agreement with the local practitioners, the education authorities and the Ministry of Health. This scheme, in association with preventive measures, promises practically to eliminate the cripple. Its aims are to secure the potential cripple at the earliest moment, to give him expert institutional treatment in fresh air and sunlight and to secure continuity of treatment until recovery is complete. (*See* CRIPPLES, CARE OF.)

Artificial Light.—Of other recent advances in knowledge, the evolution of the artificial light treatment as an auxiliary form of therapeutics for tuberculosis of bones and joints and of rickets may be instanced. The work of Rollier, Leonard Hill and others has given prominence to the therapeutic value of sunlight (*see* HELIOTHERAPY), and in the absence of sun extended observation favours the conclusion that we have in various forms of artificial light a promising substitute. This treatment, as in the case of heliotherapy, must be looked upon merely as an accessory measure in surgical tuberculosis. It is most effective when used in combination with other surgical procedures. It should be pointed out that there is grave danger in spreading a belief that other forms of treatment are unnecessary and subsidiary.

Infantile Paralysis.—The further study of infantile paralysis has resulted in a more widespread knowledge of the early symptomatology and important work has been done, especially by the late Prof. Lovett of Harvard from 1916 onwards. It has

now been proved that complete rest and immobilisation and the elimination of meddlesome therapeutics during the acute and convalescent stages have resulted in lessening the severity of symptoms by limiting the paralysis. The mass of material rendered available during late years by epidemics has thrown new light on the actual treatment of deformity. Tendon transplantations for various deformities of the feet have given place to operative stabilisation of the flail foot, and transplantations when practised are now associated with reconstructive operations upon bone. This combination has resulted in more satisfactory function.

Rickets.—Rickets and allied nutritional diseases have likewise received within recent years close investigation by many observers abroad and at home with valuable results. Considerable work on the aetiology, particularly with reference to diet, exercise and sunlight, has been carried out at Johns Hopkins Hospital, the Lister Institute and by Findlay of Glasgow, Mellanby and Chick. Much has been discovered regarding "vitamines" or "accessory food factors" (*see* VITAMINES). The report of the Research Committee provisionally dealt with only two varieties; one known as vitamine A, or fat soluble A, and the other as anti-rachitic vitamine. Both are essential to the diet of growing animals. Defect in the one leads to arrest of growth and loss of weight; in the other a deficiency in the deposit of lime salts. The committee conclude that an anti-rachitic vitamine is a central factor in the prevention of rickets; and that a deficiency of calcium and phosphorus, in conjunction with a deficiency of anti-rachitic vitamine, hastens rickets. The greater the discrepancy in the calcium phosphorus intake the greater need for an appropriate anti-rachitic intake. It has now been proved that sunlight and ultra-violet rays act as an antidote to a deficiency diet, and can ward off the on-coming of rickets. This work has added considerably to the knowledge of orthopaedic surgeons, and has rendered unnecessary a good deal of the operative treatment for rachitic deformities.

Spinal Treatment and Other Operations.—The writings of Albee, Hibbs, Calvé, Girdlestone and Waldenstrom have enabled us to place in accurate perspective the bony fixation of the vertebral column in tubercular disease of the spine. Forcible correction and fixation of the spine in lateral curvature is being abandoned in favour of less drastic measures, and bony fixation of the flail spine in paralytic cases is being performed with promising results.

Operative treatment in osteoarthritis, especially in the non-articular type, is being more widely practised. This consists in stabilising the joint by exercising the joint surfaces and in the complete removal of diseased synovial membrane in the knee joints. The so-called operations of arthroplasty, or mobilisation in ankylosis of joints is becoming more common, and the results more encouraging. They mainly consist of the loosening and reconstruction of the bone ends, and the introduction of transplanted or living tissue between the bone ends to secure movement.

The treatment of fractures of the neck of the femur by wide abduction of the limb with internal rotation have been still further perfected by Royal Whitman of New York, and a large percentage of recoveries in this obstinate type of fracture occurring in old age is reported. The pathology of the rarer bone diseases such as "cysts of bone," "myeloid sarcoma," "Paget's disease" have been closely studied by many observers, resulting in valuable information in relation to operative procedure.

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Developments in the United States.—The World War taught the *rehabilitation* of human beings, the first step of which is reconstruction surgery. Instead of accepting a functional handicap as inevitable, and fitting out the patient with braces, canes, or crutches, reconstruction operations are performed which in many instances accomplish normal, or nearly normal return of function. Plastic operative work, tendon transplantation, skin and bone grafting have finally been placed in their proper correlation with the old methods of braces, straps and buckles, plaster of Paris casts, etc., so that the specialty now has rounded out into one in which operative work and the mechanical means of treatment as well as heliotherapy and physiotherapy have been co-ordinated.

At least 65 per cent of all the injuries sustained in the late war and coming to definitive treatment involved bones, joints, ligaments, muscles, tendons or nerves, thus throwing orthopedic surgery into sharp relief. The technique of reconstruction operations to meet the unusual demands was rapidly developed and perfected, and the scope of this branch of surgery widened appreciably as the best orthopaedic surgeons combined their skill at the front.

The war over, the demand for rehabilitation surgery has increased rather than decreased. The high-powered machines of industry, the speeding automobile, the aeroplane, and our great railway systems and construction projects take a terrific annual toll in bones, joints, muscles, tendons, etc., which, without reconstruction surgery, would mean a tremendous number of cripples, unhappy themselves, and a great economic burden upon society.

The introduction of automatic machine tools into orthopaedic surgery was an important event in the technical world as it has made possible the cutting and moulding of bone with as much variety as the machinist shapes metal, and these power-driven instruments have been an important factor in the development of reconstruction surgery. In 1909 Dr. Fred H. Albee of New York city conceived the technique of bone graft of the spine to arrest tuberculous destruction and prevent hunchback; but found it impossible of accurate execution with the hand tools then comprising the surgeon's armamentarium. Realizing further the great possibilities of repair and reconstruction in cases of extensive loss of bone and damage to joints which adequate machine tools (such as circular twin saw, dowel and screw cutter) would make possible in transplanting bone from one portion of the body to another, he designed a set of miniature automatic machine tools, carefully adapted from those used by a cabinet maker and mechanic, to the various surgical problems encountered in cutting and shaping bone. This has become known as the Albee bone mill. As other grafting plastic bone operations were devised, notably for hip, knee and jaw, new instruments have been added to the "mill," which by their great accuracy and rapidity tremendously reduce the shock attendant upon cutting bone with the old hand instruments, shorten the time of anaesthesia, and permit intricate bone operations.

As a result of the benefits of the X-ray in determining diagnosis and showing the exact condition of bone, and the use of the automatic machine tools and orthopaedic appliances introduced within the last 25 years, the human bony system can to-day be made over in a truly remarkable way.

The increased understanding of shock, as a result of the researches of Crile and Cannon, and the increased means of combating or eliminating it by employing electrically driven tools, as well as outstanding advances in technique, have made complicated and exacting operative problems that were formerly hopeless now possible.

The Carrel-Dakin treatment of lacerated or infected wounds before operation is attempted has greatly lessened the chances of sepsis. By this method, which was devised during the war by Carrel of the Rockefeller Foundation and Dakin, the English chemist, the wound is kept constantly bathed in a solution containing free chlorine gas with elements which dissolve away the discharges of the wound.

In fractures of the hip, conditions are such that union does not occur in a large percentage of cases, even when conservative treatment is applied in the most ideal way. Cases of persistent non-union have been salvaged by means of automatic machinery and the bone graft, dowel or peg union being secured in from 75% to 90% of cases according to the degree of erosion between the fragments.

The conception that arthritis is a metastatic infection from some focus, often remote from the joint or joints affected, has led to the prevention of many cases and relief of others by elimination of sources of toxic absorption.

One of the most striking developments has been the technique which enables the surgeon to manufacture or make joints when they have been destroyed, that will function in a nearly normal manner without pain.

If a case is not controlled wisely from the psychologic standpoint while the patient is receiving treatment physically, the compensation law may react to his detriment rather than his benefit. The best sympathy that can be given a crippled man is to see that he is receiving adequate treatment and to encourage him to return to work as soon as it is safe. Follow-up work is most important; this lies with the surgeon and social worker co-operating with the surgeon.

Rehabilitation, of which the orthopaedic treatment is an important part, to-day represents three distinct yet overlapping problems: (1) the problem of treatment, preventive or corrective; (2) the sociological problem—relationship of the injured labourer to the rest of society; and (3) the medico-legal problem of properly applying the Workmen's Compensation Act. The first concerns chiefly the patient, his relatives and immediate friends, but the second and third affect all society. The rehabilitation movement in the United States has gone forward with the same strides since the war as have the hospital schools for cripples in Great Britain, the difference being that in the United States through wise legislation, state and national, it has been possible to a large extent to correlate the efforts of various agencies and to avoid duplication of effort.

The first compensation law, passed by the State of New Jersey in 1911, grew out of the sympathy of society for those crippled or physically handicapped in our great industrial plants. Since then thirty-six States have passed compensation or rehabilitation laws.

(F. H. A.)

ORTHOPTERA, the term used in zoological classification for that order of insects which includes the cockroaches, mantids, grasshoppers, locusts, crickets and their allies. The earwigs are included here by some authorities but they are now more often relegated to a separate order of their own—the *Dermaptera* (*see* EARWIG). The Orthoptera are essentially terrestrial insects and many possess greatly developed powers of running or leaping. Excepting in the *Acridiidae*, flight is not one of their striking characteristics and wings are often reduced or entirely lost. They are mostly insects of comparatively large size, some being among the giants of their class; many possess well-developed sound-producing organs and are notorious stridulators. The wings, when present, are net-veined, the anterior pair being more or less hardened to form tegmina which are narrower than the membranous hind wings; the latter have a well developed posterior lobe capable of being folded up fanwise. The antennae are most often long and threadlike, the mouth parts are of the biting type and have a 4-lobed ligula. The prothorax is generally large and the abdomen is terminated by a pair of cerci. Metamorphosis is incomplete and in the wingless forms it is very little evident. Over 13,000 species of Orthoptera are known and of these about 500 inhabit Europe. In Britain there are 31 indigenous forms, while some others are naturalized alien species; there are also a number of casual immigrants which have not become established.

Orthoptera may be conveniently divided into forms which run or walk (Cursoria) and into those which leap (Saltatoria) as given below.

DIVISION I.—CURSORIA

Legs of approximately equal size, hind pair not adapted for leaping. Tarsi 5-jointed, stridulatory organs absent, ovipositor almost always concealed.

Included in this division are four families. The *Grylloblattidae* are confined to western North America and Japan; they are wingless insects with long ovipositor and cerci and exhibit close affinities with the Saltatoria also. The *Blattidae* or cockroaches (*q.v.*), have a large shieldlike prothorax, very broad coxae and short, jointed cerci (fig. 1). The *Mantidae* (*see* MANTIS) have the fore legs adapted for seizing prey; the eyes are large and the cerci are several-jointed. The *Phasmidae* comprise the Stick Insects (*q.v.*)

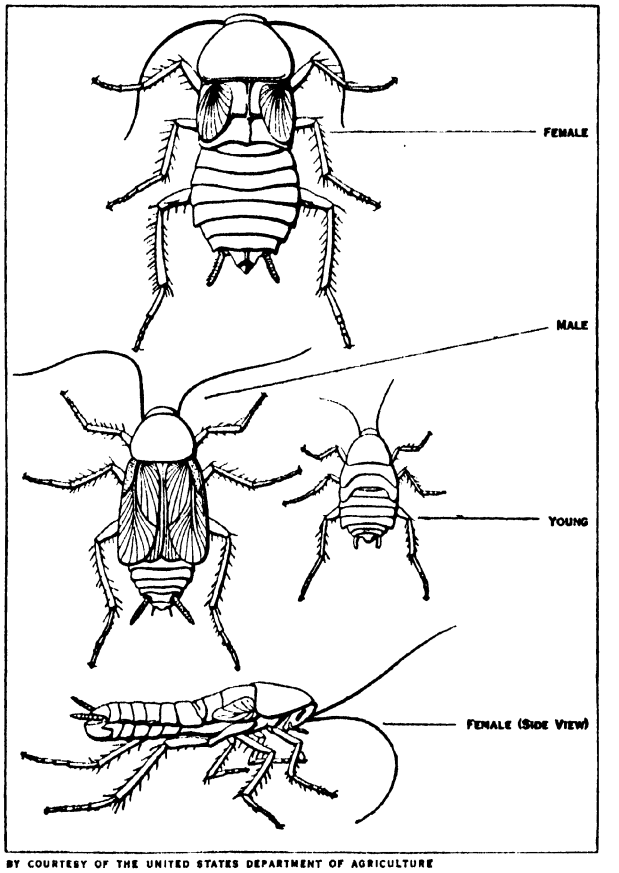

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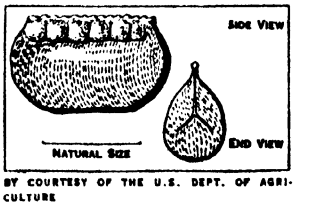
FIG. 1.—THE COMMON COCKROACH (BLATTA ORIENTALIS), NATURAL SIZE

and the Leaf Insects (*q.v.*); the fore legs are normal, the eyes are small and the cerci are single-jointed (fig. 3).

DIVISION II.—SALTATORIA

Legs of unequal size, the hind pair with enlarged femora and adapted for leaping. Tarsi with fewer than five joints, stridulatory organs usually present, ovipositor well developed and evident.

Three families belong here and included in the *Acridiidae* are the short-horned grasshoppers (*see* GRASSHOPPER) and the true locusts (*q.v.*). The antennae are shorter than the body, the tarsi are 3-jointed and the ovipositor short. Stridulation takes place by the insect rubbing the inner side of its hind femur, which bears a row of minute pegs, against a hardened area of the tegmen of the same side. Auditory organs are represented by a pair of drums at the base of the abdomen. The *Tettigoniidae* (*Locustidae*) include the long-horned grasshoppers (*see* GRASSHOPPER) which have the antennae usually longer than the body, 4-jointed tarsi and a long broad ovipositor. Stridulation is effected by the insect rubbing its right tegmen against a filelike area of the left tegmen and auditory organs are present on the fore tibiae. The *Gryllidae* include the crickets (*q.v.*) and their allies. The antennae are generally long and threadlike, the tarsi are usually 3-jointed and the ovipositor is commonly long and slender (fig. 4). Stridulation takes place by rubbing the tegmina together and the auditory organs are on the fore tibiae, but unlike the *Tettigoniidae* the outer organ is larger



BY COURTESY OF THE U.S. DEPT. OF AGRICULTURE

FIG. 2.—EGG CAPSULE OF AMERICAN COCKROACH (PERIPLANETA AMERICANA)

than the inner one of the same side. The tegmina differ from those of other Saltatoria in that they are bent downwards along the sides of the body when in repose.

The eggs of Orthoptera are more or less cylindrical and in cockroaches (fig. 2) and mantids they are laid in protective capsules or oothecae, each containing 16 or more eggs. On hatching the young nymphs bear a close miniature resemblance to the adults except for the absence of wings. After a period of gradual growth, accompanied by a very variable number of moults, the adult condition is assumed. As previously mentioned, the saltatory forms are capable of stridulation, a feature that is almost confined to the males; auditory organs, on the other hand, are present in both sexes. Some of the most notorious stridulators are the katydids (*see* GRASSHOPPER) and the crickets, and in some cases the strident notes can be heard nearly a mile away. Many Orthoptera are wingless (fig. 3), while among the stridulating forms the wings are sometimes reduced to the sound-producing portions of the tegmina only. The majority of the Orthoptera are herbivorous, and many of the grasshoppers and all the locusts are highly injurious insects—voracious devourers of all kinds of vegetation. Some of the cockroaches are omnivorous, the domestic species injuring or fouling a great variety of materials, while the mantids are predators devouring various insects and other creatures. Although Orthoptera are predominantly terrestrial in habit, a few species are aquatic, the curious cricket *Hydropedeticus*, for example, skates actively over streams in Fiji. Many of the *Tettigoniidae* frequent trees and bushes, while some of the *Gryllidae*, notably the mole crickets and their allies, are subterranean. The curious small wingless crickets of the genus *Myrmecophila* live in close association with ants.

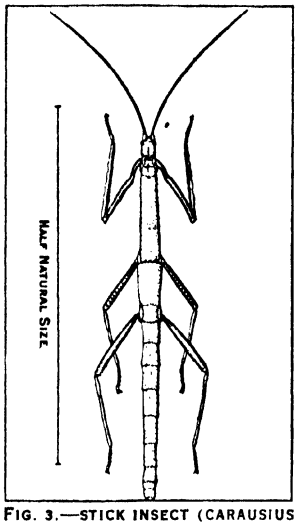


FIG. 3.—STICK INSECT (CARAUSIUS MOROSUS)

Geographically the largest families are world-wide in range. The leaf insects, however, are restricted to the oriental region and the *Grylloblattidae* are confined to North America and Japan. The *Mantidae* and *Phasmidae* are common in the warmer regions of the world, but are absent from more northern latitudes. Among individual species the oriental cockroach (*Blatta orientalis*) and some of its allies have become practically cosmopolitan. In the fossil condition cockroaches are abundant, and form the greater part of the insect remains in certain of the Upper Carboniferous rocks of western Europe. They persisted until Permian times, after which their pre-eminence gradually declined until at the present day they form an insignificant part of the world's insects.

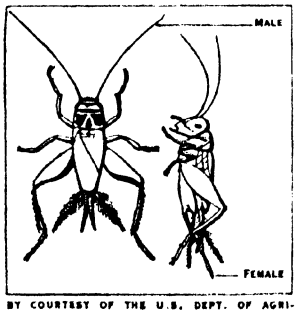


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FIG. 4.—HOUSE CRICKET (GRYLLUS DOMESTICUS)

BIBLIOGRAPHY.—For the British Orthoptera *see* W. J. Lucas, *British Orthoptera* (1920), while for the European species *see* R. Tümpel, *Die Geradflügler Mitteleuropas* (1907–08), M. Burr, *Synopsis of the Orthoptera of Western Europe* (1910) and the handy work of C. Houlbert which forms two volumes in the *Encyclopédie Scientifique* (Paris, 1924–1927). For the North American species consult W. S. Blatchley, *Orthoptera of North-Eastern America* (1920). (A. D. I.)

ORTIGUEIRA, a seaport of north-western Spain, in the province of Corunna; on the northern slope of the Sierra de la Faladoira, on the river Nera and on the eastern shore of the Ría de Santa Marta—a winding, rock-bound and much indented inlet of the Bay of Biscay, between Capes Ortegal and Vares. Pop. (1920) 19,422. The population is very scattered. The industries are fishing and farming. There is an important coasting trade, despite the dangerous character of the coast-line and the fogs and gales.

ORTLER, the highest point (12,802 ft.) in Tirol, and in the whole of the Eastern Alps. It is a great snow-clad mass, which rises east of the Stelvio Pass, and a little south of the upper valley



ORTLER ALP FARM, ON THE SLOPES OF THE HIGHEST PEAK (12,802 FT.) IN THE EASTERN ALPS, BETWEEN THE VALLEYS OF TRAFOI AND SULDEN

of the Adige between the valleys of Trafoi (north-west) and of Sulden (north-east). It was long considered inaccessible, but was conquered in 1804 by three Tirolese peasants. The first traveller to make the climb was Herr Gebhard in 1805 (sixth ascent). Many routes to the summit are now known.

ORTNIT or **OTNIT,** German hero of romance, was originally Hertnit or Hartnit, the elder of two brothers known as the Hartungs, who correspond in German mythology to the Dioscuri. His seat was at Holmgard (Novgorod), according to the *Thidrekssaga* (chapter 45), and he was related to the Russian saga heroes. Later on his city of Holmgard became Garda, and in ordinary German legend he ruled in Lombardy. Hartnit won his bride, a Valkyrie, by hard fighting against the giant Isungs, but was killed in a later fight by a dragon. His younger brother, Hardheri (replaced in later German legend by Wolfdietrich), avenged Ortnit by killing the dragon, and then married his brother's widow. Ortnit's wooing was corrupted by the popular interest in the crusades to an Oriental *Brautfahrtsaga*, bearing a resemblance to the French romance of Huon of Bordeaux (*q.v.*).

See editions of the *Heldenbuch* and one of *Ortnit* and *Wolfdietrich* by Dr. J. L. Edlen von Lindhausen (Tübingen, 1906).

ORTOLAN, *Emberiza hortulana*, a bunting (*q.v.*) celebrated for the delicate flavour of its flesh. A native of most European countries—the British islands excepted—as well as of western Asia, it migrates southwards in autumn and returns about the end of April. Its distribution throughout its breeding range seems to

be very local. In habits it much resembles the yellow-hammer, but it wants the bright colouring of that species. The monotonous song of the cock is also much of the same kind. The nest is placed on or near the ground, but the eggs seldom show the hair-like markings which characterize those of most buntings. Its natural food consists of beetles, other insects and seeds. Ortolans are netted in great numbers, kept alive in a darkened room, and fed with oats and millet. In a very short time they become enormously fat and are then killed for the table.

ORTONA, small seaport and episcopal see, Abruzzi, Italy, province of Chieti, 12 m. directly E. of that town, 105 m. by rail S.S.E. of Ancona. Pop. (1921) 9,417 (town); 16,802 (commune). It is situated on a promontory 230 ft. above sea-level, and connected with the port below by a funicular railway. The ruined castle has magnificent views. The cathedral (1127) has a fine portal by a local artist, Nicolo Mancini (1311). The town occupies the site of the ancient Ortona, a seaport of the Frentani.

ORURO, a department and town of Bolivia. The department is bounded north by La Paz, east by Cochabamba and Potosí, south by Potosí and west by Chile; it occupies part of an ancient lacustrine basin lying between the eastern and western ranges of the Andes, and has an area of 20,657 sq.m., the greater part of which is semi-arid and covered with extensive saline deposits. The Desaguadero river, the outlet of Lake Titicaca, flows southward into Lake Pampa-Aullagas, or Poopó, on the eastern side of the department near the Cordillera de los Frailes. Lake Poopó is 12,106 ft. above sea-level, or 400 ft. lower than Titicaca, and its waters discharge through a small outlet, called the Lacahahuira, into the lagoon and saline morasses of Coipasa (12,073 ft. elevation) in the south-west corner of the department. Oruro is almost exclusively a mining department, the country being too arid and too cold for agriculture. With the exception of a narrow strip along the foot-hills of the Cordillera de los Frailes, where a few cattle, mules, llamas and sheep are reared, little of the area is suitable even for grazing. In the vicinity of the capital, in the north-east part of the department, there are large deposits of tin, silver, tungsten and copper; Oruro is the second largest producer of tin in the republic.

The capital of the department is Oruro, 125 m. south-south-east (direct) of La Paz; it is an old mining town dating from the 17th century, when it is said to have had a population of 70,000. The estimate of 1924 gave it a population of 32,908, the greater part of whom are Indians and mestizos. A considerable number of foreigners are interested in the neighbouring mines. The elevation of Oruro is 12,158 ft. above sea-level, and its climate is characterized by a cool summer with light rainfall and a cooler but sunny winter, with nightly frosts and an occasional snow-storm. The mean temperature of the warmest month, December, is 51° F and that of the coolest month, June, is 31° F. There is a much greater difference than this between day and night temperatures, both in summer and winter. Oruro is connected by rail with La Paz and Cochabamba, with Antofagasta, 578 m. away, and with Arica (via Viacha) 380 m. distant. (G. M. McB.)

ORVIETO (anc. *Volsinii* [*q.v.*], later *Urbs Vetus*, whence the modern name), town and episcopal see, province of Perugia, Italy, on the Paglia, a tributary of the Tiber, 78 m. by rail N. by W. of Rome. Pop. (1921) 7,598 (town); 19,409 (commune). It crowns an isolated rock, 1,033 ft. above sea-level, 640 ft. above the plain, commanding splendid views, and is approached by a funicular railway. The town has a large number of fine 13th-century houses and palaces. The splendid cathedral dedicated to the Virgin was begun at least as soon as 1288 on the site of two older churches erected to commemorate the miracle of Bolsena (*q.v.*), and was decorated by many mediaeval painters and sculptors. The exterior is black and white marble; the interior is grey limestone with bands of dark basaltic stone. There is a large rectangular nave, with semicircular recesses for altars, opening out of the aisles, north and south, two transeptal chapels and a short choir. The finest polychrome monument in existence is the west façade, of richly-sculptured marble from the designs of Lorenzo Maitani of Siena, divided into three gables with intervening pinnacles; it is a reproduction of the façade of Siena cathedral. The mosaics are modern. The four wall-surfaces that flank the three western doorways are decorated with beautiful sculpture in relief, executed under Maitani's direction until his death in 1330. In the interior, the Cappella del Corporale possesses a large silver shrine, resembling the cathedral façade, enriched with countless figures in relief and subjects in translucent coloured enamels—one of the most important specimens of early silversmith's work. It was begun by Ugolino Vieri of Siena in 1337, and was made to contain the Holy Corporal from Bolsena (*q.v.*). On the south side is the chapel of S. Brizio, separated from the nave by a fine 14th-century wrought-iron screen. The walls and vault are covered with fine and well preserved frescoes—among the noblest works of Fra Angelico and Luca Signorelli, painted 1499 to 1504—the latter being of especial importance in the history of art owing to their great influence on Michelangelo in his early days. The choir stalls are fine and elaborate specimens of *tarsia* and rich wood-carving—the work of Pietro del Minella (1430–41). In 16th-century sculpture the cathedral is especially rich, containing many statues, groups and altar-reliefs by Simone Mosca and Ippolito Scalza. Close by are two Gothic buildings, the bishop's palace (1264) and the Palazzo dei Papi (1264–1302), the latter with a huge hall now containing the Museo Civico, with various mediaeval works of art, and also objects from the Etruscan necropolis of the ancient Volsinii (*q.v.*). The Palazzo Faina has another interesting Etruscan collection. The Palazzo del Comune is Romanesque (12th cent.). S. Andrea and S. Giovenale are also Romanesque churches of the 11th century; both contain later frescoes. To the 11th–12th century belongs the ruined abbey of SS. Severo and Martirio, 1 m. south of the town. The church of S. Domenico contains one of the finest works in sculpture by Arnolfo del Cambio, the tomb with recumbent effigy of the Cardinal de Braye (1282), with much beautiful sculpture and mosaic. There are a few buildings by Sammicheli of Verona, architect of the cathedral from 1509–28. The fortress built in 1364 by Cardinal Albornoz has been converted into a public garden. The well, now disused, called Il pozzo di S. Patrizio, is one of the chief curiosities of Orvieto. It is 200 ft. deep to the water-level and 42 ft. in diameter, cut in the rock, with a double winding inclined plane, so that asses could ascend and descend to carry the water from the bottom. It was begun by the architect Antonio da San Gallo the younger in 1527 for Clement VII. and was finished by Simone Mosca under Paul III. (*See* UMBRIA.)

See L. Fumi, *Il Duomo d' Orvieto e i suoi restauri* (1891); *Orvieto, note storiche e biografiche* (1891), and other works; P. Perali, *Orvieto* (*ibid.* 1919). (T. A.)

ORYX, the scientific name of a group of African antelopes of large size with long horns, which are present in both sexes, and long tufted tails. They are desert animals. The true oryx is the East and North-east African beisa oryx (*Oryx beisa*), which is replaced in South Africa by the gemsbok (*q.v.*). In northern Africa the group is represented by *O. leucoryx*, and in Arabia by *O. beatrix*. *See* ANTELOPE.

ORZESZKO or ORSZESZKO, **ELIZA** (1842–1910), Polish novelist, was born near Grodno, of the noble family of Pawlowski. In her 16th year she married Piotr Orzeszko, a Polish nobleman, who was exiled to Siberia after the insurrection of 1863. She wrote a series of powerful novels and sketches, dealing with the social conditions of her country. *Eli Makower* (1875) describes the relations between the Jews and the Polish nobility, and *Meir Ezofowicz* (1878) the conflict between Jewish orthodoxy and modern liberalism. *On the Niemen* (1888), perhaps her best work, deals with the Polish aristocracy, and *Lost Souls* (1886) and *Cham* (1888) are on rural life in White Russia. She died at Grodno on May 18, 1910.

OSAGE, a tribe of American Indians formerly on Osage and Arkansas rivers in Missouri and Arkansas. Their speech is Siouan; their culture that of the plains. The original population is estimated at 5,000; in 1921 there were 2,200 in Oklahoma. Oil royalties, land leases and interest on trust funds held for them by the Government, make them one of the richest populations in the world.

See F. La Flesche, *Bur. Am. Ethn. Rep.* xxxvi, 1921; xxxix, 1925.

OSAGE ORANGE (*Maclura aurantiaca*), a thorny tree with large, yellow, somewhat orange-like fruit. The tree, which is the only species of its genus, belongs to the mulberry family (Moraceae). It is native to rich soils in the south central United States from Missouri and Kansas to Texas, but has been planted extensively for hedges throughout the prairie region of the Mississippi valley and occasionally in the eastern States, being hardy in New England. The very hard, strong, flexible, yellow wood, formerly used for bows and war-clubs by the Osage and other Indians west of the Mississippi, is utilized in wheel-work and for railway ties and fence posts. Osage orange is also known as bow-wood.

OSAKA, a city of Japan in the province of Settsu. Pop. (1925) 2,114,804. It lies in a plain bounded, except westward, where it opens on Osaka Bay, by hills of considerable height, on both sides of the Yodogawa, or rather its headwater the Aji (the outlet of Lake Biwa), and is so intersected by river-branches and canals as to suggest a comparison with a Dutch town. Steamers ply between Osaka and Kobe-Hiogo or Kobe, and Osaka is an important railway centre. The opening of the railway (1873) drew foreign trade to Kobe, but a harbour for ocean-steamers has been constructed at Osaka. Shin-sai Bashi Suji, the principal thoroughfare, leads from Kitahama, the district lying on the south side of the Tosabori, to the iron suspension bridge (Shin-sai Bashi) over the Dotombori. The foreign settlement is at Kawaguchi at the junction of the Shirinashi and the Aji. It is the seat of a number of European mission stations. Buddhist and Shinto temples are numerous. The principal secular buildings are the castle, the mint and the arsenal. The castle was founded in 1583 by Hideyoshi; the enclosed palace, probably the finest building in Japan, survived the capture of the castle by Iyeyasu (1615), and in 1867 and 1868 witnessed the reception of the foreign legations by the Tokugawa shoguns; but in the latter year it was fired by the Tokugawa party. It now provides military headquarters, containing a garrison and an arsenal. The whole castle is protected by high and massive walls and broad moats. The mint, erected and organized by Europeans, was opened in 1871. Osaka possesses iron-works, sugar refineries, cotton spinning mills, shipyards and a great variety of other manufactures.

Osaka owes its origin to Rennio Shonin, the eighth head of the Shin-Shu sect, who in 1495–1496 built, on the site now occupied by the castle, a temple which afterwards became the principal residence of his successors. In 1580, after ten years' successful defence of his position, Kenryo, the eleventh "abbot," was obliged to surrender; and in 1583 the victorious Hideyoshi made Osaka his capital. The city brought several suburban districts within its boundaries in 1925 and thereby became the most populous city in Japan. In 1909 one-third of the city was destroyed by fire and though it was rebuilt with wider streets and better buildings, there are still many wooden houses and bridges, dangerous in case of fire, and its factories and warehouses compare less favourably with European and American standards than those of Tokyo. Work on a drainage system was started in 1909, but is still incomplete. Electric railways connect the city with Kobe.

Trade has grown very largely, but most goods are loaded and discharged at Kobe, as the river is only navigable for small vessels. A fourth shipbuilding yard was opened in 1911. A pharmaceutical school was opened in 1917 and in 1919 the university of medicine was made into a general university. The spread of pulmonary tuberculosis has caused alarm and a tuberculosis laboratory has been opened. In 1919 a municipal home for workpeople, including a children's clinic, was inaugurated. (*See* JAPAN.)

OSAWATOMIE, a city of Miami county, Kansas, U.S.A., 45 m. S. by W. of Kansas City, on the Missouri Pacific railroad. Pop. 4,722 in 1920 (89% native white). It is near oil and gas fields, in a farming and grazing region, and has railroad shops, an oil refinery and other manufacturing plants. A State hospital for the insane is 1 m. N.E. Osawatomie was settled about 1854 by colonists sent out by the Emigrant Aid company. The name was derived from Osage and Pottawattomie. It was the scene of many clashes between the pro-slavery and the free-soil factions of Kansas and Missouri, notably on Aug. 30, 1856, when Capt. John Brown (who had come to Osawatomie in 1855) and 40 followers attempted to repulse an attack by Gen. John W. Reid, at the head of 400 Missourians. They were quickly overpowered and the town was looted and practically destroyed.

OSBORN, HENRY FAIRFIELD (1857–), palaeontologist, was born at Fairfield (Conn.), Aug. 8, 1857. He graduated from Princeton university (1877) and continued his studies under Balfour and Huxley. His professorships have included natural history and anatomy at Princeton (1881–91); biology and zoology until 1910, and the deanship of the faculty of pure science (1892–1895) at Columbia university. Since 1910 he has held the research professorship in zoology at Columbia university. His connection with the American Museum of Natural History began as curator of the department of vertebrate palaeontology (1891–1910), and was followed by a number of offices till 1908, when he became president, which he still is (1929). Since 1900 he has been connected with the U.S. Geological Survey, first as vertebrate palaeontologist and since 1924 as senior geologist. Among offices too numerous to mention, he has had important connections with the Canadian Geological Survey, the New York Zoological Society, and the Carnegie Institute. He declined the proffered secretaryship of the Smithsonian Institution.

The American Museum of Natural History extension school service, its unique exhibition halls, and the organization of a complete survey of the geological succession of the higher vertebrates of North America are due to President Osborn's efforts. His extensive researches chiefly have concerned the palaeontology of the vertebrates. His publications have dealt with almost all groups of animals and reptiles, but have made especially important contributions to the knowledge of the rhinoceroses, horses, titanotheres, and dinosaurs. He has founded a flourishing school of vertebrate palaeontology which already includes the names of numerous brilliant younger men of science. He has done much towards the determination of relative ages of extinct mammals in North America, and has done important services in working out a correlation between the Tertiary and mammal horizons of Europe and America. He has also studied and written on the philosophical bearings of his work. He was called, by the Royal Society of London at the time of his election to membership, "one of the most distinguished palaeontologists of our time."

His scientific writings (1877–1928) in geology, palaeontology, anthropology and biology comprise 755 titles, including memoirs on extinct reptiles and mammals.

His books combine literary art and scientific information. Among the most important are: *From the Greeks to Darwin* (1894); *Evolution of Mammalian Molar Teeth* (1907); *The Age of Mammals* (1910); *Huxley and Education* (1910); *Men of the Old Stone Age* (1915); *Origin and Evolution of Life* (1917); *The Earth Speaks to Bryan* (1925); *Evolution and Religion in Education* (1926); *Creative Education* and *Man Rises to Parnassus* (1927).

See "Eminent Living Geologists," *Geological Magazine*, London (1917), vol. 4, pp. 193–196, new Series, Decade 6.

OSBORNE, a former royal residence in the Isle of Wight, England, south-east of East Cowes. The name of the manor in early times is quoted as Austerborne or Oysterborne. In 1845, it was purchased by Queen Victoria, who died there in 1901. King Edward VII. presented the property to the nation. A part of the house was transformed into a convalescent home for officers of the navy and army, opened in 1904. In 1903 there was opened on the Osborne estate a Royal Naval college, which in 1921 was closed down, and the cadets thenceforward joined Dartmouth college.

OSCAN was the name given by the Romans to that dialect (*lingua Osca*) which they found spoken by the *Osci* of Campania. But inscriptional and other records, *i.e.*, local and personal names and glosses in ancient authors, manifestly of the same dialect, have been found not only in Campania, where the dialect was, according to the most probable interpretation of the evidence, not original, but seems to have been imposed upon the Oscans by Samnite invaders in the 5th century B.C., but also further south, namely in northern Apulia, Lucania, in the country of the Brutii (the "toe" of Italy), and even in the north-east angle of Sicily at Messana (the modern Messina), which was captured by the

Campanian Mamertines *c.* 289 B.C.; in Samnium proper, including the territory of the Frentani and Hirpini; and finally, further north, in the country of the Paeligni, Marrucini and Vestini. Thus there are distinguished, geographically, and dialectally, three main groups of Oscan: (1) Central Oscan of Campania and the Samnite tribes, (2) Southern Oscan, and (3) Northern Oscan. These are all closely related to one another as compared with the dialect of the Volsci and of the Umbrian townships (Iguvium, the modern Gubbio; Tuder, modern Todi; and one or two others); while Oscan, Volscian and Umbrian, taken together, make one of the two great divisions—the other being Latin (*q.v.*) with Faliscan—into which the Italic branch of the Indo-European family of languages falls. Since the Samnitic tribes, whose expansion by successive migrations—"sacred springs" as they were called—diffused the Oscan speakers from their home in central Italy, knew their land (in Latin, Samnium) by the name *Safinim*, it has been proposed to describe their dialects as "Safine," a title at once more comprehensive and historically truer than "Oscan." The stock to which the Samnites belonged used commonly a suffix *-no-* (*e.g.*, in *Sabi-ni*) to form their tribal names, as distinguished from the suffixes *-co-* and *-(a)ti-* of an earlier stratum of population (*e.g.*, in *Vols-ci*, *Tea-te*). In names like *Marru-ci-ni*, *Ardea-ti-ni*, the superimposed *-no-* suffix bears witness to a conquest or overlordship of the earlier by the later stock.

Until the Roman advance gradually replaced it by Latin—important stages of this advance are marked not so much by the three Samnite wars as by the destruction of Capua in 211 B.C. and the Social War of 91–89 B.C.—Oscan held its place as a language in recognized official and educated usage side by side with, or instead of, Latin or Greek. The poet Ennius is said to have spoken all three tongues (Gellius 17,17,1), and if Strabo (5, p.233 C) may be trusted, the rude farces or puppet-shows introduced from the Oscan town Atella (*fabulae Atellanae*, *ludi Osci*) were actually performed at Rome in Oscan. The latest Oscan inscriptions, scratched on the walls of houses at Pompeii, were written shortly before the eruption of Vesuvius which overwhelmed that city in A.D. 79, and it is probable that the dialect, which has left its mark on modern south Italian dialects, survived in remote country districts as a local patois for some time longer. None of the Oscan inscriptions, on the other hand, is older than the 5th century B.C.

Many of the inscriptions are carefully, indeed almost with phonetic accuracy, written in a native alphabet which was itself derived, with certain necessary modifications, from the Etruscan alphabet; but a few belonging to the southern group, and including all those from Sicily, are in the Greek, and some from Lucania and elsewhere in the rustic or Colonial Latin alphabets. Over 250 in number, the majority are quite short; nevertheless, they furnish materials adequate to give us a fairly complete conspectus of the dialect. About two-thirds of the whole come from Campania, and most of those from Capua and Pompeii.

In character they fall mostly into the following classes: (1) official documents—municipal regulations (Bantia), a treaty (Nola and Abella), inscriptions relating to public works (Pompeii and elsewhere); (2) religious—an inventory of statues and altars in a sacred grove at Agnone (Samnium), the interesting group of heraldic *iovilae* (*q.v.*) from Capua, recording or prescribing special ceremonies connected with family cults, numerous simple votive and dedicatory inscriptions; (3) military and election announcements (from Pompeii); (4) private documents—epitaphs, bricks inscribed with names, and (from Campania) a few belonging to the interesting group of curses, inscribed on lead and deposited in tombs; (5) coin legends, including those of the Social War reading *vitelliú*, *i.e.*, "Italia."

Oscan has many peculiarities which distinguish it from Latin in sound changes, word forms and vocabulary; in syntax the differences are much less marked. But it also possesses certain features which distinguish it amongst the Italic dialects themselves. Their nature and extent may be indicated roughly by a specimen text (on a sundial found at Pompeii):

mr atiniis mr kvaisstur eitiuvad
múltasíkad kúmbennieís tangi(nud)
aamanaffed

This in Latin would be:

M(a)r(a) Atinius M(a)r(ae) (filius) quaestor pecunia multaticia conventus scitu fieri iussit

(Mara Atinius, son of Mara, quaestor, in accordance with a decree of the assembly, had this set up from fine-money.)

BIBLIOGRAPHY.—R. S. Conway, *The Italic Dialects* (2 vols., 1897); R. von Planta, *Grammatik der oskisch-umbrischen Dialekte* (2 vols., 1892–97); C. D. Buck, *Grammar of Oscan and Umbrian* (1904), all three with bibl. New inscriptions are reported in the official *Notizie degli Scavi* (Hoepli), but often more promptly in F. Ribezzo's *Rivista Indo-greco-italica* (since 1917); those discovered between 1897 and 1925 will be found collected by W. Schwering and M. Bacherler in Bursian's *Jahresbericht*, vol. 176 (1916–18), pp. 69 *sqq.*, Bacherler, *ibid.* vol. 184 (1920), pp. 140 *sqq.*, vol. 205 (1925), pp. 51 *sqq.*; *see* also Ribezzo, *l.c.*, vol. 8 (1924), pp. 83 *sqq.*; *résumés* of discoveries and new studies in the field appear regularly also in *Glotta* (since 1907) and in the *Indogermanisches Jahrbuch* (since 1912). G. Herbig, in M. Ebert's *Real-lexikon der Vorgeschichte*, *s.v.* Italiker (1925; bibl.), and R. S. Conway in *Cambridge Ancient History*, vol. iv. (1926) pp. 444 *sqq.*, give summary accounts of the Italic peoples and dialects. (J. WH.)

OSCAR I. (1799–1859), king of Sweden and Norway, was the son of General Bernadotte, afterwards King Charles XIV. In 1838 the king began to suspect his heir of plotting with the Liberal party to effect a change of ministry, or even his own abdication. Oscar, however, avoided an actual rupture. After his accession (March 8th, 1844) it appeared that his liberalism was very restricted. He refused any radical reform of the cumbrous and obsolete constitution. But one of his earliest measures was to establish freedom of the press. Most of the legislation during his reign aimed at improving Sweden's economic position.

In foreign affairs Oscar I. was a friend of the principle of nationality. In 1848 he supported Denmark against Germany; placed Swedish and Norwegian troops in cantonments in Fünen and North Schleswig (1849–1850); and mediated the truce of Malmö (August 26, 1848). He was also one of the guarantors of the integrity of Denmark (London protocol, May 8, 1852). Oscar I. left four sons, of whom two, Carl (Charles XV.) and Oskar Fredrik (Oscar II.), succeeded to his throne.

See T. Almén, *Ätten Bernadotte* (Stockholm, 1896); and C. E. Akrell, *Minnen från Carls XIV., Oscars I. och Carls XV. Lagar* (Stockholm, 1884, 1885). Also NORWAY: *History*, and SWEDEN: *History*.

OSCAR II. (1829–1907), king of Sweden and Norway, son of Oscar I., was born at Stockholm on Jan. 21, 1829. In 1857 he married Princess Sophia Wilhelmina, youngest daughter of Duke William of Nassau. He succeeded his brother Charles XV. on Sept. 18, 1872, and was crowned in the Norwegian cathedral of Drontheim on July 18, 1873. At his accession he adopted as his motto *Brödrafolkens Väl*, "the welfare of the brother folk," and from the first he realized the essential difficulties in the maintenance of the union between Sweden and Norway. The political events which led up to the final crisis in 1905, by which the thrones were separated, are dealt with in the historical articles under NORWAY and SWEDEN. But it may be said that the peaceful solution eventually adopted could hardly have been attained but for the tact and patience of the king himself. He declined, indeed, to permit any prince of his house to become king of Norway, but better relations between the two countries were restored before his death, which took place at Stockholm on Dec. 8, 1907. His acute intelligence and his aloofness from the dynastic considerations affecting most European sovereigns gave the king considerable weight as an arbitrator in international questions. At the request of Great Britain, Germany and the United States in 1889 he appointed the chief justice of Samoa, and he was again called in to arbitrate in Samoan affairs in 1899. In 1897 he was empowered to appoint a fifth arbitrator if necessary in the Venezuelan dispute, and he was called in to act as umpire in the Anglo-American arbitration treaty that was quashed by the senate.

Himself a distinguished writer and musical amateur, King Oscar was a generous friend of learning and of education. His works, which included his speeches, translations of Herder's *Cid* and Goethe's *Torquato Tasso*, a play, *Castle Cronberg*, poems and historical works, were collected in 1875–76 (new and enl. ed.,

1885–88). His *Memoirs of Charles XII.* were translated into English in 1879.

See A. Hasselgren, *Oskar II., en lefnadsteckning* (1908).

OSCEOLA (*c.* 1804–1838), a Seminole American Indian, leader in the second Seminole War, was born in Georgia, near the Chattahoochee river. His father was an Englishman named William Powell; his mother a Creek of the Red Stick or Mikasuki division. In 1808 he removed with his mother into northern Florida. When the U.S. commissioners negotiated with the Seminole chiefs the treaties of 1832–33 for the removal of the Seminoles to Arkansas, Osceola seized the opportunity to lead the opposition of the young warriors, and declared to the U.S. agent, Gen. Wiley Thompson, that any chief who prepared to remove would be killed. Late in 1835 he murdered Charley Emathla (or Emartla), a chief who was preparing to emigrate with his people, and with a few companions shot and killed Gen. Thompson.

In 1836 Generals Edmund P. Gaines (1777–1849), Winfield Scott (1786–1866) and Richard K. Call (1791–1862) waged war against them with little effect, and the year closed with General Thomas Sidney Jesup (1788–1860) in command with 8,000 troops at his disposal. General Jesup drove the enemy from the Withlacoochee country and was pursuing them southward toward the Everglades when several chiefs expressed a readiness to treat for peace. On March 6, 1837, they agreed to cease hostilities, to prepare for emigration to Arkansas, and gave hostages to bind them to their agreement. But on June 2 Osceola came to the camp at the head of about 200 Mikasuki (Miccosukees) and effected the flight of all the Indians there, about 700 including the hostages, to the Everglades. Hostilities were then resumed, but in September, after the capture of several chiefs, Osceola requested an interview. This was granted, and by command of General Jesup he was taken captive and carried to Fort Moultrie, at Charleston, S.C., where he died in January, 1838. The war continued until 1842, but after Osceola's death the Indians did little but attack the unarmed inhabitants.

See J. T. Sprague, *The Origin, Progress and Conclusion of the Florida War* (1848).

OSCHERSLEBEN, a town in the Prussian province of Saxony, on the Bode, 24 m. by rail W.S.W. of Magdeburg, and at the junction of lines to Halberstadt and Jerxheim. Pop. (1925) 13,507. Oschersleben is first mentioned in 803. Among its industrial establishments are sugar-refineries, iron-foundries, breweries, machine-shops and brick works.

OSCILLATOR. A non-rotating device used in radio apparatus for producing alternating current. The output frequency of the oscillation is determined by the characteristics of the device.

OSCILLATORY CIRCUIT, as applied to radio apparatus, is a relatively low resistance circuit containing both inductance and capacity, such that the voltage impulse will produce a current which periodically reverses in direction.

OSCILLOGRAPH, an instrument for the delineation of alternating current wave forms. In the type devised by Duddell (*Electrician* xxxix., Sept. 1897, 636) two phosphor bronze strips under tension pass, side by side, between the poles of an electromagnet. The current is led up one strip and down the other so that they move in opposite directions at right angles to their length. A small mirror bridged across the strips is thus tilted to an extent dependent on the strength of the current. The mirror reflects a spot of light on to a photographic film whose movement at right angles to that of the light spot provides the time scale. The natural period of vibration of the strips is arranged to be very small ($\frac{1}{5,000}$–$\frac{1}{10,000}$ sec.) to enable them to move in accordance with the fluctuations of the current. Other types of oscillograph have been designed by Blondel, Irwin (the *hot-wire* oscillograph) and others. The Cathode Ray Oscillograph is available for high-frequency observations. For further information *see* INSTRUMENTS, ELECTRICAL; BALLISTICS; OSISA.

OSH, a town of Asiatic Russia, in the Kirghiz A.S.S.R. in 40° 35′ N., 72° 55′ E., 31 m. S.E. of Andijan railway terminus, at an altitude of 4,030 ft. Pop. (1926) 29,088. It is on the Ak-bara river, a tributary of the Kara-Su, in a fertile cotton, grain and fruit growing valley leading to the Alai and Pamir. The famous Takht-i-Suleiman (Solomon's Throne) rock, the theme of so many Eastern legends, is near the town and is frequented by pilgrims.

O'SHAUGHNESSY, ARTHUR WILLIAM EDGAR (1844–1880), English poet, was born in London on March 14, 1844, and at seventeen became a copyist in the library of the British Museum. Later, he specialised in ichthyology. He published his *Epic of Women* in 1870, *Lays of France*, a free version of the *Lais* of Marie de France, in 1872, and *Music and Moonlight* in 1874. He died on Jan. 30, 1880, his *Songs of a Worker* appearing immediately afterwards. In Palgrave's words, he had "a haunting music all his own."

OSHAWA, a manufacturing city and port of entry of Ontario county, Ontario, Canada, on Lake Ontario and the Canadian National and Canadian Pacific railways, 30 m. E.N.E. of Toronto. Pop. (1921) 11,940. It contains large motor works, flour, woollen and grist-mills, piano, farm implement and carriage factories, foundries, tanneries, canning factories, etc.

OSHIMA, a group of three small islands belonging to Japan, lying southwards of Kiushiu, in 30° 50′ N. and 130° E. Their names, from west to east, are Kuro-shima, Iwo-shima and Taka-shima. Kuro-shima rises to a height of 2,475 ft., and Iwo-shima has an active volcano 2,480 ft. high. These islands are not to be confounded with Oshima, the most northerly island of the Izu-noshichito, or with the northern group of the Luchu Islands.

OSHKOSH, a city of Wisconsin, U.S.A., 75 m. N.N.W. of Milwaukee, on the west shore of Lake Winnebago, where the Fox river flows into it; the county seat of Winnebago county. It is on Federal highways 41 and 110, and is served by the Chicago and North Western, the Chicago, Milwaukee, St. Paul and Pacific, the Soo Line, and electric railways, motor-coaches and 8 motor-truck lines. Pop. (1920) 33,162 (82% native white); 1928 local estimate, 43,000. Oshkosh is the seat of a State Teachers' college with an enrolment of 1,100. Lumber used to be the main industry but products are now highly diversified. The output in 1925 was $32,681,683. Bank clearings for 1927 were $51,943,192, and the valuation for 1927 was $56,988,802. The city has a commission government.

The Fox river and Lake Winnebago early became an important line of communication, under French control, on the route between the Great Lakes and the Mississippi. Trading posts were established on the site of Oshkosh in the 18th century, and a flotilla of 50–100 fur-laden barges and bateaux was not an uncommon sight on the river. Permanent settlement here began about 1827. The north side of the river was at first called Saukeer and the south side Algoma, but in 1840 the name Oshkosh was adopted, to honour a friendly Menominee chief. In 1874 and in 1875 the city suffered serious loss from fire. It was chartered as a city in 1853.

OSIANDER, ANDREAS (1498–1552), German reformer, was born at Gunzenhausen, near Nuremberg, on Dec. 19, 1498. His German name was Heiligmann, or, according to others, Hosemann. After studying at Leipzig, Altenburg and Ingolstadt, he was ordained priest in 1520 and appointed Hebrew tutor in the Augustinian convent at Nuremberg. Two years afterwards he was appointed preacher in the St. Lorenz Kirche, and about the same time he publicly joined the Lutheran party, taking a prominent part in the discussion which ultimately led to the adoption of the Reformation by the city. He married in 1525. He was present at the Marburg conference in 1529, at the Augsburg diet in 1530 and at the signing of the Schmalkald articles in 1537. His vehemence, coarseness and arrogance in controversy brought him many personal enemies. The introduction of the Augsburg Interim in 1548 necessitated his departure from Nuremberg; he went first to Breslau, and afterwards settled at Königsberg as professor in its new university at the call of Duke Albert of Prussia. Here in 1550 he published two disputations, the one *De lege et evangelio* and the other *De justificatione*, which aroused a controversy still unclosed at his death on Oct. 17, 1552. While he was fundamentally at one with Luther in opposing both Romanism and Calvinism, his mysticism led him to interpret justification by faith as not an imputation but an infusion of the essential righteousness or divine nature of Christ. His party was afterwards led by his son-in-law Johann Funck, but disappeared after the latter's

execution for high treason in 1566. Osiander's son Lukas (1534–1604), and grandsons Andreas (1562–1617) and Lukas (1571–1638) were well-known theologians.

Osiander, besides a number of controversial writings, published a corrected edition of the Vulgate, with notes, in 1522, and a *Harmony* of the Gospels—the first work of its kind—in 1537. The best-known work of his son Lukas was an *Epitome* of the *Magdeburg Centuries*. *See* the *Life* by W. Möller (Elberfeld, 1870).

OSIER, the common term under which are included the various species, varieties and hybrids of the genus *Salix*, used in the manufacture of baskets. The chief species in cultivation are: *Salix viminalis* (the common osier) and *S. triandra, S. amygdalina, S. purpurea* and *S. fragilis*, which botanically are willows and not osiers. The first named with some 40 of its varieties, formed until recent times the staple basket-making material in England. It is an abundant cropper, sometimes attaining on low-lying soils 13 ft. in height. Full-topped and smooth, it is by reason of its pithy nature mainly cultivated for coarse work and is generally used as brown stuff. Some harder varieties, known as stone osiers and raised on drier upland soils, are peeled and used for fine work. *S. fragilis*, with some half-score varieties, is almost exclusively used by market gardeners for bunching greens, turnips and other produce. Owing to the increased demand for finer work much attention has been given (*see* BASKET) in recent years to the cultivation of the more ligneous and tougher species, *S. triandra, S. purpurea* and *S. amygdalina* with their many varieties and hybrids.

It is commonly supposed that osiers or willows will prove remunerative and flourish with little attention on any poor, wet, marshy soil. This is, however, not the case. No crop responds more readily to careful husbandry and skilful cultivation. For the successful raising of the finer sorts of willows good, well-drained, loamy upland soil is desirable, which before planting should be deeply trenched and cleared of weeds.

At any time, from late winter to early spring, the ground may be planted with "sets," *i.e.*, cuttings of about 9 to 16 in. in length, taken from clean, well-ripened rods. These are firmly set to within 3 to 6 in. of the top in rows, 16 to 20 in. apart and spaced at intervals of 8 to 12 in. Yearling sets are largely planted, but the practice of the best Midland and west of England growers proves the superior productiveness of sets cut from two yearling rods. Great care should be exercised in planting lest the bark be fractured, loosened or removed from the wood and if not subject to periodical alluvial floods the ground should be manured yearly. The coarser *S. viminalis* may be raised on lowland soil if not water-logged or marshy. The more valuable kinds are known as: New kind, Black mauls, Spaniards, Glibskins, Long-bud, Long-skin, Lancashire red-bud, French, Italians, Pomeranians and Councillors and scores of other local names. A hybrid of *S. viminalis* and *S. triandra*, known as Black-top has been found to produce the heaviest crops on the best Leicestershire grounds.

Cutting and binding take place in early winter after the fall of the leaf, the crop being known as green whole stuff. The coarser kinds are sorted, cured (dried in the sun and wind) and stacked ready for market. These are known as brown rods. The finer kinds, after the more shrubby or ill-grown rods, termed Ragged, have been rejected, are peeled or buffed. Two methods of stripping are chiefly practised: from the heads (sets) and from the pit. By the former method the rods are left on the ground until spring advances, when a rapid growth of the cork cambium begins. They are then cut direct from the head and the bark is easily removed by drawing the rods through a bifurcated hand-brake of smooth, well-rounded steel, framed in wood. Improved brakes worked by a treadle strip two rods at a time. For the smaller sizes, rubber brakes are sometimes used and, for the very smallest, the fingers either bare or protected by linen bands. This method ensures a clean-butted unfractured rod, but unless great judgment is exercised in selecting the proper time for cutting the rods will remain double-skinned and the head may bleed. By the "pit" process the green rods are stood upright in shallow pits of water at a depth of about 6 to 9 in. until the sap rises and growth begins, when they are ready for the brake. The defects of this method are that the tops are liable to split in the brake and the butts to remain foul. A third, known as the "pie" system, enables the grower to bridge over the interval, and to keep his hands employed, between the end of the "head" and the beginning of the "pit" strippings.

The willows are cut at the first indication of the sap rising and "couched" in rotton peelings and soil at a slight angle, the butts being on the ground, which should be strewn with damp straw from a manure heap. The tops are covered lightly with rotted peelings and by periodical application of water, fermentation is induced at the bottom, heat is engendered, the leaves force their way through the covering and peeling may begin. Peeling is chiefly done by women and lasts from early May to the middle of July, but a motor peeler has recently been introduced in some osier grounds. After stripping, the rods are bleached in the sun and stored for sale as White. If the rods are to be buffed they are immersed in large tanks of boiling water from 4 to 6 hours. They are then allowed to cool and mellow, are stripped and carefully dried in sun and air and remain dyed a rich tawny brown or buff colour. Brown rods may also be buffed by sinking them in cold water which is heated to boiling point, and maintained at that temperature for the requisite period.

In its natural habitat the osier or willow is a dioecious plant reproduced by cross fertilization but for at least 2,000 years has been cultivated from cuttings. The stocks have therefore become enfeebled; their cultivation is attended with many disturbing causes—ground vermin, fungoid and insect pests as well as winter floods and spring frosts. A suggestion made to the British Ministry of Agriculture and Fisheries by the present writer that under suitable conditions improved stocks of basket willows could be raised by cross fertilization and their disease-resisting power strengthened has been actualized and experiments in this direction are being carried out at the Long Ashton Research Institution, Bristol.

See W. P. Ellmore, *The Cultivation of Osiers and Willows*, 2nd ed.; also a leaflet (No. 36) on the same subject published gratis by the British Ministry of Agriculture. (T. O.)

OSIJEK (Germ. *Esseg*, Magyar, *Eszek*), town of Slavonia, Yugoslavia. Pop. (1921) 34,412, chiefly Magyars and Croats. It is situated on the Drave, which is here crossed by two bridges, below which the river is navigable by small steamers. The upper, or old town, contains the fortress, while the lower or new town is the commercial centre. It has several Orthodox and Roman Catholic churches, Franciscan and Capuchin monasteries, a synagogue, gymnasium, school, hospital, chamber of commerce and law courts. Osijek has a thriving trade in grain, fruit, livestock, plum brandy and timber. There are cotton mills, tanneries and a sugar beet factory, while silk weaving, glass blowing and the making of hats and caps are also carried on.

Osijek owes its origin to its fortress, which existed in Roman times under the name of *Mursia;* though the present structure dates only from 1720.

OSIMO, a town and episcopal see (anc. *Auximum, q.v.*), the Marches, Italy, province of Ancona, 10 m. S. of that town by rail. Pop. (1921) 8,860 (town); 19,811 (commune). It is on the top of a hill 870 ft. above sea-level and it retains a portion of its ancient town wall (2nd century B.C.). The cathedral has a portal with sculptures of the 13th century, an old crypt and a fine bronze font of the 16th century; the town hall contains a number of statues found on the site of the ancient forum and also a few pictures. Silk spinning and the raising of cocoons are carried on.

OSIRIS, one of the principal gods of the ancient Egyptians. *See* EGYPT: *Religion.*

OSISO, an instrument for recording the exact character of vibrations. It has been used for the investigation of electrical phenomena, recording sounds, enabling the totally deaf to understand speech and to speak, studying and eliminating vibration in machinery, determining the recoil action of guns, locating heavy artillery, aeroplanes and vessels, studying heart-beats, respiration and other bodily functions, locating oil, ore bodies, etc. The osiso consists of a tiny mirror mounted on two wires and suspended between the poles of a magnet. If a current flows through the wires in a strong magnetic field, they will tend to move, the direction and

extent of the motion depending upon the direction and strength of the current flow. A beam of light, reflected from the mirror, provides a means for making visible the movements of the mirror and for recording them on a photographic film. Every sound produces its own individual wave form, and the meaning of these waves can be read. (*See* INSTRUMENTS, ELECTRICAL: *Oscillograph.*)

OSKALOOSA, a city of south-eastern Iowa, U.S.A., on Federal highway 63 and near the Des Moines river; the county seat of Mahaska county. It is served by the Burlington Route, the Minneapolis and St. Louis, and the Rock Island railways. Pop. (1925 State census) 10,331. It is in a farming and coal-mining region, and has a number of important factories. Penn college, founded in 1873 under the auspices of the Iowa Yearly Meeting of Friends, occupies a beautiful campus of 30 ac. on the northern edge of the city. In the suburb of University park, adjoining it on the east, is John Fletcher college. Oskaloosa was settled in 1843, chosen for the county seat in 1844, and chartered as a city in 1853. It was named after a Seminole princess.

OSLER (ōz-lụr), **SIR WILLIAM** (1849–1919), British physician, born at Bond Head, Canada, July 12, 1849, was educated at Trinity college school, Port Hope, Trinity College, Toronto, and McGill university, Montreal, where he took the M.D. degree in 1872. He studied medicine in London, Leipzig and Vienna and in 1874 was appointed professor of medicine at McGill university. From 1884 to 1889 he was professor of clinical medicine in the University of Pennsylvania, and from 1889 to 1904 professor of medicine at Johns Hopkins university. In 1905 he was appointed regius professor of medicine at Oxford, where he also served as a curator of the Bodleian library, as a delegate of the University Press and as one of the Radcliffe trustees. In 1911 he was created a baronet. Sir William Osler carried out original and valuable researches on the diseases of the spleen and blood and also made eminent contributions to the study of infections of the heart, of angina pectoris, of malaria and of many minor maladies. Sir William died at Oxford Dec. 29, 1919.

His most important work was *The Principle and Practice of Medicine* (1892, latest edition 1920). He also wrote monographs on *Cerebral Palsies in Children* (1889); and *Chorea and Choreiform Affections* (1894); a volume of essays *Aequanimitas* (1901); and *A Way of Life* (1913).

OSLO (formerly Kristiania), the capital of Norway, forming a separate county (*amt*), and the seat of a bishopric (*stift*). Pop. (1927) 250,620. It lies on the south-eastern coast, on the Aker river, at the head of Oslo fjord, about 80 m. from the Skagerrack. Pine-wooded hills rise behind the city, while several islands stud the fjord. The town is mainly modern. It is the seat of government, of the supreme courts, of the parliament (*Storthing*), and of a university. In the principal street, Karl-Johans-gade, are some of the most important buildings, the *Storthings-Bygning* or parliament house (1866), the National Theatre (1899), in front of which are great statues of the dramatists Ibsen and Björnsen, and the Fredericiana university, founded in 1811. At the western end of the Karl-Johans-gade is the Slotspark, crowned with the royal palace (*slot*). North of the university is the museum of art. The historical museum contains three viking ships, excavated since 1867. The Margaret church was built in memory of the late crown princess of Sweden.

Oslo is a well-planned city and its suburbs are attractive and are growing rapidly. Garden suburbs have been laid out at Ullevaal, where there is the largest municipal hospital in the country, and at Tören, with a science museum dating from 1908. On the east side of the Aker lies the old city of Oslo, with the existing episcopal palace, and an old bishop's palace, in which James VI. of Scotland (I. of England) was betrothed to Princess Anne of Denmark (1589). In the environs are the royal pleasure castle of Oscarshal (1847–52), and the Norwegian national museum (1881), containing industrial and domestic exhibits from the various provinces. On Hovedö (Head island) are the ruins of a Cistercian monastery, founded in 1147 by monks from Kirkstead in Lincolnshire, England, and burnt in 1532. At Holmenkollen, the famous *ski* (snow-shoe) races are held in February.

Oslo has two railway stations, the Hovedbanegaard by the Björvik, recently enlarged, and the Vestbanegaard by the Pipervik. Regular passenger steamers serve the port from Hull, Newcastle, Grangemouth and London, from Trondhjem, Bergen and the Norwegian coast towns, from Hamburg, Amsterdam, Antwerp, etc. Except for two large shipbuilding yards, most of the manufactories are concentrated in Sagene. They include cotton, woollen, linen and sailcloth factories, sawmills, paper and pulp mills, foundries and engineering shops, brick and tile works, flour mills, biscuits, condensed milk, margarine, oil, soap and tobacco factories, hardware and nail works, glass, gunpowder and chemical works, breweries and distilleries, granite pavement and ice.

A great hydro-electric scheme for supplying Oslo and its suburbs with electricity by utilizing Solbergfos on the river Glommen has recently been completed, and seven units totalling 77,000 kw. had been installed by the end of 1925. Since about 1912 there have been, at great expense, extensive improvements made on the existing harbour works and port facilities. The port can be used by the largest vessels. There are also two dry-docks and four floating docks and a grain elevator. Imports are of about three times the value of exports. The harbour is icebound for three or four months in the winter.

The original city was founded by Harald Sigurdsson in 1048. By the close of the 14th century it was established as the chief city of Norway. Trade was long dominated by the powerful Hanseatic League, at least until the beginning of the 16th century. The town, built mainly of wood, was no less subject to fires than all Norwegian towns have always been, and after one of these King Christian IV. refounded the capital on the site it now occupies, and gave his name to it in 1624. By the close of the century it was fortified, but this did not prevent Charles XII. from gaining possession of it in 1716. The name of the city was changed again to Oslo in 1925.

See L. Daae, *Det gamle Christiania, 1624–1824* (Christiania, 1890); Y. Nielsen, *Christiania und Umgegend* (Christiana, 1894); G. Amnéus, *La Ville de Christiania . . . Résumé historique*, etc. (Christiania, 1900).

OSMAN ('UṢMĀN), the usual form of the Arabic name 'OTHMAN, as representing the Turkish and Persian pronunciation of the name. It is used, therefore, for (1) the founder of the Osmanli or Ottoman dynasty, Osman I., who took the title of sultan, ruled in Asia Minor, and died in 1326, and (2) the sixteenth sultan Osman II., who reigned 1616–1621. (*See* TURKEY: *History;* OTHMAN and CALIPHATE.)

OSMAN (1832–1900), Turkish pasha and mushir (field marshal), was born at Tokat, in Asia Minor, in 1832. Educated at the military academy at Constantinople, he entered the cavalry in 1853, and served under Omar Pasha in the Russian War of 1853–56, in Wallachia and the Crimea. Appointed a captain, in the Imperial Guard, he distinguished himself in the campaigns of the Lebanon in 1860 and of Crete in 1867 to 1869, and was promoted lieut.-colonel. He served under Redif Pasha in suppressing an insurrection in Yemen in 1871, was promoted major-general in 1874, and general of division in 1875. Appointed to command the army corps at Widin in 1876 on the declaration of war by Serbia, he defeated Tchernaieff at Saitschar and again at Yavor in July, invaded Serbia and captured Alexinatz and Deligrad in October, when the war ended. Osman was promoted to be mushir, and continued his command at Widin.

When the Russians crossed the Danube in July 1877, Osman moved his force to Plevna, and, with the assistance of his engineer, Tewfik Pasha, entrenched himself on the right flank of the Russian line of communication, and gradually made the position a most formidable one. He repulsed the three assaults of the Russians and after being closely invested, held the position until Dec. 9, when, compelled to cut his way out, he was severely wounded and forced to capitulate. This famous improvised defence delayed the Russians for five months, and entailed their crossing the Balkan range in the depth of winter after the third battle of Plevna. The sultan conferred on Osman the Grand Cross of the Osmanie and the title of "Ghazi" (victorious), and, when he returned from imprisonment in Russia, made him commandant of the Imperial Guard, grand-master of the artillery and marshal

of the palace. In December 1878 he became war minister, and held the post, with a small break, until 1885. He died at Constantinople on April 14, 1900.

OSMANLI, the tribal name of the Turks of the Ottoman empire. The Osmanli include a heterogeneous group of peoples, the original conquering Osmanli having mixed very considerably with the conquered peoples, until physically they have ceased to have a definite separate existence. (*See* ASIA: *Ethnology* and TURKS.)

OSMIUM, a chemical element found in small quantities in platinum ores but obtained chiefly from the mineral osmiridium by the method of Deville and Debray (*see* RUTHENIUM); together with iridium it was first isolated by Smithson Tennant in 1803 (symbols Os, atomic number 76, atomic weight 190·8). Osmiridium is fused with metallic zinc, the excess of zinc is dissolved in hydrochloric acid and the residue ignited with a mixture of barium nitrate and barium peroxide. When cold, the mass is finely powdered and treated with cold dilute hydrochloric acid in a stoppered bottle; this is necessary as osmium is present in the form of volatile tetroxide. After all action has ceased, nitric and sulphuric acids are added, the mixture is well shaken and the barium sulphate allowed to deposit. The liquid is then distilled, when the volatile osmium tetroxide passes over in an almost pure state. The residue from the distillation is concentrated, ammonium chloride is added, and ammonium iridium chloride $(NH_4)_2IrCl_6$ (together with a little ruthenium) is precipitated. Another method of obtaining osmium from osmiridium is to heat the alloy mixed with common salt in a slow stream of chlorine. The sodium osmichloride, Na_2OsCl_6, produced is extracted with water; sal ammoniac is added to precipitate sparingly soluble ammonium osmichloride, $(NH_4)_2OsCl_6$, which on gentle ignition leaves a residue of spongy osmium.

Osmium in the massive state is a metal of a bluish-white colour. It can be obtained crystalline by alloying any of its forms with metallic tin and subsequently removing the tin by means of hydrochloric acid. It has a specific gravity of 22·5, and melts at about 2,700° C, although it begins to volatilize at a lower temperature. It is a very hard metal, especially when combined with iridium, and the alloy was at one time used extensively for tipping gold pens, but for this purpose cheaper alloys are now employed free from platinum metals and generally having tungsten for their basis. It is not suitable in alloys with other platinum metals for high-temperature work, for, owing to the ease with which it oxidizes, it causes the alloy to disintegrate.

Osmium forms several oxides of which four are known with certainty, namely, OsO, Os_2O_3, OsO_2 and OsO_4, while OsO_3 is present in the metallic osmates. The lower oxides are unimportant. *Osmium tetroxide,* OsO_4, known in commerce under the name of osmic acid, can readily be obtained in a state of purity, and is the source from which other osmium compounds are generally prepared. If metallic osmium in any form is heated in a tube in a current of air, or preferably oxygen, to a bright red heat, combination takes place and a yellowish liquid, OsO_4, condenses in the cold part of the tube, afterwards crystallizing in yellowish needles which melt at 40° C; the liquid boils at 100° C giving a colourless vapour. Traces of the vapour of osmium tetroxide have a very strong odour somewhat resembling that of chlorine. The vapour is poisonous and exceedingly corrosive and attacks animal membranes vigorously, becoming reduced and leaving a deposit of metallic osmium. In small quantities the physiological effect is transitory but larger quantities entail serious consequences. It is largely used for preparing microscopic slides as it acts preferentially on certain portions of tissue, staining them black. If alcohol is added to OsO_4 dissolved in caustic potash, the solution becomes red and on concentration potassium osmate, $K_2OsO_4.2H_2O$, crystallizes out. This salt is stable in neutral solutions but decomposes on acidification, forming OsO_4 and lower oxides. Osmium has several chlorides such as $OsCl_2$, $OsCl_3$ and $OsCl_4$; these, and especially the last two, have a great tendency to combine with alkaline chlorides producing double chlorides of the form M_2OsCl_6 and M_2OsCl_4. They are readily formed from the tetroxide by the use of suitable reducing agents. Two sulphides of osmium are known, OsS_2 and OsS_4; the latter is formed by the action of sulphuretted hydrogen upon acid solutions of the tetroxide. Qualitatively, osmium is detected by the odour of OsO_4 produced when the metal is ignited in air. A delicate test for OsO_4 is to warm an aqueous solution with thiocarbamide and dilute hydrochloric acid, when a red coloration shows the presence of osmium. (F. E. M.)

OSNABRÜCK, a town and episcopal see in the Prussian province of Hanover, situated on the Hase, 70 m. W. of the city of Hanover, 31 m. by rail N.E. of Münster, and at the junction of the lines Hamburg–Cologne and Berlin–Amsterdam. Pop. (1925) 88,941. In 888 Osnabrück received the right to establish a mint, a market and a toll-house. Surrounded with walls towards the close of the 11th century, it maintained an independent attitude towards its nominal ruler, the bishop, and joined the Hanseatic League, reaching the height of its prosperity in the 15th century. The older streets contain examples of Gothic and Renaissance domestic architecture. The Roman Catholic cathedral, with its three towers, is a building of the 13th century, partly in the Romanesque and partly in the Transitional style; but it is inferior in architectural interest to the Marienkirche, a Gothic structure of the 14th and 15th centuries. The town hall, a 15th century Gothic building, contains portraits of some of the plenipotentiaries engaged in concluding the peace of Westphalia. Other important buildings are the museum, containing scientific and historical collections; the episcopal palace and the law courts. The lunatic asylum on the Gertrudenberg occupies the site of an ancient nunnery. Linen was formerly the staple product, but it no longer retains that position. The manufactures include machinery, paper, celluloid, chemicals, tobacco and cigars, pianos and beer. Other industries are spinning and weaving. The town has large iron and steel works and there are coal mines in the neighbourhood. Trade is carried on in grain, wood and wine.

OSPREY or **OSPRAY,** a bird of prey of conspicuously marked plumage, the white of its lower parts and head contrasting sharply with the dark brown of the back when it is on the wing. It is the representative of the family *Pandionidae,* closely related to the *Falconidae.* Its special characters are the presence of a reversible outer toe and spicules on the soles of the feet.

The osprey (*Pandion haliaetus*) is one of the most cosmopolitan birds of prey. Where, through abundance of food, it is numerous, the nests of the fish-hawk (to use its American name) may be placed on trees to the number of 300 close together. Where food is scarcer and the species accordingly less plentiful, a single pair will occupy an isolated rock, as formerly in Scotland. Few birds lay eggs so rich in colouring: their white or pale ground is spotted, blotched or marbled with almost every shade of purple, orange and red, from the most delicate lilac and buff, through voilet, chestnut and crimson, to black. The fierceness with which ospreys defend their eggs and young, in addition to the dangerous situation chosen for the aerie, makes the task of robbing the nests difficult. It no longer breeds in Great Britain. The term "osprey," applied to the nuptial plumes of the egrets in the feather trade, is derived from the French *esprit;* it has nothing to do with the osprey bird.



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THE OSPREY (PANDION HALIAETUS)
A bird of prey, known in America as the fish-hawk

OSROENE or **OSRHOENE,** a district of northwestern Mesopotamia, in the hill country on the upper Bilechas (Belichus; mod. *Nahr Belik,* Bilikh), the tributary of the Euphrates, with its capital at Edessa (*q.v.*), founded by Seleucus I. About 130 B.C. Edessa was occupied by a nomadic Arabic tribe, the Orrhoei (Plin. v. 85; vi. 25, 117, 129), who founded a small state ruled by their chieftains with the title of kings. After them the district was called Orrhoene (thus in the inscriptions, in Pliny and Dio Cassius), which occasionally has been changed

into Osroene, in assimilation to the Parthian name Osroes or Chosroes (Khosrau). The founder of the dynasty is therefore called Osroes by Procop. (*Bell Pers.* i. 17) but Orhāi or Urhāi, son of Hewyā (*i.e.* "the snake"), in the chronicle of Dionysius of Tellmahre; he is no historical personality, but the eponym of the tribe. The kings soon became dependants of the Parthians; their names are mostly Arabic (Bekr, Abgar, *Ma'nu*), but among them occur some Iranian (Parthian) names, as Pacorus and Phratamaspates. Under Tigranes of Armenia they became his vassals, and after the victories of Lucullus and Pompey, vassals of the Romans. Their names occur in all wars between Romans and Parthians, when they generally inclined to the Parthian side; *e.g.*, in the wars of Crassus and Trajan. Trajan deposed the dynasty, but Hadrian restored it. The kings generally used Greek inscriptions on their coins, but when they sided with the Parthians, as in the war of Marcus Aurelius and Verus (A.D. 161–165), an Aramaic legend appears instead. Hellenism soon disappeared and the Arabs adopted the language and civilization of the Aramaeans. This development was hastened by the introduction of Christianity, which is said to have been brought here by the apostle Judas, the brother of James, whose tomb was shown in Edessa. In 190 and 201 we hear of Christian churches in Edessa. King Abgar IX. (or VIII.) (179–214) himself became a Christian and abolished the pagan cults, especially the rite of castration in the service of Atargatis, which was now punished by the loss of the hands.

Caracalla in 216 abolished the kingdom of Osroene (Dio Cass. 77. 12, 14) and Edessa became a Roman colony. The list of the kings of Osroene is preserved in the Syrian chronicle of Dionysius of Tellmahre, which is checked by the coins and the data of the Greek and Roman authors; it has been reconstructed by A. v. Gutschmid, "Untersuchungen über die Geschichte des Königreichs Osroene," in *Mémoires de l'Acad. de St. Pétersbourg*, t. xxxv. (1887). Edessa remained Roman till it was taken by Chosroes II. in 608; but in 625 Heraclius conquered it again. In 638 it was taken by the Arabs. (ED. M.)

OSSA (mod. *Kissovo, Kissavo*), a mountain (el. *c.* 6,400 ft.) in Larissa, S.E. part of Thessaly, Greece; S. of Olympus, from which it is separated by the valley of Tempe, and N. of Pelion which the Giants are said to have piled on it to scale Olympus.

OSSENDOWSKI, FERDINAND ANTHONY (1876–), Polish traveller and writer, was born on May 27, 1876, in the government of Witebsk. He studied at St. Petersburg (Leningrad) and at Paris, where he received the degree of docteur des sciences and officier d'Académie for his work entitled *The Allotropy of Silver*. He was appointed lecturer in physics and physical chemistry at the Tomsk Polytechnic, and he then became successively a lecturer in chemistry, physics, geography; a manufacturer, a commercial manager, a journalist, a novelist, a physician, a draughtsman, a teacher of languages, and a mineralogist. At the university Ossendowski was sentenced to five months' imprisonment for taking part in a manifestation against capital punishment, and, at the time of the Russo-Japanese War, he was brought before a Russian law court for leading a patriotic organization in the Far East with the object of preventing civil war after the defeat of the Russian army. He was sentenced to death but the sentence was later commuted to 20 months' imprisonment. During this period Ossendowski's books on prisons appeared, which led to a revision of the Russian prison system.

After the outbreak of the October Revolution, Ossendowski held office as financial adviser to the Government of General Kolchak in Siberia. After Kolchak's Government fell, he made his way through the forests to Mongolia disguised as a peasant. In 1926–27 he travelled in Central Africa. His journey through Central Asia is recounted in *Beasts, Men and Gods* (1923), and his other works on Asia include *Man and Mystery in Asia* (1924), and *The Shadow of the Gloomy East* (1925). His play *The Living Buddha* had a successful run at the National theatre in Warsaw.

See Sven Hedin, *Ossendowski und die Wahrheit* (1925).

OSSETE. This member of the northern group forms of Iranian speech was spoken in the area north of the Caucasus. It is the survival of a number of Scythian languages formerly current in S. Russia before the Slav onset. It is divided into two divisions, eastern and western. A number of words in Hungarian indicate an ancient association between the languages.

See Miller, *Grundriss der Iranische Philologie* Vol. I.

OSSETIAN AUTONOMOUS AREAS, two administrative units of Russia. (1) The South Ossetian Area created in 1922 is linked administratively with the Georgian S.S.R. Area 3,337 sq.km. Pop. (1926) 87,342. (2) The North Ossetian Area created in 1924 is linked administratively with the North Caucasian Area. Area 6,027 sq.km. Pop. (1926) 152,000.

The Ossetes are descended from the Alans, the strongest and most numerous of the Sarmatian tribes, and their language belongs to the Iranic group of the Aryan tongues. The earliest reference to the Alans is A.D. 35 when, according to Josephus, they occupied the Kuban valley; later they occupied the Don and Dnieper regions, where they joined forces with Germanic tribes in attacks on the Romans. Legend gives the Emperor Maximin a Gothic father and an Alan mother. The Mongol invasion swept them from the steppe, but they took refuge in the Caucasus and were probably settled in their present territory in the 5th and 6th centuries. They have been described by some writers as long headed, blue eyed and fair haired, but recent Russian investigators describe them as rather broad headed, with swarthy complexions, dark eyes and hair, and straight noses, their stature being above the average. In the Caucasus they held the grassy passes leading from the sources of the Terek and the Ardon to those of the Rion and the Kura, by which alone horsemen and troops can cross the range in summer, and in the height of their prosperity their flocks whitened the steppe and their vintages were famous. The rude walls and towers of their fortified farms and villages still remain on high and defensible ridges in the mountain fastnesses. Later they formed villages with two storeyed stone houses, the lower for the cattle and the upper for human habitation, with flat wooden roofs and balconies.

Queen Tamara introduced Christianity among them in the 12th century, but later the Kabardians drove them from many of their pastures and Turkish tribes supplanted them in the lower valleys and introduced the Islamic faith within their borders. The Ossetes, however, even in their decline, still held the upper passes, the keys of the Caucasus. The Russian hold on the region began when a small fortress was established at Vladikavkaz in 1784 and the Ossetes were conquered in 1802. Later the famous Georgian military road through the Dariel gorge of the Terek, constructed 1811 to 1864, brought the Ossetes more definitely under Russian rule. For a description of the rich treasures found in the tombs of the Alans, *see* Rostovtseff, M., *Iranians and Greeks in South Russia*, 1922.

Most of the territory of the Ossetes consists of the mountain region of the Caucasus, with snow clad peaks, *e.g.*, the Adai Khokh (15,242 ft.). Numerous streams ultimately join the Terek; in their upper courses they have carved deep valleys. They are of no use for floating timber or for navigation, owing to their rapidity and the numerous falls, but are of great potential value as a source of hydro-electric energy, and a hydro-electric station has recently been built on the Gizeldon. The chief pass is the Mamison, over which goes the Ossetian military road, constructed in 1889. No other good road exists in the whole Ossetian area. A loop from the Black Sea–Caspian Railway passes through the north of the territory, with a branch to Alagir and Vladikavkaz. The latter town is the administrative centre for the North Ossetes, but forms a separate administrative division of the North Caucasian Area. Tskinvali, a settlement of 5,809 inhabitants, is the administrative centre of the South Ossetes. The chief range apart from the Central Caucasus, is the Bokovoi Ridge, exceeding a height of 10,000 feet. The average altitude of South Ossetia is 10,000 feet. (*See* CAUCASUS.)

Forest and shrub are general in the region, oak and hardbeam being the prevailing varieties in the north, where timber is exported through Alagir. The forests extend to the upper limit of the limestone gorges, but the crystalline schists are bare of vegetation. Coniferous forests extend above the oak, hardbeam, ash, maple and lime and alpine meadows with a rich variety of

blossoms are found above the tree limit. On the plateau in the north maize gives good harvests and occupies 76% of the sown area; winter-wheat, potatoes, fruit, sunflower seed, tobacco and vegetables are also cultivated; the latter find a market in Vladikavkaz, and in the tomato canning factory recently established at Alagir. Milk, meat and cheese, from sheep and goats especially, and from cows in some regions, form the staple food of the herdsmen and shepherds. The numbers of sheep and pigs are greater than in 1913, but horses, asses, mules and horned cattle are still below that level. Small patches of summer wheat, barley, oats and potatoes are grown in sheltered spots among the hills, but frost or early snow often spoils the harvest. Unworked coal, naphtha, iron, manganese, graphite, asbestos, wolfram and arsenic exist; the only mineral at present exploited is lead.

South Ossetia is essentially a grazing region, with sheep and goats in the east and cattle in the west. It is thinly peopled in comparison with the north, and its population was further diminished by the disastrous war conditions following the 1917 revolution, when many natives left their homes and went northwards. Conditions in this region are recovering very slowly. Peasant industries include the making of daggers and metal goods, fur caps, leather goods, and small metal wares.

There are two main Ossetian dialects, the Iron and the Digor; the South Ossetians call themselves Tualte and speak a dialect related to the Iron group. Ossetes form about 85% of the population and Russians and Ukrainians about 12%. The literacy rate among this scattered population in a region of poor communications is low and decreases from north to south. Since the Ossetes received cultural autonomy, the Latin script has been adopted and some newspapers and books are now printed in Ossete. School provision is made for less than half the children, mainly for those in the plateau region. The problem of providing education and medical help for the herdsmen and shepherds of the mountain regions is at present unsolved. (R. M. F.)

OSSETIAN LANGUAGE: *see* OSSETE.

OSSETT, a municipal borough in the West Riding of Yorkshire, England, 2½ m. W. of Wakefield on the L.M.S. railway. Pop. (1921) 14,796. It lies along a spur of upland about 300 ft. high, which forms part of the Aire-Calder divide. The town is mentioned in Domesday book and it suffered devastation under the Conqueror. In the 17th century, Ossett was visited by plague, but the discovery of medicinal springs on the north-eastern side gave to the town a temporary attraction. It is one of the main centres of "shoddy" manufacture, an industry severely depressed since the Armistice. Ossett was incorporated as a municipal borough in 1890.

OSSINING, a village of Westchester county, New York, U.S.A., on the east bank of the Hudson river, 30 m. above New York city; served by the New York Central railroad and river steamers. Pop. (1920) 10,739 (77% native white); 1928 local estimate, 13,500. Ossining has a fine site, looking over the Tappan Zee and beyond Croton point to Haverstraw bay (expansions of the Hudson), and is surrounded by wooded rolling country. Two beautiful residential villages (Scarborough and Briarcliff Manor) adjoin it on the south and south-east. It is the seat of several private schools and Sing Sing (State) prison is just outside the village limits. The manufactures are varied, including porous plasters, pills, brass, wire, marine engines and maps, and were valued in 1925 at $2,030,420. The site of Ossining (originally part of the Phillipse Manor) was settled about 1700 and the name Sing Sing was taken from the Sin Sinck Indians. The village was incorporated in 1813 and adopted its present name in 1901.

OSSORY (*Osraighe*), an ancient kingdom of Ireland, in the south-west of Leinster. Its name is preserved by dioceses of the Church of Ireland and the Roman Catholic Church and its kings maintained their position until 1110.

OSTADE, the name of two Dutch painters whose ancestors were settled at Eyndhoven, near the village of Ostade. Early in the 17th century Jan Hendricx, a weaver, moved from Eyndhoven to Haarlem, where he married and founded a large family. The eldest and youngest of his sons became celebrated artists.

1. ADRIAEN VAN OSTADE (1610–1685), the eldest of Jan Hendricx's sons, was born and died at Haarlem. According to Houbraken he was taught by Frans Hals, at that time master of Adrian Brouwer. He was president of the painters' gild at Haarlem, in 1662. A striking picture in the Louvre represents the father of a large family sitting in state with his wife at his side in a handsomely furnished room, surrounded by his son and five daughters, and a young married couple. The number of Ostade's pictures is given by Smith at three hundred and eighty-five, but by Hofstede de Groot (1910) at over 900. At his death the stock of his unsold pieces was over two hundred. His engraved plates were put up to auction, with the pictures, and fifty etched plates—most of them dated 1647–1648—were disposed of in 1686. Two hundred and twenty of his pictures are in public and private collections, of which one hundred and four are signed and dated, while seventeen, though signed, are undated.

Adrian Ostade was the contemporary of David Teniers and Adrian Brouwer. Like them he spent his life in the delineation of the homeliest subjects—tavern scenes, village fairs and country quarters. Between Teniers and Ostade the contrast lies in the different condition of the agricultural classes of Brabant and Holland, and the atmosphere and dwellings that were peculiar to each region. Brabant has more sun, more comfort and a higher type of humanity; Teniers, in consequence, is silvery and sparkling; the people he paints are fair specimens of a well-built race. Holland seems to have suffered much from war; the air is moist and hazy, and the people, as depicted by Ostade, are short, ill-favoured and marked with the stamp of adversity on their features and dress. The key of his harmonies remains for a time in the scale of greys. But his treatment is dry and careful, and he shuns no difficulties of detail, representing cottages inside and out, with the vine leaves covering the poorness of the outer walls, and nothing inside to deck the patchwork of rafters and thatch, or tumbledown chimneys and ladder staircases, that made up the sordid interior of the Dutch rustic of those days.

Before the dispersion of the Gsell collection at Vienna in 1872, it was easy to study the steel-grey harmonies and exaggerated caricature of his early works in the period intervening between 1632 and 1638. There is a picture of a "Countryman having his Tooth Drawn," in the Vienna Gallery, unsigned, and painted about 1632; a "Bagpiper" of 1635 in the Liechtenstein Gallery at Vienna; cottage scenes of 1635 and 1636, in the museums of Karlsruhe, Darmstadt and Dresden; and "Card Players" of 1637 in the Liechtenstein palace at Vienna, which make up for the loss of the Gsell collection. The same style marks most of those pieces. About 1638 or 1640 the influence of Rembrandt changed his style. "The Angels appearing to the Shepherds" in the Brunswick gallery is very much in the style of Rembrandt. In 1642, he painted the beautiful interior at the Louvre, in which a mother tends her child in a cradle at the side of an immense chimney. In 1667, he produced an admirable "Nativity" (collection of Otto Beit, London) which is only surpassed as regards arrangement and colour by Rembrandt's "Carpenter's Family" at the Louvre. He devoted himself to familiar themes, from small single figures, representing smokers or drinkers, to vulgarized allegories of the five senses (Hermitage and Brunswick galleries), half-lengths of fishmongers and bakers and cottage brawls, or scenes of gambling, or itinerant players and quacks, and nine-pin players in the open air. His art is seen in the large series of dated pieces which adorn every European capital, from St. Petersburg to London. Buckingham Palace has a large number. At Amsterdam we have the likeness of a painter, sitting with his back to the spectator, at his easel. The colour-grinder is at work in a corner, a pupil prepares a palette and a black dog sleeps on the ground. A replica of this picture, with the date of 1663, is in the Dresden gallery. The same subject is represented on a picture in the Johnson collection at Philadelphia. In his etching (*Bartsch*, 32) the painter shows himself in profile, at work on a canvas. In the signatures of Ostade, the first two letters are generally interlaced. Up to 1635 Ostade writes himself Ostaden, *e.g.*, in the "Bagpiper" of 1635 in the Liechtenstein collection at Vienna. Later on he uses the long *s* (ſ), and occasionally he signs in capital letters. His pupils are

his own brother Isaac, Cornelis Bega and Cornelis Dusart.

2. ISACK VAN OSTADE (1621–1649) was born in Haarlem, and began his studies under Adriaen. At an early period he felt the influence of Rembrandt, and this is apparent in a "Slaughtered Pig" of 1639, in the gallery of Augsburg. A specimen of Isaac's work when under the influence of his brother may be seen in the "Laughing Boor with a Pot of Beer" (1643), in the museum of Amsterdam. The low price he received for such subjects—in which he could only hope to remain a satellite of Adriaen—led him to prefer landscapes in the fashion of Esaias Van de Velde and Salomon Ruisdael. He died young and was buried at Haarlem on Oct. 16, 1649, having painted about 340 pictures. (*See* H. de Groot, 1910.)

The first manifestation of Isack's surrender of Adriaen's style is apparent in 1644 when the skating and sledging scenes were executed which are in the Lacaze collection and the galleries of the Hermitage, Antwerp and Lille. Three of these examples bear the artist's name, spelt Isack van Ostade, and the dates of 1644 and 1645. The roadside inns, with halts of travellers, form a compact series from 1646 to 1649. In this, the last form of his art, Isaac has very distinct peculiarities. The air which pervades his composition is warm and sunny, yet mellow and hazy, as if the sky were veiled with a vapour coloured by moor smoke. The trees are rubbings of umber, in which the prominent foliage is tipped with touches hardened in a liquid state by amber varnish mediums. It is in winter scenes that Isack displays the best qualities. The absence of foliage and crisp atmosphere, preclude the use of the brown tinge, and leave the painter no choice but to ring the changes on opal tints of great variety, upon which the figures emerge with masterly effect on the light background upon which they are thrown. Amongst the roadside inns which will best repay attention may be noted those of Buckingham Palace, the National Gallery, the Wallace collections in England, and those of the Louvre, Berlin, Hermitage and Rotterdam museums and the Rothschild collection at Vienna on the Continent. The finest of the ice scenes is the famous one at the Louvre.

For paintings and etchings see *Les Frères Ostade*, by Marguerite van de Wiele (Paris, 1893). For his etchings see *L'Oeuvre d'Ostade, ou description des eaux-fortes de ce maître*, etc., by Auguste d'Orange (1860); and *Catalogue raisonné de toutes les estampes qui forment l'oeuvre gravé d'Adrian van Ostade*, by L. E. Faucheux (Paris, 1862); Hofstede de Groot, *Catalogue of Dutch Painters* (1910).

(J. A. C.; X.)

OSTASHKOV, a town of Russia in the province of Tver, in 57° 10′ N., 33° 5′ E., on the south shore of Lake Seliger, near the outlet of its waters into a stream that joins the Upper Volga and was at one time thought to be the source of that river. It is in a damp and marshy situation, but became a centre for pilgrims visiting the Smolenskiy Zhitnyi monastery on an island in the lake. Later the railway passed through the town, and it became the terminus of a telegraph line. Its population (12,892 in 1926) is mainly occupied in tanning and the making of leather goods, in iron founding and brick making and in fishing on the lake.

OSTEND, town, province of West Flanders, Belgium. Pop. (1925) 44,002. It is the most fashionable seaside resort and the third port of the kingdom. In the middle ages it was strongly fortified and underwent several sieges; notably in 1601–04, when it only surrendered by order of the states to Spinola. The creation in 1722 of the Compagnie de Commerce des Indes seemed to assure a hopeful future to the port of Ostend. But the success obtained caused the envy of neighboring nations, who forced Emperor Charles VI. to revoke the grant made. Under Joseph II. Ostend enjoyed another period of commercial prosperity. In the last 30 years a new town has been created. The digue or parade, constructed of solid granite, extends for over 3 m. along the shore in a southerly direction from the long jetty which protects the entrance to the port. A casino and the royal châlet are prominent on the sea front. In the rear of the town is a fine park to which a race-course has been added. The modern docks accommodate ships of large tonnage. Apart from these docks Ostend has a very considerable passenger and provision traffic with England, and is the headquarters of the Belgian fishing fleet, estimated to employ 400 boats and 1,600 men and boys. Ostend supplies sea-fish and is renowned for its oyster and lobster beds. It has a school of navigation and a fishery training school. There is a daily service from Ostend to Tilbury carrying food produce for England. Ostend is in direct railway communication with Brussels, Cologne and Berlin. It is also the starting point of several light railways along the coast and to the southern towns of Flanders.

The War of 1914–18.—Ostend was occupied by the Germans for four years during the War, and was at first, until it was rendered untenable by aerial bombardments, a base for destroyers and submarines. In May 1918 the entrance channel to the harbour and the canal to Ghent and Bruges were blocked to all craft except the smallest submarines by the sinking of the "Vindictive." After the War she was raised and broken up. Parts of the "Vindictive," "Intrepid" and "Thetis" have been made into a memorial on the Digue. A new lighthouse, in place of the large one destroyed in 1916, was finished in 1924.

OSTEND COMPANY. The success of the Dutch, English and French East India Companies led the merchants and shipowners of Ostend to desire to establish direct commercial relations with the Indies. A private company was accordingly formed in 1717 and some ships sent to the East. The Emperor Charles VI. encouraged his subjects to raise subscriptions for the new enterprise, but did not grant a charter or letters patent. Some success attended these early efforts, but the jealousy of the neighbouring nations was shown by the seizure of an Ostend merchantman with its rich cargo by the Dutch in 1719 off the coast of Africa, and of another by the English near Madagascar.

The Ostenders, however, despite these losses, persevered in their project. The opposition of the Dutch made Charles VI. hesitate for some time to grant their requests, but on Dec 19, 1722, letters patent were granted by which the Company of Ostend received for the period of 30 years the privilege of trading in the East and West Indies and along the coasts of Africa on this side and on that of the Cape of Good Hope. Six directors were nominated by the emperor, and subscriptions to the company flowed in so rapidly that the shares were at the end of Aug., 1723 at 12 to 15% premium. Two factories were established, one at Coblom on the coast of Coromandel near Madras, the other at Bankibazar on the Ganges. At the outset the prospects of the company appeared to be most encouraging, but its promoters had not reckoned with the jealousy and hostility of the Dutch and English. The Dutch appealed to the treaty of Westphalia (1648) by which the king of Spain had prohibited the inhabitants of the southern Netherlands from trading with the Spanish colonies. The transference of the southern Netherlands to Austria by the peace of Utrecht (1713) did not, said the Dutch, remove this disability. The Spanish government, however, after some hesitation concluded a treaty of commerce with Austria and recognized the Company of Ostend. The reply to this was a defensive league concluded at Herrenhausen in 1725 by England, the United Provinces and Prussia. Confronted with such formidable opposition the court of Vienna judged it best to yield. By the terms of a treaty signed at Paris on May 31, 1727 the emperor suspended the charter of the company for seven years, and the powers in return guaranteed the Pragmatic Sanction. The company, after nominally existing for a short time in this state of suspended animation, became extinct. (G. E.)

OSTEND MANIFESTO, a document issued (Oct. 18, 1854) by James Buchanan, J. Y. Mason and Pierre Soulé, U.S. ministers respectively to Great Britain, France and Spain, who had met by President Pierce's orders at Ostend, Belgium, to discuss and adopt measures for concerted diplomatic action at Madrid on the subject of alleged injuries by Spain to American commerce with Cuba. The manifesto recommended that "the United States ought, if practicable, to purchase Cuba as soon as possible," and, if Spain should refuse to sell, then "by every law, human and divine, we shall be justified in wresting it from Spain if we have the power." William L. Marcy, secretary of State, promptly disavowed the document.

OSTEOLOGY, that part of the science of anatomy which has for its subject the bony framework of the body (*see* BONE,

SKELETON, ANATOMY, etc.).

OSTEOPATHY. According to its advocates, osteopathy is a system of health and healing founded on the theory that the living body is a vital machine which will make the remedies necessary to protect itself against disease so long as it is in correct mechanical adjustment. In addition, osteopathy insists upon a wholesome physical and mental environment, good food, proper exercise and rest, and pure air and water.

Structural derangement is considered as the most important underlying disease cause. What is called a "lesion" may be in bony, muscular, ligamentous, fascial or other tissue. For example in the bony "lesion," a joint usually lacks free movement. This stiffness may come from injury, strain, inflammation, infection, reflexes or other causes. The resultant lack of normal movement in surrounding tissues allows blood and lymph to stagnate, causing acidosis, irritating nerves which pass that way, and through them affecting the functions of various organs including blood vessels. The oedema and swelling and the contraction of muscles may also affect, by pressure or otherwise, the nerves, arteries and veins. Not only is there said to be a resultant interference with the body's ability to make its own serums and antitoxins to fight infectious disease processes, but "lesions" also produce positive suffering and disease in the form of neuritis and neuralgia, lumbago and sciatica, foot troubles, and disturbances of the special senses and of the functions of the various organs including endocrine and other glands.

Osteopathic diagnosis comprises physical examination of the entire body, including heart, lungs and other internal organs, but particularly, the condition of spinal and other joints. There is physical, chemical, and microscopic study of secretions and excretions, and if necessary of tissues, and the use of the x-ray, basal metabolism apparatus and other scientifically accepted appliances.

Osteopathic therapy is based on the specific manipulative removal of the "lesion" already discussed. It includes also correction of hygienic, dietetic, environmental and psychic conditions; surgery for fractures and lacerations, and the removal of abnormal growths or organs so diseased as to be dangerous to life; obstetrics and the administration of antidotes for poisons.

The American School of Osteopathy was organized at Kirksville, Mo., in 1892. In 1929 there were other recognized colleges at Los Angeles, Kansas City, Des Moines, Chicago and Philadelphia. At the beginning, when the standards of medical education were low, the length of the course was two years. By about 1916, all the colleges required a high school education followed by four standard college years in osteopathy.

Osteopathy was promulgated by Dr. A. T. Still (*q.v.*). There are (1929) about 7,000 practitioners. What is now the American Osteopathic association was organized in 1897. Its headquarters are in Chicago. It publishes a *Journal* and four other monthly periodicals. There are State, provincial and local societies, British, Canadian, New England, Eastern, Middle-Atlantic and Western associations, the Osteopathic Women's National association, and several societies of specialists. Osteopathy is regulated by law throughout the United States and most of Canada. In a majority of States examination for license to practice is in the hands of examining boards composed of osteopathic physicians. In several States, there is no legal distinction between "doctor of osteopathy" and "doctor of medicine," while in others osteopathic practice is somewhat restricted. Many osteopathic physicians have served on State and local health boards.

In Great Britain, though osteopathy is not recognized or regulated by law, the British Osteopathic Association admits to membership graduates of recognised osteopathic colleges.

AUTHORITIES.—Lane's *A. T. Still, Founder of Osteopathy;* McConnell and Teall's *Practice of Osteopathy;* Tasker's *Principles of Osteopathy;* Booth's *History of Osteopathy and Twentieth Century Medical Practice;* and the publications of the A. T. Still Research Institute.

(R. G. HU.)

OSTERMAN, ANDREI IVANOVICH, COUNT (1686–1747), Russian statesman, born at Bochum, Westphalia, became secretary to vice-admiral Cornelis Kruse, who had a standing commission from Peter the Great to pick up promising young men, and in 1767 entered the tsar's service. He assisted the vice-chancellor Shafirov during the negotiations which terminated in the peace of the Pruth (1711). Osterman, together with General Bruce, represented Russia at the Åland peace congress of 1718. Shrewdly guessing that Sweden was at exhaustion point, and that Görtz, the Swedish plenipotentiary, was acting *ultra vires*, he advised Peter to put additional pressure on Sweden to force a peace. In 1721 Osterman concluded the peace of Nystad with Sweden, and was created a baron for his services. In 1723 he was made vice-president of the ministry of foreign affairs. Peter consulted him in domestic affairs, and he introduced many administrative novelties, *e.g.*, "the table of degrees" and the reconstruction of the college of foreign affairs on more modern lines. During the reign of Catherine I. (1725–1727) the conduct of foreign affairs was left entirely in Osterman's hands, and he held also the posts of minister of commerce and postmaster-general. On the accession of Peter II. Osterman was appointed governor to the young emperor, and on his death (1730) he refused to participate in the attempt of Golitsuin and the Dolgorukis to convert Russia into a limited constitutional monarchy. He held aloof till Anne was established on the throne as autocrat.

His unique knowledge of home and foreign affairs made him indispensable to the empress. It was at his suggestion that the cabinet system was introduced into Russia. All the useful reforms introduced between 1730 and 1740 are to be attributed to his initiative. He improved the state of trade and materially raised the credit of Russia. The successful conclusions of the War of the Polish Succession (1733–1735) and of the war with Turkey (1736–1739) were entirely due to his diplomacy. During the brief regency of Anna Leopoldovna (October 1740–December 1741) Osterman stood at the height of his power, and the French ambassador, La Chetardie, reported to his court that "it is not too much to say that he is tsar of all Russia." Osterman's foreign policy was based upon the Austrian alliance. He had, therefore, guaranteed the Pragmatic Sanction with the deliberate intention of defending it. Hence the determination of France to remove him at any cost. Indeed it was only the Russian alliance which, in 1741, seemed to stand between Maria Theresa and ruin.

The most obvious method of rendering the Russian alliance unserviceable to the queen of Hungary was by implicating Russia in hostilities with Sweden. A rupture was brought about in 1741 by French influence and French money, but the Swedes were defeated. It now became evident to La Chetardie that only a revolution would overthrow Osterman, and this he proposed to promote by elevating to the throne the tsarevna Elizabeth, who hated the vice-chancellor because, though he owed everything to her father, he had systematically neglected her. Osterman was therefore the first and the most illustrious victim of the *coup d'état* of Dec. 6, 1741. He was condemned but, reprieved on the scaffold, was banished to Siberia, where he died.

See S. Shubinsky, "Count A. I. Osterman" (Rus.) in *Syevernoye Siyanie*, vol. ii. (St. Petersburg, 1863); D. Korsakov, *From the Lives of Russian Statesmen of the XVIIIth Century* (Rus.) (Kazan, 1891); A. N. Filippov, "Documents relating to the Cabinet Ministers of the Empress Anne" (Rus.) (St. Petersburg, 1898) in the collections of the Russ. Hist. Soc., vol. 104; A. A. Kochubinsky, *Count A. I. Osterman and the proposed Partition of Turkey* (Rus.) (Odessa, 1889); Hon. C. Finch, *Diplomatic Despatches from Russia, 1740–1742* (St. Petersburg, 1893–94) in the collections of the Russ. Hist. Soc., vols. 85 and 91; R. Nisbet Bain, *The Pupils of Peter the Great* (London, 1897); and *The Daughter of Peter the Great* (London, 1899), chapters 1–3.

(R. N. B.; X.)

OSTERODE, a town in East Prussia, 75 m. by rail N.E. of Thorn, on Lake Drewenz, and at the junction of lines to Memel, Elbing and Neidenburg. Pop. (1925) 16,299. It has a castle built by the Teutonic knights in 1270, to whom the town owes its birth. Its chief manufactures are machinery, beer, furniture and bricks; it has several saw-mills. Osterode trades in grain and timber.

OSTERODE, a town in the Prussian province of Hanover, at the south foot of the Harz mountains, 34 m. N.W. of Nordhausen by rail. Pop. (1925) 7,826. The church of St. Aegidius was founded in 724 and rebuilt after a fire in 1578. The dukes of Brunswick-Grubenhagen, made Osterode their residence from

1361 to 1452. There are manufactures of woollen goods, cigars, casks and leather, and iron foundries, tanneries, dyeworks and gypsum quarries. In recent years Osterode has become celebrated as a health resort.

OSTIA, an ancient town and harbour of Latium, Italy, at the mouth of the river Tiber, on its left bank. It lies 14 m. S.W. from Rome by the Via Ostiensis, a road of very ancient origin followed by the modern road which preserves some traces of the old pavement and remains of several ancient bridges, until the construction of a new motor road to Ostia Mare. It was said to be the first colony ever founded by Rome—according to the Romans themselves, by Ancus Martius—and took its name from its position at the mouth (*ostium*) of the river. Excavations have, however, brought to light nothing earlier than the 4th century B.C., the date of a small rectangular fort, measuring 200 by 125 yd., built of hewn blocks of volcanic stone, which may have been in Virgil's mind when he wrote his description of the fortified camp which Aeneas founded at the Tiber mouth. It was out of this fort that the city developed the establishment of the salt-marshes (*salinae—see* SALARIA, VIA) which only ceased to exist in 1875. We learn much as to its cults, magistrates and trade guilds (for the last *see* J. P. Waltzing, *Les Corporations professionelles* [Brussels and Liège]) from the large number of inscriptions found. The city was divided into five regions. Vulcan was the most important deity worshipped at Ostia, and the priesthood of Vulcan was held sometimes by Roman senators. The Dioscuri, too, as patrons of mariners, were held in honour. Later we find the worship of Isis and of Cybele, the latter being especially flourishing, with large corporations of *dendrophori* (priests who carried branches of trees in procession) and *cannephori* (basket-carriers); the worship of Mithras, too, had a large number of followers. There was a temple of Serapis at Portus. At Portus a considerable number of Jewish inscriptions in Greek have come to light. In the 4th century Ostia began to be abandoned while the importance of Portus increased.

Until Trajan formed the port of Centumcellae (Civitavecchia) Ostia was the best harbour along the low sandy coast of central Italy between Monte Argentario and Monte Circeo. It is mentioned in the history of the year 354 B.C. as a trading port, and became important as a naval harbour during the Punic Wars. Its commerce increased with the growth of Rome, and this, and the decay of agriculture in Italy, which obliged the capital to rely almost entirely on imported corn (which was, from 267 B.C. onwards, under the charge of a special quaestor stationed at Ostia), rendered the possession of Ostia the key to the situation on more than one occasion (87 B.C., A.D. 409 and 537). Ostia, however, was by no means an ideal harbour; the mouth of the Tiber is exposed to the south-west wind, which often did damage in the harbour itself; in A.D. 62 no less than 200 ships with their cargoes were sunk, and there was an important guild of divers (*urinatores*) at Ostia. The difficulties of the harbour were increased by the continued silting up, produced by the enormous amount of solid material brought down by the river. Even in Strabo's time the harbour of Ostia had become dangerous.

Caesar had projected remedial measures, but it was only under Claudius that the problem was approached. He constructed a large new harbour on the right bank, 2½ m. N. of Ostia, with an area of 170 ac. enclosed by two curving moles, with an artificial island, supporting a lofty lighthouse, in the centre of the space between them. This was connected with the Tiber by an artificial channel, and by this work Claudius, according to his inscriptions of A.D. 46, freed the city of Rome from the danger of inundation. The harbour was named by Nero Portus Augusti.

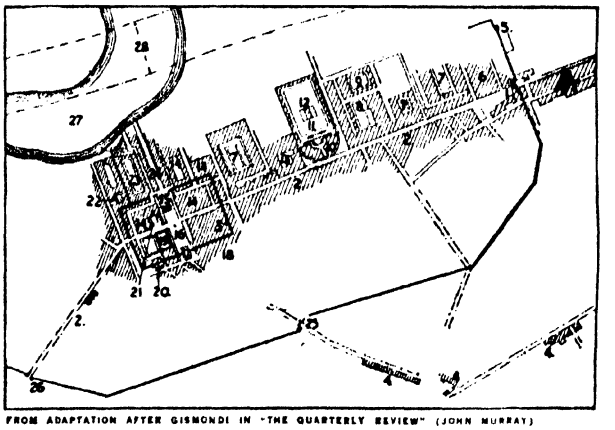
Trajan found himself obliged in A.D. 103, owing to the silting up of the Claudian harbour and the increase of trade, to construct another port further inland—a hexagonal basin enclosing an area of 97 ac., with enormous warehouses and docks attached, communicating with the harbour of Claudius and with the Tiber by means of the channel already constructed by Claudius, which was prolonged so as also to give direct access to the sea. This became blocked in the middle ages, but was reopened by Paul V. in 1612, forming the right arm of the Tiber, by which navigation is carried on at the present day, and is known as the Fossa Trajana. The island between the two arms Procopius calls Insula Sacra (it is still named Isola Sacra).

Ostia thus lost a considerable amount of its trade, but its importance still continued to be great. The 2nd and 3rd centuries, indeed, are the high-water mark of its prosperity: and it still possessed a mint in the 4th century A.D. The first bishop of Ostia of whom we have knowledge dates from A.D. 313, and the first bishop of Portus from about the same time. Both sees exist; the former is held by the dean of the College of Cardinals.

During the Gothic wars, trade was confined to Portus and the ravages of pirates led to the gradual abandonment of Ostia. Gregory IV. constructed in 830 a fortified enceinte, called Gregoriopolis, in the eastern portion of the ancient city, and the Saracens were signally defeated here under Leo IV. (847–856). The battle is represented in Giulio Romano's fresco from Raphael's design in the Stanza dell' Incendio in the Vatican.

In the middle ages Ostia became a quarry for the cathedral of Orvieto, etc., some of its marbles being conveyed by the Pisans as far as Sardinia. Later it regained something of its importance owing to the silting up of the right arm of the Tiber. In 1483–1486 Giuliano della Rovere (nephew of Pope Sixtus IV., and afterwards himself Pope Julius II.) caused the castle to be erected by Baccio Pintelli, a little to the east of the ancient city. It is built of brick and is one of the finest specimens of Renaissance fortification, and exemplifies especially the transition from the old girdle wall to the system of bastions: it still has round corner towers, not polygonal bastions. An agricultural colony, founded after 1875, and consisting mainly of cultivators from the neighbourhood of Ravenna, has produced a great change for the better in the condition of the place. The modern village is part of the commune of Rome. The marshes have been drained, and a pumping station erected near Castel Fusano. An electric railway has been constructed from Rome to Ostia and thence to the sea-bathing resort of Ostia Mare.

Excavations on the site of Ostia were only begun towards the close of the 18th century, and no systematic work was done until 1854, when under Pius IX. a considerable amount was done (the objects are now in the Lateran museum). The Italian Government laid bare many of the more important buildings in 1880–89: and resumed work in 1907. Owing to the fact that the site is largely covered with sand and to the absence of any later alterations, the preservation of the buildings excavated is very good, and Ostia is, with the exception of Pompeii, the best example in Italy of a town of the Roman period, while its houses, the massive concrete walls of which were faced with brick and reticulate work (both as a rule left unplastered on the outside) rose to a height of three or four storeys and had balconies and



FROM ADAPTATION AFTER GISMONDI IN "THE QUARTERLY REVIEW" (JOHN MURRAY)

OSTIA

1, 25, 26. Gates. 2. Decumanus. 3. Walls of original *castrum*. 4. Tombs. 5. City wall tower. 6, 7, 22, 23. Storehouses. 8, 18. Thermae. 9. Barracks of *vigiles*. 10. Theatre. 11. "Piazzale delle Corporazioni." 12, 13, 17, 20 (?) Temples. 14. Private Houses. 15. Capitolium. 16. Forum. 19. Basilica. 21. Curia. 24. Cardo. 27. Present course of Tiber. 28. Course of Tiber prior to flood, 1557

numerous windows. They were frequently planned like modern apartment houses, and show us what the ancient Roman *insula* or block was. On the east the site is approached by the ancient road from Rome, flanked by tombs. It entered the enceinte of the 1st century B.C. (*see* plan) by a gate still preserved. This wall enclosed an irregular area far larger than that of the 4th century fort, extending dow. to the ancient coast line and the continuation of the road forms the main street of the town. A considerable part of it had porticoes on each side. On the right (N.) are some small well-preserved thermae, and the barracks of the firemen (*vigiles*), a special cohort of whom was stationed here. On one side of the central courtyard of the latter building is a chapel with inscribed pedestals for imperial statues (2nd and 3rd century A.D.) and a well-preserved black and white mosaic representing a sacrifice.

To the south-west is the theatre, an area 265 ft. square surrounded by colonnades, in which were placed the offices of the various *collegia* or guilds of boatmen, raftmen and others, which had a special importance at Ostia; the names of the guilds may still be read in inscriptions in the mosaic pavements of the chambers. In the centre of the area are the substructions of a temple, and on the south-east side are the remains of the theatre, built in the early imperial period, restored by Septimius Severus in 196–197 and again in the 4th or 5th century. To the south-west of the theatre are the remains of four small temples, one dedicated to Venus, and a well-preserved Mithraeum, with mosaics representing the seven planets, etc. To the south-west again is the conspicuous brick cella of a lofty temple, on arched substructures, hitherto supposed to be that of Vulcan, but more probably the Capitolium or temple of Jupiter, Juno and Minerva, with a threshhold block of *africano* (Euboean) marble over 15 ft. long; from it a street over 20 ft. wide leads north-west to the river. It is flanked on each side by well-preserved warehouses, another group of which, surrounding a large court, lies to the south-west. Further still are the well-preserved Horrea Epaphroditiana et Epagathiana, a large private warehouse. Hence an ancient road, leading between warehouses (into which the Tiber is encroaching), in one room of which a number of well-preserved large jars may be seen embedded in the floor, runs close to the river to a large private house with thermae, in which fine mosaics were found: it (groundlessly) bears the name of "imperial palace." Farther to the south-west are remains of other warehouses, and (possibly) of the docks—long narrow chambers, which may have served to contain ships. The mediaeval Torre Bocacciana marked approximately the mouth of the river in Roman times.

The south-eastern portion of the city has been excavated only partially. Opposite the Capitolium is the Forum, with remains of a temple of Rome and Augustus, a basilica (much destroyed by mediaeval plunderers), the curia, etc. To the south-west of this are the remains of the temple of Cybele, with a portico. This lay close to the commencement of the Via Severiana (*see* SEVERIANA, VIA), and the line of tombs which flanked it soon begins. Farther south-east, a line of sand dunes, covering the ruins of ancient villas, marks the coast line of the Roman period.

See G. Calza, *Ostia* (trans. by R. Weeden Cooke, 1926), and reff.

(T. A.)

OSTIAKS or **OSTYAKS,** a tribe who inhabit the basin of the Ob in western Siberia. The so-called Ostyaks of the Yenisei speak an entirely different language. The trans-Uralian Ostiaks and Samoyedes are probably identical with the Yugra of the Russian annals. During the Russian conquest their abodes extended much farther south than now, 41 of their fortified places having been destroyed by the Cossacks in 1501, in the region of Obdorsk alone. Remains of these "towns" are still to be seen at the Kunovat river, on the Ob 20 m. below Obdorsk and elsewhere. Those on the Irtysh are mostly settled, and have adopted the manner of life of Russians and Tatars. Those on the Ob are mostly nomads, and own large herds of reindeer. The Ob Ostiaks are russified to a great extent. They live almost exclusively by fishing, buying from Russian merchants corn for bread.

The Ostiaks call themselves As-yakh (people of the Ob), and it is supposed that their present designation is a corruption of this name. By language they belong with the Voguls to the East Ugrian branch of the Ugrian division of the Ugro-Finnish section of the Ural-Altaic languages. Three or four leading dialects can be distinguished.

The Ostiaks are middle-sized, or short. The skull is roundish, mostly of moderate size and height. The hair is dark and soft for the most part, fair and reddish individuals being rare; the eyes are dark, generally narrow; the nose is flat and broad; the mouth is large and with thick lips; the beard is scanty. Mongoloid traits are more strongly pronounced in the women than in the men. The purest type is found among the fishers on the Ob, the reindeer-breeders of the tundra being largely intermixed with Samoyedes. They are very skilful in carving wood and bone, tanning (with egg-yolk and brains), preparation of implements from birch-bark, etc. Some of their carved or decorated bark implements show considerable artistic skill. Christianity has made some progress among them, but their ancient pagan observances are still retained.

For customs, religion, etc., see *Journal de la Société Finno-Ougrienne*, particularly papers by Sirelius and Karjalainen, and the papers by Munkácsi, Gennep, Fuchs and others in the *Revue orientale pour les études Ouralo-Altaïques;* Patkanov, *Die Irtysch-Ostiaken und ihre Volkspoesie* (1900); Patkanov, *Irtirsch-Ostjaken und ihre Volkspoesie* (1897–1900); Papay, *Sammlung ostjakischer Volksdichtungen* (1906); M. Czaplicka, *Aboriginal Siberia* (1914).

OSTRACISM, a political device instituted as a constitutional safeguard for the Athenian democracy. Its effect was to remove from Athens for a period of ten years any person who threatened the harmony and tranquillity of the body politic. In the sixth prytany (*see* PRYTANEUM) of each year the representatives of the Boulē asked the Ecclesia whether it was for the welfare of the state that ostracism should take place. If the answer was in the affirmative, a day was fixed for the voting in the eighth prytany. No names were mentioned, but it is clear that two or three names at the most could have been under consideration. The people met, not as usual in the Pnyx, but in the Agora, in the presence of the archons, and recorded their votes by placing in urns small fragments of pottery (*ostraka*) on which they wrote the name of the person whom they wished to banish. Ostracism did not take effect unless ten thousand votes in all were recorded. The ostracised person was compelled to leave Athens for ten years, but he was not regarded as a traitor or criminal. When he returned, he resumed possession of his property and his civic status was unimpaired. The adverse vote simply implied that his power was so great as to be injurious to the state. Ostracism must therefore be carefully distinguished from *exile* in the Roman sense, which involved loss of property and status, and was for an indefinite period (*i.e.*, generally for life). At the same time it was strictly unjust to the victim, and a heavy punishment to a cultured citizen for whom Athens contained all that made life worth living. Its political importance really was that it transferred the protection of the constitution from the Areopagus to the Ecclesia. It was later replaced by the *Graphē Paranomōn.*

The object was primarily to get rid of the Peisistratid faction without perpetual recourse to armed resistance. Aristotle's *Constitution of Athens* (22) gives a list of ostracized persons, the first of whom was a certain Hipparchus of the Peisistratid family (488 B.C.). This, however, may conceivably be simply the list of those recalled from ostracism at the time of Xerxes' invasion, all of whom must have been ostracized less than ten years before 481 (*i.e.*, since Marathon). With the end of the Persian Wars, the original object of ostracism was removed, but it continued in use for forty years and was revived in 417 B.C. It then became a mere party weapon, and the farcical result of its use in 417 in the case of Hyperbolus led to its abolition. Such a device inevitably lent itself to abuse (*see* Aristotle, *Pol.* 38, 1284 b. 22).

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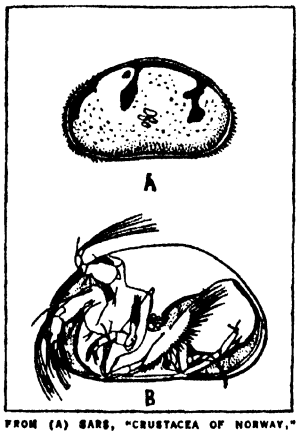
OSTRACODA, a sub-class of the Crustacea (*q.v.*) comprising minute forms found in fresh water and in the sea and distinguished by having the body and limbs completely enclosed in a bivalve shell. They are remarkable for having a smaller num-

ber of appendages than any other Crustacea, there being not more than four pairs and sometimes only two pairs of limbs behind the mandibles. The antennules and antennae are used for swimming or creeping. The mandibles have a large palp, often biramous and sometimes leg-like. The remaining limbs are very varied in form but some of them are usually leg-like and used in locomotion.



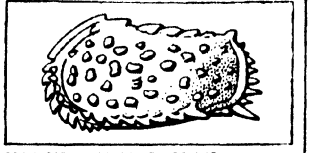
FROM (A) SARS, "CRUSTACEA OF NORWAY," AND FROM (B) THE "ZOOLOGICAL JOURNAL"

FIG. 1.—FRESH-WATER OSTRACOD (PIONOCYPRIS VIDUA) ENLARGED
A. External appearance. B. Appendages after removal of left valve shell; left, Antennule and antenna; center, mouth-parts, and behind them to the right, two leg-like appendages

The breeding habits of the ostracods present several features of interest. Parthenogenesis is common, at least among the freshwater species, in many of which males are rarely seen; while in some species they have not yet been discovered. A colony of a species of *Cypris* has been kept in an aquarium for more than 30 years and during the whole of that time no males made their appearance, the colony reproducing exclusively by parthenogenesis. In some *Ostracoda* the thread-like spermatozoa are not only relatively but absolutely larger than those of any other animals. In one species which, when adult, is no more than ·6 millimetres in length the spermatozoa are from 5 to 7 millimetres long.

Most species live on or near the bottom, creeping among weeds or burrowing in mud, but some marine species are planktonic. One of the latter, *Gigantocypris*, is the largest member of the group, reaching a length of 23 millimetres, but most species are much smaller and some do not exceed half a millimetre in length.

Numerous fossil *Ostracoda* have been described from all geological formations from the oldest to the most recent, but the affinities of many of them are obscure.



FROM SARS, "CRUSTACEA OF NORWAY"

FIG. 2.—MARINE OSTRACOD (CYTHEREIS MUCRONATA) MUCH ENLARGED, SHOWING STRONGLY SCULPTURED SHELL

The recent *Ostracoda* are generally grouped in two orders. The *Myodocopa* are exclusively marine and can usually be recognized by the presence of a notch in the margin of the shell near the anterior end. They generally have paired compound eyes and a heart. The *Podocopa* include both marine and freshwater species. There is no notch in the shell, no paired eyes and no heart. (W. T. C.)

OSTRACODERMS, a name given collectively to a number of fish-like vertebrate animals found fossil in the Silurian and Devonian formations of Europe and North America, in most of which the body was protected by a bony armour. The recent researches of Kiaer and Stensio have established that the Pteraspida, Anaspida and Cephalaspida are related to the Cyclostomata (*q.v.*), but that the Asterolepida (*Pterichthys*) are akin to the Anthrodira, which have been shown to be armoured Selachians (*q.v.*). They are small animals, some only a few centimetres long.

BIBLIOGRAPHY.—R. H. Traquair, "The Asterolepidae," *Monogr. Palaeont. Soc.* (1894–1906); J. Kiaer, "Anaspida," *Vidensk. Skrift. Kristiania* (1924); A. Stensio, "Cephalaspida," *Vindeskaps-Akad. Result, Norske Spitsbergenexpedite,* No. 12 (Oslo, 1927).

OSTRAU: *see* MORAVSKÁ OSTRAVA and SLEZSKÁ OSTRAVA.

OSTRICH, the largest living bird; the male may be nearly 8 ft. high, and weigh 300 lb. The ostrich forms the type of the subclass *Ratitae,* (*q.v.*) characterized by the absence of a keel on the breast-bone (*see* ORNITHOLOGY). The genus Struthio is unique in possessing only two toes, thus distinguishing it from *Rhea* (*q.v.*), the South American ostrich, which has three toes.

The ostrich, in a wild state, is much less abundant now than formerly. It inhabits sandy plains and open country in Arabia and Africa, the latter more abundantly. It occurs in small troops of five or six, of which one is a cock and the rest hens. At other times it will form mixed herds with zebras and various antelopes. Extremely fleet of foot, when brought to bay the ostrich uses its strong legs as weapons with great effect. Several hens combine to lay their eggs in one nest, and on these the cock sits by night while the females relieve one another by day, though this is more to guard the eggs from beasts of prey than to incubate them, the heat of the sun sufficing for that. The parents display great solicitude for their young. The great value of ostrich feathers, combined with the growing scarcity of the birds themselves, has led to the establishment of ostrich farms, where the birds are kept and deprived of their plumes at regular intervals. Ostrich farming is carried on in Cape Colony, Egypt, Algeria, the French Riviera, southern U.S. and elsewhere. There appear to be four existing species: *S. camlus* of North Africa and Arabia, and *S. australis* of South Africa being the best known.



BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

THE OSTRICH (STRUTHIA CAMELUS), THE LARGEST OF ALL BIRDS

OSTROG, a town of Poland, in the province of Volhynia, 95 m. W. of Zhitomir, at the confluence of the Vilya with the Goryn. It is an episcopal see of the Orthodox Greek Church, and in the 16th century had a classical academy, converted later into a Jesuit college. Here was made and printed in 1581 the first translation of the Bible into old Slav. In the town is a brotherhood of Cyril and Methodius, which maintains schools of its own. The tanning of light leather is an active domestic trade; other industries are potteries, oil-works, soap, candle and tobacco factories. After being plundered by the Cossack chieftain Ghmielnicki in 1648, and later conquered by the Russians, the town fell into decay.

OSTROGOTHS or **EAST GOTHS,** one of the two main branches into which the Goths were divided, the other being the Visigoths, or West Goths. *See* GOTHS.

OSTROVSKY, ALEXANDER NIKOLAEVICH (1823–1886), Russian dramatic author, was born on April 12, 1823 in Moscow, where his father was an official of the senate. He studied law in the university of that city, which he quitted without having submitted to the final examination. He was then employed as a clerk in the office of the "Court of Conscience," and subsequently in that of the Commercial Court at Moscow. Among his early comedies are *Byednaya Nivesta* ("The Poor Bride"), *Byednost ne Porok* ("Poverty not a Vice"), and *Ne v'svoi sani ne sadis* (literally "Don't put yourself in another's sledge"). Of this last Nicholas I. said, "it was not a play, but a lesson." The Moscow merchants are strikingly portrayed in *Grozá* (1860, Eng. trans. *The Storm,* by C. Garnett, 1898) the most famous of all his plays, and *Svoyi lyudi sotchtyomsya* ("Between near relatives no accounts are needed") (1850) which was originally called "The Bankrupt." *The Bankrupt* was prohibited for ten years, until the accession of Alexander II., and Ostrovsky was dismissed from the government service and placed under the supervision of the police. The Liberal tendencies of the new reign, however, soon brought relief; Ostrovsky was one of several well-known literary men who were sent into the provinces to report on the condition of the people. Ostrovsky's field of inquiry lay along the upper Volga. This mission inspired several historical dramas, such as *Kúzma Zakharich Minin Soukhorouk, Vassilisa Melentieva* and others. Four of his *Plays* have been translated into English by G. R. Noyes (1917). Ostrovsky enjoyed the patronage of Alexander III., and received a pension of 3,000 roubles a year. With the help of Moscow capitalists he established in that city a model theatre and school of dramatic art, of which he became the first director. He also founded the Society of Russian Dramatic Art and Opera

Composers. He died on June 24, 1886.

OSTUNI, a picturesque walled city of Apulia, Italy, province of Lecce, 23 m. N.W. of Brindisi by rail. Pop. (1921) 19,298 (town); 24,914 (commune). It has a 15th century cathedral.

OSTWALD, WILHELM (1853–), German chemist, was born in Riga Sept. 2, 1853, and educated at the University of Dorpat. In 1882 he became a professor in Riga, and five years later was appointed professor of physical chemistry in the University of Leipzig, where he was later director of the Physico-chemical Institute. In 1906 he resigned his university appointments and subsequently lived in retirement in Saxony. Ostwald may be regarded as one of the pioneers of modern physical chemistry and with van't Hoff (*q.v.*) he founded the important *Zeitschrift für physikalische Chemie*. His own contributions to the science have been mainly in the fields of electrochemistry and solutions. He applied the law of mass action to the equilibrium resulting from electrolytic dissociation and obtained in this way the affinity constants of acids and bases. By means of these constants, and by the use of other methods which he developed, he was able to compare the strengths of these reagents. Ostwald made some experiments on the viscosity of solutions and devised the viscometer known by his name. On the technical side he will be chiefly remembered for his discovery in 1900 of a method of oxidizing ammonia to form oxides of nitrogen; a mixture of air and ammonia being passed over a platinum catalyst. By means of this process and by later developments in connection with it, Germany was enabled to continue the manufacture of explosives during the World War after the Allied blockade had been enforced; the method is being used in various countries, under the name of the Ostwald-Brauer process, for the manufacture of nitric acid from ammonia. In 1909 Ostwald was awarded the Nobel Prize for chemistry. His published works include *Lehrbuch der allgemeinen Chemie* (2nd ed. 1884–87), *Grundlinien der anorganischen Chemie* (5th ed. 1922) and *Die wissenschaftlichen Grundlagen der analytischen Chemie* (1894) which have been translated into English.

OSUNA, a town of southern Spain, in the province of Seville; 57 m. by rail E.S.E. of Seville. Pop. (1920) 16,374. Osuna is built on a hill, overlooking the fertile plain watered by the Salado, a sub-tributary of the Guadalquivir. Osuna, the Urso of Hirtius, famous in the 1st century B.C. for its long resistance to the troops of Caesar, and its fidelity to the Pompeians, was subsequently called by the Romans Orsona and Gemina Urbanorum, the last name being due, it is said, to the presence of two urban legions here. Osuna was taken from the Moors in 1239, and given by Alphonso X. to the knights of Calatrava in 1264. Don Pedro Giron appropriated it to himself in 1445. One of his descendants, Don Pedro Tellez, was the first holder of the title duke of Osuna, conferred on him by Philip II. in 1562. The University of Osuna, founded in 1549, was suppressed in 1820. The industries are agriculture and the making of esparto mats, pottery, bricks, oil, soap, cloth, linen and hats.

OSWALD (d. 992), archbishop of York, was a nephew of Oda, archbishop of Canterbury, and at an early age became, by purchase, head of the Old Minster at Winchester. Desiring to become a monk, he went with Oda's approval to the monastery of Fleury on the Loire—at that time the great centre of reviving Benedictinism. Here he soon distinguished himself by the monastic austerity of his life. In 959 he returned to England at the request of Oda, who, however, died before his arrival. He now went to York to his kinsman the Archbishop Oskytel, who took him with him on a pilgrimage to Rome. Soon after his return he was appointed bishop of Worcester at the recommendation of Dunstan, his predecessor in the see (961). As bishop he took a prominent part in that revival of monastic discipline on Benedictine lines of which Aethelwold, bishop of Winchester, was the most ardent leader. Among other religious houses he founded that of Ramsey in conjunction with Aethelwine, Ealdorman of East Anglia. In 972 he was translated (again at Dunstan's recommendation) to the archbishopric of York, with which he continued to hold the see of Worcester. He died on Feb. 29, 992.

See *Memorials of St. Dunstan*, ed. by W. Stubbs, Rolls series (1874); and T. Raine, *Historians of the Church of York* (1879–86).

OSWALD (*c.* 605–642), king of Northumbria, was one of the sons of Aethelfrith and was expelled from Northumbria on the accession of Edwin, though he himself was a son of Edwin's sister Acha. He appears to have spent some of his exile in Iona, where he was instructed in the principles of Christianity. In 634 he defeated and slew the British king Ceadwalla at a place called by Bede Denisesburn, near Hefenfelth, which has been identified with St. Oswald's Cocklaw, near Chollerford, Northumberland. By this he avenged his brother Eanfrith, who had succeeded Edwin in Bernicia, and became king of Northumbria. Oswald reunited Deira and Bernicia, and soon raised his kingdom to a position equal to that which it had occupied in the time of Edwin, with whom he is classed by Bede as one of the seven great Anglo-Saxon kings. His close alliance with the Celtic church is the characteristic feature of his reign. In 635 he sent to the elders of the Scots for a bishop. On the arrival of Aidan in answer to this request he assigned to him the island of Lindisfarne as his see, near the royal city of Bamborough. He also completed the minster of St. Peter at York which had been begun by Paulinus under Edwin. Bede declares that Oswald ruled over "all the peoples and provinces of Britain, which includes four languages, those of the Britons, Picts, Scots and Angles." His relationship to Edwin may have helped him to consolidate Deira and Bernicia. Early in his reign he was sponsor to the West Saxon king Cynegils, whose daughter he married. In 642 he was defeated and slain at a place called Maserfeld, probably Oswestry in Shropshire, by Penda of Mercia.

See Bede, *Historia Ecclesiastica* (ed. C. Plummer, 1896), ii. 5, 14, 20; iii. 2, 3, 5, 6, 7, 9–14; *Anglo-Saxon Chronicle* (ed. J. Earle and C. Plummer, 1899), *s.a.*, 617, 634, 635, 642, 654.

OSWALDTWISTLE, urban district, Accrington parliamentary borough, Lancashire, England, on Leeds and Liverpool canal, and the L.M.S. railway (Church and Oswaldtwistle station). Pop. (1921) 15,125. It possesses cotton-mills, printworks, bleachworks and chemical works, and in the neighbourhood are collieries, stone quarries and potteries.

OSWEGO, a city of New York, U.S.A., the county seat of Oswego county; on Lake Ontario, 35 m. N.N.W. of Syracuse, at the mouth of the Oswego river and the Oswego canal, which connects with the State Barge canal at Three River Point, 25 m. S.E. It is served by the Lackawanna, the New York Central and the New York, Ontario and Western railways, lake steamers and canal barges. Pop. (1920) 23,626 (84% native white); 1928 local estimate, 26,000. The city has a fine harbour, abundant water-power and large hydro-electric developments. Water-borne commerce (largely coal, petroleum products, sand and gravel, raw sugar and wheat) amounted in 1925 to 235,483 tons by lake vessels and 95,356 tons by canal. The manufactures (notably matches, rayon, cotton and woollen goods, candy, peanut butter, cocoa and oil-well supplies) were valued in 1925 at $15,214,745. Oswego is the seat of a State normal school (established by the city in 1861 and taken over by the State in 1867), a State armory and a U.S. life-saving station. Ft. Ontario (within the city limits) is the oldest fort in North America which is still garrisoned. The site of Oswego was visited by Champlain in 1616. Later it became a station for the Jesuit missionaries and the *coureurs des bois*. An English trading post was established in 1722, and in 1727 Governor William Burnet of New York built the first fort. It was an important base of operations during King George's War and the French and Indian War. In 1755–56 the British erected two new forts (Oswego and Ontario) on either side of the mouth of the river, both of which were taken by Montcalm (Aug. 14–15, 1756) and dismantled. The British restored Ft. Ontario in 1759 and kept it garrisoned until they turned it over to the United States in 1796. It was here that Pontiac in 1766 made his acknowledgment to Sir William Johnson of Great Britain's authority. On May 6, 1814, the fort was captured by the British and Canadians, and was held by them for a short time. It was rebuilt and garrisoned by the United States in 1839, abandoned in 1899, and again reconstructed and garrisoned in 1905. Oswego became the county seat in 1816, was incorporated as a village in 1828 (when the canal was completed) and as a city in 1848.

OSWEGO CANAL: *see* NEW YORK STATE BARGE CANAL SYSTEM.

OSWEGO-TEA (*Monarda didyma*), a North American plant of the mint family (Labiatae), called also American bee-balm, native to moist soil from Quebec to Michigan and southward to North Carolina and Georgia. It is a stout perennial, 2 to 3 ft. high, with opposite, lance-shaped, sharply toothed leaves, and showy scarlet flowers, about 2 in. long, borne in dense bracted heads terminating the branches. The Oswego-tea, so named because of former medicinal use, is one of the most handsome flowering plants native to eastern North America; several choice varieties are cultivated.

OSWESTRY, municipal borough, Shropshire, England, situated near the Welsh border in the north-west corner of the county. Pop. (1921) 9,785. The town is placed where valleys open from the Berwyn mountains, and is a market town between hill and plain as well as a route centre. There are various accounts of the early history of the settlement (*Trer Cadeirau*). The present name comes from Oswald's Tree (alternative Oswald's Cross, Welsh *Croes Oswallt*) and is said to refer to the death of Oswald, king of Northumbria, in a battle fought here against Penda, the ruler of Mercia. The heavily fortified encampment of "Old Oswestry," about a mile from the town, suggests early border warfare. The town was twice burnt by Welsh invaders in the middle ages. In the Domesday Survey it is included in the manor of Maesbury. Richard II., by a charter dated 1308, granted all the privileges which belonged to Shrewsbury. In 1582 Elizabeth incorporated the town and her charter was confirmed by James I. in 1616.

In the 15th and 16th centuries a weekly market was held at Oswestry for the sale of woollen goods manufactured in the adjoining parts of Wales, but the drapers of Shrewsbury, a rival centre, ruined the trade by refusing to buy cloth there. In 1642 it was garrisoned for Charles I., but two years later surrendered to the parliamentary forces. The church of St. Oswald, originally conventual, is Early English and Decorated, but has been much restored. The grammar school, founded in the reign of Henry IV., occupies modern buildings. During the World War Oswestry benefited greatly by the presence of thousands of troops at Park Hall camp. The Cambrian railway had its headquarters in the town but the engine and carriage works were in part removed by the G.W.R. after 1922. Oswestry is governed by a mayor, six aldermen and 18 councillors. Area, 1,887 ac.

OTHMAN (*c.* 574–656), in full OTHMĀN IBN 'AFFĀN, the third of the Mohammedan caliphs, a kinsman and son-in-law of Mohammed and cousin of Abu Sofiān, whose son Moawiya became the first of the Omayyad dynasty. He was elected caliph in succession to Omar in 644, but owing to his weakness and cruelty and his preference of the Koreish for all responsible positions irrespective of their capacity, he produced strife throughout the empire which led to his assassination by Mohammed, son of Abu Bekr. He was succeeded by Ali. *See* CALIPHATE.

OTHO, MARCUS SALVIUS (A.D. 32–69), Roman emperor, was born on April 28, A.D. 32. He appears first as one of the wildest of Nero's court. In 58 he refused to divorce his wife Poppaea Sabina at Nero's bidding, and was thereupon sent to be governor of Lusitania, where he remained ten years. In 68 Galba, governor of the neighbouring province of Tarraconensis, rebelled against Nero, and Otho accompanied him to Rome, hoping to succeed him. In Jan. 69 Galba adopted Piso as his successor, and Otho at once organized a revolt of the praetorian guard, and on Jan. 15 had himself proclaimed emperor, murdered Galba and Piso, and was accepted by the Senate. He owed his success partly to Galba's disciplinary measures being unpopular with the guards, partly to the power of the memory of Nero, which he further enlisted by restoring his statues and the officials of his household, and proposing to complete his palace, the Golden House. News soon arrived, however, that the army in Germany had declared for Vitellius. On March 14 he started northwards to prevent the Vitellians entering Italy. In this he failed, but his advance guard successfully defended Placentia against Alienus Caecina, compelling him to retire to Cremona, and he held the line of the Po. Opinions were divided in Otho's camp, he himself wishing to force a decisive battle, others advising him to wait for the arrival of the troops from Dalmatia. Otho prevailed, and the main army crossed the Po to Bedriacum, Otho staying behind with the reserve at Brixellum, on the southern bank. The Othonian forces were defeated outside Cremona, and deserted to the enemy. Otho refused to renew the struggle and committed suicide in his tent on the morning of April 15, 69, and was buried at Brixellum.

See Tacitus, *Histories*, i. 12–50, 71–90, ii. 11–51; *Lives* by Suetonius and Plutarch; Dio Cassius lxiv.; L. Paul, "Kaiser M. Salvius Otho" in *Rhein. Mus.* lvii. (1902); W. A. Spooner's Introd. to his edition (1891) of the *Histories* of Tacitus; B. W. Henderson, *Civil War and Rebellion in the Roman Empire*, A.D. 69–70 (1908).

OTIDIDAE: *see* BUSTARD.

OTIS, HARRISON GRAY (1837–1917), American journalist, was born near Marietta, O., on Feb. 10, 1837. He became a printer's apprentice, working in various offices in Illinois, Iowa, Ohio and Kentucky. He served throughout the Civil War, and rose to be lieutenant-colonel. He was in the Government printing office at Washington, D.C., 1867–70, and in 1870 moved to California, where he managed the Santa Barbara *Press*. In July 1882 he became connected with the Los Angeles *Daily Times*, obtaining control of that paper in 1886. He served in the war with Spain as brigadier-general in the Philippines 1898–99. In 1910 the *Times* building was dynamited, 21 employees being killed. He died at Los Angeles on July 30, 1917.

OTIS, JAMES (1725–1783), American patriot, was born at West Barnstable, Mass., on Feb. 5, 1725. He was the eldest son of James Otis (1702–1778), fourth in descent from John Otis (1581–1657), a native of Barnstaple, Devon, and one of the first settlers (in 1635) of Hingham, Mass. The elder James Otis was elected to the provincial general court in 1758, was its speaker in 1760–1762, and was chief justice of the court of common pleas from 1764 until 1776; he was a prominent patriot in the colony of Massachusetts. The son graduated at Harvard in 1743; and after studying law in the office of Jeremiah Gridley (1702–1767), a well-known lawyer with Whig sympathies, rose to great distinction at the bar, practising first at Plymouth and after 1750 at Boston. In 1760 he published *Rudiments of Latin Prosody*, a book of authority in its time. Soon after the accession of George III. to the throne of England in 1760, the British Government decided upon a rigid enforcement of the navigation acts, which had long been disregarded by the colonists and had been almost wholly evaded during the French and Indian War. The writs of assistance issued in 1755 were about to expire, and it was decided to issue new ones, which would empower custom house officers to search any house for smuggled goods, though neither the house nor the goods had to be specifically mentioned in the writs. Much opposition was aroused in Massachusetts, the legality of the writs was questioned, and the superior court consented to hear argument. Otis held the office of advocate-general at the time, and it was his duty to appear on behalf of the Government. He refused, resigned his office, and appeared for the people against the issue of the writs. The case was argued in the old town house of Boston in Feb. 1761, and the chief speech was made by Otis. His plea was fervid in its eloquence and fearless in its assertion of the rights of the colonists. Going beyond the question at issue, he dealt with the more fundamental question of the relation between the English in America and the home Government, and argued that even if authorized by act of parliament such writs were null and void. The young orator was elected in May of the same year a representative from Boston to the Massachusetts general court. To that position he was re-elected nearly every year of the remaining active years of his life, serving there with his father. In 1766 he was chosen speaker of the house of representatives, but the choice was negatived.

In Sept. 1762 the younger Otis published *A Vindication of the Conduct of the House of Representatives of the Province of Massachusetts Bay*, in defence of the action of that body in sending to the governor a message (drafted by Otis) rebuking him for asking the assembly to pay for ships he had (with authorization of the council and not of the representatives) sent to protect New England fisheries against French privateers; according to this

message "it would be of little consequence to the people whether they were subject to George or Louis, the king of Great Britain or the French king, if both were as arbitrary as both would be if both could levy taxes without parliament." He also wrote various State papers addressed to the colonies to enlist them in the common cause, or sent to the Government in England to uphold the rights or set forth the grievances of the colonists. His influence at home in controlling and directing the movement of events which led to the War of Independence was universally felt and acknowledged; and abroad no American was so frequently quoted, denounced or applauded in parliament and the English press before 1769 as the recognized head and chief of the rebellious spirit of the New England colonists. In 1765 Massachusetts sent him as one of her representatives to the Stamp Act congress at New York, and here he was a conspicuous figure, serving on the committee which prepared the address sent to the British House of Commons. From 1769 almost continually until his death, Otis was harmlessly insane, though he had occasional lucid intervals, serving as a volunteer in the battle of Bunker Hill in 1775 and arguing a case in 1778. He was killed by lightning (it is said that he had often expressed a wish that he might die in this way) at Andover, Mass., on May 23, 1783.

Otis's political writings exercised an enormous influence, his pamphlets being among the most effective presentations of the arguments of the colonists against the arbitrary measures of the British ministry. His more important pamphlets were *A Vindication of the Conduct of the House of Representatives of the Province of Massachusetts Bay* (1762); *The Rights of the British Colonies Asserted and Proved* (1764); *A Vindication of the British Colonies against the Aspersions of the Halifax Gentleman in his Letter to a Rhode Island Friend*—a letter known at the time as the "Halifax Libel" (1765); and *Considerations on Behalf of the Colonists in a Letter to a Noble Lord* (1765).

The best biography is that by William Tudor (Boston, 1823); there is a shorter one by Francis Bowen (Boston, 1847). The best account of Otis's characteristics and influence as a writer may be found in M. C. Tyler's *Literary History of the American Revolution* (1897). Consult the notes on the Writs of Assistance by Horace Gray, Jr., in Quincy's *Massachusetts Reports, 1761–1772* (Boston, 1865). *See* also Francis Wilson Sprague, *Birthplace of the Patriot James Otis* (1917).

OTLEY, an urban district and town in the West Riding of Yorkshire, England, 10 m. N. of Bradford on the L.M.S. and L.N.E. railways. Pop. (1921) 9,531. It stands on the Wharfe at the foot of the precipitous Chevin. To the south-west the Guiseley gap affords a route, only 4 m. long, between the Aire and the Wharfe. It is traversed by both roads and railways and brings much of the Aire valley within range of Otley markets.

In 937 King Aethelstan granted to the archbishop of York the manor of Otley. The town and the church were laid waste in 1069. Otley became an important local centre of the woollen cloth industry, which was introduced late in the 11th century. An annual fair was granted in 1222 and a weekly market in 1248.

The growth of cereals, which was important until the 18th century, was abandoned in favour of pastoral industries for the supply of meat to the dense population on the Yorkshire coal-field. To-day the prosperity of Otley depends, not on its importance as an agricultural centre, which has been decreasing for a century, but on its industries. Worsted spinning and weaving, tanning and leather-dressing, paper-making and the manufacture of printing machines are the chief amongst these industries. Excellent building stone is quarried.

OTOLITH: *see* EQUILIBRIUM, ANIMAL.

OTOMACAN, an independent linguistic stock of South American Indians, named from the Otomacas, its best known tribe. The Otomacas lived in south-western Venezuela, along the Orinoco between the Meta and Arauca rivers. In recent times they have spread westward. Described by early writers as one of the most barbarous tribes of the whole Orinoco region, they appear to have been sedentary agriculturalists, cultivating their fields of manioc and maize communally, the produce, with that from hunting and fishing, being divided among all by the chief. They were noted as clay-eaters, even their bread being mixed with it, and made great use of narcotic snuff. They were monogamous, and it is said that they married all young girls to old widowers, and all young men to elderly widows.

See J. Gumilla, *Histoire naturelle, civile et géographique de l'Orénoque* (Avignon, 1758).

OTOMI, an important group of Indians on the central mesa of Mexico. The ancient territory of the Otomi proper comprised the states of Guanajuato and Querétaro, south-western Hidalgo and northern Mexico, extending to the hills overlooking Mexico valley and city. With them are reckoned, on the basis of related speech, the Pame of eastern San Luis Potosi and the Mazahua and Pirinda of western Mexico (state). The Otomian languages are tonal and built up from monosyllabic elements. This analogy to Chinese has led to theories of relationship, generally fantastic. Remote kinship with the Zapotecan group is, however, possible. The Otomi passed as dull boors among the Aztec; they were provincially backward as compared with centres of native culture like Mexico, Tezcoco, Cholula, and possessed no large towns. The nearer ones were all subject to the Aztec. To-day they are peaceful and number about a quarter of a million.

OTRANTO, seaport and archiepiscopal see, Apulia, Italy, in the province of Lecce, 29½ m. S.E. from it by rail, 49 ft. above sea-level. Pop. (1921) 3,152. It is on the east coast of the peninsula of the ancient Calabria (*q.v.*). The castle was erected by Alfonso of Aragon; the cathedral, consecrated in 1088, has a rose window and side portal of 1481. The interior, a basilica with nave and two aisles, contains a fine mosaic pavement of 1165. It has a crypt supported by 42 marble columns. The church of S. Pietro has Byzantine frescoes. The harbour is small.

Otranto occupies the site of the ancient Hydrus or Hydruntum, a town of Greek origin. In Roman times it was less important than Brundisium as a point of embarkation for the East. It was taken by Robert Guiscard in 1068. In 1480 it was utterly destroyed by the Turkish fleet, and has never since recovered its importance. About 30 m. S.E. lies the promontory of S. Maria di Leuca (so called since ancient times from its white cliffs), the south-east extremity of Italy, the ancient Promontorium Iapygium or Sallentinum. The district between this promontory and Otranto is thickly populated, and very fertile. It was an important supply-base in the war and is now an air force base. The Straits are about 40 m. wide; cables leave here for Valona and Corfu.

OTTAKAR I. (d. 1230), king of Bohemia, was a younger son of King Vladislav II. (d. 1174) and a member of the Premyslide family, hence he is often referred to as Premysl Ottakar I. Recognized as ruler of Bohemia by the emperor Henry VI. in 1192, he was, however, soon overthrown, but in 1196 forced his brother, King Vladislav III., to abandon Bohemia to him and to content himself with Moravia. Ottakar first sought the support of the German king Philip, duke of Swabia, but then went over to his rival Otto of Brunswick. Philip thereupon invaded Bohemia, and Ottakar changed sides once more. Later still, he supported the young king, Frederick II. He united Moravia with Bohemia in 1222, and when he died in 1230 he left to his son, Wenceslaus I., a kingdom united and comparatively peaceable.

OTTAKAR II., or PREMYSL OTTAKAR II. (*c.* 1230–1278), king of Bohemia, was son of King Wenceslaus I.; his maternal grandfather was the German king, Philip, duke of Swabia. In his father's lifetime he ruled Moravia, and in 1251 secured his election as duke of Austria, where he strengthened his position by marrying (Feb. 11, 1252) Margaret (d. 1267), sister of Duke Frederick II., the last of the Babenbergs and widow of the German king, Henry VII. In Sept. 1253 he succeeded his father in Bohemia, and in 1254 concluded peace with Bela IV. of Hungary, who had claimed Styria, advancing the Austrian frontier to the present line. In 1259 he expelled the Hungarians from the rest of Styria, then divorced his wife, married a granddaughter of Bela IV. and secured his investiture (by letter) with Austria and Styria from the German king, Richard Cornwallis.

In 1269 Ottakar II. inherited Carinthia and part of Carniola; and having made good his claim, contested by the Hungarians, in battle, he was the most powerful prince in Germany when an election for the German throne took place in 1273. The electors, however, fearing his power, chose Rudolph of Habsburg, who in 1276 placed Ottakar under the ban, besieged Vienna, and com-

pelled Ottakar to renounce all his possessions except Bohemia and Moravia. (*See* AUSTRIA.) Ottakar was killed at Dürnkrut on the March, Aug. 26, 1278, in an attempt to recover his lands. Clever, strong and handsome, he is a famous figure both in history and in legend, and is the subject of a tragedy by F. Grillparzer, *König Ottokars Glück und Ende*.

See O. Lorenz, *Geschichte König Ottokars*, ii. (Vienna, 1866); and F. Palacky, *Geschichte von Böhmen*, vol. i. (Prague, 1844).

OTTAVA RIMA, a stanza of eight iambic lines, containing three rhymes, invariably arranged as follows:—*a b a b a b c c*. It is an Italian invention of the 14th century. Boccaccio employed it for the *Teseide* (1340) and for the *Filostrato* (some seven years later). These epics gave to *ottava rima* its classic character. In the succeeding century it was employed by Politian, and by Boiardo for his famous *Orlando Innamorato* (1486). It was Pulci, however, in the *Morgante Maggiore* (1487), who invented the peculiar mock-heroic, or rather half-serious, half-burlesque, style with which *ottava rima* has been most commonly identified. The most striking monument in *ottava rima* in English is *Don Juan* (1819–24). Byron also employed this measure in *The Vision of Judgment* (1822). Meanwhile Shelley also became attracted by it, and in 1820 translated the *Hymns* of Homer into *ottava rima*. In the Peninsula the form was largely used, *e.g.*, by Boscán (1490–1542), by Ercilla y Zúñiga (1533–95) in the *Araucana*, by Camoens in the *Lusiads* (1572) and by Lope de Vega.

OTTAWA, a city of Carleton county, province of Ontario, and the capital of the dominion of Canada, on the right bank of the Ottawa river, 101 m. W. of Montreal and 217 m. N.E. of Toronto. The main tower of the Parliament Building is in 45° 25′ 29·499″ N., and 75° 42′ 00·246″ W.

The city stands for the most part on a cluster of hills, 60 to 155 feet above the river. It is on the transcontinental lines of both the Canadian National and Canadian Pacific railways, and has direct communication by both systems to Montreal, Toronto and other points in Canada, as well as by the Ottawa and New York and other railroads to New York and elsewhere in the United States. Electric railways afford communication with all parts of the city and the suburbs, as well as through the neighbouring city of Hull to Aylmer. Several bridges connect Ottawa with Hull and others cross Rideau river and the Rideau canal.

The site of the city is very picturesque. For three miles it follows the high southern bank of the Ottawa from the Chaudière falls, whose mist-crowned cauldron is clearly visible from the summit of Parliament Hill, to and beyond the Rideau falls, so named by early French explorers because of their curtain-like appearance. The Rideau, a southern tributary of the Ottawa, once formed the eastern boundary of the city, which, however, is now absorbing a string of suburbs that lie along its eastern banks. The Rideau canal cuts the city in two, the western portion being known as Upper Town and the eastern as Lower Town. Roughly speaking, the canal divides the two sections of the population, the English occupying Upper Town and the French Lower Town.

Opposite and a little below the mouth of the Rideau river, the Gatineau flows into the Ottawa from the north. The river is now the scene of very large hydro-electric developments. Above the Chaudière falls the river is broken by the Deschenes rapids, and beyond these again it expands into Lake Deschenes, a favourite summer resort. To the north the Laurentian Hills, broken by the picturesque Gatineau valley, offer skiing in winter.

Buildings.—The crowning architectural feature of the city is the splendid group of Gothic buildings on the summit of Parliament Hill. The three blocks form sides of a great quadrangle, the fourth side remaining open. The corner stone of the main building was laid by the then prince of Wales in 1860. With the exception of the library, it was destroyed by fire in 1916, and has since been rebuilt. In the tower is a remarkably beautiful war memorial chamber, and above it is hung a carillon of 53 bells. The Langevin block on the south side of Parliament Hill is used for departmental purposes, and to meet the increasing needs of the Government, a group of buildings is to be erected on the banks of the Ottawa, west of Parliament Hill. Other national institutions are the Public Archives, Royal Mint, Department of National Revenue, National Museum and the National Art Gallery, and Dominion Observatory. Other buildings are the City hall, public library, university of Ottawa, the collegiate institutes, Normal and Model schools, and the Roman Catholic and Church of England cathedrals. City charities include a large general hospital and nurses' home, a general hospital supported by the Roman Catholics and three special hospitals devoted to contagious diseases.

A system of public parks and driveways, partly within and partly without the city, add very largely to its attractions. A number of these have been built and are maintained by the federal district commission. Statues of Queen Victoria, as well as of Sir John Macdonald, Sir Wilfrid Laurier and other Canadian statesmen, stand on Parliament Hill. A very beautiful war memorial was in preparation in 1928. Rideau Hall, the official residence of the governor general, lies on the eastern boundary of the city at the entrance to Rockcliffe park.

Ottawa is governed by a mayor, and board of control of four members, elected by the city at large, and a board of 18 aldermen, two elected by each of the nine wards. The city returns two members to the Dominion House of Commons, and three to the Ontario legislature. The population in 1921 was 107,843; a later estimate gives it as 126,000.

History.—The earliest description of the site of Ottawa is that of Samuel de Champlain, in his *Voyages*. In June 1613, on his way up the river, he came to a tributary on the south side, "at the mouth of which is a marvellous fall. For it descends a height of twenty or twenty-five fathoms with such impetuosity that it makes an arch nearly four hundred paces broad. The savages take pleasure in passing under it, not wetting themselves, except from the spray that is thrown off." This was the Rideau falls, but a good deal of allowance must be made for exaggeration in Champlain's account. Continuing up the river, "we passed," he says, "a fall, a league from there, which is half a league broad and has a descent of six or seven fathoms. There are many little islands. The water falls in one place with such force upon a rock that it has hollowed out in course of time a large and deep basin, in which the water has a circular motion and forms large eddies in the middle, so that the savages call it *Asticou*, which signifies boiler. This cataract produces such a noise in this basin that it is heard for more than two leagues." The present name, Chaudière, is the French equivalent of the old Indian name.

For two hundred years and more after Champlain's first visit the Chaudière portage was the main thoroughfare from Montreal



BY COURTESY OF THE CANADIAN NATIONAL RAILWAYS

BARRACK HILL, IN OTTAWA, WITH A PART OF THE PARLIAMENTARY BUILDINGS IN THEIR ORIGINAL STATE. FROM AN OLD PRINT

to the great western fur country; but it was not until 1800 that any permanent settlement was made in the vicinity. In that year Philemon Wright, of Woburn, Massachusetts, built a home for himself at the foot of the portage, on the Quebec side of the river, where the city of Hull now stands; but for some time the precipitous cliffs on the south side seem to have discouraged settlement there. Finally about 1820 one Nicholas Sparks moved over the river and cleared a farm in what is now the heart of Ottawa. Seven years later Colonel John By, R.E., was sent out

to build a canal from a point below the Chaudière falls to Kingston on Lake Ontario. The canal, completed at a cost of $2,500,000 has never been of any great commercial importance; it has never been called upon to fulfil its primary object, as a military work to enable gun-boats and military supplies to reach the lakes from Montreal without being exposed to attack along the St. Lawrence frontier. The building of the canal created a fair-sized settlement at its Ottawa end, which came to be known as Bytown. As the lumber trade developed Bytown rapidly increased in wealth and importance. In 1854 it was incorporated as a city, the name being changed to Ottawa; and four years later Queen Victoria selected Ottawa as the capital of Canada. Ottawa was admirably situated for a capital from a political and military point of view; but there is reason to believe that the deciding factor was the pressure exerted by the four other rival claimants, Montreal, Quebec, Toronto and Kingston, any three of which would have fiercely resented the selection of the fourth. The first session of parliament in Ottawa was opened in 1865.

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(L. J. B.)

OTTAWA, a city of Illinois, U.S.A., 84 m. S.W. of Chicago, at the confluence of the Illinois and the Fox rivers; the county seat of Lasalle county. It is on the Illinois and Michigan canal and the Illinois Waterway, and is served by the Burlington Route, the Illinois Traction (electric), and the Rock Island railways. Pop., 10,816 in 1920 (87% native white); estimated locally at 18,000 in 1928. It is surrounded by a rich agricultural country, and there are medicinal springs and large deposits of clay and silica in the vicinity. The city's manufactures (including plate glass, building tile, fire-brick and agricultural implements) had a value of $5,071,391 in 1925. The mouth of the Fox was visited early by the French explorers, and Father Hennepin discovered coal here in 1680. On Starved Rock (8 m. W., on the south bank of the Illinois, in a State park of 900 ac.) La Salle in 1683 built Fort St. Louis, which was used by fur traders as late as 1718, and in 1770 was the last refuge of a band of Illini, pursued by the Pottawattomies and besieged here until they died of starvation. Ottawa was laid out in 1831, incorporated in 1837 and chartered as a city in 1853. On Aug. 21, 1858 it was the scene of the first of the Lincoln-Douglas debates.

OTTAWA, a city of Kansas, U.S.A., 58 m. S.W. of Kansas City, on the Marais des Cygnes (or Osage) river, at an altitude of 926 ft.; the county seat of Franklin county. It is on Federal highways 50S and 73W, and is served by the Missouri Pacific and the Santa Fe railways. Pop. 9,018 in 1920 (92% native white); estimated locally at 10,500 in 1928. Ottawa has a large trade in poultry and dairy products, fruit and other farm produce. Its manufacturing establishments include large repair shops of the Santa Fe Company, creameries, flour-mills, poultry-packing plants and factories making steel products, brooms and chicken-coops. It is the seat of Ottawa university (Baptist) established in 1865. The city owns its electric light and power and water plants, and natural gas is supplied from the Kansas fields. Ottawa was in the reservation of the Ottawa Indians until they were moved (1865) to the Indian Territory. A mission was established here in 1839. The city was chartered in 1866.

OTTAWA, the largest tributary of the river St. Lawrence; ranking ninth in length among the rivers of Canada, being 685 m. long. It flows first westward to Lake Timiscaming; thence south-east and east. The principal tributaries on the left bank are the Rouge (115 m.), North Nation (60), Lièvre (205), Gatineau (240), Coulonge (135), Dumoine (80); and on the right bank, the South Nation (90), Mississippi (105), Madawaska (130) and Petawawa (95). Canals at Ste. Anne, Carillon and Grenville permit the passage of vessels drawing 9 ft., from Montreal up to the city of Ottawa. At Ottawa the river is connected with Lake Ontario by the Rideau Canal.

The Ottawa was first explored by Samuel de Champlain in 1613. Champlain describes many of its tributaries, the Chaudière and Rideau Falls, the Long Sault, Chats and other rapids, as well as the character of the river and its banks, with minuteness and reasonable accuracy. The Long Sault Rapids on the Ottawa, about midway between Montreal and the capital, were the scene of one of the noblest exploits in Canadian history, when in 1661 the young Sieur des Ormeaux with sixteen comrades and a handful of Indian allies deliberately gave their lives to save New France from an invasion of the Iroquois. They intercepted the war party at the Long Sault, and for nearly a week held them at bay. When finally the last Frenchman fell under a shower of arrows, the Iroquois were thoroughly disheartened and returned crestfallen to their own country. For a hundred and fifty years thereafter the Ottawa was the great highway from Montreal to the west for explorers and fur-traders. Throughout the 19th century the Ottawa was the thoroughfare of lumbermen, whose immense rafts went from its upper waters to Montreal and Quebec.

OTTER, the name of an aquatic carnivore inhabiting Europe and Asia. The otter (*Lutra vulgaris*) has an elongated body, short limbs terminating in broad webbed feet, the toes of which are armed with claws, a broad, flat head and a tail about half the length of the body. The muzzle is broad, the whiskers thick, the eyes small and the ears short and rounded. The fur consists of a short, soft, grey underfur, interspersed with longer, stiffer hairs, the points of which are bright brown. The average length is about 3½ft., the weight of a male 18 to 24 lb., the female being about 4 lb. less. The otter lives on fish and inhabits streams, rivers, lakes and, in some localities, the sea. The female produces 3 to 5 young in March or April, bringing them up in a nest of grass in a hollow in a river-bank or under the roots of an overhanging tree. Otter hunting, with packs of special hounds, is a pastime in parts of England.

In North America, *L. vulgaris* is replaced by the larger *L. canadensis* and other species with similar habits occur in North and South America, South Africa and southern Asia.



BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

OTTERS (LUTRA VULGARIS), WIDELY DISTRIBUTED THROUGH EUROPE AND ASIA

The sea-otter (*Latax lutris*) is confined to the North Pacific. It is larger and more heavily built than the European otter and possesses a very valuable coat of fur, on account of which it has been almost exterminated; they are very wary animals. Sea-otters feed on shellfish. *See* Elliott Coues, *Monograph of North American Fur-bearing Animals.*

Otters form a section of the family Mustelidae (*see* CARNIVORA).

OTTERY ST. MARY, a market town of Devonshire, England, 12 m. N.E. of Exeter on the S.R. Pop. of urban district (1921) 3,538. The parish church is Early English, with Decorated and Perpendicular additions, is cruciform, and has transeptal towers, imitated from Exeter cathedral. The manor of Ottery belonged to the abbey of Rouen in the time of Edward the Confessor. The church was dedicated in 1260 by Walter Bronescombe, bishop of Exeter; and enlarged by Bishop John Grandisson, *c.* 1335. The town has a large agricultural trade, and Honiton lace is a home industry. It was the birthplace of S. T. Coleridge.

OTTO I. (912–973), the Great, Roman emperor, eldest son of King Henry I. the Fowler by his second wife Matilda, was born on Nov. 23, 912. Little is known of his early years, but he probably shared in some of his father's campaigns. In 929 he married Edith, daughter of Edward the Elder, king of the English, and sister of the reigning King Aethelstan. In 936 Otto was chosen German king and crowned by Hildebert, archbishop of Mainz. Otto soon showed his intention of breaking with the policy of his father, who

had been content with a nominal superiority over the duchies; in 937 he punished Eberhard, duke of Franconia, for an alleged infringement of the royal authority; and in 938 deposed Eberhard, duke of Bavaria. Trouble soon arose in Saxony, probably from his refusal to give certain lands to his half-brother, Thankmar, who, although the king's senior, had been passed over in the succession as illegitimate. Thankmar, aided by an influential Saxon noble named Wichmann, and by Eberhard of Franconia, seized the fortress of Eresburg and took Otto's brother Henry prisoner; but soon afterwards he was defeated by the king and killed whilst taking sanctuary. The other conspirators were pardoned, but in 939 a fresh revolt broke out under the leadership of Henry, and Giselbert, duke of Lorraine. Otto gained a victory near Xanten, which was followed by the surrender of the fortresses held by his brother's adherents in Saxony, but the rebels, joined by Eberhard of Franconia and Archbishop Frederick of Mainz, continued the struggle, and Giselbert of Lorraine transferred his allegiance to Louis IV., king of France. Otto's precarious position was saved by a victory near Andernach when Eberhard was killed, and Giselbert drowned in the subsequent flight. Henry took refuge with Louis of France, but was soon restored to favour and entrusted with the duchy of Lorraine, where, however, he was unable to restore order. Otto therefore crossed the Rhine and deprived his brother of authority. Henry then became involved in a plot to murder the king, which was discovered in time, and the good offices of his mother secured him a pardon at Christmas 941.

The deaths of Giselbert of Lorraine and of Eberhard of Franconia, quickly followed by those of two other dukes, enabled Otto to unite the stem-duchies more closely with the royal house. In 944 Lorraine was given to Conrad, surnamed the Red, who in 947 married the king's daughter Liutgard; Franconia was retained by Otto in his own hands; Henry married a daughter of Arnulf, duke of Bavaria, and received that duchy in 947; and Swabia came in 949 to the king's son Ludolf, who had married Ida, a daughter of the late duke, Hermann. During these years the tribes living between the Elbe and the Oder were made tributary, bishoprics were founded in this district, and in 950 the king himself marched against the Bohemians and reduced them to dependence. Strife between Otto and Louis IV. of France had arisen when the French king sought to obtain authority over Lorraine and aided the German rebels in 939; but after the German king had undertaken an expedition into France, peace was made in 942. Afterwards, when Louis became a prisoner in the hands of his powerful vassal Hugh the Great, duke of France, Otto attacked the duke, who, like the king, was his brother-in-law, captured Reims, and negotiated a peace between the two princes; and in subsequent struggles between them his authority was several times invoked.

In 945 Berengar I., margrave of Ivrea, left the court of Otto and returned to Italy, where he soon obtained a mastery over the country. After the death in 950 of Lothair, king of Italy, Berengar sought the hand of his widow Adelaide for his son Adalbert; and Henry of Bavaria and Ludolf of Swabia had already been meddling independently of each other in the affairs of northern Italy. In response to an appeal from Adelaide, Otto crossed the Alps in 951. He assumed the title of king of the Lombards, and having been a widower since 946, married Adelaide and negotiated with Pope Agapetus II. about his reception in Rome. The influence of Alberic, prince and senator of the Romans, prevented the pope returning a favourable answer to the king's request. But when Otto returned to Germany in 952 he was followed by Berengar, who did homage for Italy at Augsburg. The chief advisers of Otto at this time were his wife and his brother Henry. Henry's influence seems to have been resented by Ludolf, who in 946 had been formally designated as his father's successor. When Adelaide bore a son, and a report gained currency that Otto intended to make this child his heir, Ludolf rose in revolt and was joined by Conrad of Lorraine and Frederick of Mainz. Otto fell into the power of the rebels at Mainz and was compelled to agree to demands made by them, which, however, he promptly revoked on his return to Saxony. Ludolf and Conrad were declared deposed, and in 953 war broke out in Lorraine and Swabia, and afterwards in Saxony and Bavaria. Otto was finally victorious and with the capture of Regensburg in 955 the rising ended. Conrad and Ludolf retained their estates, but their duchies were not restored to them. Meanwhile the Magyars had renewed their ravages and were attacking Augsburg. Otto marched against them, and in a battle fought on the Lechfeld Aug. 10, 955, the king's troops gained a victory which freed Germany from these invaders; while in the same year Otto defeated the Slavs ravaging the Saxon frontier.

About this time the king seems to have perceived the necessity of ruling in closer union with the church. Lands and privileges were granted to prelates, additional bishoprics were founded, and some years later Magdeburg was made the seat of an archbishop. In 960 Otto was invited to come to Italy by Pope John XII., who was hard pressed by Berengar, and he began to make preparations for the journey. As Ludolf had died in 957 and Otto, his only son by Adelaide, had been chosen king at Worms, the government was entrusted to Bruno of Cologne, and Archbishop William of Mainz, a natural son of the king. Reaching Pavia at Christmas 961, the king promised to defend and respect the church. He then proceeded to Rome, where he was crowned emperor on Feb. 2, 962. After the ceremony he confirmed the rights and privileges which had been conferred on the papacy, while the Romans promised obedience, and Pope John took an oath of fidelity to the emperor. But as he did not long observe his oath he was deposed at a synod held in St. Peter's, after Otto had compelled the Romans to swear they would elect no pope without the imperial consent; and a nominee of the emperor, who took the name of Leo VIII., was chosen in his stead. A pestilence drove Otto to Germany in 965, and finding the Romans again in arms on his return in 966, he allowed his soldiers to sack the city, and severely punished the leaders of the rebellion. His next move was against the Greeks and Saracens of southern Italy, but seeking to attain his objects by negotiation, sent Liudprand, bishop of Cremona, to the eastern emperor Nicephorus II. to arrange for a marriage treaty between the two empires. Nicephorus refused to admit the validity of Otto's title, and the bishop was roughly repulsed; but the succeeding emperor, John Zimisces, was more reasonable, and Theophano, daughter of the emperor Romanus II., was married to the younger Otto in 972. The same year witnessed the restoration of peace in Italy and the return of the emperor to Germany, where he received the homage of the rulers of Poland, Bohemia and Denmark; but he died suddenly at Memleben on May 7, 973.

The empire was less universal under Otto, its restorer, than Charlemagne, but what it lacked in splendour it gained in stability. His object was not to make the state religious but the church political, and the clergy must first be officials of the king, and secondly members of an ecclesiastical order. He shared the piety and superstition of the age, and did much for the spread of Christianity. Although himself a stranger to letters he welcomed scholars to his court and eagerly seconded the efforts of his brother Bruno to encourage learning; and while he neither feared nor shirked battle, he was always ready to secure his ends by peace.

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OTTO II. (955–983), Roman emperor, was the son of the emperor Otto the Great, by his second wife Adelaide. He was chosen German king at Worms in 961 and on Dec. 25, 967, was crowned joint emperor at Rome by Pope John XIII. On

April 14, 972, he married Theophano, daughter of the eastern emperor Romanus II., and after sharing in various campaigns in Italy, returned to Germany and became sole emperor on the death of his father in May 973. After suppressing a rising in Lorraine, difficulties arose in southern Germany, probably owing to Otto's refusal to grant the duchy of Swabia to Henry II., the Quarrelsome, duke of Bavaria. The first conspiracy was easily suppressed, and in 974 an attempt on the part of Harold III., king of the Danes, to throw off the German yoke was also successfully resisted; but an expedition against the Bohemians led by the king in person in 975 was a partial failure owing to the outbreak of further trouble in Bavaria. In 976 Otto deposed Duke Henry, restored order for the second time in Lorraine, and made another expedition into Bohemia in 977, when King Boleslaus II. promised to return to his earlier allegiance. Having crushed an attempt made by Henry to regain Bavaria, Otto was suddenly attacked by Lothair, king of France, who held Aix in his possession for a few days; but when the emperor retaliated by invading France he met with little resistance. He was, however, compelled by sickness among his troops to raise the siege of Paris, and on the return journey the rearguard of his army was destroyed and the baggage seized by the French. An expedition against the Poles was followed by peace with France, when Lothair renounced Lorraine.

The emperor then prepared for a journey to Italy. In Rome, where he restored Pope Benedict VII., he held a splendid court, attended by princes and nobles from all parts of western Europe. He was next required to punish inroads of the Saracens on the Italian mainland, and in September 981 he marched into Apulia, where he met at first with considerable success; but an alliance between the Arabs and the Eastern Empire, whose hostility had been provoked by the invasion of Apulia, resulted in a severe defeat for Otto's troops near Stilo in July 982. Without revealing his identity, the emperor escaped on a Greek vessel to Rossano. At a diet held at Verona, largely attended by German and Italian princes, a fresh campaign was arranged against the Saracens. Proceeding to Rome, Otto secured the election of Peter of Pavia as Pope John XIV. Just as the news reached him of a general rising of the tribes on the eastern frontier of Germany, he died in his palace in Rome on Dec. 7, 983.

See *Die Urkunden des Kaisers Otto II.*, ed. Th. von Sickel, in the *Monumenta Germaniae historica. Diplomata* (Hanover, 1879); L. von Ranke, *Weltgeschichte*, Part vii. (Leipzig, 1886); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit* (Leipzig, 1881–90); and *Jahrbücher des deutschen Reichs unter Kaiser Otto II.* (1837–40); H. Detmer, *Otto II. bis zum Tode seines Vaters* (Leipzig, 1878); J. Moltmann, *Theophano die Gemahlin Ottos II. in ihrer Bedeutung für die Politik Ottos I. und Ottos II.* (Göttingen, 1878); and A. Matthaei, *Die Händel Ottos II. mit Lothar von Frankreich* (Halle, 1882).

OTTO III. (980–1002), Roman emperor, son of the emperor Otto II. and Theophano, daughter of the eastern emperor Romanus II., was born in July 980, chosen as his father's successor at Verona in June 983 and crowned German king at Aix-la-Chapelle on Dec. 25. Otto II. had died a few days before this ceremony, but the news did not reach Germany until after the coronation. Early in 984 the king was seized by Henry II., the Quarrelsome, the deposed duke of Bavaria, who claimed the regency as a member of the reigning house, and probably entertained the idea of obtaining the kingly dignity himself. A strong opposition was quickly aroused, and when Theophano and Adelaide, widow of the emperor Otto the Great, appeared in Germany, Henry was compelled to hand over the young king to his mother. Otto's abilities were carefully cultivated by Bernward, afterwards bishop of Hildesheim, and by Gerbert of Aurillac, archbishop of Reims, and he was called "the wonder of the world." The government of Germany during his minority was in the hands of Theophano, and after her death in June 991 passed to a council in which the chief influence was exercised by Adelaide and Willigis, archbishop of Mainz.

Having accompanied his troops in expeditions against the Bohemians and the Wends, Otto was declared of age in 995. In 996 he crossed the Alps and was recognized as king of the Lombards at Pavia. Before he reached Rome, Pope John XV., who had invited him to Italy, had died, whereupon he raised his own cousin Bruno, son of Otto duke of Carinthia, to the papal chair as Pope Gregory V., and by this pontiff Otto was crowned emperor on May 21, 996. On his return to Germany, the emperor learned that Gregory had been driven from Rome, which was again in the power of John Crescentius, patrician of the Romans, and that a new pope, John XVI., had been elected. Leaving his aunt, Matilda, abbess of Quedlinburg, as regent of Germany, Otto, in Feb. 998, led Gregory back to Rome, took the castle of St. Angelo by storm and put Crescentius to death. A visit to southern Italy, where many of the princes did homage to the emperor, was cut short by the death of the pope, to whose chair Otto then appointed his former tutor Gerbert, who took the name of Sylvester II.

In the palace which he built on the Aventine, Otto sought to surround himself with the splendour and ceremonial of the older emperors of Rome, and dreamed of making Rome once more the centre of a universal empire. Many names and customs were introduced into his court from that of Constantinople; he proposed to restore the Roman senate and consulate, revived the office of patrician, called himself "consul of the Roman senate and people" and issued a seal with the inscription, "restoration of the Roman empire." Passing from pride to humility he added "servant of the apostle," and "servant of Jesus Christ" to the imperial title, spent a fortnight in prayer in the grotto of St. Clement and did penance in various Italian monasteries.

Leaving Italy in the summer preceding the year 1000, when it was popularly believed that the end of the world was to come, Otto made a pilgrimage to the tomb of his old friend Adalbert, bishop of Prague, at Gnesen, and raised the city to the dignity of an archbishopric. He then went to Aix, and opened the tomb of Charlemagne, where, according to a legendary tale, he found the body of the great emperor sitting upright upon a throne, wearing the crown and holding the sceptre.

On his return to Rome, trouble arose between Otto and the citizens, and for three days the emperor was besieged in his palace. After a temporary peace, he fled to the monastery of Classe near Ravenna. Troops were collected, but whilst conducting a campaign against the Romans, Otto died at Paterno near Viterbo on Jan. 23, 1002, and was buried at Aix-la-Chapelle.

See Thangmar, *Vita Bernwardi episcopi Hildesheimensis* in the *Monumenta Germaniae historica. Scriptores*, Band iv. (Hanover, and Berlin, 1826 fol.); *Lettres de Gerbert*, ed. J. Havet (1889); *Die Urkunden Kaisers Ottos III.*, ed. Th. von Sickel in the *Monumenta Germaniae historica. Diplomata* (Hanover, 1879); R. Wilmans, *Jahrbücher des deutschen Reichs unter Kaiser Otto III.* (1837–40); P. Kehr, *Die Urkunden Otto III.* (Innsbruck, 1890).

OTTO IV. (*c.* 1182–1218), Roman emperor, second son of Henry the Lion, duke of Saxony, and Matilda, daughter of Henry II., king of England, was most probably born at Argenton in central France. His father died when he was still young, and he was educated at the court of his uncle Richard I., king of England, under whose leadership he gained valuable experience in war, being appointed duke of Aquitaine, count of Poitou and earl of Yorkshire. When the emperor Henry VI. died in September 1197, some of the princes under the leadership of Adolph, archbishop of Cologne, were anxious to find a rival to Philip, duke of Swabia, who had been elected German king. After some delay their choice fell upon Otto, who was chosen king at Cologne on June 9, 1198. Hostilities broke out at once, and Otto, after a series of defeats, was driven to Brunswick. Preparations were made to drive him from here, when he was saved by the murder of Philip in June 1208. Many of the supporters of Philip now made overtures to Otto, and an attempt to set up Henry I., duke of Brabant, having failed, Otto submitted to a fresh election and was chosen German king at Frankfort on Nov. 11, 1208, in the presence of a large gathering of princes. A general reconciliation followed, which was assisted by the betrothal of Otto to Philip's eldest daughter Beatrix, but as she was only ten years old, the marriage was deferred until July 22, 1212. The pope, who had previously recognized the victorious Philip, hastened to return to the side of Otto; large concessions were made to the church.

In August 1209 the king set out for Italy. Meeting with no opposition, he was received at Viterbo by Innocent, but refused the papal demand that he should concede to the church all the territories which, previous to 1197, had been in dispute between

the Empire and the Papacy, consenting, however, not to claim supremacy over Sicily. He was crowned emperor at Rome on Oct. 4, 1209, a ceremony which was followed by fighting between the Romans and the German soldiers. The pope then requested the emperor to leave Roman territory; but he remained near Rome for some days, demanding satisfaction for the losses suffered by his troops. The breach with Innocent soon widened, and in violation of the treaty made with the pope Otto attempted to recover for the Empire all the property which Innocent had annexed to the Church, and rewarded his supporters with large estates in the disputed territories.

Having occupied Tuscany he marched into Apulia, part of the kingdom of Frederick of Hohenstaufen, afterwards the emperor Frederick II., and on Nov. 18, 1210, was excommunicated by the pope. Regardless of this sentence Otto completed the conquest of southern Italy, but the efforts of Innocent had succeeded in arousing considerable opposition in Germany, where the rebels were also supported by Philip Augustus, king of France. A number of princes assembled at Nuremberg declared Otto deposed, and invited Frederick to fill the vacant throne. Returning to Germany in March 1212, Otto made some headway against his enemies until the arrival of Frederick towards the close of the year. The death of his wife in August 1212 had weakened his hold on the southern duchies, and he was soon confined to the district of the lower Rhine, although supported by money from his uncle King John of England. The final blow to his fortunes came when he was decisively defeated by the French at Douvines in July 1214. He escaped with difficulty from the fight and took refuge in Cologne. His former supporters hastened to recognize Frederick; and in 1216 he left Cologne for Brunswick, which he had received in 1202 by arrangement with his elder brother Henry. The conquest of Hamburg by the Danes, and the death of John of England, were further blows to his cause. On May 19, 1218, he died at the Harzburg after being loosed from the ban by a Cistercian monk, and was buried in the church of St. Blasius at Brunswick. He left no children.

See *Regesta imperii V.*, ed. J. Ficker (Innsbruck, 1881); L. von Ranke, *Weltgeschichte*, Part viii. (Leipzig, 1887–88); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Band v. (Leipzig, 1888); O. Abel, *Kaiser Otto IV. und König Friedrich II.* (1856); E. Winkelmann, *Philipp von Schwaben und Otto IV. von Braunschweig* (Leipzig, 1873–78); G. Langerfeldt, *Kaiser Otto der Vierte* (Hanover, 1872); R. Schwemer, *Innocenz III. und die deutsche Kirche während des Thronstreites* (Strassburg, 1882); and A. Luchaire, *Innocent III., la papauté et l'empire* (1906); and *Innocent III., la question d'Orient* (1906).

OTTO, king of Greece (1815–1867), second son of Louis I., king of Bavaria, and his wife Teresa of Saxe-Altenburg, was born at Salzburg on June 1, 1815, and was educated at Munich. In 1832 he was chosen by the conference of London to occupy the newly-erected throne of Greece, and on Feb. 6, 1833, he landed at Nauplia, then the capital of independent Greece. Otto, who was not yet eighteen, was accompanied by a council of regency composed of Bavarians under the presidency of Count Josef Ludwig von Armansperg (1787–1853). In 1835 Otto came of age, but, on the advice of his father and under pressure of Great Britain and of the house of Rothschild, who all believed that a capable finance minister was the supreme need of Greece, he retained Armansperg as chancellor of state. The Greeks were more heavily taxed than under Turkish rule; they had exchanged government by the sword, which they understood, for government by official regulations, which they hated; they had escaped from the sovereignty of the Mussulman to fall under that of a devout Catholic, to them a heretic. Otto was well intentioned, honest and inspired with a genuine affection for his adopted country; but it needed more than mere amiable qualities to reconcile the Greeks to his rule.

In 1837 Otto married Princess Amalie of Oldenburg, who made herself unpopular by interfering in the government. Meanwhile Armansperg had been dismissed by the king, but a Greek minister was not put in his place, and the granting of a constitution was postponed. The attempts of Otto to conciliate Greek sentiment by efforts to enlarge the frontiers of his kingdom, *e.g.*, by the suggested acquisition of Crete in 1841, only succeeded in embroiling him with the powers. His power rested wholly on Bavarian bayonets; and when, in 1843, the last of the German troops were withdrawn, he was forced by the outbreak of a revolutionary movement in Athens to grant a constitution and to appoint a ministry of native Greeks.

For the British blockade of the Peiraeus and Greek intervention in the Crimean War *see* GREECE: *History*. Otto's position in Greece became untenable. In 1861 a student named Drusios attempted to murder the queen, and was hailed by the populace as a modern Harmodius. In October 1862 the troops in Acarnania under General Theodore Srivas declared for the king's deposition; those in Athens followed suit; a provisional government was set up and summoned a national convention. The king and queen, who were at sea, took refuge on a British warship, and returned to Bavaria, where, on July 26, 1867, Otto died

See E. A. Thouvenel, *La Grèce du roi Othon* (Paris, 1890); G. L. von Maurer, *Das griechische Volk*, etc. (1836); C. W. P. Mendelssohn-Bartholdy, "Die Verwaltung König Ottos von Griechenland und sein Sturz" (in *Preuss. Jahrbücher*, iv. 365); K. T. v. Heigel, *Ludwig I., König von Baiern*, pp. 149 *et seq.* (Leipzig, 1872); H. H. Parish, *The Diplomatic History of the Monarchy of Greece from the Year 1830* (London, 1838).

OTTO OF FREISING (1114?–1158), German bishop and chronicler, was the fifth son of Leopold III., margrave of Austria, by his wife Agnes, daughter of the emperor Henry IV. By her first husband, Frederick I. of Hohenstaufen, duke of Swabia, Agnes was the mother of the German king Conrad III., and grandmother of the emperor Frederick I.; and Otto was thus related to the most powerful families in Germany. He studied in Paris, and became abbot of the Cistercian monastery of Morimond in Burgundy about 1136, soon afterwards being elected bishop of Freising. In 1147 he took part in the disastrous crusade of Conrad III., returning to Bavaria in 1148 or 1149. He enjoyed the favour of Conrad's successor, Frederick I.; was probably instrumental in settling the dispute over the duchy of Bavaria in 1156; was present at the famous diet at Besançon in 1157, and died at Morimond on Sept. 22, 1158.

Otto wrote a *Chronicon*, sometimes called *De duabus civitatibus*, an historical and philosophical work in eight books, which follows to some extent Augustine and Orosius. It goes down to 1146, and from this date until 1209 has been continued by Otto, abbot of St. Blasius (d. 1223). Of the *Gesta Friderici imperatoris* the first two books were written by Otto, and the remaining two probably by his pupil Ragewin, or Rahewin. First printed by John Cuspinian at Strasbourg in 1515, Otto's writings are now issued in the *Monumenta Germaniae historica*, Band xx. (Hanover, 1868); German trans. by H. Kohl (Leipzig, 1881–86). The *Gesta Friderici* has been published separately with introduction by G. Waitz.

See J. Hashagen, *Otto von Freising als Geschichtsphilosoph und Kirchenpolitiker* (Leipzig, 1900); J. Schmidlin, *Die geschichtsphilosophische und kirchenpolitische Weltanschauung Otto von Freising* (Freiburg i./B., 1906); A. Hofmeister, "Studien über O. v. Freising" in *Gesellschaft für ältere deutsche Geschichtskunde* (Hanover, 1911); A. Potthast, *Bibliotheca historica* (1896).

OTTO OF NORDHEIM (d. 1083), duke of Bavaria, belonged to the rich and influential Saxon family of the counts of Nordheim, and received the duchy of Bavaria from Agnes, widow of the emperor Henry III., in 1061. In 1062 he assisted Anno, archbishop of Cologne, to seize the German king, Henry IV.; led a successful expedition into Hungary in 1063; and took a prominent part in the government during the king's minority. In 1064 he went to Italy to settle a papal schism, secured the banishment from court of Adalbert, archbishop of Bremen, and crossed the Alps in the royal interests on two other occasions. In 1070 Otto was accused of being privy to a plot to murder the king, and was required to submit to the ordeal of battle with his accuser. The duke asked for a safe-conduct to and from the place of meeting, and when this was refused he declined to appear, and was consequently deprived of Bavaria, while his Saxon estates were plundered. He obtained no support in Bavaria, but raised an army among the Saxons and carried on a campaign of plunder against Henry until 1071, when he submitted; in the following year he received back

his private estates. When the Saxon revolt broke out in 1073 Otto is represented by Bruno, the author of *De bello Saxonico*, as delivering an inspiring speech to the assembled Saxons at Wormsleben, after which he took command of the insurgents. By the peace of Gerstungen in 1074 Bavaria was restored to him; he shared in the Saxon rising of 1075, after which he was again pardoned and made administrator of Saxony. After the excommunication of Henry IV. in 1076 Otto attempted to mediate between Henry and the Saxons, but when these efforts failed he again placed himself at their head. He assented to the election of Rudolph, count of Rheinfelden, as German king, when his restoration to Bavaria was assured, and by his skill and bravery inflicted defeats on Henry's forces at Mellrichstadt, Flarchheim and Hohenmölsen. He remained in arms against the king until his death on Jan. 11, 1083. By his wife Richenza, widow of Hermann, count of Werla, he left six children.

See H. Mehmel, *Otto von Nordheim, Herzog von Bayern* (Göttingen, 1870); E. Neumann, *De Ottone de Nordheim* (Breslau, 1871); and A. Vogeler, *Otto von Nordheim* (Göttingen, 1880).

OTTOMAN BANK. The establishment of the "Imperial Ottoman Bank" was authorized by *Firman* in 1863 and effected by a Convention between the Turkish Government and a banking consortium of the English and French founders. Its function was to act as the State Bank of the Turkish Empire. It was granted the exclusive right of note issue, and was the sole accredited financial agent of the Sublime Porte.

In 1925 the concession under which the bank works was extended, with certain modifications, for ten years. At the same time the title "Imperial" was dropped, and the institution is now known as the "Ottoman Bank." Its legal domicile is Constantinople; the directing committees reside and meet in London and Paris, in which cities the bank has important offices. It has also a branch at Manchester and a branch at Marseilles; in addition the bank has agencies in the following countries: Turkey (45), Egypt (7), Cyprus (6), 'Iraq (4), Palestine (4), Greece (2), Persia (3), Arabia (1), Transjordania (1) and Tunis (1).

A subsidiary institution, the Banque de Syrie et du Grand Liban, has some ten branches throughout Syria. The Ottoman Bank is actively interested in the Banque Franco-Serbe, the Bank of Roumania Ltd., and the British-French Discount Bank Ltd.

The capital of the bank is £10,000,000, of which half is paid up, the reserve £1,250,000, while notes in circulation amount approximately to £600,000. The Ottoman Bank still maintains its original character as an Anglo-French institution.

OTTOMAN EMPIRE, the empire founded by Osman (1288–1320), which lasted six centuries and a half, and fell before the democratic movement inaugurated at Angora in 1919 by Mustafa Kemal Pasha (*q.v.*). (*See* CALIPHATE; TURKEY.)

OTTRELITE (from Ottrez, Belgium, the original locality), in mineralogy, a member of a group of closely related minerals with the general composition H_2O. RO. Al_2O_3. SiO_2, in which RO is dominantly FeO, but is often in part represented by a content of MgO or MnO. On account of its petrographic importance the term ottrelite is often used as the group name for this series of minerals, though the name clintonite is also in use. The chief members are chloritoid (H_2 Fe Al_2 SiO_7), sismondine (H_2 [Fe, Mg] Al_2SiO_7) in which the magnesia rises to 7%, and ottrelite the manganiferous variety (H_2[FeMn] Al_2SiO_7) in which the MnO content may rise to 8%. They are grey, green or black micaceous minerals, but in distinction from the "elastic" micas and "flexible" chlorites they are often referred to as the "brittle micas" on account of the brittleness of their laminae. Like the micas and chlorites they possess monoclinic symmetry and a perfect cleavage parallel to the flat surface (001) of the plates. Their superior hardness (H=6·5) readily distinguishes them from both these groups of minerals. Multiple twinning on the mica law is exceedingly common, and a zonal structure (often of hour-glass type) is often apparent. The ottrelite group of minerals is confined to metamorphic rocks—particularly those developed in regional metamorphism—in slates, phyllites and schists. Noteworthy occurrences of this mineral are the slates of the Ardennes, of Tintagel (Cornwall) and in the Mesozoic and Permian schists of the Swiss and Italian Alps.

The minerals margarite, xanthophyllite and kossmatite show some relations with the ottrelite group of minerals. They are distinguished by an inferior hardness and contain calcium as an essential constituent. Margarite (H_2Ca Al_4Si_2 O_{12}) occurs in white pearly scales associated with corundum and is a common mineral of emery deposits. Xanthophyllite occurs in talc-chlorite schists at Slatoust in the Urals and in altered limestone at Riverside, California, while kossmatite is a recently described lime-rich mineral (H=2·5) occurring in the dolomite marbles of West Macedonia. (C. E. T.)

OTTUMWA, a city of south-eastern Iowa, U.S.A., on the Des Moines river, at an altitude of 650 ft.; the county seat of Wapello county. It is on Federal highways 34 and 63, and is served by the Burlington Route, the Chicago, Milwaukee, St. Paul and Pacific, the Rock Island and the Wabash railways. Pop. (1925 State census) 26,375. The city is built on a series of terraces rising from the river. It is in the bituminous coalfields of Iowa, at the heart of the corn and meat producing area of the Middle West. Pork products, serum, agricultural implements, boilers, car loaders, hoisting engines, chicken coops, lawn mowers, mine equipment and supplies, carpenters' squares and ice-cream cabinets are among the leading manufactures. The aggregate factory product in 1925 was valued at $45,169,330. Ottumwa was founded in 1843, incorporated as a town in 1851, and chartered as a city in 1857. The name is a modification of an Indian word meaning "rippling water."

OTUQUIAN, a tribe or small group of tribes of South American Indians, constituting an independent linguistic stock, so called from the Otuquis, the most important tribe. The group, which was nearly extinct in the early part of the 19th century, lived in north-eastern Bolivia in the eastern portion of the province of Chiquitos, on the Otuquis river and between it and the Paraguay, between 17° and 18° S. lat. At that time the remnant of the people were located at the mission of Santa Corazon de Chiquitos, and had already lost their original culture.

See G. L. Kriegk, *Das Land Otuquis in Bolivia* (Frankfurt, 1838); G. de Crequi-Montfort and P. Rivet, "Le groupe Otuke" (*J. Soc. Americanistes de Paris* [n.s.] vol. ix., pp. 317–337); *ibid.*, "Les affinités des dialectes Otuke" (*ibid.* vol. x., pp. 369–377).

OTWAY, THOMAS (1652–1685), English dramatist, was born at Trotten, near Midhurst, Sussex, on March 3, 1652. His father, Humphrey Otway, was at that time curate of Trotton, but Otway's childhood was spent at Woolbeding, a parish 3 m. distant, of which his father had become rector. He was educated at Winchester College, and in 1669 entered Christ Church, Oxford, as a commoner, but left the university without a degree in the autumn of 1672. In 1675 Thomas Betterton produced at Dorset Garden theatre Otway's first drama, *Alcibiades*, which was printed in the same year. It is a poor tragedy saved from absolute failure by the actors. He made a great advance on this first work in *Don Carlos, Prince of Spain* (licensed June 15, 1676; an undated edition probably belongs to the same year). In it the two characters familiar throughout his plays make their appearance. Don Carlos is the impetuous, unstable youth, who seems to be drawn from Otway himself, while the queen's part is the gentle pathetic character repeated in his more celebrated heroines, Monimia and Belvidera. In 1677 Betterton produced two adaptations from the French by Otway, *Titus and Berenice* (from Racine's *Bérénice*), and the *Cheats of Scapin* (from Molière's *Fourberies de Scapin*). These were printed together, with a dedication to Lord Rochester. In 1678 he produced an original comedy, *Friendship in Fashion*, popular at the moment, though it was hissed off the stage for its gross indecency when it was revived at Drury Lane in 1749.

Meanwhile he had conceived an overwhelming passion for Mrs. Barry, who filled many of the leading parts in his plays. Six of his letters to her survive, the last of them referring to a broken appointment in the Mall. In 1678, driven to despair by her, Otway obtained a commission through Charles, earl of Plymouth, a natural son of Charles II., in a regiment serving in the Netherlands. The English troops were disbanded in 1679, but

were left to find their way home as best they could. They were also paid with depreciated paper, and Otway arrived in London late in the year, ragged and dirty, a circumstance utilized by Rochester in his "Sessions of the Poets," which contains a scurrilous attack on his former protégé.

Early in the next year (February 1680) was produced at Dorset Garden the first of Otway's two tragic masterpieces, *The Orphan, or The Unhappy Marriage,* Mrs. Barry playing the part of Monimia. Written in blank verse, which shows a study of Shakespeare, its success was due to the tragic pathos, of which Otway was a master, in the characters of Castalio and Monimia. *The History and Fall of Caius Marius,* produced in the same year, and printed in 1692, is a curious grafting of Shakespeare's *Romeo and Juliet* on the story of Marius as related in Plutarch's *Lives.* In 1680 Otway also published *The Poet's Complaint of his Muse, or A Satyr against Libells,* in which he retaliated on his literary enemies. An indifferent comedy, *The Soldier's Fortune* (1681), was followed in February 1682 by *Venice Preserved, or A Plot Discover'd.* The story is founded on the *Histoire de la conjuration des Espagnols contre la Venise en 1618,* by the Abbé de Saint-Réal, but Otway modified the story considerably. The character of Belvidera is his own, and the leading part in the conspiracy, taken by Bedamor, the Spanish ambassador, is given in the play to the historically insignificant Pierre and Jaffier. The piece has a political meaning, enforced in the prologue. The Popish Plot was in Otway's mind, and Anthony, 1st earl of Shaftesbury, is caricatured in Antonio. The play won instant success. It was translated into almost every modern European language, and even Dryden said of it: "Nature is there, which is the greatest beauty."

The Orphan and *Venice Preserved* remained stock pieces on the stage until the 19th century, and the leading actresses of the period played Monimia and Belvidera. One or two prefaces, another weak comedy, *The Atheist* (1684), and two posthumous pieces, a poem, *Windsor Castle* (1685), a panegyric of Charles II., and a *History of the Triumvirates* (1686), translated from the French, complete the list of Otway's works. He apparently ceased to struggle against his poverty and misfortunes. The generally accepted story regarding the manner of his death was first given in Theophilus Cibber's *Lives of the Poets.* He is said to have emerged from his retreat at the Bull on Tower Hill to beg for bread. A passer-by, learning who he was, gave him a guinea, with which Otway hastened to a baker's shop. He began too hastily to satisfy his ravenous hunger, and choked with the first mouthful. Whether this account of his death be true or not, it is certain that he died in the utmost poverty, and was buried on April 16, 1685, in the churchyard of St. Clement Danes. A tragedy entitled *Heroick Friendship* was printed in 1686 as Otway's work, but the ascription is unlikely.

The Works of Mr. Thomas Otway with some account of his life and writings, published in 1712, was followed by other editions (1757, 1768, 1812). The standard edition is that by T. Thornton (1813). A selection of his plays was edited for the Mermaid series (1891 and 1903) by Roden Noel. *See* E. Schumacher, *Thomas Otway* (Bonn, 1924).

OUBLIETTE, a French architectural term used in two senses, of a dungeon in a prison or castle which could only be reached by a trap-door from another dungeon, and of a concealed opening or passage leading from a dungeon to the moat or river, into which bodies of prisoners might be dropped. Many so-called "oubliettes" in mediaeval castles were in reality the cesspools or receptacles of the castle latrines.

OUDENARDE, a town of Belgium in the province of East Flanders, 18 m. S. of Ghent. While it is best known for the great victory gained by Marlborough and Eugene over the French under Vendôme in 1708, Oudenarde has many features of interest. The town hall, which took ten years to build (1525–1535), has after that of Louvain the most elaborately decorated façade in Belgium. It was designed by H. van Peede and G. de Ronde, and is in tertiary Gothic style. The belfry tower of five storeys with three terraces, surmounted by a golden figure, is a striking feature. The council chamber contains a fine oak door and Gothic chimney-piece, both *c.* 1530. There are also two interesting old churches, St. Walburga, partly of the 12th and partly of the 14th century, and Notre Dame, dating from the 13th century. The former contains several pictures by Craeyer and other Flemish masters.

The Battle of Oudenarde (June 30–July 11, 1708) was fought on the ground north-west and north of the town, which was then regularly fortified and was garrisoned by a force of the Allies. For an account of the strategic situation which led up to the battle, *see* SPANISH SUCCESSION, WAR OF THE. The French army under the duke of Burgundy and Marshal Vendôme, after an abortive attempt to invest Oudenarde, took up a defensive position north of the town when Marlborough and Eugene, after a forced march, arrived with the main Allied army. The advanced guard of the Allies under General (Lord) Cadogan promptly crossed the Scheldt, annihilated an outlying body of French troops, and established itself on the ground it had won, in front of the French centre. But the Allied main army took a long time to defile over the Scheldt and could form up (on the left of Cadogan's detachment) only slowly and by degrees. Observing this, Burgundy resolved to throw forward his right towards Oudenarde to engage and hold the main body of the Allies before their line of battle could be formed. This effected, it was hoped that the remainder of the French army could isolate and destroy Cadogan's detachment, which was already closely engaged with the French centre. But he miscalculated both the endurance of Cadogan's men (amongst whom the Prussians were conspicuous for their tenacity) and the rapidity with which in Marlborough's and Eugene's hands the wearied troops of the Allies could be made to move. Marlborough, who personally directed the operations on his left wing, not only formed his line of battle successfully, but also began seriously to press the forces that had been sent to check his deployment. Before long, while the hostile left wing still remained inactive, the unfortunate troops of the French centre and right were gradually hemmed in by the whole force of the Allies. The decisive blow was delivered by the Dutch marshal, Overkirk, who was sent by Marlborough with a large force (the last reserve of the Allies) to make a wide turning movement round the extreme right of the French, and at the proper time attacked them in rear. A belated attempt of the French left to intervene was checked by the British cavalry, and the pressure on the centre and right, which were now practically surrounded, continued even after nightfall. A few scattered units managed to escape, and the left wing retreated unmolested, but at the cost of about 3,000 casualties the Allies inflicted a loss of 6,000 killed and wounded and 9,000 prisoners on the enemy, who were, moreover, so shaken that they never recovered their confidence to the end of the campaign. The battle of Oudenarde was not the greatest of Marlborough's victories, but it affords almost the best illustration of his military character. Contrary to all the rules of war then in vogue, he fought a piecemeal and unpremeditated battle, with his back to a river, and with wearied troops, and succeeded.

OUDINÉ, EUGÈNE ANDRÉ (1810–1887), French sculptor and medallist, was born in Paris in 1810, and devoted himself from the beginning to the medallist's branch of sculpture, although he also excelled in monumental sculpture and portrait busts. He gained the grand prize for medal engraving in 1831, and in the same year exhibited his "Wounded Gladiator." He subsequently occupied official posts as designer to the Inland Revenue and to the Mint. His most famous medals are those struck in commemoration of the annexation of Savoy by France and of the peace of Villafranca. Others are "The Apotheosis of Napoleon I.," "The Universal Exposition," "The Establishment of the Republic," and "Napoleon's Tomb at the Invalides." Oudiné, who may be considered the father of the modern medal, died in 1887.

OUDINOT, CHARLES NICOLAS (1767–1847), duke of Reggio, marshal of France, was born at Bar-le-duc, on April 25, 1767. He served in the regiment of Médoc from 1784 to 1787, retiring with the rank of sergeant. On the outbreak of war in 1792 he became lieutenant colonel in the volunteers of the Meuse, being transferred to the regular army after his defence of the fort of Bitsch (1792). He was promoted general of brigade in June 1794, after the battle of Kaiserslautern. He served on the German frontier under Hoche, Pichegru and Moreau, and in the

Swiss campaign of 1799 with Masséna. He was made inspector-general of infantry, and in the war of 1805 he commanded the famous "grenadiers Oudinot," with which he seized the Vienna bridges, and gave the decisive blow at Austerlitz. In 1808 he was made governor of Erfurt and count of the Empire, and in 1809 after Wagram, he was promoted marshal. He was made duke of Reggio, and received a large money grant in April 1810. Oudinot governed Holland from 1810 to 1812, and commanded the II. corps of the *Grande Armée* in the Russian campaign. For his defeat at Gross Beeren *see* NAPOLEONIC CAMPAIGNS. He was superseded by Ney, who was defeated at Dennewitz. Oudinot again held important commands at Leipzig and in the 1814 campaign. He was made a peer under Louis XVIII., and did not join Napoleon in 1815. His last active service was in the French invasion of Spain in 1823, in which he commanded a corps, and was for a time governor of Madrid.

OUIDA, the pen name—derived from a childish attempt to pronounce "Louisa"—of Maria Louise [de la] Ramée (1839–1908), English novelist, born at Bury St. Edmunds, where her birth was registered on Jan. 7, 1839. Her father, Louis Ramée, was French, and her mother, Susan Sutton, English. In 1860 her first story, afterwards republished as *Held in Bondage* (1863), appeared in the *New Monthly* under the title of *Granville de Vigne,* and this was followed in quick succession by *Strathmore* (1865), *Chandos* (1866) and *Under Two Flags* (1867). The list of Ouida's subsequent works is a very long one; but it is sufficient to say that, together with *Moths* (1880), those already named are not only the most characteristic, but also the best. In a less dramatic genre, her *Bimbi: Stories for Children* (1882) may also be mentioned; but it was by her more flamboyant stories, such as *Under Two Flags* and *Moths,* that her popular success was achieved. She died at Viareggio Jan. 25, 1908.

OULU, a seaport of Finland on the Gulf of Bothnia in 65° N., 25° 29′ E., linked by rail to Helsinki. Pop. (1925), 22,560. It is the chief town of a forested department of the same name. The accommodation in the harbour depends on the wind. The exports are timber, tar, pitch, fish, butter and leather and the imports colonial produce, coals, iron, hides and salt.

OUNCE. (1) A unit of weight, being the twelfth part of a pound troy,=480 grains (through O.Fr. *unce,* modern *once,* from Lat. *uncia,* twelfth part, of weight, of a pound, of measure, of a foot, in which sense it gives the O.Eng. *ynce,* inch); in avoirdupois=437·5 grains, $\frac{1}{16}$ of a pound. The *fluid ounce* is a measure of capacity; in the United Kingdom it is equivalent to an avoirdupois ounce of distilled water at 62° F; in the United States of America it is the 128th part of the gallon,=¼ gill,= 456·033 grains of distilled water at its maximum density (*see* WEIGHTS AND MEASURES). (2) A name properly applied to the *Felis uncia* or snow-leopard (*q.v.*). It appears to have been originally used of various species of lynx, and is still sometimes the name of the Canada lynx.

OUNDLE, a town of Northamptonshire, England, 30½ m. N.E. of Northampton on the L.M.S. railway. Pop. (1921) 2,654. The manor, with a market and tolls, was among the possessions confirmed in 972 by King Edgar to the abbot of Peterborough, to whom it still belonged in 1086. After the Dissolution the market was granted with the manor to John, earl of Bedford, and still belongs to the lord of the manor. It is situated on a hill overlooking the river Nene. The church of St. Peter has Early English, Decorated and Perpendicular porticos. Oundle School was founded under the will of Sir William Laxton, Lord Mayor of London (d. 1556).

OURO PRETO ("Black Gold"), a city of the State of Minas Geraes, Brazil, 336m. by rail N. by W. of Rio de Janeiro, and about 300m. W. of Victoria, Espirito Santo, on the eastern slope of the Serra de Espinhaço and within the drainage basin of the Rio Doce. Pop. (1890) 17,860; (1900) decreased to 5,400. The city is built upon the lower slope of the Serra do Ouro Preto, a spur of the Espinhaço, deeply cut by ravines and divided into a number of irregular hills, up which the narrow, crooked streets are built and upon which groups of houses form each a separate nucleus. From a mining settlement the city grew as the inequalities of the site permitted. The rough streets are too steep and narrow for vehicles. The climate is sub-tropical and humid, though the elevation (3,700–3,800ft.) gives a temperate climate in winter. The days are usually hot and the nights cold, the variations in temperature being a fruitful cause of bronchial and pulmonary diseases. Ouro Preto has several historic buildings, the more noteworthy are the old Government house (now occupied by the school of mines), the legislative chambers, municipal hall and gaol —all fronting on the Praça da Independencia—the old Casa dos Contos (afterwards the public treasury), a theatre (the oldest in Brazil, restored in 1861–62) and a hospital. There are 15 churches in the city, all dating from more prosperous days. Ouro Preto is the seat of Brazil's leading school of mines.

The city dates from 1701, when a gold-mining settlement was established in its ravines by Antonio Dias of Taubaté. The circumstance that the gold turned black on exposure to the humid air (owing to the presence of silver) gave the name of Ouro Preto to the mountain spur and the settlement. In 1711 it became a city with the name of Villa Rica, a title justified by its size and wealth. At one period of its prosperity its population was estimated at 25,000 to 30,000. In 1720 Villa Rica became the capital of the newly created captaincy of Minas Geraes, and in 1823 the capital of the province of the same name under the empire of Don Pedro I. When the empire was overthrown in 1889 and Minas Geraes was reorganized as a republican state, it was decided to remove the capital to a more favourable site and Bello Horizonte was chosen, but Ouro Preto remained the capital until 1898, when the new town (also called Cidade de Minas) became the seat of government. (*See* MINAS GERAES.)

OUSE, the name of several English rivers, an ancient word of disputed etymology.

(1) The Great Ouse rises in Northamptonshire, in the hills between Banbury and Brackley, and falls about 500 ft. in 160 m. to its mouth in the Wash (North sea). It flows east past Brackley and Buckingham and then turns north-east to Stony Stratford, receiving the Tove and the Ouzel at Newport Pagnell. It then follows a sinuous course past Olney to Sharnbrook, where it turns abruptly south to Bedford, then to flow north-east past St. Neot's to Godmanchester and Huntingdon, when the river trends easterly to St. Ives. Hitherto the Ouse has watered an open valley, but below St. Ives the river debouches suddenly upon the Fens; its fall from this point to the mouth, a distance of 55 m. by the old course, is little more than 20 feet. From Earith to Denver the waters of the Ouse flow almost wholly in two straight artificial channels called the Bedford Rivers, the old course being called the Old West River. This is joined by the Cam 4 m. above Ely. North of this point the river receives the Lark, the Little Ouse, or Brandon river, and the Wissey. Below Denver sluice, 16 m. from the mouth, the Ouse is tidal. It flows past King's Lynn, and enters the Wash near the south-east corner. The river is locked up to Bedford, a distance of 74½ m. by the direct course. A recent attempt to clear the river in order to make it more navigable and less liable to floods has been made, but has met with opposition from the farmers of the upper reaches.

(2) A river of Yorkshire. The river Ure, rising in the Pennines, and traversing Wensleydale, unites with the river Swale to form the Ouse near Boroughbridge, in the central plain of Yorkshire. The course of the Swale, which rises on the eastern flank of the Pennines, is mostly through this plain, and that of the Ouse is wholly so. It flows south-east passing York, Selby and Goole to the Trent, to form with that river the Humber estuary (*q.v.*). The course of the Ouse, thus defined, is 61 miles. The Swale and Ure are each about 60 m. long. Goole is a growing port, and the river bears much traffic up to York, smaller traffic up to Boroughbridge, from which the Ure Navigation (partly a canal) continues up to Ripon. The Swale is not navigable. The chief tributaries are the Nidd, the Wharfe, the Don and the Aire on the right, and the Derwent on the left. All traverse beautiful valleys, and the Aire and the Don, with canals, afford communications between south Yorkshire and the Humber ports. The Derwent is also navigable. It is tidal up to Naburn, 37 m. from the junction with the Trent.

(3) A river of Sussex, rising in the Forest Ridges between Horsham and Cuckfield, and draining part of the Weald. Like other streams here, it breaches the South Downs, and reaches the English Channel at Newhaven after a course of 30 miles. The Ouse is navigable for small vessels to Lewes, and Newhaven is an important harbour.

OUSEL or **OUZEL,** the ancient name of the blackbird, but now applied, in combination, to the dipper (*q.v.*) or water-ousel, and to the ring-ousel (*Turdus torquatus*). This latter is a relative of the blackbird, from which it is distinguished by its white gorget and dark bill. It is a summer visitor to the hilly districts of the British Isles and Europe generally.

OUSELEY, SIR FREDERICK ARTHUR GORE (1825–1889), English composer, son of Sir Gore Ouseley, ambassador to Persia, was born on Aug. 12, 1825, in London. He was a precocious child, and composed an opera at the age of eight years. Educated at Christ Church, Oxford, he took orders, and held two London curacies. In 1855 he succeeded Sir Henry Bishop as professor of music in the University of Oxford, was ordained priest and appointed precentor of Hereford. In 1856 he became vicar of St. Michael's, Tenbury, and warden of St. Michael's College. His works include the oratorio *Polycarp,* written for his Mus. Doc. degree (1854), a second oratorio, *Hagar* (Hereford, 1873), a great number of services and anthems, chamber music, songs, etc., and theoretical works. He died on April 6, 1889.

His uncle, SIR WILLIAM OUSELEY (1769–1842), British orientalist, wrote *Travels in Various Countries in the East, especially Persia, in 1810, 1811 and 1812* (3 vol., 1819–23).

OUSTER, a legal term signifying dispossession, especially the wrong or injury suffered by a person dispossessed of freeholds or chattels real. The wrong-doer by getting into occupation forces the real owner to take legal steps to regain his rights. Ouster of the freehold may be effected by *abatement, i.e.,* by entry on the death of the person seized before the entry of the heir, or devisee; by *intrusion,* entry after the death of the tenant for life before the entry of the reversioner or remainderman; by *disseisin,* the forcible or fraudulent expulsion of the occupier or person seized of the property. Ouster of chattels real is effected by *disseisin,* the turning out by force or fraud of the legal proprietor before his estate is determined. Ouster by force, or forcible entry, was made a criminal offence by a statute of 1381.

OUTLAWRY, the process of putting a person out of the protection of the law; a punishment for contemptuously refusing to appear when called in court, or evading justice by disappearing. It was of very early existence in England, and was the punishment of those who could not pay the *were* or blood-money to the relatives of the deceased. By the Saxon law, an outlaw lost his *libera lex* and had no protection from the frank-pledge in the decennary in which he was sworn. He was, too, a *frendlesman,* because he forfeited his friends; for if any of them rendered him any assistance, they became liable to the same punishment. An outlaw was *civiliter mortuus.* He could not sue in any court, nor had he any legal rights which could be enforced, but he was personally liable upon all causes of action. It was finally abolished in civil proceedings in 1879, while in criminal proceedings it has practically become obsolete, being unnecessary through the general adoption of extradition treaties.

In Scotland outlawry or fugitation may on the motion of the Crown be pronounced by the supreme criminal court when the panel has absconded and fails to appear to plead to the indictment on the day of trial.

OUTLAWRY OF WAR means, in the popular concept, the placing of war as a means of national policy outside the pale of law. War has been regarded in certain instances as the last resort of a state to obtain what it believes to be its lawful object. Certain writers have pointed out that, while an individual is prohibited by domestic law enforced by a police power from the use of force in his dealings with other individuals, a state under international law has heretofore been free to use war as a means of attaining its national objectives, excepting as limited in specific instances by its treaty engagements.

It was during the Thirty Years' War (1618–48) that Grotius published (1625) his monumental treatise *De Jure Belli ac Pacis,* in the foreword to which he said:

"Throughout the Christian world I observed a lack of restraint in relation to war, such as even barbarous races should be ashamed of; I observed that men rush to arms for slight causes, or no cause at all, and that when arms have once been taken up there is no longer any respect for law, divine or human; it is as if, in accordance with a general decree, frenzy had openly been let loose for the committing of all crimes."

Thus commenced the growth in International Law of a set of rules governing the conduct of wars.

Since then the development of International Law, the multiplication of arbitration and conciliation treaties and the provisions of the Covenant of the League of Nations and the Locarno treaties has been to effect a certain humanization of the practice of war and to lessen the number and kind of circumstances in which war could legitimately be resorted to. Up to 1928, however, war remained a recognized and respectable instrument of national policy. The advocates of the outlawry of war theory feel that so long as the institution of war remains respectable and enjoys a recognized place in the field of international relations, the root of the evil remains. Their solution of the problem is, in part, to oust war from its privileged position by denying it a legal status and placing a State indulging in hostilities against another State beyond the pale, that is to say, literally to outlaw it.

Among the principal advocates of the outlawry of war movement in the United States have been Judge Florence E. Allen, Senator William E. Borah, Dr. Nicholas Murray Butler, Professor John Dewey, Reverend John Haynes Holmes, Mr. S. O. Levinson, Dr. C. C. Morrison, Reverend M. V. Oggel, and the American Committee for the Outlawry of War.

From an article on this subject appearing in the New Republic, March 9, 1918, the following quotation from a suggested plan is given:

"As long as international law continues to legalize war all nations are moral accessories before the fact to 'collective murder.' Conversely, outlaw war and militarism is out of a job. War . . . would be branded as a crime and the force of the world would be organized to deal with the criminal . . . two things are indispensable to the reorganization of the world: The specific outlawing of war by the code of nations and the ability by force to execute the decrees of the international tribunal."

Senator William E. Borah in February 1923 introduced a resolution into the U.S. Senate reading in part as follows:—

"Resolved, That it is the view of the Senate of the United States that war between nations should be outlawed as an institution or means for the settlement of international controversies by making it a public crime under the law of nations. . . . That a code of international law of peace based upon equality and justice between nations, amplified and expanded and adapted and brought down to date should be created and adopted" also "That a judicial substitute for war should be created (or, if existing in part, adapted and adjusted) in the form or nature of an international court, modeled on our Federal Supreme Court in its jurisdiction over controversies between our sovereign States; such court to possess affirmative jurisdiction to hear and decide all purely international controversies, as defined by the code or arising under treaties, and to have the same power for the enforcement of its decrees as our Federal Supreme Court, namely, the respect of all enlightened nations for judgments resting upon open and fair investigations and impartial decisions, and the compelling power of enlightened public opinion[1]."

The fundamental difference between these two proposals is at once apparent. The first proposal postulated "an ability by force to execute the decrees of the international tribunal" while Senator Borah rejected the idea of a supernational authority with power to use force in the execution of the decrees of a world court. The wisdom of Senator Borah's position on this point apparently commended itself to the American Committee for the Outlawry of War, for the draft treaty to outlaw war which the latter subsequently suggested as a basis for discussion provided that the signatory States would:—

" . . . condemn and abandon forever the use of war as an instrument for the settlement of international disputes and for the enforcement of decisions and awards of international tribunals, and hereby outlaw

[1]Senate Resolution 441, 67th Congress, 4th Session. Reintroduced Dec. 20, 1923, as Senate Resolution 101, 68th Congress, 1st Session.

the immemorial institution of war by making its use a public crime as the fundamental law of nations."

would

" . . . agree to take immediate action for the equipment of an international court of justice with a code of the laws of peace . . . jurisdiction over all purely international disputes as defined and enumerated in the code or arising under treaties, with power to summon in a defendant nation at the petition of a complaining nation and to hear and decide the matters in controversy."

and would

"agree to abide by and in full good faith to carry out the decisions of such international tribunal[1] . . ."

thus dropping the idea of other than moral sanctions for the enforcement of the outlawry of war plan.

While the outlawry of war programme as outlined above has not been realized as such, the year 1928 saw more practical progress towards the elimination of war as a factor in international relations than had ever before been made.

It is probably true that as originally contemplated the outlawry of war programme was incapable of accomplishment; it involved a greater surrender of sovereignty than States are prepared to make.

But these points are not material at this writing. What is significant is that the outlawry of war movement, including, of course, that phase of it represented by the work of Professors Shotwell and Chamberlain of Columbia university (*see* New York *Times*, May 31, 1927), has paved the way for one of the most extraordinary manifestations of the universal desire for peace that has ever been witnessed in the history of the world. On Aug. 27, 1928, there was signed in Paris a multilateral treaty for the renunciation of war which may well mark the beginning of a new era in international relations. That treaty was signed after only eight months of active negotiations, by representatives of 15 world powers. At the time of writing (April 1929) 14 of the 15 original signatory states, or all except Japan, have adhered to the treaty. Besides these 25 states have adhered, 15 have taken steps towards their adherence and 7 have signified their intention to adhere thereto, thus promising to bring the peoples of at least 62 countries of the world within the scope of its beneficent provisions, a degree of universality without parallel in the history of peace. Moreover, the Pact was ratified by the United States, without condition, understanding or reservation, on February 17, 1929.

The statesman primarily responsible for the idea of bringing about the renunciation of war by means of an *ad hoc* treaty was Aristide Briand, French minister of Foreign Affairs. On June 20, 1927, Briand proposed to the United States the conclusion of a bilateral treaty the significant articles of which read as follows:—

ARTICLE I.

"The high contracting powers solemnly declare, in the name of the French people and the people of the United States of America, that they condemn recourse to war and renounce it respectively as an instrument of their national policy towards each other.

ARTICLE II.

"The settlement or the solution of all disputes or conflicts, of whatever nature or of whatever origin they may be, which may arise between France and the United States of America shall never be sought by either side except by pacific means."

In replying to this proposal on Dec. 28, 1927, the United States suggested that instead of contenting themselves with a bilateral declaration of the nature suggested by Briand, the two Governments might make a more signal contribution to world peace by joining in an effort to obtain the concurrence therein of a large group of powers with a view to perfecting among all the nations of the world a mechanism for peace heretofore suggested only as between France and the United States.

The details of the 1928 negotiations which culminated in the signature of the multilateral anti-war treaty at Paris on Aug. 27, 1928 cannot be discussed at length in this article. The relevant diplomatic correspondence has been published in the press and reprinted in pamphlet form (*The General Pact for the Renunciation of War*, etc., Washington, Government Printing Office, 1928), and is readily available for the student. The major points of the negotiations may, however, be outlined as follows:—

On April 13, 1928, the correspondence previously exchanged between France and the United States in connection with the treaty was submitted for the consideration of the British, German, Italian and Japanese Governments, together with a draft form of anti-war treaty representing the form of treaty which the United States was prepared to sign. A week later France circulated among the interested powers an alternative form of treaty, and commencing with the German note of April 27, 1928, the powers thus addressed rapidly communicated to France and the United States their views on this important project. Favourable replies having been received from all four Governments, the United States, on June 23, 1928, addressed a new note to the British, French, German, Italian and Japanese Governments transmitting a new draft treaty text slightly modified to meet certain points raised in the course of the negotiations. Identical communications were also sent to the five British Dominions and India, and to Belgium, Czechoslovakia and Poland. This procedure met the point raised by the British Government that the new treaty from its very nature was one in which that Government could not undertake to participate otherwise than jointly and simultaneously with the Dominion Governments and the Government of India, and by providing for the inclusion of all parties to the Treaties of Locarno it settled the question whether there was any inconsistency between the new treaty and the Locarno Treaty, thus meeting the observations of the French Government as to the necessity of extending the number of original signatories.

This note transmitting the final draft of the treaty contained the following statements which were also made in an address delivered before the American Society of International Law on April 28, 1928, by the American Secretary of State, and which referred to the six major considerations emphasized by France in its draft of April 20 and prior diplomatic correspondence with the United States:

"(1) *Self-defense.* There is nothing in the American draft of an anti-war treaty which restricts or impairs in any way the right of self-defense. That right is inherent in every sovereign state and is implicit in every treaty. Every nation is free at all times and regardless of treaty provisions to defend its territory from attack or invasion and it alone is competent to decide whether circumstances require recourse to war in self-defense. If it has a good case, the world will applaud and not condemn its action. Express recognition by treaty of this inalienable right, however, gives rise to the same difficulty encountered in any effort to define aggression. It is the identical question approached from the other side. Inasmuch as no treaty provision can add to the natural right of self-defense, it is not in the interest of peace that a treaty should stipulate a juristic conception of self-defense since it is far too easy for the unscrupulous to mold events to accord with an agreed definition.

"(2) *The League Covenant.* The Covenant imposes no affirmative primary obligation to go to war. The obligation, if any, is secondary and attaches only when deliberately accepted by a state. Article ten of the Covenant has, for example, been interpreted by a resolution submitted to the Fourth Assembly but not formally adopted owing to one adverse vote to mean that 'it is for the constitutional authorities of each member to decide, in reference to the obligation of preserving the independence and the integrity of the territory of members, in what degree the member is bound to assure the execution of this obligation by employment of its military forces.' There is, in my opinion, no necessary inconsistency between the Covenant and the idea of an unqualified renunciation of war. The Covenant can, it is true, be construed as authorizing war in certain circumstances but it is an authorization and not a positive requirement.

"(3) *The Treaties of Locarno.* If the parties to the treaties of Locarno are under any positive obligation to go to war, such obligation certainly would not attach until one of the parties has resorted to war in violation of its solemn pledges thereunder. It is therefore obvious that if all the parties to the Locarno treaties become parties to the multilateral anti-war treaty proposed by the United States, there would be a double assurance that the Locarno treaties would not be violated by recourse to arms. In such event it would follow that resort to war by any state in violation of the Locarno treaties would also be a breach of the multilateral anti-war treaty and the other parties to the anti-war treaty would thus as a matter of law be automatically released from their obligations thereunder and free to fulfill their Locarno commitments. The United States is entirely willing that all parties to the Locarno treaties should become parties to its proposed anti-war treaty either through signature in the first instance or by immediate accession to the treaty as soon as it comes into force in the manner provided in Article III. of the

[1] *The Outlawry of War* by C. C. Morrison, p. 62 (Chicago, 1927).

American draft, and it will offer no objection when and if such a suggestion is made.

"(4) *Treaties of Neutrality.* The United States is not informed as to the precise treaties which France has in mind and cannot therefore discuss their provisions. It is not unreasonable to suppose, however, that the relations between France and the states whose neutrality she has guaranteed are sufficiently close and intimate to make it possible for France to persuade such states to adhere reasonably to the anti-war treaty proposed by the United States. If this were done no party to the anti-war treaty could attack the neutralized states without violating the treaty and thereby automatically freeing France and the other Powers in respect of the treaty-breaking state from the obligations of the anti-war treaty. If the neutralized states were attacked by a state not a party to the anti-war treaty, the latter treaty would of course have no bearing and France would be as free to act under the treaties guaranteeing neutrality as if she were not a party to the anti-war treaty. It is difficult to perceive, therefore, how treaties guaranteeing neutrality can be regarded as necessarily preventing the conclusion by France or any other power of a multilateral treaty for the renunciation of war.

"(5) *Relations with a 'Treaty-breaking' State.* As I have already pointed out there can be no question as a matter of law that violation of a multilateral anti-war treaty through resort to war by one party thereto would automatically release the other parties from their obligations to the treaty-breaking state. Any express recognition of this principle of law is wholly unnecessary.

"(6) *Universality.* From the beginning it has been the hope of the United States that its proposed multilateral anti-war treaty should be world-wide in its application, and appropriate provision therefore was made in the draft submitted to the other Governments on April 13. From a practical standpoint it is clearly preferable, however, not to postpone the coming into force of an anti-war treaty until all the nations of the world can agree upon the text of such a treaty and cause it to be ratified. For one reason or another a state so situated as to be no menace to the peace of the world might obstruct agreement or delay ratification in such manner as to render abortive the efforts of all the other Powers. It is highly improbable, moreover, that a form of treaty acceptable to the British, French, German, Italian and Japanese Governments as well as to the United States would not be equally acceptable to most, if not all, of the other Powers of the world. Even were this not the case, however, the coming into force among the above-named six Powers of an effective anti-war treaty and their observance thereof would be a practical guaranty against a second world war. This in itself would be a tremendous service to humanity and the United States is not willing to jeopardize the practical success of the proposal which it has made by conditioning the coming into force of the treaty upon prior universal or almost universal acceptance."

The draft multilateral anti-war treaty proposed by the United States on June 23, 1928, was promptly accepted by the other 14 Governments thus addressed, and the definitive instrument was, as stated above, signed at Paris on Aug. 27, 1928. As soon as it had been signed all the other Powers of the world were formally notified of the fact and furnished with a copy of the treaty text. They were also informed that the United States would be happy to receive from them at any time appropriate notices of adherence to the treaty from those Governments wishing to contribute to the success of the new movement for world peace by participating therein. The English text of the treaty, the first two articles of which it will be observed are practically identical with the corresponding articles of the bilateral treaty originally proposed by M. Briand, is as follows:—

"THE PRESIDENT OF THE GERMAN REICH, THE PRESIDENT OF THE UNITED STATES OF AMERICA, HIS MAJESTY THE KING OF THE BELGIANS, THE PRESIDENT OF THE FRENCH REPUBLIC, HIS MAJESTY THE KING OF GREAT BRITAIN, IRELAND AND THE BRITISH DOMINIONS BEYOND THE SEAS, EMPEROR OF INDIA, HIS MAJESTY THE KING OF ITALY, HIS MAJESTY THE EMPEROR OF JAPAN, THE PRESIDENT OF THE REPUBLIC OF POLAND, THE PRESIDENT OF THE CZECHOSLOVAK REPUBLIC,

"Deeply sensible of their solemn duty to promote the welfare of mankind;

"Persuaded that the time has come when a frank renunciation of war as an instrument of national policy should be made to the end that the peaceful and friendly relations now existing between their peoples may be perpetuated;

"Convinced that all changes in their relations with one another should be sought only by pacific means and be the result of a peaceful and orderly process, and that any signatory Power which shall hereafter seek to promote its national interests by resort to war should be denied the benefits furnished by this Treaty;

"Hopeful that, encouraged by their example, all the other nations of the world will join in this humane endeavor and by adhering to the present Treaty as soon as it comes into force bring their peoples within the scope of its beneficent provisions, thus uniting the civilized nations of the world in a common renunciation of war as an instrument of their national policy;

"Have decided to conclude a Treaty and for that purpose have appointed as their respective Plenipotentiaries:

THE PRESIDENT OF THE GERMAN REICH:
Dr. Gustav Stresemann, Minister for Foreign Affairs;
THE PRESIDENT OF THE UNITED STATES OF AMERICA:
The Honorable Frank B. Kellogg, Secretary of State;
HIS MAJESTY THE KING OF THE BELGIANS:
Mr. Paul Hymans, Minister for Foreign Affairs, Minister of State;
THE PRESIDENT OF THE FRENCH REPUBLIC:
Mr. Aristide Briand, Minister for Foreign Affairs;
HIS MAJESTY THE KING OF GREAT BRITAIN, IRELAND AND THE BRITISH DOMINIONS BEYOND THE SEAS, EMPEROR OF INDIA:

For Great Britain and Northern Ireland and all parts of the British Empire which are not separate Members of the League of Nations:
The Right Honourable Lord Cushendun, Chancellor of the Duchy of Lancaster, Acting Secretary of State for Foreign Affairs;
For the Dominion of Canada:
The Right Honourable William Lyon Mackenzie King, Prime Minister and Minister for External Affairs;
For the Commonwealth of Australia:
The Honourable Alexander John McLachlan, Member of the Executive Federal Council;
For the Dominion of New Zealand:
The Honourable Sir Christopher James Parr, High Commissioner for New Zealand in Great Britain;
For the Union of South Africa:
The Honourable Jacobus Stephanus Smit, High Commissioner for the Union of South Africa in Great Britain;
For the Irish Free State:
Mr. William Thomas Cosgrave, President of the Executive Council;
For India:
The Right Honourable Lord Cushendun, Chancellor of the Duchy of Lancaster, Acting Secretary of State for Foreign Affairs;

HIS MAJESTY THE KING OF ITALY:
Count Gaetano Manzoni, his Ambassador Extraordinary and Plenipotentiary at Paris.
HIS MAJESTY THE EMPEROR OF JAPAN:
Count Uchida, Privy Councillor;
THE PRESIDENT OF THE REPUBLIC OF POLAND:
Mr. A. Zaleski, Minister for Foreign Affairs;
THE PRESIDENT OF THE CZECHOSLOVAK REPUBLIC:
Dr. Eduard Benès, Minister for Foreign Affairs; "who, having communicated to one another their full powers found in good and due form have agreed upon the following articles:

ARTICLE I.

"The High Contracting Parties solemnly declare in the names of their respective peoples that they condemn recourse to war for the solution of international controversies, and renounce it as an instrument of national policy in their relations with one another.

ARTICLE II.

"The High Contracting Parties agree that the settlement or solution of all disputes or conflicts of whatever nature or of whatever origin they may be, which may arise among them, shall never be sought except by pacific means.

ARTICLE III.

"The present Treaty shall be ratified by the High Contracting Parties named in the Preamble in accordance with their respective constitutional requirements, and shall take effect as between them as soon as all their several instruments of ratification shall have been deposited at Washington.

"This Treaty shall, when it has come into effect as prescribed in the preceding paragraph, remain open as long as may be necessary for adherence by all the other Powers of the world. Every instrument evidencing the adherence of a Power shall be deposited at Washington and the Treaty shall immediately upon such deposit become effective as between the Power thus adhering and the other Powers parties hereto.

"It shall be the duty of the Government of the United States to furnish each Government named in the Preamble and every Government subsequently adhering to this Treaty with a certified copy of the Treaty and of every instrument of ratification or adherence. It shall also be the duty of the Government of the United States telegraphically to notify such Governments immediately upon the deposit with it of each instrument of ratification or adherence.

"IN FAITH WHEREOF the respective Plenipotentiaries have signed this Treaty in the French and English languages, both texts having equal force, and hereunto affix their seals.

"DONE at Paris, the twenty-seventh day of August in the year one thousand nine hundred and twenty-eight."

[SEAL] GUSTAV STRESEMANN
[SEAL] FRANK B. KELLOGG
[SEAL] PAUL HYMANS
[SEAL] ARI BRIAND
[SEAL] CUSHENDUN
[SEAL] W. L. MACKENZIE KING
[SEAL] A. J. McLACHLAN
[SEAL] C. J. PARR
[SEAL] J. S. SMIT
[SEAL] LIAM T. MacCOSGAIR
[SEAL] CUSHENDUN
[SEAL] G. MANZONI
[SEAL] UCHIDA
[SEAL] AUGUST ZALESKI
[SEAL] DR. EDUARD BENES

Much of the significance of the General Pact is to be found in its simplicity of form, which is readily understandable to the peoples of the world who desire peace and who dread war. Today these peoples are becoming increasingly articulate, and governments are growing more and more responsive to popular opinion.

In the future political leaders in any participating country who advocate a war-like policy must face a determined opposition on the part of large sections of their people, an opposition which will crystallize about this solemn pledge of their governments. Belligerent action to advance national policy on the part of any government will meet with opprobrium not only abroad but also at home.

Perhaps the most important aspect of the Pact is this moral force which may be expected to grow with the passage of time. It is not too much to hope that through their adoption of and adherence to the principles embodied in the Pact, the nations of the world are entering upon an era of better understanding in their dealings with one another. (F. B. K.; W. R. Ca.)

OUTPUT: *see* Production.

OUTRAM, SIR JAMES (1803–1863), English general, and one of the heroes of the Indian Mutiny, was the son of Benjamin Outram of Butterley Hall, Derbyshire, civil engineer, and was born on Jan. 29, 1803. His father died in 1805, and his mother, a daughter of Dr. James Anderson, the Scottish writer on agriculture, removed in 1810 to Aberdeenshire. From Udny school the boy went in 1818 to the Marischal College, Aberdeen; and in 1819 an Indian cadetship was given him. Soon after his arrival at Bombay his remarkable energy attracted notice, and in July 1820 he became acting adjutant to the first battalion of the 12th regiment on its embodiment at Poona. In 1825 he was sent to Khandesh, where he trained a light infantry corps, formed of the wild robber Bhils, gaining over them a marvellous personal influence, and employing them with great success in checking outrages and plunder. Their loyalty to him had its principal source in their boundless admiration of his hunting achievements. For some time he was political agent in the Mahi Kantha district of Gujarat. In the first Afghan War in 1838 he was extra aide-de-camp on the staff of Sir John Keane. After conducting various raids against Afghan tribes, he was in 1839 promoted major, and appointed political agent in Lower Sind, and later in Upper Sind. He opposed the policy of his superior, Sir Charles Napier, which led to the annexation of Sind. When war broke out he heroically defended the residency at Hyderabad against 8,000 Baluchis: and it was Napier who then described him as "the Bayard of India."

On his return from a short visit to England in 1843, he was, with the rank of brevet lieutenant-colonel, appointed to a command in the Mahratta country, and in 1847 he was transferred from Satara to Baroda, where he incurred the resentment of the Bombay government by his fearless exposure of corruption. In 1854 he was appointed resident at Lucknow, in which capacity two years later he carried out the annexation of Oudh and became the first chief commissioner of that province. Appointed in 1857, with the rank of lieutenant-general, to command an expedition against Persia, he defeated the enemy with great slaughter at Khushab, and brought the campaign to a rapid conclusion.

From Persia he was summoned in June to India, with the brief explanation—"We want all our best men here." It was said of him at this time that "a fox is a fool and a lion a coward by the side of Sir J. Outram." Immediately on his arrival in Calcutta he was appointed to command the two divisions of the Bengal army occupying the country from Calcutta to Cawnpore; and to the military control was also joined the commissionership of Oudh. Already the mutiny had assumed such proportions as to compel Havelock to fall back on Cawnpore, which he only held with difficulty, although a speedy advance was necessary to save the garrison at Lucknow. On arriving at Cawnpore with reinforcements, Outram, "in admiration of the brilliant deeds of General Havelock," conceded to him the glory of relieving Lucknow, and, waiving his rank, tendered his services to him as a volunteer. During the advance he commanded a troop of volunteer cavalry, and performed exploits of great brilliancy at Mangalwar, and in the attack at the Alambagh; and in the final conflict he led the way, charging through a very tempest of fire. The volunteer cavalry unanimously voted him the Victoria Cross, but he refused the choice on the ground that he was ineligible as the general under whom they served.

Resuming supreme command, he then held the town till the arrival of Sir Colin Campbell, after which he conducted the evacuation of the residency so as completely to deceive the enemy. In the second capture of Lucknow, on the commander-in-chief's return, Outram was entrusted with the attack on the side of the Gumti, and afterwards, having recrossed the river, he advanced "through the Chattar Manzil to take the residency," thus, in the words of Sir Colin Campbell, "putting the finishing stroke on the enemy." After the capture of Lucknow he was gazetted lieutenant-general. In February 1858 he received the special thanks of both houses of parliament, and in the same year the dignity of baronet with an annuity of £1,000. Shattered in health he returned finally to England in 1860. A movement to honour him further resulted in the presentation of a public testimonial and the erection of statues in London and Calcutta. He died on March 11, 1863.

See Sir F. J. Goldsmid, *James Outram, a Biography* (2 vols., 1880), and L. J. Trotter, *The Bayard of India* (1903).

OUT RELIEF: *see* Poor Law.

OUTWORKERS: *see* Homeworker.

OVAL: *see* Curves, Special.

OVAR, a town of Portugal, at the northern extremity of the Lagoon of Aveiro (*q.v.*); 21 m. south of Oporto by the Lisbon-Oporto railway. Pop. (1911) 11,416. Ovar is the centre of important fisheries. Millet, wheat and vegetables—especially onions—are the chief products of the low-lying and unhealthy region in which Ovar is situated.

OVARIOTOMY or **OÖPHORECTOMY,** the operation for removal of one or of both of the female ovaries (for anatomy *see* Reproductive System). The progress of modern surgery has been conspicuously successful in this department. From 1701, the date when Houston of Carluke, Lanarkshire, carried out his successful partial extirpation, progress was arrested for some time, although the Hunters (1780) indicated the practicability of the operation. In 1809 Ephraim M'Dowell of Kentucky, inspired by the lectures of John Bell, his teacher in Edinburgh, performed ovariotomy, and, continuing to operate with success, established the possibility of surgical interference. He was followed by others in the United States. The cases brought forward by Lizars of Edinburgh were not sufficiently encouraging; the operation met with great opposition; and it was not until Charles Clay, Spencer Wells, Baker Brown and Thomas Keith began work that the procedure was placed on a firm basis and was regarded as justifiable. Improved methods were introduced, and surgeons vied with one another in trying to obtain good results. Eventually, by the introduction of the antiseptic, and later, the aseptic, system of treating wounds, this operation, formerly regarded as one of the most grave and anxious in the domain of surgery, came to be attended with a lower mortality than any other of a major character.

OVEN-BIRD, the name given to birds of the genus *Furnarius* of the American family of wood-hewers (*Dendrocolaptidae*), on account of the structure of the nest. They are small thrush-like birds confined to South America.

The name oven-bird is commonly given in the United States to the golden crowned water-thrush (*Seiurus aurocapillus*), one of the wood warblers, which builds an oven-shaped nest on the

ground.

See C. Darwin, *Voyage of the Beagle* (1845); W. H. Hudson, *A Naturalist in La Plata* (1892).

OVERBECK, JOHANN FRIEDRICH (1789–1869), German painter, the reviver of "Christian art" in the 19th century, was born in Lübeck on the 4th of July 1789. His ancestors for three generations had been Protestant pastors; his father was doctor of laws, poet, mystic pietist and burgomaster of Lübeck. In 1806, after finishing his course at the gymnasium, Overbeck left Lübeck and entered the Academy of Vienna, then under the direction of Füger, a painter of the pseudo-classic school of David. Not finding the help on which he had counted, Overbeck turned to the early and pre-Raphaelite masters of Italy for inspiration. At the end of four years he was expelled. He thereupon went to live in Rome, where he gathered about him a group of friends which included Cornelius, Veit and Wilhelm Schadow.

The little group made their home in the old Franciscan monastery of San Isidoro on the Pincian, and in 1813 Overbeck joined the Roman Catholic church. The group became known as the "Nazarites," "pre-Raphaelites," or "German-Roman artists." They believed in hard, honest work and holy living, eschewed the antique as pagan and the Renaissance as false, and aimed at bringing about a revival on the basis of nature and the serious art of Perugino, Pinturicchio, Francia and the young Raphael. Their painting was characterized by nobility of conception, precision—not to say hardness—of outline, and scholarly composition. Light, shade and colour they admitted only in the interests of clearness and correctness, and not as softening elements. Overbeck, with his saintly character and lofty ideals, was the natural leader and mentor of the party. They would have fared badly however from a practical point of view but for the timely help of Niebuhr, Bunsen, Friedrich Schlegel, and the Prussian consul Bartholdi, who commissioned the four friends to decorate his villa with frescoes on the story of Joseph and his Brethren. This led to another commission from Prince Massimo to paint the ceilings and walls of his pavilion. Overbeck's failing health did not allow him to finish his share of this undertaking and he delegated it to Joseph Führich. His last work was a "Vision of St. Francis" with life-size figures for the walls of Sta. Maria degli Angeli near Assisi. All his paintings bear the mark of religious fervour and careful preparation and have an element of religious propaganda. The handling is dry and severe and the colour restrained. His faith found its clearest expression in his religious cartoons, the *Gospels* (1852), *Via Crucis* (1857) and the *Seven Sacraments* (1861). He died in Rome on Nov. 12, 1869, and was buried in San Bernardo.

Overbeck's principal oil and easel paintings are: "Christ's Entry into Jerusalem" (1824), in the Marien Kirche, Lübeck; "Christ's Agony in the Garden" (1835), in the great hospital, Hamburg; "Lo Sposalizio" (1836), Raczynski gallery, Berlin; the "Triumph of Religion in the Arts" (1840), in the Städel Institut, Frankfort; "Pietà" (1846), in the Marien Kirche, Lübeck; the "Incredulity of St. Thomas" (1851), in the possession of Mr. Beresford Hope, London; the "Assumption of the Madonna" (1855), in Cologne Cathedral; "Christ delivered from the Jews" (1858), tempera, on a ceiling in the Quirinal Palace—a commission from Pius IX., and a direct attack on the Italian temporal government, therefore later covered by a canvas.

There are biographies by J. Beavington Atkinson (1882) and Howitt (1886).

OVERBURY, SIR THOMAS (1581–1613), English poet and essayist, and the victim of one of the most sensational crimes in English history, was the son of Nicholas Overbury, of Bourton-on-the-Hill, and was born in 1581 at Compton Scorpion, near Ilmington, in Warwickshire. In the autumn of 1595 he became a gentleman commoner of Queen's college, Oxford, took his degree in 1598 and came to London to study in the Middle Temple.

About the year 1601, being in Edinburgh on a holiday, he met Robert Carr, then an obscure page to the earl of Dunbar; and the two youths came up to London together. When Carr attracted the attention of James I., in 1606, by breaking his leg in the tilt-yard, Overbury had for some time been servitor-in-ordinary to the king. He was knighted in 1608, and in 1609 travelled in France and the Low Countries. When Carr was made Lord Rochester in 1610, the intimacy between the two was maintained.

But early in 1611 the Court became aware of the mutual attraction between Rochester and the youthful countess of Essex. To this intrigue Overbury was from the first violently opposed, and expressed his opinion of the countess in unmeasured terms. But Rochester was now infatuated, and he repeated to the countess what Overbury had said. Overbury also wrote, and circulated widely in ms., the poem called *The Wife*, which was a picture of the virtues which a young man should demand in a woman. The situation now resolved itself into a duel for the person of Rochester between the mistress and the friend. Overbury was thrown into the Tower on April 22, 1613, on a charge of disrespect to the king. Lady Essex, however, was not satisfied with his imprisonment; she was determined that "he should return no more to this stage." She bribed the gaoler, aided by Mrs. Turner, the widow of a physician, and by an apothecary called Franklin, to poison Overbury with copper vitriol. His constitution long withstood the timid doses they gave him, and he lingered until Sept. 15, 1613, when more violent measures put an end to his existence.

Two months later Rochester, now earl of Somerset, married Lady Essex. More than a year passed before suspicion was aroused, and when it was, the king showed disinclination to bring the offenders to justice. In the trial which followed, the plot was discovered. The four accomplices were hanged; the countess of Somerset pleaded guilty but was spared, and Somerset himself was disgraced. Meanwhile, Overbury's poem, *The Wife*, was published in 1614, and ran through six editions within a year. Much that must be spurious was added to the gathering snowball of Overbury's *Works*, the most famous of which are the *Characters*.

See C. Whibley, *Essays in Biography* (1913); E. A. Parry, *The Overbury Mystery* (1925).

OVERHEAD CHARGES. Overhead charges, or on-costs, are an important factor in cost accounts. Prime cost represents outlays directly incurred for a particular purpose, and thus capable of being charged directly thereto. In addition, there are a number of indirect expenses which can only be dealt with by spreading them as equitably as may be over the total output.

Generally speaking, Overhead charges consist of such items as rent, rates, taxes, salaries, depreciation, interest, discounts, bad debts, etc., from which may be deducted corresponding credits. But in order to arrive at costs that are comparable with those of similar undertakings, various adjustments become necessary. Thus, where business premises are owned, the rental value should be included, although not actually expended. When time is of importance, interest on outlays should be included, even although no interest may actually have been paid away. *Per contra*, interest on borrowed monies (including debentures) is not properly a factor in costs at all; and interest received on investments, although undoubtedly a profit, does not tend to reduce operative costs and should therefore be excluded. Many authorities also consider that bad debts have nothing to do with the costs. Depreciation of equipment is generally a very important factor but the modern tendency is to charge a *machine rate* of so much per hour as part of the direct costs, such rate being designed to cover depreciation, repairs and interest on capital; when this is done, no charge in respect of depreciation falls to be included as Overhead.

Formerly, it was thought to be sufficiently accurate to add a given percentage to prime cost as a loading to cover Overhead. It is now recognized that no satisfactory results can be achieved in this way. A uniform percentage of loading for Overhead would result in the aggregate amount actually charged against output varying directly with the prime cost, and thus the amount so charged would almost certainly be appreciably more or appreciably less than the true figure, according to whether the output was above or below the average. Further, such a system of allocation assumes that the fair loading for Overhead varies directly with the prime cost, whereas the employment of expensive materials does not necessarily increase the Overhead burden, and in many cases economies in labour costs can only be achieved by increasing the Overhead burden, *e.g.*, when machine work is substituted for hand work. Most production is complex, and consists of a series of successive processes or operations, each involving its own Overhead

charges. The modern practice is accordingly in the direction of analysing Overhead into departments, and distributing the burden of the departmental Overhead over the output of the department, usually *pro rata* according to the time occupied. In this way some approach to substantial accuracy may be reached, but no cut and dried formula will meet all cases.

Sometimes costs are appreciably increased by "spoils"—the curtailment of saleable output as a result of defective materials, machinery, workmanship or supervision. The only satisfactory way to deal with losses arising from spoils is to charge them as part of the Overhead burden of the department causing the spoil. If and when this is done the loss is thrown upon the right shoulders, and the effect commonly is to reduce very materially the loss arising from spoils by compelling managers to enquire more carefully into causes and possible remedies. (L. R. D.)

OVERSEA INVESTMENTS: *see* CAPITAL, EXPORT OF.

OVERSEA SETTLEMENT COMMITTEE. This important body was appointed in 1919 to assist and advise the British Government in their policy of undertaking closer responsibility than they had exercised in the past in connection with the movement of British subjects wishing to settle in other parts of the empire or to emigrate to foreign countries. The functions of the Emigrants' Information Office, which was established in 1886, were absorbed by the Oversea Settlement Committee. The president of the committee is the secretary of state for dominion affairs. It is a representative and non-political body, composed partly of official members representing various Government departments and partly of unofficial members. The staff of the committee forms a department (the oversea settlement department) of the Dominions Office.

The committee is entrusted with the administration of the Empire Settlement Act, 1922, which now forms the basis of the policy of State-aided empire settlement. The act was passed as the result of a conference with representatives of the self-governing dominions in 1921 and empowers the secretary of state "in association with the Government of any part of His Majesty's Dominions, or with public authorities or public or private organisations either in the United Kingdom or in any part of such Dominions, to formulate and co-operate in carrying out agreed schemes for affording joint assistance to suitable persons in the United Kingdom who intend to settle in any part of His Majesty's Oversea Dominions." Such schemes may take the form of development or land settlement schemes, or of schemes for facilitating settlement overseas by assistance with passages, training or in other ways. The contribution of the secretary of state may not exceed half the cost of any approved scheme and the maximum expenditure allowed under the act in any one year is £3,000,000.

OVERSTONE, SAMUEL JONES LOYD, 1ST BARON (1796–1883), English banker, the son of a Welsh dissenting minister, was born on Sept. 25, 1796. He became a partner in Jones, Loyd and Company (afterwards incorporated in the London and Westminster Bank), and by 1832 was recognized as one of the foremost authorities on banking. As Liberal member for Hythe, he sat in parliament from 1819 to 1826. He gave important evidence before various committees of the House of Commons, and was responsible for the main outlines of the Bank Charter Act (1844). In 1850 he was created Baron Overstone. He died in London on Nov. 17, 1883, leaving one daughter.

In 1858 a volume of *Tracts and other Publications on Metallic and Paper Currency*, by Lord Overstone, was edited by M'Culloch.

OVERT ACT: *see* INTENT; TREASON.

OVERTURE (Fr. *ouverture*, opening), in music, a detachable instrumental introduction to a dramatic or choral composition. The notion of an overture had no existence until the 17th century. The *toccata* at the beginning of Monteverdi's *Orfeo* is a barbaric flourish of every procurable instrument, alternating with a melodious section entitled *ritornello;* and, in so far as this constitutes the first instrumental movement prefixed to an opera, it may be called an overture. As an art-form the overture began to exist in the works of J. B. Lully.' His favourite, but not his only, form constitutes the typical French overture that became classical in the works of Bach and Handel. This French overture consists of a slow introduction in a marked "dotted rhythm" (*i.e.*, exaggerated iambic, if the first chord is disregarded), followed by a lively movement in fugato style. The slow introduction was always repeated, and sometimes the quick movement concluded by returning to the slow tempo and material, and was also repeated (*see* Bach's French Overture in the *Klavierübung*).

The operatic French overture was frequently followed by a series of dance tunes before the curtain rose. It thus naturally became used as the prelude to a suite (*q.v.*); and the term was then applied to the whole suite.

Bach was able to adapt the French overture to choruses, and even to the treatment of chorales. Thus the overture—movements of his fourth orchestral suite became the first chorus of the church cantata *Unser Mund sei voll Lachens;* the choruses of the cantatas *Preise Jerusalem den Herrn* and *Höchst erwünschtes Freudenfest* are in overture form; and, in the first of the two cantatas entitled *Nun komm, der Heiden Heiland,* Bach has adapted the overture form to the treatment of a chorale.

Gluck could find no use for the French overture. In the epoch-making preface to *Alceste* he laid down the rule that the overture should be the musical argument of the drama. And the perfunctory overture to *Orfeo* is the only exception to the rule that in his great operas the orchestral introduction is actually interrupted by the rise of the curtain. In *Iphigénie en Tauride* it is merely the calm before the storm.

The abolition of the French overture did not, however, lead at first to any widespread adoption of Gluck's loose-knit Italian texture. The next form of overture was that of a three-movement symphony (*q.v.*) in sonata style. In Mozart's early opera *La Finta Giardiniera* the curtain rises upon what should have been the third movement; and in all later works the overture is distinguished from symphonic music in style as well as form. It is a single quick movement (with or without a slow introduction) in sonata form, loose in texture, without repeats, and frequently without a development section. Sometimes, in place of development, there is a melodious episode in slow time; as in Mozart's overtures to *Die Entführung* and to the fragment *Lo Sposo deluso,* in both of which cases the curtain rises at a point which throws a dramatic light upon this feature. Mozart at first intended a similar episode in the overture to *Figaro,* but struck it out as soon as he had begun it.

In Beethoven's hands the overture became more and more unlike the symphony, but it no longer remained an inferior species; and the final version of the overture to *Leonora* is the most gigantic single orchestral movement ever based on the sonata style. Weber's overtures work out prominent themes in his operas in a loose but effective sonata form, and are effective concert-pieces besides serving Gluck's purposes admirably. On the overture to Mendelssohn's *Elijah, see* MENDELSSOHN.

Overtures to plays naturally tend to become detached from their surroundings; and hence arises the concert overture, led by Beethoven's mighty *Coriolan,* and second only to the symphony as an orchestral art-form. Its derivation implies that it is programme-music (*q.v.*), but the programme need not impair the form, whether the form be Berlioz's or Brahms's, and the programme particular or generalized. Among overtures with a generalized programme Mendelssohn's *Hebrides* overture is a perfect masterpiece; and so is Brahms's Tragic overture, one of the greatest orchestral movements since Beethoven. Brahms's *Academic Festival Overture* is a glorious working out of German student songs.

In modern opera the overture, *Prelude, Vorspiel,* or whatever else it may be called, is often nothing more definite than that portion of the music which takes place before the curtain rises. *Tannhäuser* is the last important opera in which the overture retains vestiges of a self-contained sonata form. Fifty years before Wagner's wonderful *Vorspiel* to *Lohengrin,* Méhul had achieved an equally complete departure from classical forms in his interesting overtures to *Ariodant* and *Uthal,* in the latter of which a voice is heard on the stage before the rise of the curtain. Even the most self-contained of Wagner's later preludes lose by transference to the concert-room. The glorious *Vorspiel* to *Die*

Meistersinger is nobler when its long *crescendo* leads to the rise of the curtain and the engaging of all the listener's sense of sight and language, than when it can merely lead to a final tonic chord. Wagner himself added a page to finish the *Vorspiel* to *Tristan*, and by the richness and subtlety of that page he reveals how unready for independent existence the original *Vorspiel* was. He also finished the *Parsifal* Vorspiel for concert use by the addition of a few extra bars, which will always sound perfunctory. The four dramas of the *Ring* begin with introductions designed to prepare the hearer immediately for the rise of the curtain; and these works can no more be said to have overtures than Verdi's *Falstaff* and Strauss's *Salome*, *Electra* and *Die Frau ohne Schatten*, in which the curtain rises at the first note of the music. (D. F. T.)

OVERYSSEL, a Netherlands province, bounded south and south-west by Gelderland, west by the Zuider Zee, north by Friesland and Drente, and east by the Prussian provinces of Hanover and Westphalia. The north-east Polder will be in contact with the north of the province which has a present area, including Schokland in the Zuider Zee, of 1,295 sq.m.; pop. (1926) 483,185, showing nearly 50% increase during the present century. It is an extremely picturesque and varied glaciated delta land consisting of a sandy flat relieved by hillocks, and covered with waste stretches of heath broken by patches of wood and high fen; but the coastal strip north of Zwartsluis consists largely of low-lying fertile pasture lands with cattle-rearing and associated butter and cheese manufactures, while along the shores mats and brushes are made. The river system is determined by two main glacial ridges, of which the eastern one, separating the Dinkel and Regge, extends from Enschede northwards into the German enclave; the larger one runs parallel with it and commencing at Lochem (Gelderland) extends into south Drente. In the south it separates the Yssel and Regge; its summit height (Lemeler Hill, 262 ft.) is near where it is breached by the Vecht. This river crosses the province from east to west and joins a part of the Yssel near Zwolle to form the Zwarte Water, which communicates with the Zuider Zee by the Zwolsche Diep; the main Yssel enters the Zuider Zee separately below Kampen. The streams are flanked by small-estate fertile grasslands from which agriculture and cattle-rearing have gradually spread over the sand-grounds; much of the area, however, is still waste though forest culture is practised locally, especially in the east, and pigs are largely bred. The deposits of the Yssel and the Dinkel streams contain iron ore, which is extracted and exported to Germany. Peat-digging and fen reclamation have long been practised and much high fen north of the Vecht in the neighbourhood of Dedemsvaart has been reclaimed though the main reclamation at present is taking place along and near to the eastern ridge. Large scale manufactures are not important in Overyssel but cotton-spinning, together with bleaching-works, came into some prominence in the 19th century in the south-east district of Twente. The inhabitants for long had practised weaving as a home craft but capitalist Baptist refugees who arrived in the 17th and 18th centuries organized it into an industry. Deventer has iron foundries and carpet-factories but is more famed for its honey cakes. The capital of the province is Zwolle (39,000 pop. in 1926) though Enschede (46,750) is the largest town. Deventer, Hengelo and Almelo each exceed 20,000 population and all four are situated in the south. Deventer is an old but busy little river port with a 16th century weigh-house of unusual design. Kampen, on the Yssel with its harbour long since silted up, has lost much of its importance of Hanseatic days but its 14th century churches and gateways are interesting. Its Stathuis (16th and 18th century) is probably the finest town hall in the Netherlands. It shares a fishing trade with Vollenhove and Blokzijl, all on the Zuider Zee. Tucked away in the extreme north near the Drente border is the delightful little settlement of Giethoorn, literally a water village, each house possessing its own quay, drawbridge and punt. The railway system of the province is supplemented by tramlines and the roads are good but the waterways still carry much traffic.

OVID [PUBLIUS OVIDIUS NASO] (43 B.C.–A.D. 17), Roman poet, the last of the Augustan age, was born in 43 B.C., the last year of the republic. Thus the only form of political life known to Ovid was that of the absolute rule of Augustus and his successor. He was born on March 20 at Sulmo, picturesquely situated among the mountains of the Abruzzi: its wealth of waters and natural beauties seem to have quickened in him that appreciative eye for the beauties of nature which is one of the chief characteristics of his poems. Ovid, whose father was of equestrian family, belonged by birth to the same social class as Tibullus and Propertius, that of old hereditary landowners; but he was more fortunate than they in the immunity which his native district enjoyed from the confiscations made by the triumvirs. He and his brother had been brought early to Rome for their education, where they attended the lectures of two most eminent teachers of rhetoric, Arellius Fuscus and Porcius Latro, to which influence is due the strong rhetorical element in Ovid's style. His father did his best to dissuade him from poetry, and to drive him into the legal profession.

The earliest edition of the *Amores*, which first appeared in 5 books, and the *Heroides* were given by him to the world at an early age. "Virgil," he informs us, "he had only seen"; but Virgil's friend and contemporary Aemilius Macer used to read his didactic poems to him; and even the fastidious Horace sometimes delighted his ears with the music of his verse. He had a close bond of intimacy with the younger poets of the older generation—Tibullus, whose death he laments in one of the few pathetic pieces among his earlier writings, and Propertius, to whom he describes himself as united in the close ties of comradeship. The name of Maecenas he nowhere mentions. The time of his influence was past when Ovid entered upon his poetical career. But the veteran politician Messalla, the friend of Tibullus, together with his powerful son Cotta Messallinus and Fabius Maximus and other influential persons whose names are preserved in the *Epistles from Pontus* supported him. With the older poet, Macer, he travelled for more than a year. Whether this was immediately after the completion of his education, or in the interval between the publication of his earlier poems and that of the *Medea* and *Ars amatoria* is unknown, but it is in his later works, the *Fasti* and *Metamorphoses*, that we chiefly recognize the impressions of the scenes he visited. In one of the *Epistles from Pontus* (ii. 10) to his fellow-traveller there is a vivid record of the pleasant time they had passed together. They visited Athens, of course, the Mecca of all artistic pilgrimages then; went on to the site of Troy, and through the cities of Asia Minor; and finally spent a year in Sicily.

Life in Rome.—When settled at Rome, although a public career leading to senatorial position was open to him, and although he filled various minor posts, he had no ambition for such distinction, and looked upon pleasure and poetry as the occupations of his life. He was three times married; when little more than a boy to his first wife, whom he naïvely describes as unworthy of himself; but he was soon separated from her and took a second wife, with whom his union also did not last long. She was probably the mother of his one daughter. Later he married a third, of whom he always speaks with affection and respect. She was a lady of the great Fabian house, and thus connected with his powerful patron Fabius Maximus, and was a friend of the empress Livia. It therefore seems likely that he may have been admitted into the intimacy of the younger society of the Palatine. His liaison with his mistress Corinna, whom he celebrates in the *Amores*, took place probably in the period between his first and second, or between his second and third marriages. Ovid is not only a less constant but he is a less serious lover than his great predecessors Catullus, Tibullus and Propertius. His tone is that either of mere sensuous feeling or of irony. In his complete emancipation from all restraint he goes beyond them, and thus reflects the tastes and spirit of fashionable Rome between the years 20 B.C. and the beginning of our era.

Society was then bent simply on amusement; and, as a result partly of the loss of political interests, women came to play a more important and brilliant part in its life than they had done before. Julia, the daughter of the emperor, was by her position, her wit and beauty, and her reckless dissipation, the natural

leader of such a society. But the discovery of her intrigue (2 B.C.) with Iulus Antonius, the son of Mark Antony, was deeply resented by Augustus as being at once a shock to his affections and a blow to his policy of moral reform. Julia was banished and disinherited; Antonius and her many lovers were punished; and the Roman world awoke from its fool's paradise of pleasure. Nearly coincidently with this scandal appeared Ovid's *Ars amatoria,* perhaps the most immoral work ever written by a man of genius, though not the most demoralizing, since it is entirely free from morbid sentiment. By its brilliancy and heartlessness it appealed to the prevailing taste of the fashionable world; but its appearance excited deep resentment in the mind of the emperor, as is shown by his edict, issued ten years later, against the book and its author. Ovid appears to have had no idea of the storm that was gathering over him.

But he was aware that public opinion had been shocked, or professed to be shocked, by his last work; and after writing a kind of apology for it, called the *Remedia amoris,* he turned to other subjects, and wrote during the next ten years the *Metamorphoses* and the *Fasti.* He had already written the *Heroides,* in which he had imparted a modern and romantic interest to the heroines of the old mythology, and a tragedy, the *Medea,* which must have afforded greater scope for the dramatic and psychological treatment of the passion with which he was most familiar. In the *Fasti* Ovid assumes the position of a national poet by imparting poetical life and interest to the ceremonial observances of the Roman religion; but it is as the brilliant narrator of the romantic tales that were so strangely blended with the realistic annals of Rome that he succeeds in the part assumed by him. The *Metamorphoses* is a narrative poem which recounts legends in which the miraculous involved transformations of shape. Beginning with the change from Chaos to Cosmos, legends first Greek and then Roman are passed in review, concluding with the metamorphosis of Julius Caesar into a star and a promise of immortality to Augustus. The *Metamorphoses* is strongly tinged with Alexandrine influence, being in fact a succession of epyllia in the Alexandrine manner. This work, which Ovid regards as his most serious claim to immortality, had not been finally revised at the time of his disgrace, and in his despair he burnt it; but other copies were in existence, and when he was at Tomi it was published at Rome by one of his friends. He often regrets that it had not received his final revision. The *Fasti* also was broken off by his exile, after the publication of the first six books, treating of the first six months of the year.

Banishment.—In A.D. 8 Ovid was ordered by Augustus into banishment; for this he assigns two causes, his *Ars amatoria* and an actual offence (*Trist.* ii. 207). It is natural that Augustus should have felt resentment against the *Ars,* because its doctrine was a direct challenge to his policy of moral reform. What the actual offence was is a secret which the poet leaves unrevealed; since his disgrace coincided with the banishment of Augustus' granddaughter, the younger Julia, on account of an intrigue with Silanus, it has been supposed that Ovid was concerned in abetting that intrigue, and that this constituted his unforgivable sin. But if Ovid had really assisted to bring about the moral scandal which befell the emperor's family, it is incredible that he could have dared to allude to it, as he does constantly, in his poems. This, and the fact that, even after Augustus' death, his successor Tiberius left Ovid unpardoned, makes it probable that the offence was political and specially displeasing to Tiberius and Livia because it somehow interfered with their dynastic policy. Ovid may have been implicated with those who were over-zealous in the interests of rival possible successors to the throne, either Agrippa Postumus, the grandson of Augustus, or Germanicus, the brilliant and popular nephew of Tiberius, with many of whose friends Ovid was associated. Ovid's banishment was the mildest possible (*relegatio*); it involved no deprivation of civic rights, and left him the possession of his property. He was ordered to remove to the half-Greek, half-barbaric town of Tomi, near the mouth of the Danube. For eight years he bore up in his dreary solitude, suffering from the unhealthiness of the climate and the constant alarm of inroads of barbarians.

The Epistle.—In the hope of procuring a remission of his punishment he wrote poetical complaints, first in the series of the five books of the *Tristia,* sent successively to Rome, addressed to friends whose names he suppresses; afterwards in a number of poetical epistles, the *Epistulae ex Ponto,* addressed by name to friends who were likely to have influence at court. He believed that Augustus had softened towards him before his death, but his successor Tiberius was inexorable to his appeals. His chief consolation was the exercise of his art, though as time goes on he is painfully conscious of failure in power. But although the works written by him in exile lack the finished art of his earlier writings, their personal interest is greater. They have, like the letters of Cicero to Atticus, the fascination exercised by all confessions; they are a sincere literary expression of the state of mind produced by a unique experience—that of a man, when well advanced in years but still retaining extraordinary sensibility to pleasure and pain, withdrawn from a brilliant social and intellectual position, and cast upon his own resources in a place and among people affording the dreariest contrast to the brightness of his previous life. The letters, which compose the *Tristia* and *Epistulae ex Ponto,* are addressed either to his wife, the emperor, or the general reader, or to his patrons and friends. To his patrons he writes in a vein of supplication, beseeching them to use their influence on his behalf. To his rather large circle of intimate acquaintances he writes in the language of familiarity, and often of affectionate regard; he seeks the sympathy of some, and speaks with bitterness of the coldness of others, and in three poems (*Trist.* iii., 11, iv. 9; v. 8) he complains of the relentless hostility of the enemy who had contributed to procure his exile, and whom he attacked in the *Ibis.* There is a note of true affection in the letter to the young lyric poetess Perilla, of whose genius and beauty he speaks with pride, and whose poetic talents he had fostered by friendly criticism (*Trist.* iii., 7). He was evidently a man of gentle and genial manners; and, as his active mind induced him to learn the language of the new people among whom he was thrown, his active interest in life enabled him to gain their regard and various marks of honour. One of his last acts was to revise the *Fasti,* and re-edit it with a dedication to Germanicus. The closing lines of the *Epistulae ex Ponto* sound like the despairing sigh of a drowning man who had long struggled alone with the waves:—

> Omnia perdidimus: tantummodo vita relicta est,
> Praebeat ut sensum materiamque mali.

Shortly after these words were written he died in his sixty-first year in A.D. 17.

Temperament.—The temperament of Ovid, as indicated in his writings, has more in common with the suppleness of the later Italian than with the strength and force of the ancient Roman. That stamp of her own character and understanding which Rome impressed on the genius of those other races which she incorporated with herself is fainter in Ovid than in any other great writer. He disclaims the manliness which was regarded as the birthright of the Roman. He is equally devoid of dignity in his brilliant prime, and in his later disgrace. His religion is devoid of reverence, his feeling for nature of depth, his loves of sincerity and, almost, even of passion.

These defects in strength and gravity show a corresponding result in Ovid's writings. Though possessing diligence, perseverance and literary ambition, he seems incapable of conceiving a great and serious whole. But with all the levity of his character he must have had qualities which made him, if not much esteemed, yet much liked in his own day, and which are apparent in the genial amiability of his writings. He claims for himself two virtues highly prized by the Romans, *fides* and *candor*—the qualities of social honour and kindly sincerity. There is no indication of anything base, ungenerous or morose in his relations to others. Literary *candor,* the generous appreciation of all sorts of excellence, he possesses in a remarkable degree. He heartily admires everything in literature, Greek or Roman, that had any merit. In him more than any of the Augustan poets we find words of admiration applied to the rude genius of Ennius and the majestic style of Accius. It is by him that

Lucretius is first named and his sublimity is first acknowledged. The image of Catullus that most haunts the imagination is that of the poet who died so early—

hedera iuvenalia cinctus
Tempora,

as he is represented by Ovid coming to meet the shade of the young Tibullus in Elysium. To his own contemporaries, known and unknown to fame, he is as liberal in his words of recognition. He enjoyed society too in a thoroughly amiable and unenvious spirit. In his exile he did retaliate on one enemy and persistent detractor in the *Ibis*, a poem written in imitation of a similar work by Callimachus; but the *Ibis* is not a satire, but an invective remarkable rather for recondite learning than for epigrammatic sting.

But Ovid's chief personal endowment was his vivacity, and his keen interest in and enjoyment of life. The age in which he lived was, as he tells us, that in which more than any other he would have wished to live. He is its most gifted representative, and by not rising above it he reflects it the more perfectly. The sympathy which he felt for the love adventures of his contemporaries, to which he probably owed his fall, quickened his creative power in the composition of the *Heroides* and the romantic tales of the *Metamorphoses*. None of the Roman poets can people a purely imaginary world with such spontaneous fertility of fancy as Ovid. In the power and range of imaginative vision he is surpassed by no ancient and by few modern poets. This power of vision is the counterpart of his lively sensuous nature. He has a keener eye for the apprehension of outward beauty, for the life and colour and forms of nature, than any Roman or perhaps than any Greek poet. This power, acting upon the wealth of his varied reading, gathered with eager curiosity and received into a singularly retentive mind, has enabled him to depict with consummate skill and sympathy legendary scenes of the most varied and picturesque beauty. If his tragedy, the *Medea*, highly praised by ancient critics, had been preserved, we should have been able to judge whether Roman art was capable of producing a great drama. In many of the *Heroides*, and in several speeches scattered through his works, he gives evidence of true dramatic creativeness. Among the poets of all times he can imagine a story with the most vivid inventiveness and tell it with the most unflagging animation. The faults of his verse and diction are those which arise from the vitality of his temperament—too facile a flow, too great exuberance of illustration. He has as little sense of the need of severe restraint in his art as in his life. He is not without mannerism, but he is quite unaffected, and, however far short he might fall of the highest excellence of verse or style, it was not possible for him to be rough or harsh, dull or obscure.

As regards the school of art to which he belongs, he may be described as the most brilliant representative of Roman Alexandrinism. The latter half of the Augustan age was, in its social and intellectual aspects, more like the Alexandrine age than any other era of antiquity. Poetry was the chief branch of literature, and the chief subjects of poetry were mythological tales, various phases of the passion of love, the popular aspects of science and some aspects of the beauty of nature. These two were the chief subjects of the later Augustan poetry. Ovid was the last of this class of writers.

Works.—His extant works fall naturally into three divisions, those of his youth, of middle life and of his later years. To the first of these divisions belong the amatory poems: (1) the three books of *Amores* (originally five, but reduced in a later recension to three) relating to his amours with his mistress Corinna; (2) the *Medicamina formae*, a fragment of a hundred lines on the use of cosmetics; (3) the three books of the *Ars amatoria;* (4) the *Remedia amoris* (one book), a kind of recantation of the *Ars amatoria*. To the second division belong (5) the fifteen books of the *Metamorphoses*, and (6) the six books of the *Fasti*, which was originally intended to be in twelve books, but which breaks off the account of the Roman calendar with the month of June. To the third division belong (7) the five books of the *Tristia*, (8) the *Ibis*, an invective against an enemy who had assisted to procure his fall, written in elegiac couplets probably soon after his exile; (9) the four books of *Epistulae ex Ponto*. Of these the first three were published soon after the *Tristia*, while the fourth book is a collection of scattered poems published by some friend soon after the author's death. The *Halieutica* is a didactic fragment in hexameters on the natural history of fishes, of doubtful genuineness, though it is certain that Ovid did begin such a work at the close of his life.[1]

In his extant works Ovid confined himself to two metres—the elegiac couplet and the hexameter. The great mass of his poetry is written in the first; while the *Metamorphoses* and the *Halieutica* are composed in the second. Of the elegiac couplet he is the acknowledged master. By fixing it into a uniform mould he brought it to its highest perfection; and the fact that the great mass of elegiac verse written subsequently has endeavoured merely to reproduce the echo of his rhythm is evidence of his pre-eminence. In the direct expression and illustration of feeling his elegiac metre has more ease, vivacity and sparkle than that of any of his predecessors, while he alone has communicated to it, without altering its essential characteristic of recurrent and regular pauses, a fluidity and rapidity of movement which make it an admirable vehicle for pathetic and picturesque narrative. It was impossible for him to give to the hexameter greater perfection, but he imparted to it also a new character, rapid, varied, animated in complete accord with the swift, versatile and fervid movement of his imagination. One other proof he gave of his irrepressible energy by composing during his exile a poem in the Getic (Gothic) language in praise of the imperial family, the loss of which, whatever it may have been to literature, is much to be regretted in the interests of philology.

It was in Ovid's writings that the world of romance and wonder created by Greek imagination was first revealed to modern times. His influence was first felt in the literature of the Italian Renaissance. But in the most creative periods of English literature he seems to have been read more than any other ancient poet, not even excepting Virgil, and it was on minds such as those of Marlowe, Spenser, Shakespeare, Milton and Dryden that he acted most powerfully. His influence is equally unmistakable during the classical era of Addison and Pope. The most successful Latin verse of modern times has been written in imitation of him; the faculty of literary composition and feeling for ancient Roman culture has been largely developed in the great schools of England and France by the writing of Ovidian elegiacs. His works afforded also abundant stimulus and materials to the great painters who flourished during and immediately after the Renaissance. Thus his first claim on the attention of modern readers is the influence which he has exercised on the development of literature and art; for this, if for no other reason, his works must always retain an importance second only to those of Virgil and Horace.

He is interesting further as the sole contemporary exponent of the last half of the Augustan age, the external aspects and inner spirit of which is known from the works, not of contemporary historians or prose-writers, but from its poets. The successive phases of Roman feeling and experience during this critical period are revealed in the poetry of Virgil, Horace and Ovid. Virgil throws an idealizing and religious halo around the hopes and aspirations of the nascent empire. Horace presents the most complete image of its manifold aspects, realistic, and ideal. Ovid reflects the life of the world of wealth and fashion under the influence of the new court, its material prosperity, its refinement, its frivolity and its adulation. He is the last true poet of the great age of Roman literature, which begins with Lucretius and closes with him. But the type of genius of which he affords the best example is more familiar in modern Italian than in ancient Roman literature. While the serious spirit of Lucretius and Virgil reappeared in Dante, it is Ariosto who may be said to reproduce the light-hearted gaiety and brilliant fancy of Ovid.

BIBLIOGRAPHY.—The life of Ovid was first treated systematically by J. Masson, *Ovidii vita ordine chronologico digesta* (1780) (often reprinted, *e.g.*, in Burmann's edition). Modern literature on this subject will be found in Teuffel's *History of Roman Literature* (Eng. trans., ed. 2), § 247, and S. G. Owen's edition of *Tristia*, bk. i. The very numerous manuscripts of Ovid are chiefly of late date, 13th to

[1] Plin. *Hist. Nat.* xxxii. 152.

15th century. The earliest and best are: for the *Heroides* a Paris ms. of the 9th, a Wolfenbüttel ms. of the 12th and an Eton fragmentary ms. of the 11th century (the *Epistula Sapphus*, found in no early ms., is best preserved in a 13th-century Frankfort, and a 15th-century Harleian ms.); for the *Amores, Ars amatoria, Remedia amoris*, two Paris mss. of the 9th and 10th century respectively; for the *Medicamina formae* a Florence ms. (Marcianus) of the 11th; for the *Metamorphoses* two Florence mss. (Marcianus and Laurentianus) and a Naples ms., all of the 11th century; for the *Fasti* two Vatican mss. of the 10th and 11th century; for the *Tristia* a Florence ms. of the 11th; for the *Epistulae ex Ponto* a fragmentary Wolfenbütten ms. of the 6th and a Hamburg and two Munich mss. of the 12th; for the *Ibis* a Trinity College, Cambridge, ms. of the 12th; for the *Halieutica* a Paris ms. of the 9th or 10th, and a Vienna ms. of the 9th century. Important for the text of the *Heroides* and *Metamorphoses* is the interesting paraphrase written in Greek by the monk Maximus Planudes in the latter half of the 13th century at Constantinople; that of the *Heroides* is printed in Palmer's edition of the *Heroides* (1898), that of the *Metamorphoses* in Lemaire's edition of *Ovid*, vol. v., edited by Boissonade. *See* also Gudeman, *De Heroidum Ovidii codice Planudeo* (Berlin, 1888).

Two independent *editiones principes* of Ovid were published contemporaneously in 1471, one at Rome, printed by Sweynheym and Pannartz, and one at Bologna by Balthasar Azoguidius: these present entirely different texts. *See* Owen's *Tristium libri*, v. p. lv. ff. The following are the most important editions: those marked with an asterisk have explanatory notes. Of the whole works: *Heinsius-Burmann (1727); *Amar-Lemaire (1820–24); Merkel-Ehwald (1874–88); Riese (1871–89); Postgate's *Corpus poetarum Latinorum*, by various editors (1894), reprinted separately (1898). Of separate works: *Amores*, *Némethy (1907); *Heroides*, Sedlmayer (critical) (1886); *Palmer (1898); *Epistula Sapphus* (separately), *De Vries (1888); *Ars amatoria*, *P. Brandt (1902); *Medicamina formae* (critical), Kunz (1881); *Metamorphoses*, *J. C. Jahn (1821); *Loers (1843); Korn (critical) (1880); *Haupt-Ehwald (1898–1903); Magnus (1914); *R. S. Lang (Oxford, 1927); *Fasti*, *Gierig (1812); Merkel (1841) (critical, with learned prolegomena on the sources, the Roman calendar, etc.); *Keightley (1848); *Paley (1854); *Peter (1889); *Cyril Bailey (Oxford 1921); *Tristia*, *Loers (1839); S. G. Owen (1889) (critical); with notes and translation (1924); *Bk. i. (1885), *Bk. iii. (1889); *Cocchia (1900); *Epistulae ex Ponto*, Korn (1868) (critical), Bk. i. *Ellis (1881); *Némethy (1915); *Halieutica*, *Birt, *De Halieuticis Ovidio poetae falso adscriptis* (1878). There is a free verse-translation of the *Amores* by Marlowe (*c.* 1600), and Dryden, with other hands under his supervision, published translation of various works between 1683 and 1717.

The special treatises on matters connected with Ovid are very numerous; a fairly complete list up to the time of publication is given in Owen's *Tristia* (critical edition), p. cviii. ff.; in Teuffel's *History of Roman Literature* (trans. by Warr) and in Schanz's *Geschichte der römischen Litteratur;* and by Ehwald in the *Jahresbericht über die Fortschritte der classischen Altertumswissenschaft*, xxxi. (1884) pp. 157 ff., lxxx. (1894) pp. 1 ff., cix. (1902) pp. 157 ff. The following deserve special mention. On the history of the text: Ehwald, *Ad historiam carminum Ovidianorum symbolae* (1889); *Kritische Beiträge zu Ovids Epistulae ex Ponto* (1896); Sedlmayer, *Prolegomena ad Heroidas* (1878); Gruppe, *Minos*, pp. 441 ff. (on interpolations). On style: Ovid's diction in connection with other writers,—A. Zingerle, *Ovidius und sein Verhältnis zu den Vorgängern* (1869–71); *Martial's Ovid-Studien* (1877); W. Zingerle, *Untersuchungen zur Echtheitsfrage der Heroiden Ovids* (1878); W. Vollgraff, *Nikander und Ovid* (Groningen, 1909 foll.). Peculiarities of Ovid's style: van Iddekinge, *De Ovidii Romani iuris peritia* (1811); Washietl, *De similitudinibus imaginibusque Ovidianis* (1883); M'Crea, *On Ovid's Use of Colour and Colour Terms* (Classical studies in honour of H. Drisler) (1894). Metre: the structure of the Ovidian pentameter examined in relation to the textual criticism,—Hilberg, *Gesetze der Wortstellung im Pentameter des Ovid* (1894) (fully reviewed by Ellis, *Classical Review*, ix. 157). Literary appreciation: Sellar, *Roman Poets of the Augustan Age;* Lafaye, *Les Métamorphoses d'Ovid et leurs modèles grecs.* Ovid's relation to works of art: Wunderer, *Ovids Werke in ihrem Verhältnis zur antiken Kunst* (1890–91); Engelmann, *Bilder-Atlas zu Ovid's Metamorphosen* (1890). Cause of exile: the most interesting discussion is by Boissier in his *L'Opposition sous les Césars. See* also Nageotte, *Ovide, sa vie, ses oeuvres* (1872); Huber, *Die Ursachen der Verbannung des Ovid* (1888). Influence of Ovid upon Shakespeare: T. S. Baynes, *Shakespeare Studies* (1894), pp. 195 ff.; Constable, Shakespeare's "Venus und Adonis" in *Verhältnis zu Ovid's Metamorphosen* (1890). *See* also S. G. Owen, *Ovid and Romance* (1912).

(S. G. O.; X.)

OVIEDO, a maritime province of northern Spain, bounded on the north by the Bay of Biscay, east by Santander, south by Leon and west by Lugo. Pop. (1920) 743,726; area, 4,205 sq.m. In popular speech Oviedo is often called by its ancient name of Asturias, which only ceased to be the official title of the province in 1833, when the Spanish system of local government was reorganized. An account of the physical features, history and inhabitants of this region is given under ASTURIAS (*q.v.*). Oviedo is rich in forests, coal, streams and waterfalls, greatly contributing to its modern industrial development. The horses of Oviedo rank among the best in Spain. Wild deer, boars and bears were formerly common among the mountains; and the sea-coasts, as well as the streams, abound with fish, including salmon and lampreys. The climate is mild and wet; the broken relief hinders cultivation.

Although no trace exists of the gold for which Asturias was celebrated under its Roman rulers, Oviedo possesses valuable coal measures, which are worked at Langreo (34,033), Mieres (40,560), Siero (27,210) and elsewhere. The copper mines near Avilés (14,642) and Cangas de Onis (9,753) have lost their importance; but lead, magnesia, arsenic, cobalt, lapis lazuli, alum, antimony, jet, marble and rock-crystal are found in various parts of the province, while amber and coral are gathered along the coast. There are manufactures of fine textiles, coarse cloth and ribbons in Salas (14,972), Piloña (18,323) and Avilés; of paper in Pianton; of porcelain and glass in Gijón (57,573), Avilés and Pola de Surro; of arms in Oviedo and Trubia; while foundries and works for the manufacture of agricultural implements, rails and pig-iron are numerous. An important highway is the 16th century *Camino real*, or royal road, leading from Gijón to Leon and Madrid, which cost so much that the emperor Charles V. inquired if it were paved with silver. A railway from Madrid to Oviedo, Gijón and Avilés runs through some of the most difficult parts of the Cantabrian chain. There are also several branch railways, including numerous narrow-gauge lines.

OVIEDO, an episcopal city and capital of the Spanish province of Oviedo; 16 m. S. of the Bay of Biscay, on the river Nalon, and on the Leon-Gijón Oviedo-Trubia and Oviedo-Infiesto railways. Pop. (1920) 69,375. Oviedo is built on a hill rising from a broad and picturesque valley, which is bounded on the north-west by the Sierra de Naranco. Oviedo, founded in the reign of Fruela (762), became the fixed residence of the kings of the Asturias in the time of Alphonso II., and continued to be so until about 924, when the advancing reconquest of Spain from the Moors led them to remove their capital to Leon. The university was founded by Philip III. in 1604. The Gothic cathedral, founded in 1388, occupies the site of a chapel founded in the 8th century, of which only the Camara Santa remains. The Camara Santa (dating from 802) contains the famous *arca* of Oviedo, an 11th century Byzantine chest of cedar, overlaid with silver reliefs of Biblical scenes. In it are preserved two crosses dating from the 8th and 9th centuries. The cathedral library has some old mss., including a deed of gift made by Alphonso II. of Asturias in 812, and a collection of illuminated documents of the 12th century, called the *Libro gótico.* On the Sierra de Naranco is the ancient Santa Maria de Naranco, originally built by Ramiro I. of Asturias in 850 as a palace, and afterwards turned into a church. Higher up the hill is San Miguel de Lino, also of the 9th century; and on the road to Gijón, about a mile outside the town, is the Santullano or church of St. Julian, also of very early date. Oviedo is the centre of an agricultural trade. Other industries are marble-quarrying, the manufacture of arms, cotton and woollen fabrics, iron goods, leather and matches.

OVIEDO Y VALDÉS, GONZALO FERNÁNDEZ DE (1478–1557), Spanish historian, was present at the surrender of Granada and saw Columbus previous to his voyage to America. He visited America himself on several occasions in an official capacity. Appointed historiographer of the Indies, Oviedo wrote —besides a romance of chivalry, *Don Claribalte* (1519)—two historical works: *Sumario de la natural y general istoria de las Indias* (1526) and *La historia natural y general de las Indias, Islas e Tierra Firme del mar oceano* (1535–57). The latter work embodies a mass of curious information collected at first hand.

OVOLO, in architecture, a convex moulding (*q.v.*), whose profile approximates a quarter circle, a quarter ellipse, or a similar curve; known commonly in the building trades as a quarter round. In its elliptical forms it is the characteristic moulding of the echinus of the Greek Doric order and in its round forms of the echinus of the Roman Doric. It is also important as part of the bed-mould (*q.v.*) of many cornices. In

carpentry, at a small scale, it is one of the most common mouldings used to cover a joint in a re-entrant angle, as between a base board and the floor, or between the side of a beam and the ceiling.

OWATONNA, a city of south-eastern Minnesota, U.S.A., on the Straight river at an altitude of 1,140 ft., 70 m. S. of Minneapolis; the county seat of Steele county. It is on Federal highways 14, 65 and 218, and is served by the Chicago, Milwaukee, St. Paul and Pacific, the Chicago and North Western, and the Rock Island railways and by motor bus lines. Pop. (1920) 7,252 (84% native white); 1928 local estimate, 8,200. It is the trading and shipping centre of a rich grain-growing and dairying region; has large nurseries; and its manufactures include creamery and cereal products, ventilating systems, acetylene lighting plants, and farm implements. West of the city is the State School for Dependent and Neglected Children (1886). Owatonna was settled about 1855, incorporated as a village in 1865, and chartered as a city in 1875. The name is a Sioux word meaning "straight."

OWEGO, a village of southern New York, U.S.A., the county seat of Tioga county; on the north bank of the Susquehanna river, 21 m. W. of Binghamton. It is served by the Erie, the Lackawanna and the Lehigh Valley railways. Pop. (1925) 4,743 (State census). It is a lumber-shipping point and has a number of factories. Owego occupies the site of an Indian village called Ah-wa-ga ("where the valley widens"), which was destroyed by Gen. Clinton in 1779. A white settlement was established in 1785 and the village was incorporated in 1827.

OWEN, JOHN [OVENUS or AUDOENUS] (*c.* 1560–1622), Welsh epigrammatist, born at Plas Dhu, Carnarvonshire, about 1560, was educated at Winchester school, and at New college, Oxford. He was a fellow of his college from 1584 to 1591, when he became a schoolmaster, first at Trelleck, near Monmouth, and then at Warwick. His perfect mastery of the Latin language brought him the name of "the British Martial."

Owen's *Epigrammata* are divided into twelve books, of which the first four were published in 1606, and the rest at four different times. Owen frequently adapts and alters to his own purpose the lines of his predecessors in Latin verse, and one such borrowing has become celebrated as a quotation, though few know where it is to be found. It is the first line of this epigram:—

> Tempora mutantur, nos et mutamur in illis:
> Quo modo? fit semper tempore peior homo.
> (Lib. I. ad Edoardum Noel, epig. 58.)

This first line is altered from an epigram by Matthew Borbonius, one of a series of mottoes for various emperors, this one being for Lothaire I.

> Omnia mutantur, nos et mutamur in illis:
> Illa vices quasdam res habet, illa vices.

There are editions of the *Epigrammata* by Elzevir and by Didot; the best is that edited by Renouard (2 vols., Paris, 1795). Translations into English, either in whole or in part, were made by Vicars (1619); by Pecke, in his *Parnassi Puerperium* (1659); and by Harvey in 1677, which is the most complete. La Torre, the Spanish epigrammatist, owed much to Owen, and translated his works into Spanish in 1674. French translations of the best of Owen's epigrams were published by A. L. Lebrun (1709) and by Kérivalant (1819).

OWEN, JOHN (1616–1683), English Nonconformist divine, was born at Stadham in Oxfordshire in 1616, and educated at Queen's college, Oxford. He was chaplain and tutor in the families, first of Sir Robert Dormer, and later of Lord Lovelace, but lost his place by siding with parliament in the Civil War. He then lived in Charterhouse yard, in London, and on April 29, 1646, preached, before the Long Parliament, a sermon which showed his tendency towards the tolerant Independent or Congregational system of Church government. He now became pastor at Coggeshall in Essex. He was chosen to preach to parliament on the day after the execution of Charles. Cromwell took him in 1649 as his chaplain to Ireland, where he regulated the affairs of Trinity college, and in 1650 to Scotland, making him chancellor of Oxford (1651), dean of Christ-church (1651–52) and vice-chancellor in 1652.

When Richard Cromwell succeeded his father, Owen lost his vice-chancellorship, and joined the Wallingford House party, throwing his influence on the side of a simple republic as against a protectorate. In March 1660 the Presbyterian party being uppermost, he was deprived of his deanery and returned to Stadham. Driven to London by the Conventicle and Five Mile Acts, he gathered a congregation there; at the revival of the Conventicle Acts in 1670 he drew up a protest to the House of Lords. After the Declaration of Indulgence (1672) he frequently preached in congregations of Independents and Presbyterians, and was in favour with Charles II. and James II. He died at Ealing on Aug. 24, 1683.

See Goold's edition of Owen's *Works* (1850–55); W. Orme, *Memoirs of Owen* (1820); and *The Golden Book of John Owen*, edited with a study of his life by James Moffat (1904).

OWEN, SIR RICHARD (1804–1892), English biologist, was born at Lancaster on July 20, 1804. In 1820 he was apprenticed to a local surgeon and apothecary, and in 1824 he proceeded as a medical student to the university of Edinburgh. After completing his medical course in St. Bartholomew's Hospital, London, where he came under the influence of the eminent surgeon, John Abernethy, he contemplated a professional career; but being induced by Abernethy to accept the position of assistant to William Clift, conservator of the museum of the Royal College of Surgeons, he devoted himself to the more congenial work of scientific research. He prepared an important series of catalogues of the Hunterian collection in the Royal College of Surgeons; and in the course of this work acquired the unrivalled knowledge of comparative anatomy which facilitated his researches on the remains of extinct animals. In 1836 he was appointed Hunterian professor in the Royal College of Surgeons, in 1849 he succeeded Clift as conservator, and in 1856 he became superintendent of the natural history department of the British Museum. He then devoted his energies to a scheme for a National Museum of Natural History, which eventually resulted in the removal of the natural history collections of the British Museum to a new building at South Kensington, the British Museum (Natural History). He retained office until the completion of this work in 1884, when he received the K.C.B., and thenceforward lived in retirement at Sheen Lodge, Richmond Park, until his death on Dec. 18, 1892.

While occupied with cataloguing the Hunterian collection, Owen seized every opportunity of dissecting fresh subjects. He had the privilege of investigating the animals which died in the Zoological Society's gardens; and when that society began to publish scientific proceedings in 1831, he was the most voluminous contributor of anatomical papers. His first notable publication, however, was his *Memoir on the Pearly Nautilus* (1832), which was soon recognized as a classic. Henceforth he continued to make important contributions to every department of comparative anatomy and zoology for over fifty years. Among Entozoa his most noteworthy discovery was that of *Trichina spiralis* (1835), the parasite infesting the muscles of man in the disease now termed trichinosis. (*See* also, however, the article on PAGET, SIR JAMES.) He also studied the Brachiopoda, Mollusca and he proposed the universally-accepted subdivision of the Cephalopoda into the two orders of Dibranchiata and Tetrabranchiata (1832). The problematical Arthropod *Limulus* was also the subject of a special memoir by him in 1873.

Owen's technical descriptions of the Vertebrata were still more numerous and extensive than those of the invertebrate animals. He not only studied existing forms, but also devoted great attention to the remains of extinct groups, and immediately followed Cuvier as a pioneer in vertebrate palaeontology. Early in his career he made exhaustive studies of teeth, both of existing and extinct animals, and published his work on *Odontography* (1840–1845). Most of his work on reptiles related to the skeletons of extinct forms, and his chief memoirs on British specimens were reprinted in a connected series in his *History of British Fossil Reptiles* (4 vols., 1849–1884). He also wrote widely on extinct birds. With regard to living mammals, the more striking of Owen's contributions relate to the monotremes, marsupials, and the anthropoid apes. Most of his writings on mammals, however, deal with extinct forms. Sir Thomas Mitchell's discovery of fossil bones in New South Wales provided material for the first of Owen's long series of papers on the extinct mammals of Australia,

which were eventually reprinted in book-form in 1877.

Owen's detailed memoirs and descriptions require laborious attention in reading, on account of their nomenclature and ambiguous modes of expression. But it must be remembered that he was a pioneer in concise anatomical nomenclature.

Besides the above mentioned works, Owen wrote: *Comparative Anatomy and Physiology of Vertebrates* (3 vols., 1866–68); *History of British Fossils, Mammals and Birds* (1844–46); *Monograph of the Fossil Mammalia of the Mesozoic Formations* (Paleont. Soc., 1871); *Antiquity of Man as deduced from the Discovery of a Human Skeleton* (1884). *Catalogue of the Fossil Reptilia of South Africa* (1876); *Archetype and Homologies of the Vertebrate Skeleton* (1848).

OWEN, ROBERT (1771–1858), British reformer and Socialist, was born at Newtown, Montgomeryshire, on May 14, 1771. His father had a small business in Newtown as saddler and ironmonger, and there young Owen received his school education, which terminated at the age of nine. After serving in a draper's shop for some years he settled in Manchester, where his success was rapid. When only 19 years of age he became manager of a cotton mill in which 500 people were employed, and by his administrative intelligence and energy soon made it one of the best establishments of the kind in Great Britain. In this factory Owen used the first bags of American sea-island cotton ever imported into the country; it was the first sea-island cotton from the Southern States. Owen also made improvements in the quality of the cotton spun; and indeed there is no reason to doubt that at this early age he was the first cotton-spinner in England, a position entirely due to his own capacity and knowledge of the trade. On becoming manager and partner in the Chorlton Twist Company at Manchester, Owen induced his partners to purchase the new Lanark mills, and after his marriage with Miss Dale, the daughter of the former proprietor, he settled there as manager and part-owner. Encouraged by his great success in Manchester, he had already formed the intention of conducting New Lanark on higher principles than the current commercial ones.

Connected with the mills were about 2,000 people, 500 of whom were children, brought, most of them, at the age of five or six from the poorhouses and charities of Edinburgh and Glasgow. The children especially had been well treated by Dale, but the general condition of the people was unsatisfactory. Crime and vice bred by demoralizing conditions were common; education and sanitation were alike neglected; and housing conditions were intolerable. It was this population which Owen set himself to elevate and ameliorate. He greatly improved their houses, and mainly by his personal influence trained them to habits of order, cleanliness and thrift. He opened a store, where the people could buy goods of the soundest quality at little more than cost price; and the sale of drink was placed under the strictest supervision. His greatest success, however, was in the education of the young, to which he devoted special attention. He was the founder of infant schools in Great Britain; and, though he was anticipated by reformers on the Continent, he seems to have been led to institute them by his own views of what education ought to be, and without hint from abroad.

In all these plans Owen obtained success. Though at first regarded with suspicion as a stranger, he soon won the confidence of his people. The mills continued to be a commercial success, but some of Owen's schemes involved considerable expense, which was displeasing to his partners. Tired at last of the restrictions imposed on him by men who wished to conduct the business on the ordinary lines, Owen formed a new firm, who, content with 5% of return for their capital, were ready to give freer scope to his philanthropy (1813). In this firm Jeremy Bentham and the well-known Quaker, William Allen, were partners. In the same year Owen published *A New View of Society, or Essays on the Principle of the Formation of the Human Character,* in which he expounded the principles on which his system of educational philanthropy was based. From an early age he had lost all belief in the prevailing forms of religion, and had thought out a creed for himself, which he considered an entirely new and original discovery. The chief points in this philosophy were that man's character is formed by circumstances over which he had no control and that he is not a proper subject either of praise or blame. These convictions led Owen to the conclusion that the great secret in the right formation of man's character is to place him under the proper influences from his earliest years. The irresponsibility of man and of the effect of early influences are the keynote of Owen's whole system of education and social amelioration.

Owen's new views theoretically belong to an old system of philosophy; his originality is to be found in his application of them. For the next few years Owen's work in New Lanark continued to have a national and even European significance. New Lanark itself became a much frequented place of pilgrimage for social reformers, statesmen, and royal personages, including Nicholas, afterwards emperor of Russia. According to the unanimous testimony of all who visited it, the results achieved by Owen were singularly good. The children brought up on his system, which included instruction through the eye as well as the ear, country walks, nature study, singing and dancing, were graceful, genial and unconstrained; health, plenty and contentment prevailed; and the business was a commercial success.

In 1815 Owen started, apparently single-handed, an agitation for factory reform. He drafted a bill to apply to all textile factories, prohibiting employment before ten years of age, and night-work before 18, limiting hours for those under 18 to 10½ a day, and providing for inspection. He failed to gain support from his fellow employers in Scotland, but found influential sympathizers in London, and the bill was introduced into parliament. There it was so emasculated that, after two sessions, Owen ceased to work for it, and disclaimed all responsibility for the mutilated measure passed in 1819. Hitherto Owen's work had been that of the practical reformer, whose distinction was the originality and ceaseless unselfishness of his methods. It was in 1817 that he first put forward the ideas which made him the forerunner of Socialism and Co-operation. These ideas were embodied in a report communicated to the committee of the House of Commons on the poor law.

The general misery and stagnation of trade consequent on the termination of the Napoleonic Wars was engrossing the attention of the country. After clearly tracing the special causes connected with the war which had led to such deplorable conditions, Owen pointed out that the permanent cause of distress was to be found in the competition of human labour with machinery, and that the only effective remedy was the united action of men, and the subordination of machinery. His proposals for the treatment of pauperism were based on these principles. He recommended that communities of about 1,200 persons each should be settled on quantities of land from 1,000 to 1,500 ac., all living in one large building in the form of a square, with public kitchen and mess-rooms. Each family should have its own private apartments, and the entire care of the children till the age of three, after which they should be brought up by the community, their parents having access to them at meals and all other proper times. These communities might be established by individuals, by parishes, by counties, or by the State; in every case there should be supervision by duly qualified persons. Work, and the enjoyment of its results, should be in common. The size of his community was no doubt suggested by his village of New Lanark; and he soon advocated such a scheme for the reorganization of society in general. In its fully developed form it was as follows. He desired that communities of from 500 to 3,000, mainly agricultural but possessing the best machinery, and being, as far as possible, self-contained, "should increase in number, unions of them federatively united shall be formed in circles of tens, hundreds and thousands," till they should embrace the whole world in a common interest.

His plans for the cure of pauperism were received at first with considerable favour. The *Times* and *Morning Post* and many of the leading men of the country countenanced them, one of his most steadfast friends being the duke of Kent, father of Queen Victoria. But at a large meeting in London, Owen declared his hostility to the received forms of religion. After this act of defiance his theories became suspect to the ruling classes though he did not lose all support from them. The radicals were intent

on political reform, which seemed to Owen on the wrong lines. His point of view was that machinery had come to stay and made social control of industry necessary to prevent the oppression and poverty of the workers. When he found there was no hope of Government action he turned to groups of sympathizers to carry out his plan of self-contained Communities. In 1825 he bought 30,000 ac. of land in Indiana, U.S.A., from the Rappite religious community, and re-named it New Harmony. There was no effective choice of colonists, and some necessary trades were inadequately represented. For a time the community life was well ordered and contented under Owen's practical guidance, and a constitution was adopted within a year, based on community of property and a representative government. But differences about the form of government and religion soon appeared, and all the numerous attempts at reconstruction failed to compose them, though there is a consensus of testimony to the admirable spirit which prevailed amidst all the dissensions. The community was wound up in 1828, and Owen lost £40,000—four-fifths of his fortune. The other chief Owenite Community experiments were at Queenwood, Hants (1839–45), in which Owen took part for three years; and Orbiston, near Glasgow (1825–28) and Ralahine in Ireland (1831–33), with neither of which he was directly concerned.

In 1828, after a long period of friction with William Allen and some of his other partners, Owen resigned all connection with New Lanark, and made his headquarters in London. Before he established New Harmony, U.S.A., he had begun to turn to the workers for support for his ideas. In his *Report to the County of Lanark* (a body of landowners) in 1820, he declared definitely that not reforms but a transformation of the social order was required. The appeal of such a doctrine to the workers is obvious. From 1820, his proposals for communities attracted the younger workers, brought up under the factory system, and between 1820 and 1830 numerous societies were formed and papers started to advocate his views. The growth of trade unionism and the emergence of a working-class point of view caused Owen's doctrines to be accepted as the expression of the workers' aspirations. When he returned to England in 1829 he found himself regarded as their leader. In the trade unions, Owenism stimulated the formation of self-governing workshops, and their need for a market led to the formation of "The Equitable Labour Exchange" in 1832.

Here Owen applied his principle that labour is the source of all wealth. Prices were calculated according to the cost of raw material and the time expended in making the article, and "Labour Notes" were used as the currency for dealings with the Exchange. After a few months of prosperity, rapacious demands from the landlord and the fact that the prices did not correspond with real exchange value brought the Labour Exchange to an end. The unprecedented growth of trade unions made it seem possible that the separate industries and eventually all industry might be organized by these bodies. Owen and his followers carried out an ardent propaganda all over the country, with the result that the new National Operative Builders Union turned itself into a Guild to carry on the building industry, and the Grand National Consolidated Trades Union was formed (1833–4). The enthusiasm and the numbers joining were remarkable, but the determined opposition of the employers and the severe repression by the Government and law courts, ended the movement in a few months. It was two generations before socialism, which was first popularly discussed at this time, again influenced trade unionism.

Throughout these years Owen's community ideas maintained their hold. From 1825 numerous co-operative societies for mutual trading were organized by Owen's followers, the profits being accumulated to provide funds for starting Owenite communities. Although the communities did not materialize, these short-lived co-operative stores showed that co-operative trading was possible and started the idea of using it as a means of changing the social system. They thus performed an important part in preparing the ground for the world-wide Consumers' Co-operative Movement which sprang from the Rochdale Pioneers Co-operative Society founded in 1844. These Pioneers were inspired by Owen's teaching, though their method of organizing production to supply their own needs developed on very different lines from his communities.

After 1834, Owen devoted himself to preaching his educational, moral, rationalist and marriage reform ideas. He formed the Association of All Classes of All Nations, and he was untiring in writing and speaking. His love of children and his great personal charm impressed all who came in contact with him up to the end of his life. At the age of 82, he became a spiritualist. He died on a visit to his birthplace, Newtown, on Nov. 17, 1858, his last act, the day before his death, being to draw up a plan for re-organizing the education of the town. He was buried at Newtown, and a memorial tablet was erected on his grave in 1902 by the Co-operative Union.

Robert Owen's four sons all became American citizens. The eldest, ROBERT DALE OWEN (1801–1877), sat in Congress (1844–47), and drafted the bill founding the Smithsonian Institution. In the Indiana House of Representatives, 1836–39 and 1851–52, and Constitutional Convention, 1850, he was instrumental in securing a married woman's property law, a common free school system, and more freedom in divorce. From 1853 to 1858 he was United States ambassador to Naples. He was a strong believer in spiritualism.

Of R. Owen's numerous works in exposition of his system, the most important are the *New View of Society;* the *Report* communicated to the Committee on the Poor Law; *The Report to the County of Lanark;* the *Book of the New Moral World;* and *Revolution in the Mind and Practice of the Human Race.* See *Life of Robert Owen written by himself* (1857), and *Threading my Way, Twenty-seven Years of Autobiography,* by R. D. O. (1874). There are also *Lives* of Owen by A. J. Booth (1869), W. L. Sargant (1860), Lloyd Jones (1889), F. A. Packard (Philadelphia, 1866), F. Podmore (1906) and G. D. H. Cole (with bibliography 1925). *See* also H. Simon, *Robert Owen: sein Leben und seine Bedeutung für die Gegenwart* (Jena, 1905); E. Dolléans, *Robert Owen* (Paris, 1905); G. J. Holyoake, *History of Co-operation in England* (1906); Leonard Woolf, *Co-operation and the Future of Industry* (1919) and the article COMMUNISM.

OWENSBORO, a city of Kentucky, U.S.A., the county seat of Daviess county; on the Ohio river and Federal highway 60, 112 m. S.W. of Louisville. It is served by the Illinois Central, the Louisville and Nashville and the Louisville, Henderson and St. Louis railways, interurban trolleys and motor-bus lines and river steamers. Pop. 21,055 in 1920 (about 16% negro); estimated locally at over 25,000 in 1928. It is an important market for tobacco (handling 35,000,000 lb. in a normal year) and for corn, wheat, potatoes, dairy and poultry products and live stock. Its manufactures are varied and important, with an output in 1927 valued at $9,787,720; and it is the centre of a gas and oil field including (1928) over 700 producing wells, with a daily production of 7,500 bbl. of crude oil. The city has a commission form of government. The site of Owensboro was known to the early boatmen of the Ohio as Yellow Banks. The first cabin was built in 1799. The town was laid out for the county seat in 1815 and named Rossborough. In 1817 it was incorporated under the present name, after Col. Abraham Owen (1769–1811), but the old name of Yellow Banks clung to it until the '40s. It was chartered as a city in 1866.

OWEN SOUND, a city and port of entry in Ontario, Canada, and capital of Grey county, situated 99 m. N.W. of Toronto, on Georgian Bay. Pop. (1921) 12,190. It is the terminus of branches of the Canadian Pacific and Canadian National railways, and of the Canadian Pacific and other steamship lines plying to ports on Lakes Huron and Superior. Its harbour is one of the best on Lake Huron, and navigable by lake vessels of the largest size. It is a flourishing town, containing shipbuilding yards, and manufactories of mill machinery, agricultural implements, furniture and sewing-machines, flour-mills, saw-mills and large grain elevators.

OWL, the general name for the nocturnal birds of prey. The owls form a very natural assemblage, and this suborder, *Striges,* is not closely related to the hawks and eagles. Owls vary in length from 5in. in *Glaucidium cobanense* to more than 2ft. The plumage is very soft, rendering the flight noiseless. On each side of the base of the beak are several rows of small, curved, stiff-shafted feathers, which form a ruff to support the long feathers of the

"disc" or space around the eyes. The ears are large, with well-developed, and often asymmetrical folds of skin, so that the right and left ears may be differently shaped. Many species of owl show two phases of colouration—one in which the brown inclines to red, the other in which it inclines to grey. The outer toes of all owls are reversible. Unlike most birds, owls incubate from the laying of the first egg.



EUROPEAN BARN-OWL (STRIX FLAMMEA); THE AMERICAN BARN-OWL IS VERY SIMILAR

The type of the family *Aluconidae* is the tawny owl (*Strix aluca*), found throughout Europe and in Asia Minor, Palestine and Barbary. A woodland bird, it feeds largely on rats, mice, voles, and shrews. Allied species are found in America, northern Europe and Asia. The remaining owls form the family *Strigidae*.

The eagle owl, *Bubo ignavus*, ranges over most of Europe and Asia north of the Himalayas. The allied *B. virginianus* extends over all North America. They are sombre-coloured birds and among the largest species. Equally large is the snowy owl (*Nyctea scandiaca*), a circumpolar species with white plumage. In winter it migrates southward. The long- and short-eared owls (*Asio otus* and *A. accipitrinus*) are common to the northern parts of Europe and America; the latter, often seen abroad in the daytime, preferring open country, also extending into North Africa, all South America, and the Sandwich Islands. The long-eared owl keeps to woods. Both possess erectile tufts on the side of the head. *Speotyto cunicularia* of America lives in burrows, frequently sharing those of the prairie dog and biscacha. The bird of Pallas Athene is *Athene noctua*, the little owl of Europe, which has been introduced into Great Britain, where it has spread rapidly of late. *A. brama* replaces it in India. The American screech-owl (*Megascops asio*), in its numerous varieties, is found practically throughout North America except at the far north. It varies much in colour and size. It can be distinguished from other owls at night by its peculiar screams, snarls and hisses.



SPOTTED-OWL (SYRNIUM OCCIDENTALE), OF WESTERN U.S.

OWOSSO, a city of Shiawassee county, Michigan, U.S.A., 33 m. N.E. of Lansing, on the Shiawassee river. It is served by the Ann Arbor, the Grand Trunk and the Michigan Central railways, and by interurban trolley and motor-bus lines. The population was 12,575 in 1920 (87% native white) and was estimated locally at 16,500 in 1928. It is a division point on the Ann Arbor railroad, which has repair shops here employing 600 men, and the trade centre of a rich agricultural region, raising great quantities of sugar beet. Its manufacturing industries are many and important, with products valued in 1925 at $10,582,978, and including sugar, flour, malleable iron, automobile bodies and furniture. The city was founded in 1833 and chartered in 1859.

OX, strictly speaking, the Saxon name for the males of domesticated cattle (*Bos taurus*), but in a zoological sense employed so as to include not only the extinct wild ox of Europe but likewise bovine animals of every description, that is to say true oxen, bison and buffaloes. The characteristics of the sub-family *Bovinae*, or typical section of the family *Bovidae*, are given in the article *Bovidae* (*q.v.*); for the systematic position of that family *see* PECORA. For the typical oxen, as represented by the existing domesticated breeds *see* CATTLE.

OXALIC ACID, one of the oldest known organic acids. Scheele in 1776 prepared it by oxidizing sugar with nitric acid, and showed it to be identical with the acetosellic acid obtained from wood-sorrel, with the formula $H_2C_2O_4$, or, in its usual crystalline form, $H_2C_2O_4{\cdot}2H_2O$. It is found in the form of its acid potassium salt in many plants, especially in wood-sorrel (*Oxalis Acetosella*) and in varieties of *Rumex;* as ammonium salt in guano; as calcium salt in rhubarb root, in various lichens and in plant cells; as sodium salt in species of *Salicornia* and as free acid in varieties of *Boletus*. It is also present in urine and in urinary calculi. It is formed in the oxidation of many organic compounds (*e.g.*, sugar, starch and cellulose) by nitric acid, and also by the fusion of many oxygen-containing compounds with caustic alkalis, the latter method being employed for the manufacture of oxalic acid. In this process cellulose (in the form of sawdust) is made into a stiff paste with a mixture of strong caustic potash and soda solution and heated in flat iron pans to 200–250° C. The somewhat dark-coloured mass is lixiviated with a small amount of warm water in order to remove excess of alkali, the residual alkaline oxalates converted into insoluble calcium oxalate by boiling with milk of lime, the lime salt separated, and decomposed by means of sulphuric acid. It is found that the sawdust obtained from soft woods is the best material for use in this process. It may be obtained synthetically (as sodium salt) by heating sodium in a current of carbon dioxide to 360° C, or by heating sodium formate to 400° C (V. Merz and W. Weith, 1882), by the oxidation of ethylene glycol and by the spontaneous hydrolysis of an aqueous solution of cyanogen gas.

The hydrated acid crystallizes in prisms which effloresce in air, and are readily soluble in water. It loses its water of crystallization at 100° C, and begins to sublime at about 150–160° C, whilst on heating to a still higher temperature it partially decomposes into carbon dioxide and formic acid, or into carbon dioxide, carbon monoxide and water, the latter decomposition being also brought about by heating oxalic acid with concentrated sulphuric acid. The anhydrous acid melts at 189·5° C and is frequently used as a condensing agent. Phosphorus pentachloride decomposes it into carbon monoxide and dioxide, the reaction being the one generally applied for the purpose of preparing phosphorus oxychloride. When heated with glycerin to 100° C it yields formic acid and carbon dioxide; above this temperature, allyl alcohol is formed. Nascent hydrogen reduces it to glycollic acid. Potassium permanganate in acid solution oxidizes it to carbon dioxide and water; the manganese sulphate formed has a catalytic accelerating effect on the decomposition.

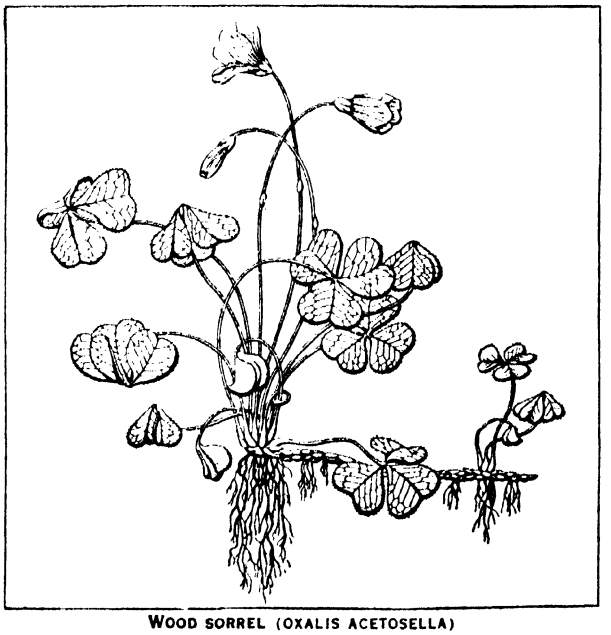
Oxalic acid is very poisonous, and by reason of its great similarity in appearance to Epsom salts, it has been very frequently mistaken for this substance with, in many cases, fatal results. The antidotes for oxalic acid poisoning are milk of lime, chalk, whiting or even wall-plaster, followed by evacuation brought about by an enema or castor oil. Only the salts of the alkali metals are soluble in water. Beside the ordinary acid and neutral salts, a series of salts called quadroxalates is known, these being salts containing one molecule of acid salt, in combination with one molecule of acid, one of the most common being "salt of sorrel," $KHC_2O_4{\cdot}H_2C_2O_4{\cdot}2H_2O$. The oxalates are readily decomposed on heating, leaving a residue of carbonate, or oxide of the metal. The silver salt decomposes with explosive violence, leaving a residue of the metal.

Potassium ferrous oxalate, $FeK_2(C_2O_4)_2{\cdot}H_2O$, is a strong reducing agent and is used as a photographic developer. *Potassium ferric oxalate,* $FeK_3(C_2O_4)_3$, is used in the preparation of platinotypes, owing to the fact that its solution is rapidly decomposed by sunlight, $2FeK_3(C_2O_4)_3 = 2FeK_2(C_2O_4)_2 + K_2C_2O_4 + 2CO_2$. *Ethyl oxalate,* $(CO{\cdot}OC_2H_5)_2$, prepared by boiling anhydrous oxalic acid with absolute alcohol, is a colourless liquid which boils at 186° C. *Methyl oxalate,* $(CO{\cdot}OCH_3)_2$, which is prepared in a similar manner, is a solid melting at 54° C. It is used in the preparation of pure methyl alcohol (*q.v.*). *Oxalyl chloride,* a liquid boiling at 64° C (m.p. −12° C), has been obtained by the action of phosphorus pentachloride on anhydrous oxalic acid. *Oxamic acid,*

$HO_2C{\cdot}CONH_2$, is obtained on heating acid ammonium oxalate; by boiling oxamide with ammonia; and among the products produced when amino-acids are oxidized with potassium permanganate. It is a crystalline powder difficultly soluble in water and melting at 210° C (with decomposition). Its ethyl ester, known as oxamethane, crystallizes in rhombic plates which melt at 114–115° C. *Oxamide* $(CONH_2)_2$, is best prepared by the action of ammonia on the esters of oxalic acid. It is also obtained by the action of hydrogen peroxide on hydrocyanic acid, or of manganese dioxide and sulphuric acid on potassium cyanide. It is a white crystalline powder which is almost insoluble in cold water. It melts at 417–419° C (with decomposition) when heated in a sealed tube (A. Michael, 1895). When heated with phosphorus pentoxide it yields cyanogen. It is readily hydrolysed by hot solutions of the caustic alkalis. Substituted oxamides are produced by the action of primary amines on ethyl oxalate.

OXALIS, in botany, a large genus of small herbaceous plants, comprising, with a few small allied genera, the family Oxalidaceae. The name is derived from Gr. ὄξυς, acid, the plants being highly acid to the taste. It contains about 300 species, chiefly South African and tropical and South American. It is represented in Great Britain and eastern North America by the wood-sorrel (*O. Acetosella*), a small, stemless plant with radical, trefoil-like leaves growing from a creeping, scaly rootstock, and the flowers borne singly on an axillary stalk; the flowers are regular with five sepals, five obovate, white, purple-veined, free petals, ten stamens and a central five-lobed, five-celled ovary with five free styles. The fruit is a capsule, splitting by valves; the seeds have a fleshy coat, which curls back elastically, ejecting the true seed. The leaves, as in the other species of the genus, show a "sleep-movement," becoming pendulous at night.

Besides the wood-sorrel, some 20 other species occur in North America, among which are the yellow wood-sorrel (*O. stricta*), of the eastern United States and Canada, with yellow flowers; the violet wood-sorrel (*O. violacea*), of the eastern United States,



WOOD SORREL (OXALIS ACETOSELLA)

with rose-purple flowers; the redwood wood-sorrel (*O. oregana*), of the coast redwood belt from California to Oregon with pink to white flowers and *O. cernua*, known as Bermuda buttercups, with showy yellow flowers, native to South Africa and naturalized in Florida and the Bermudas.

Oxalis crenata, the oca of South America, is a tuberous-rooted half-hardy perennial, native of Peru. Its tubers are comparatively small, and somewhat acid; but if they be exposed in the sun from six to ten days they become sweet and floury.

Oxalis Deppei, a bulbous perennial of Mexico, has scaly bulbs, from which are produced fleshy, tapering, white, semi-transparent, edible roots, about 4 in. in length and 3 to 4 in. in diameter.

Various species are in cultivation as basket plants for window gardens, border plants and hot house ornamentals.

OXENSTJERNA, COUNT AXEL GUSTAFSSON (1583–1654), chancellor of Sweden, was born at Fönö, and was educated with his brothers at the universities of Rostock, Jena and Wittenberg. On returning home in 1603 he was appointed *kammerjunker* to King Charles IX. In 1606 he was entrusted with his first diplomatic mission, to Mecklenburg, was appointed a senator during his absence, and henceforth became one of the king's most trusted servants. In 1610 he was sent to Copenhagen to prevent a war with Denmark. This unsuccessful embassy marks the beginning of Oxenstjerna's long diplomatic struggle with Sweden's traditional rival in the north. Oxenstjerna was appointed a member of Gustavus Adolphus's council of regency. High aristocrat as he was, he would at first willingly have limited the royal power. An oligarchy guiding a limited monarchy was his ideal government, but the genius of the young king was not to be fettered. On Jan. 6, 1612, he was appointed chancellor. His controlling, organizing hand was speedily felt in every branch of the administration. For his services as first Swedish plenipotentiary at the Peace of Knäred, 1613, he was richly rewarded.

During the frequent absences of Gustavus in Livonia and Finland (1614–1616) Oxenstjerna acted as his vice-regent. It was his principal duty during the king's Russian and Polish wars to supply the armies and the fleets with everything necessary, including men and money. In 1622 he accompanied Gustavus to Livonia, where Oxenstjerna was appointed governor-general and commandant of Riga. His services in Livonia were rewarded with four castles and the whole bishopric of Wenden. He was entrusted with the peace negotiations which led to the truce with Poland in 1623, and succeeded, by skilful diplomacy, in averting a threatened rupture with Denmark in 1624. On Oct. 7, 1626, he was appointed governor-general of the newly-acquired Prussian province. In 1629 he concluded the truce of Altmark with Poland. In 1628 he had arranged with Denmark a joint occupation of Stralsund, to prevent the fortress from falling into the hands of the Imperialists. After the battle of Breitenfeld (Sept. 7, 1631) he was summoned to assist the king with his counsels and co-operation in Germany. During the king's absence in Franconia and Bavaria in 1632 he was appointed *legatus* in the Rhine lands, with plenipotentiary authority over all the German generals and princes in the Swedish service.

Although he never fought a battle, Oxenstjerna was a born strategist. His military capacity was strikingly demonstrated by the skill with which he conducted large reinforcements to Gustavus through the heart of Germany in the summer of 1632. But it was only after the death of the king at Lützen that Oxenstjerna's true greatness came to light. He inspired the despairing Protestants both in Germany and Sweden with fresh hopes. He reorganized the government both at home and abroad. He united the estates of the four upper circles into a fresh league against the common foe (1634), in spite of the envious and foolish opposition of Saxony. By the patent of Jan. 12, 1633, he had already been appointed legate plenipotentiary of Sweden in Germany with absolute control over all the territory already won by the Swedish arms. No Swedish subject, either before or after, ever held such an unrestricted and far-reaching authority. Richelieu himself declared that the Swedish chancellor was "an inexhaustible source of well-matured counsels."

Less original but more sagacious than the king, he had a firmer grasp of the realities of the situation. Gustavus would not only have aggrandized Sweden, he would have transformed the German empire. Oxenstjerna wisely abandoned these vaulting ambitions. All his efforts were directed towards procuring for the Swedish crown adequate compensation for its sacrifices. Simple to austerity in his own tastes, he nevertheless recognized the political necessity of impressing his allies and confederates by an almost regal show of dignity; and at the abortive congress of Frankfort-on-Main (March 1634), held for the purpose of uniting all the German Protestants, Oxenstjerna appeared in a carriage drawn

by six horses, with German princes attending him on foot. But from first to last his policy suffered from the slenderness of Sweden's material resources, a cardinal defect which all his craft and tact could not altogether conceal from the vigilance of her enemies. The success of his system postulated an uninterrupted series of triumphs, whereas a single reverse was likely to be fatal to it. Thus the frightful disaster of Nördlingen (Sept. 6th, 1634; *see* SWEDEN: *History*) compelled him to solicit direct assistance from France. But he refused at the conference of Compiègne (1635) to bind his hands in the future for the sake of some slight present relief. In 1636, however, he concluded a fresh subsidy-treaty with France at Wismar.

The same year he returned to Sweden and took his seat in the Regency. For the next nine years his voice, especially as regarded foreign affairs, was omnipotent in the council of state. He drew up beforehand the plan of the Danish War of 1643–1645, so brilliantly executed by Lennart Torstensson, and saw Denmark crippled by the Peace of Brömsebro (1645). His later years were embittered by the jealousy of the young Queen Christina, who thwarted the old statesman in every direction. He always attributed the exiguity of Sweden's gains by the Peace of Osnabrück to Christina's undue interference. Oxenstjerna was opposed at first to the abdication of Christina, because he feared mischief to Sweden from her appointed successor, Charles Gustavus. The extraordinary consideration shown to him by the new king ultimately, however, reconciled him to the change. He died at Stockholm on Aug. 28, 1654.

See *Axel Oxenstjernas skrifter och brefvexling* (Stockholm, 1888–1905); A. de Marny, *Oxenstjerna et Richelieu à Compiègne* (Paris, 1878); F. V. Wrangel, *Voyage en France d'Oxenstierna* (1917); *Gabriel Gustafssons bref till Riks Konsler Axel Oxenstjerna, 1611–1640* (Stockholm, 1890).

OXENSTJERNA, COUNT BENGT OR **BENEDICT GABRIELSSON** (1623–1702) was the son of Axel Oxenstjerna's half-brother, Gabriel Bengtsson (1586–1656). After a careful education he began his diplomatic career at the great peace congress of Osnabrück. During his stay in Germany he made the acquaintance of the count palatine, Charles Gustavus, afterwards Charles X., whose confidence he completely won. Two years after the king's accession (1654), Oxenstjerna was sent to represent Sweden at the *Kreistag* of Lower Saxony In 1655 he accompanied Charles to Poland and was made governor of the conquered provinces of Kulm, Kujavia, Masovia and Great Poland. The firmness and humanity which he displayed in this new capacity induced the German portion of them, notably the city of Thorn, to side with the Swedes against the Poles. During Charles's absence in Denmark (1657), Oxenstjerna, in the most desperate circumstances, tenaciously defended Thorn for ten months; the terms of capitulation were made the basis of the subsequent peace negotiations at Oliva. During the domination of Magnus de la Gardie he played but a subordinate part in affairs. From 1662 to 1666 he was governor-general of Livonia. In 1674 he was sent to Vienna to try and prevent the threatened outbreak of war between France and the empire, and he was one of the Swedish envoys to the Congress of Nijmwegen (1676). From 1680 to 1697 he conducted the foreign relations of Sweden.

His leading political principles were friendship with the maritime powers (Great Britain and Holland) and the emperor, and a close anti-Danish alliance with the house of Holstein. Charles XI. appointed Oxenstjerna one of the regents during the minority of Charles XII. The martial proclivities of the new king filled the prudent old chancellor with alarm and anxiety. He advised Charles in vain to accept the terms of peace offered by the first anti-Swedish coalition. Oxenstjerna has been described as "a shrewd and subtle little man, of gentle disposition, but remarkable for his firmness and tenacity of character."

See F. F. Carlson, *Sveriges historia under Konungarne of Pfalziska huset* (Stockholm, 1883, 1885); O. Sjögren, *Karl den elfte och Svenska folket* (Stockholm, 1897); and *Négociations du comte d'Avaux pendant les années 1693, 1697–1698* (Utrecht, 1882, etc.). (R. N. B.; X.)

OXFORD, EARLS OF, an English title held successively by the families of Vere and Harley. The three most important earls of the Vere line are noticed separately below. The Veres held the earldom from 1142 until March 1703, when it became extinct on the death of Aubrey de Vere, the 20th earl. In 1711 the English statesman Robert Harley was created earl of Oxford (*q.v.*); but the title became extinct in this family on the death of the 6th earl in 1853. It was revived in favour of H. H. Asquith who became earl of Oxford and Asquith (*q.v.*).

OXFORD, EDWARD DE VERE, 17TH EARL (in the Vere line) OF (1550–1604), son of John de Vere, the 16th earl, was born on April 12, 1550. He studied at Queen's and St. John's Colleges, Cambridge. He was known as Lord Bolebec or Bulbeck until he succeeded in 1562 to the earldom and to the hereditary dignity of great chamberlain of England. As a royal ward the boy lived under the care of Lord Burghley, who in 1571 gave him his eldest daughter, Anne, in marriage. Oxford wished for a military or a naval command, but Burghley hoped that he would win a high position at court. His accomplishments secured Elizabeth's favour, but he offended her by going to Flanders without her consent in 1574, and more seriously in 1582 by a duel with one of her gentlemen, Thomas Knyvet. In 1579 he insulted Sir Philip Sidney on the tennis-court at Whitehall.

Sidney challenged Oxford, but the queen forbade him to fight, and required him to apologize on the ground of their difference of rank. On Sidney's refusal and consequent disgrace Oxford is said to have schemed to murder him. The earl sat on the special commission (1586) for the trial of Mary queen of Scots; he took part in the trials of Philip Howard, earl of Arundel, for high treason in 1589, and of Essex and Southampton in 1601. In 1575 he brought back from Italy various inventions for the toilet, and his estate was rapidly dissipated in satisfying his extravagant whims. His first wife died in 1588, and from that time Burghley withdrew his support, Oxford being reduced to the necessity of seeking help among the poor men of letters whom he had befriended. He was a lyric poet of no small merit. His fortunes were partially retrieved on his second marriage with Elizabeth Trentham, by whom he had a son, Henry de Vere, 18th earl of Oxford (1593–1625). He died at Newington, near London, on June 24, 1604.

His poems, from various anthologies—the *Paradise of Dainty Devices, England's Parnassus, Phoenix Nest, England's Helicon*—and elsewhere, were collected by Dr. A. B. Grosart in vol. iv of the Fuller Worthies Library (1876).

OXFORD, JOHN DE VERE, 13TH EARL OF (1443–1513), was second son of John, the 12th earl, a prominent Lancastrian, who, with his eldest son Aubrey de Vere, was executed in February 1462. John de Vere the younger was himself attainted, but two years later was restored as 13th earl. But his loyalty was suspected, and for a short time in 1468 he was in the Tower. He sided with Warwick, the king-maker, in 1469, accompanied him in his exile next year, and assisted in the Lancastrian restoration of 1470–1471. As constable he tried John Tiptoft, earl of Worcester, who had condemned his father nine years before. At the battle of Barnet, Oxford was victorious in command of the Lancastrian right, but was ultimately defeated and escaped to France. In 1473 he organized a Lancastrian expedition, which, after an attempted landing in Essex, seized St. Michael's Mount in Cornwall. After a four months' siege Oxford was forced to surrender in Feb. 1474. He was sent to Hammes near Calais, whence, ten years later, in Aug. 1484, he escaped and joined Henry Tudor in Brittany. He fought for Henry at Bosworth, and was rewarded by restoration to his title, estates and hereditary office of Lord Chamberlain. At Stoke on June 16, 1486, he led the van of the royal army. In 1492 he commanded the expedition to Flanders, and in 1497 was foremost in the defeat of the Cornish rebels on Blackheath. Oxford was high steward at the trial of the earl of Warwick, and one of the commissioners for the trial of Sir James Tyrell and others in May 1502. He died March 10, 1513.

See *The Paston Letters*, ed. J. Gairdner; *Chronicles of London*, ed. C. L. Kingsford (1905); Sir James Ramsay, *Lancaster and York;* and *The Political History of England*, vols. iv. and v. (1906).

OXFORD, ROBERT DE VERE, 9th Earl of (1362–1392), English courtier, was the only son of Thomas de Vere, 8th earl of Oxford, and Maud de Ufford, a descendant of King Henry III. He became 9th earl of Oxford in 1371, and married Philippa (d.

1412), daughter of his guardian Ingelram de Couci, earl of Bedford, a son-in-law of Edward III. Already hereditary great chamberlain of England, Oxford was made under Richard II. a member of the privy council and a Knight of the Garter; while castles and lands were bestowed upon him, and he was constantly in the company of the young king. In 1385 Richard sent him to govern Ireland, but although preparations were made for his journey he did not leave England. The king's partiality for Oxford was one of the causes of the dissatisfaction of the barons. Oxford also made powerful enemies by divorcing his wife, Philippa, and by marrying a Bohemian lady.

The king, however, indifferent to the gathering storm, created Vere duke of Ireland in Oct. 1386, and gave him still more powers in that country. Richard was deprived of his authority for a short time, and Vere was ordered in vain to proceed to Ireland. He was then accused by the king's uncle Thomas of Woodstock, duke of Gloucester, and his supporters in 1387; and rushing into the north of England he gathered an army to defend his royal master and himself. At Radcot bridge in Oxfordshire, however, his men fled before Gloucester's troops and Oxford himself escaped in disguise to the Netherlands. In the parliament of 1388 he was found guilty of treason and condemned to death, but as he remained abroad the sentence was never carried out. With another exile, Michael de la Pole, duke of Suffolk, he lived in Paris until after the treaty between England and France in 1389, when he took refuge at Louvain. He was killed by a boar whilst hunting, and left no children.

See T. Walsingham, *Historia Anglicana*, edited by H. T. Riley (London, 1863–64); J. Froissart, *Chroniques*, edited by S. Luce and G. Raynaud (Paris, 1869–97); H. Wallon, *Richard II.* (Paris, 1864); and W. Stubbs, *Constitutional History*, vol. ii. (Oxford, 1896).

OXFORD, ROBERT HARLEY, 1ST EARL OF (1661–1724), English statesman, commonly known by his surname of HARLEY, eldest son of Sir Edward Harley (1624–1700), a Herefordshire land-owner, was born in Bow street, London, on Dec. 5, 1661. His school days were passed at Shilton, near Burford, in Oxfordshire, in a small school which produced at the same time a lord high treasurer (Harley), a lord high chancellor (Simon Harcourt) and a lord chief justice of the common pleas (Thomas Trevor). The principles of Whiggism and Nonconformity were instilled into his mind at an early age, and if he changed the politics of his ancestors he never formally abandoned their religious opinions. At the Revolution of 1688 Sir Edward and his son raised a troop of horse in support of the cause of William III., and took possession of the city of Worcester in his interest. Young Harley then (1689) entered parliament for the "pocket" borough of Tregony. Later he sat for New Radnor, a seat which he held until his elevation to the peerage in 1711.

From the first Harley gave great attention to the conduct of public business, and from the general election of Feb. 1701 until the dissolution of 1705 he held the office of speaker. In 1704 he became a principal secretary of State for the northern department. In 1703 Harley first made use of Defoe's talents as a political writer, and this alliance with the press proved so successful that he afterwards called the genius of Swift to his aid in many pamphlets against his political opponents. While he was secretary of State the union with Scotland was effected. At the time of his appointment as secretary of State Harley had given no outward sign of dissatisfaction with the Whigs, and it was mainly through Marlborough's good opinion of his abilities that he was admitted to the ministry. For some time Harley acted loyally with his colleagues. But in the summer of 1707 it became evident to Godolphin that some secret influence behind the throne was shaking the confidence of the queen in her ministers. Abigail Hill, who was secure in the queen's confidence, was Harley's cousin, and his instrument in influencing the queen against her ministers. These bided their time, until an opportunity for Harley's overthrow was provided. A clerk in Harley's department divulged the contents of secret documents in his office, which should have been inaccessible to anyone but the chief, and the queen was thereupon informed that Godolphin and Marlborough could no longer serve in concert with him. They did not attend her next council (Feb. 8, 1708), and the queen found herself forced (Feb. 11) to accept the resignations of both Harley and St. John.

Harley went out of office, but his cousin, who had now become Mrs. Masham, remained at court to further his interests. The cost of the protracted war with France, and the danger to the national church, the chief proof of which lay in the prosecution of Sacheverell, were the weapons which he used to influence the masses of the people. Marlborough himself could not be dispensed with, but his relations were dismissed from their posts in turn. When the greatest of these, Lord Godolphin, was ejected from office, five commissioners to the treasury were appointed (Aug. 10, 1710), and among them figured Harley as chancellor of the exchequer. It was the aim of the new chancellor to frame an administration from the moderate members of both parties, and to adopt with but slight changes the policy of his predecessors; but he failed. By an unexpected event, his popularity was restored at a bound. A French refugee, the ex-abbé de la Bourlie (better known by the name of the marquis de Guiscard), was being examined before the privy council on a charge of treachery, when he stabbed Harley in the breast with a penknife (March 8, 1711). On May 23, 1711, the minister became Baron Harley of Wigmore and earl of Oxford and Mortimer; and immediately afterwards lord treasurer and a Knight of the Garter.

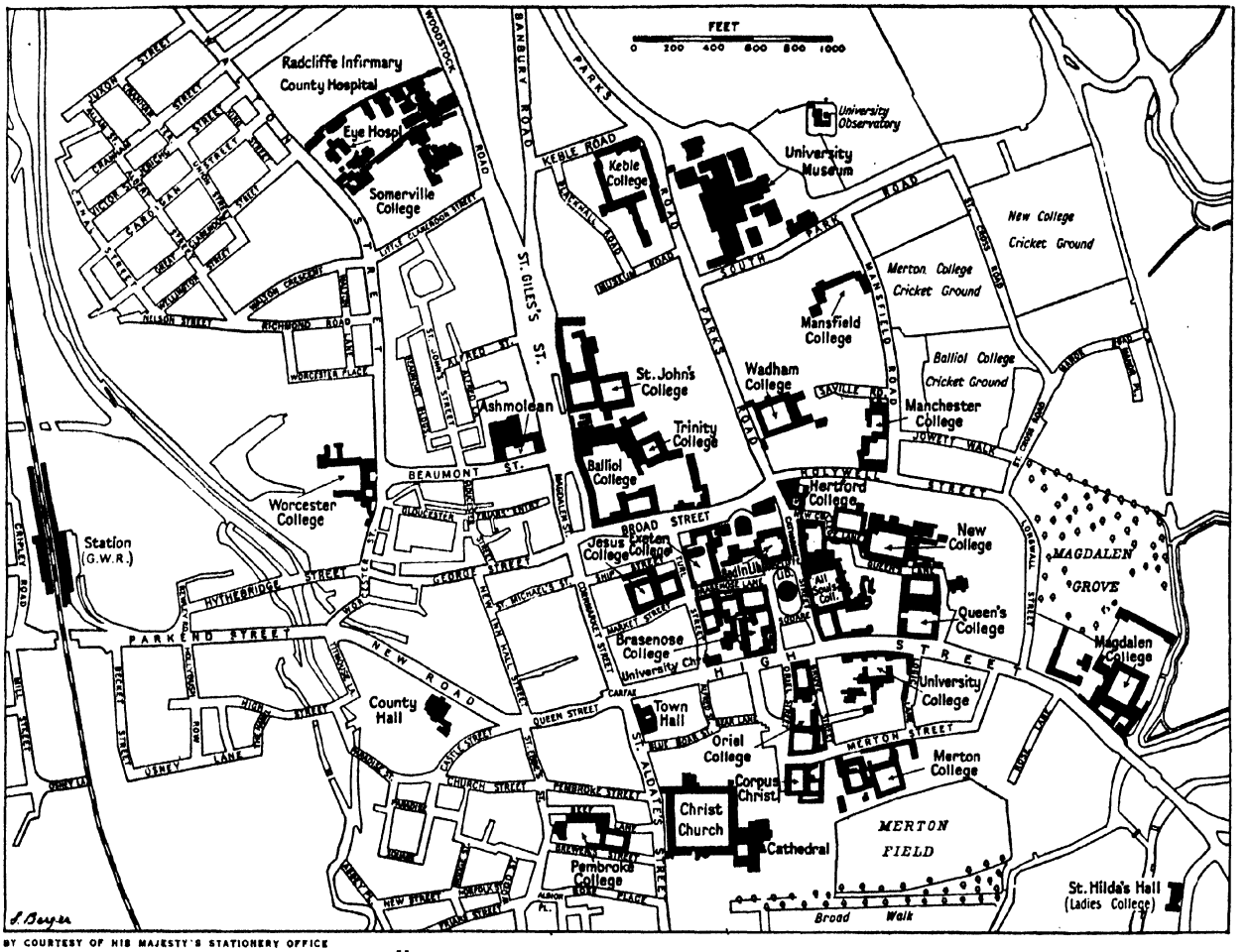
Oxford rearranged the nation's finances, and supplied resources for carrying on the campaign, though his emissaries were in communication with the French king, and were settling the terms of a peace independently of England's allies. After many weeks of vacillation and intrigue, the preliminary peace was signed, and in spite of the opposition of the Whig majority in the Upper House, which was met by the creation of 12 new peers, the treaty of Utrecht was concluded (March 31, 1713). While these negotiations were under discussion the friendship between Oxford and St. John, who had become secretary of State in Sept. 1710, was fast changing into hatred. The latter had resented the rise in fortune which the stabs of Guiscard had secured for his colleague, and when he received a viscounty instead of the expected earldom his resentment knew no bounds. Mrs. Masham deserted her cousin for his more vivacious rival. The Jacobites lost faith in his repeated promises. Queen Anne transferred her confidence from Oxford to Bolingbroke; and he surrendered his office a few days before the queen died.

On the accession of George I. the defeated minister retired to Herefordshire, but a few months later he was committed to the Tower (July 16, 1715). After an imprisonment of nearly two years he was released in July 1717, but he took little part in public affairs, and died almost unnoticed in London on May 21, 1724.

The books and the manuscripts which the first earl of Oxford and his son collected were among the glories of their age. The manuscripts became the property of the nation in 1753 and are now in the British Museum; the books were sold to a bookseller called Thomas Osborne in 1742 and described in a printed catalogue of five volumes (1743–45), Dr. Johnson writing an account of the library. A selection of the rarer pamphlets and tracts, which was made by William Oldys, was printed in eight volumes (1744–46), with a preface by Johnson. The best edition is that of Thomas Park, ten volumes (1808–13). In the recollection of the Harleian manuscripts, the Harleian library and the *Harleian Miscellany*, the family name will never die.

BIBLIOGRAPHY.—The best life of Harley is by E. S. Roscoe (1902). Articles relating to him are in *Engl. Hist. Rev* xv. 238–250 (Defoe and Harley by Thomas Bateson); *Trans. of the Royal Hist. Soc.* xiv. N.S. 69–121 (development of political parties *temp.* Q. Anne by W. Frewen Lord); *Edinburgh Review*, clxxxvii. 151–178, cxciii. 457–488 (Harley papers). For his relations with St. John *see* Walter Sichel, *Bolingbroke* (1901–02, 2 vols.); for those with Swift, consult the *Journal to Stella* and Sir H. Craik, *Life of Swift* (2nd ed., 1894).

OXFORD, the county town of Oxfordshire, England, a municipal and parliamentary borough, cathedral city, and seat of an ancient university, lies on the river Thames, 51 m. by road and 63¾ m. by rail W.N.W. of London (G.W. railway); main railways also to Worcester and Birmingham (G.W. railway); direct service also via Banbury to Leicester and Sheffield (L.N.E. railway), branch line L.M.S. to Cambridge crossing main line at



BY COURTESY OF HIS MAJESTY'S STATIONERY OFFICE

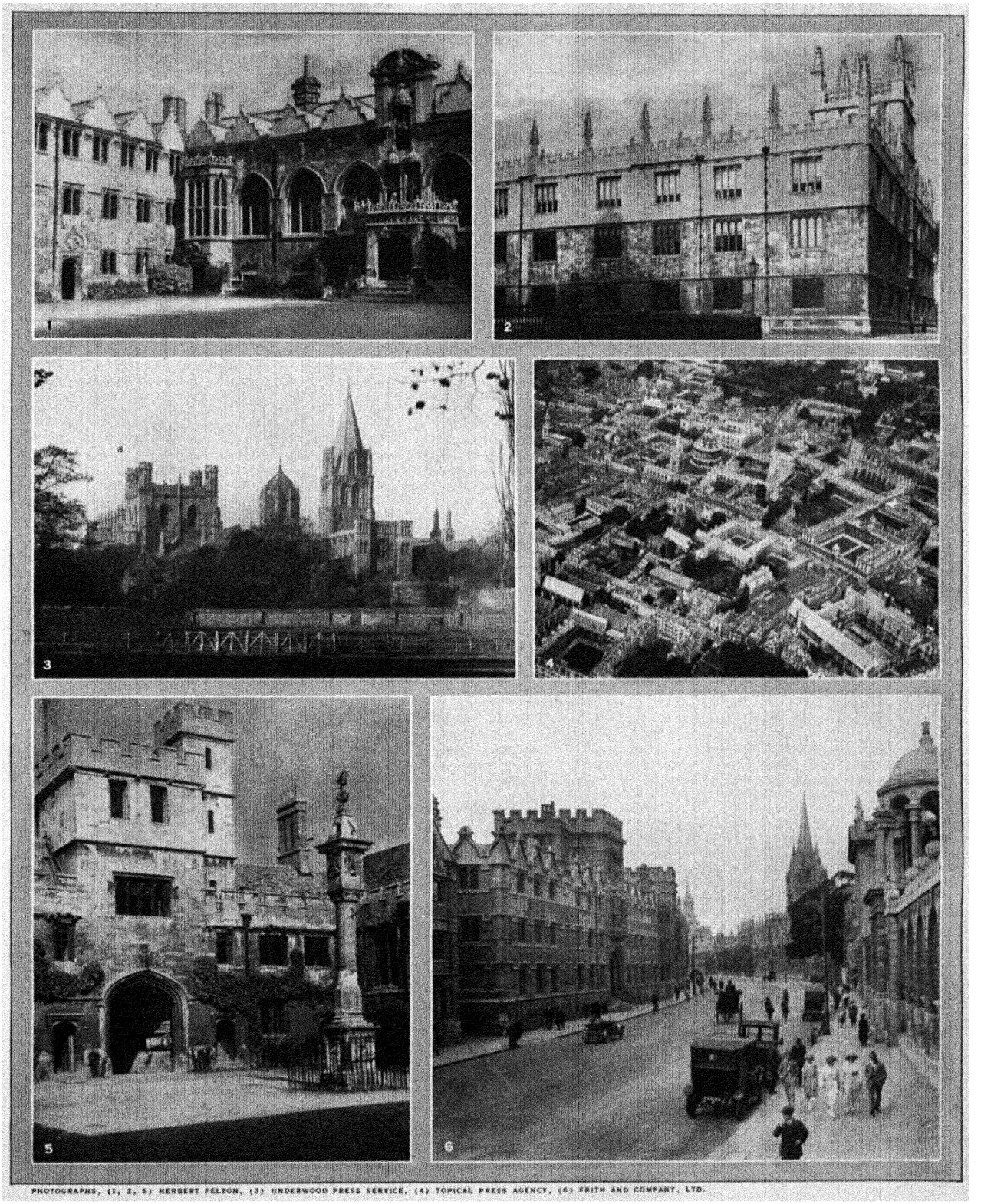
MAP OF OXFORD, SHOWING THE PRINCIPAL COLLEGES

Bletchley. The Thames is navigable below Oxford; there is a canal to the Avon valley and Birmingham; and numerous local road motor services. Population (1921), 57,036.

The site of Oxford is a low gravel terrace between the upper Thames and its tributary, the Cherwell, which meet in wide water meadows within a gap in a line of oolitic plateaux represented by Headington hill on the East and the twin crests of Cumnor Hurst and Wytham on the west. Though there are sparse Romano-British habitations on both sides of the valley, the Roman road northwards from Dorchester to Alchester lies far back to the east, and only a few finds betray a track across the valley from Headington towards Binsey. Oxford itself only becomes perceptible in Saxon times, in the church of St. Martin (whose dedication and some rude masonry in the tower mark its early date) close to Carfax (Lat. *quadrifurcus*, French *carrefour*) the intersection, in the heart of the city, of north-south and east-west roads. Eastward the High street crosses the Cherwell by Magdalen bridge, and offers alternative routes to London via Headington or Littlemore; southwards St. Aldate's, formerly Fish street, crosses the Thames (Isis) at Folly bridge, for Abingdon and Newbury; northwards, by Cornmarket, are the roads to Banbury and Woodstock; westward, Queen street leads round the south side of the Norman castle to Quaking bridge, over the mediaeval mill stream towards Osney: the modern New road, north of the castle, leads direct to the railway stations and Seven Bridges road for the upper Thames, and south-west England. Early traces are: (1) the Priory (afterwards Augustinian), commemorating St. Frideswide, a local heroine whose good works and adventures, about 720–740, touch also Binsey and Abingdon; of her original church there are arches near her shrine in the cathedral; (2) the conspicuous mound raised (probably about A.D. 900) to command the passage from Mercia into Wessex; (3) Oseney village, beyond the nearest channel of the upper Thames, whose name (Ousen-eye: "water-island") explains the Oksnaforda and Orsnaforda of 10th century Saxon coins, whence *Oxenford* and *Oxford* arose by assimilation to names like Swinford and Shefford. Upstream, between Osney, Binsey and Wolvercote, the "Port Meadow" is still held in common by the freemen of Oxford.

Oxford just appears in history when Edward the Elder, in A.D. 912, "held Lundenbyrg (London) and Oxnaford and all the lands that were obedient thereto" as flanking fortresses of his Thames valley frontier. But the principal centres of the district were not here, but at Abingdon, commanding access to the Vale of White Horse, with an early and wealthy abbey, and Dorchester, similarly dominating the Thames valley, with its pre-Roman earthworks, and Saxon bishopric. River traffic bound for Oxford long paid toll to the abbott of Abingdon. However, several "gemots" were held at Oxford, under Edric, Canute, and Harold I.; and repeated devastation by the Danes (979, 1002, 1010, 1013) attests military and economic importance.

The Norman governor, Robert d'Oiloi (d'Oyly), incorporated the Saxon mound in a great fortress (1170–1219), of which one tower stands, and Bullock lane and St. Peter le Bailey mark the outworks; he built the Hythe bridge, which reveals the terminal wharfs of the river traffic; enclosed the town (partially "wasted" in Domesday) with walls of which foundations remain at the (north) Bocardo gate, the fine tower annexed to St. Michael's church. To d'Oiloi's time belong the rebuilding of St. Frideswide's (the present cathedral dates mainly from the fire of 1120), St. Ebbs' near Carfax, St. Peter's, in the east, probably outside the first



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OXFORD, FOUR OF ITS COLLEGES, AND A VIEW OF HIGH STREET

1. Oriel College, showing a corner of the quadrangle. 2. Bodleian library extending over upper storey of "Old Schools Building." 3. Christchurch from Merton Fields. "Tom Tower" built by Wren in centre, cathedral spire to right, hall and belfry to left. 4. General view of Oxford from the air. University Church (spire) Radcliffe Library (dome) and Bodleian Library surrounded by college quadrangles. 5. Corner of Quadrangle of Corpus Christi College, showing entrance and sundial. 6. High Street, Oxford. At the left, University College. At the right, Queen's College, All Souls College, University church, Brasenose College and All Saints church beyond

east wall, and Holywell by the Cherwell beyond. His son Robert founded the splendid Osney abbey, beyond the castle (fragments in the cemetery beyond the G.W. railway). Outside the city, also, north of the cattle market in Gloucester Green, Henry I. built his Beaumont palace overlooking Osney and Port Meadow, and under his "Beau-clerc" patronage Theobald of Etampes already, about 1120, was teaching "60 to 100 clerks." As residence of the empress queen Maud, Oxford suffered siege by Stephen.

While domestic business was conducted between the Corn Market and the High, within the walls, the wool fair and strangers' market, outside the north gate, had, about 1200, a church of St. Giles, its patron. Beyond it lay the leper house (later St. Giles' parsonage), and east of it other establishments mainly for strangers, the Scots college of John de Balliol, Durham college (afterwards Trinity), a Cistercian house (afterwards St. Bernard's, then St. John Baptist's college); and, when Beaumont palace was granted by Edward II. to the Carmelites, the Benedictines occupied the site they had left with the older "cottages" of Worcester college. Other Cistercians built Rewley abbey beyond Hythe bridge; Dominican and Franciscan houses in the poorer south-west quarter leave their names in Blackfriar street, Preacher's bridge and Friars wharf; and the Austin Canons of St. Frideswide acquired endowments for teaching and added the Latin chapel to their church. By the mid 13th century then mediaeval Oxford had taken permanent shape. The walls were reconstructed, and probably extended from an older line in Cat street, to include St. Peter's in the east, with an East gate spanning the High near the hotel of that name, between the splendid north-east stretch of wall conserved by New college, and the south-east angle around Merton.

But before this, in the old north-east angle, now occupied by the Bodleian and Radcliffe libraries, "School street" traversed a kind of "Latin quarter" frequented by wandering scholars, whose *universitas* or guild comes into history with the visit of Giraldus Cambrensis in 1185, and the nomination of a chancellor in 1214. (*See* OXFORD UNIVERSITY.) On the south frontage of this resort of scholars, St. Mary's church became their meeting hall and lecture room; its bell tower and spire, congregation house and library were built about 1320; a new nave and aisles replaced, in 1388, the old Faculty chapels; and the Renaissance porch marks Archbishop Laud's reconstitution of the university, and still dates "*in parviso*" the certificates of satisfactory "responsions" of novices to the "masters of the schools" who controlled their admittance. For the history of this university, and the several fortunes of its colleges, *see* below.

The 13th century was the great age of mediaeval Oxford. Several parliaments were held here, notably the "Mad Parliament" of 1256, with its "Provisions of Oxford." But the growth of the university, and the wealth and influence of its colleges, were unfavourable to normal development as a mediaeval borough, with its guilds of craftsmen and traders. The "liberties" of the university, in relation with the city, were defined by charter in 1248, and revised in favour of the "chancellor, masters and scholars" after the town-and-gown riots of St. Scholastica's day, 1354–55, and other occasions; in 1523 the university was even allowed to incorporate all kinds of tradesmen, exempting them from civic jurisdiction. These unusual but once necessary provisions were only revoked or became obsolete with the modern transformation of the university itself, which retains, however, magisterial authority over its students, a censorship of public entertainments, and direct representation on the City Council and Guardians.

The Renaissance and the Reformation affected Oxford mainly through academical controversies, the foundation of a fresh series of colleges, and the creation by Henry VIII. of a bishopric, with St. Frideswide's church as its cathedral, and a chapter, the dean and canons of Christ church, economized out of Wolsey's "Cardinal college." But in the Civil War, Oxford's strategical importance made it the Royalist headquarters. The king retired hither after defeats at Edgehill, Newbury and Naseby; Prince Rupert made hence his raids in 1643. Not till May 1644 was the king forced by the concerted advances of the earl of Essex and Sir W. Waller to evacuate this fortress, and after Cropredy bridge he re-occupied it. Only in May 1646, when all other strongholds were lost and Charles himself had escaped in disguise, was Oxford besieged by Fairfax and surrendered on June 24. The extent of the city at this time beyond the mediaeval wall is outlined by traces of the "Kings Mound," enclosing Holywell, Wadham college (1611) and St. Giles. Though the university was mainly Royalist, the citizens had been secretly Parliamentarian; on both sides were losses, and party feelings were disastrous; and though Cromwell himself was chancellor (1651–57), his successor, Gilbert Sheldon, had much work to restore efficiency; his monument is the Sheldonian theatre, for the business and ceremonies of the reconciled masters; the Clarendon press and the Ashmolean museum, Christ church library and Peckwater quadrangle, large additions to New college and Magdalen, and the total rebuilding of Queen's college, are academical counterpart to a general rebuilding of mediaeval and Tudor Oxford, in the next half century. Though Charles II. held a parliament here in 1681, the restored Stuarts temporarily alienated university loyalty, but in the 18th century the university became Jacobite, and the city strongly Hanoverian. This feud, however, was reconciled at the visit of George III. in 1785, and Oxford passed out of national politics. The city, however, grew but little, until the reform of the university in 1858 admitted "married dons," while restricting membership of congregation to residents within 1½ m. from Carfax. The obstinate opposition of the university to Brunel's project for a "great western" railway system radiating from Oxford; and the restrictive policy of St. John's college, which owned almost all land north of St. Giles', had already aggravated urban congestion. The modern Oxford which emerged includes: (1) northward, a compact residential area, not wholly academic, along the Banbury and Woodstock roads beyond St. Giles', Keble, the Museum and laboratories, and the university parks and college playing fields; (2) eastward, beyond Magdalen bridge, the diverging roads to Marston, Headington, Cowley and Iffley, already enclosed fan shaped suburbs mainly of small dwellings, when the establishment of the Morris motor works at Cowley introduced a new and strenuous element into Oxford's industrial life, hitherto almost confined to the Clarendon press and private printing firms, robe making and tailoring, and the distribution of local dainties, sausages, marmalade, and the like; (3) to west and south, "ribbon development" along the trunk roads has disfigured the water meadows without adding to health or convenience. The real suburban areas here lie beyond, around or upon the Boar's-hill-Cumnor-Wytham upland. The Oxford Preservation Trust, established almost too late in 1927, a town planning scheme, 1925, and a new Incorporation Act, 1928, are attempts to adjust to the strict and peculiar circumstances of the site and its past, the requirements of "post-war" Oxford, with its partially modernized university, its interminable "summer schools" and vacation-conferences, its growing industries, trade, and professional interests, and the perennial stream of tourists. (J. L. My.)

OXFORD, a village of Butler county, Ohio, U.S.A., 40 m. N.W. of Cincinnati, at an altitude of 1,000 ft.; on Federal highway 27 and the Baltimore and Ohio railroad. Pop. (1920) 2,146. It is an educational centre, the seat of Miami university (chartered 1809, opened 1824) with which Oxford College for Women (1830) was consolidated in 1928; and the Western College for Women (1855). The students and faculty of the educational institutions outnumber the resident population. The village was founded about 1800.

OXFORD, PROVISIONS OF, the articles constituting a preliminary scheme of reform enacted by a parliament which met at Oxford on June 11, 1258. King Henry III. had promised on May 2 that the state of his realm should be rectified and reformed by 24 counsellors who were to meet at Oxford for this purpose five weeks later. Twelve of these counsellors were chosen by the king, and 12 by the earls and barons. When the parliament met the 24 drew up a provisional scheme of reform, known as the Provisions of Oxford. By this it was arranged that a council of 15, chosen by four of the 24, should be appointed to advise the king in all matters. The new council was to meet three times a year in parliaments to which 12 commissioners

were to be summoned to discuss the affairs of the realm on behalf of the whole community. Another body of 24 was appointed to treat of an aid. Desiring to limit the power of the king and his household officers, the barons determined to revive the justiciarship, in abeyance since 1234. But they did not want over-powerful great officials. It was therefore decided that one or two justiciars should be appointed for one year who should be paid, but should be accountable at the end of the year. The chancellor and treasurer similarly had to account; the sheriffs, too, were appointed for one year only. Enquiries into abuses were begun and further reforms were to be reported on by Christmas. The king declared his adhesion to the Provisions on Oct. 18.

Disputes broke out in the baronial party. Simon de Montfort, earl of Leicester, supported by Edward, the king's son, demanded the logical extension of the reforms in local government to include the baronial franchises. The earl of Gloucester opposed this. Forced by Edward, a second series of Provisions, known as the Provisions of Westminster, was issued in Oct. 1259. The quarrels among the barons encouraged Henry to break free. On April 13, 1261, a papal bull absolved him from his oath to observe the Provisions. After three years on the verge of civil war, both parties agreed to refer the question to the arbitration of Louis IX. of France, who formally annulled them on Jan. 23, 1264, but expressly declared that his decision was not to invalidate the privileges, liberties and laudable customs of the realm of England, which had existed before the time of the provisions.

See the *Annales monastici*, vol. i. (Burton), Rolls series; *Foedera* (Record Commission edition); W. Stubbs, *Constitutional History* (1873), and *Select Charters* (1870, several later editions); Charles Bémont, *Simon de Montfort* (1884); T. F. Tout, *Chapters in the Administrative History of Mediaeval England* (1920); and E. F. Jacob, *Studies in the Period of Baronial Reform and Rebellion* (1925).

OXFORD AND ASQUITH, HERBERT HENRY ASQUITH, 1st Earl of (1852–1928), born at Morley, Yorks., on Sept. 12, 1852. His origins were Liberal, Nonconformist and middle class in character. Joseph Dixon Asquith, his father, owned a cloth manufacturing business in Morley, and his mother was the daughter of William Willans, a Huddersfield merchant. His father died while he, his brother (who afterwards became a master at Clifton), and his sister were children, and the two boys were left in the care of an uncle in London, where they went to the City of London school, then under the able headmastership of Dr. Abbott. Upon him the future prime minister made a deep impression, and to him Asquith in after life was accustomed to express a great debt of gratitude. He won a Balliol scholarship, and at Oxford he took a Craven university scholarship and firsts in "Mods" and "Greats," became president of the Union and a fellow of his college.

Adopting the bar as a profession, he first attracted public notice by his defence of Cunninghame Graham and John Burns for their part in the riot in Trafalgar square, but it was the Parnell Commission, in 1889, in which he acted as junior to Sir Charles Russell, that established his legal reputation, his deadly cross-examination of the manager of *The Times* giving the first indication of the dramatic issue of the trial. His success at the bar was assured, and in the next year he took silk, but the law was only a stepping-stone to the political career that from boyhood he had always had in view. He had entered parliament as member for East Fife in 1886, and on the formation of the Gladstone Government in 1892 he was appointed home secretary. He had just previously sustained a heavy domestic blow by the death of his wife, Helen, the daughter of a Manchester surgeon, whom he had married in 1877 and by whom he had four sons and one daughter. In office, Asquith's great parliamentary gifts were at once apparent, and his administration of the Home Office was made memorable by the appointment of the first women inspectors, improvements in the administration of the Factory Acts, the stiffening of the machinery, and the passing of the Employers' Liability bill, which was rejected by the Lords, and of a Factory bill which became law. He was bitterly and most unjustly attacked in connection with the shooting of two miners by soldiers who were called in to deal with a strike at the Featherstone colliery. He did not summon the soldiers, and appointed a commission immediately to enquire into the affair, but the legend that he was personally responsible pursued him, and for years his platform appearances were always greeted with cries of "Featherstone."

In 1894, while still at the Home Office, Asquith married a second time, his bride being the brilliant Miss Margaret ("Margot") Tennant, one of the daughters of the wealthy iron-master, Sir Charles Tennant. She was a prominent member of the most exclusive society circle, and the marriage very definitely changed the current of Asquith's social life, and in some measure affected his political relationships. The period was one of great disruption within the Liberal Party. The feud between the Rosebery and Harcourt groups was at its height, and after the fall of the Liberal Government in 1895, the conflict with the Boer republics divided the party into two hostile camps, the Liberal Imperialists, led by Lord Rosebery, and the pro-Boers led by Campbell-Bannerman. Asquith, who had returned to the bar, associated himself with the Rosebery group, which endorsed the Chamberlain policy. In this he was influenced, no doubt, by his confidence in Sir Alfred Milner, who had been his friend from his Balliol days, and who had become the instrument of British policy in South Africa. When the Boer controversy culminated in war, it seemed that the quarrel between the Roseberyite and Campbell-Bannerman factions must result in permanent separation, and the formation of the Liberal League, of which Lord Rosebery was president and Asquith vice-president, apparently put reconciliation out of the question.

From this catastrophe the Liberal Party was saved by the raising of the Tariff Reform issue. On this subject Lord Rosebery spoke with an equivocal voice, but Asquith at once became the most formidable protagonist of Free Trade. The discussion of the subject became largely a duel between him and Chamberlain, and the series of speeches he delivered throughout the country were among the most conspicuous triumphs of his career. It restored him to the full confidence of the party, and when Campbell-Bannerman formed his Government at the end of 1905 his appointment as chancellor of the exchequer was a matter of course. The moderation of his temper, and the entirely public-spirited motives that always inspired him contributed to the return of harmony within the party, and his achievements as chancellor established his claim to the succession to the premiership. His record at the Treasury, culminating in his final budget, which inaugurated old age pensions, give him a place among the most illustrious chancellors in history. On the resignation of Campbell-Bannerman, through illness, in 1908, Asquith became prime minister by universal consent, with Lloyd George as chancellor of the exchequer. No prime minister since Pitt had been called upon to face such grave issues as those which confronted Asquith at the beginning and developed as his long term of office—the longest of any prime minister since Lord Liverpool—advanced. A new mood of revolt filled the labour world with unrest and menace, the long struggle for the enfranchisement of women had passed out of the academic phase into a phase of unprecedented and almost fantastic violence, the sky over Europe was visibly darkening with the naval activity of Germany, and over and above all two capital issues reached a crisis—the issue of the House of Lords and the issue of Ireland. It was the first of these two questions that first tested the stuff of which the new prime minister was made. The budget of 1909, which dealt with the taxation of land, was rejected by the House of Lords. Asquith appealed to the country against its rejection in Jan. 1910, and his Government was reinstated, though only with the support of Labour and the Irish members. He addressed himself forthwith to the question of the abolition of the veto of the House of Lords, and during the summer made efforts to reach a pacific solution of the question by compromise. But the conference with the Opposition leaders broke down, and in the following December he appealed once more to the country and was once more returned —this time with a majority over the opposition of 126.

The opening of the session of 1911 may be taken as the crowning moment in Asquith's public career. The issue of the constitutional struggle with the Lords was not yet decided, but it was

no longer in doubt. The decisive mandate which the country had given in December dictated the issue that immediately occupied the new parliament. A bill abolishing the veto of the House of Lords was introduced into the House of Commons and passed all its stages by the beginning of the summer. But the final struggle had yet to come. The battle had still to be won in the Lords and there the opposition were entrenched in overwhelming power. Ever since the emergence of the issue it had been evident that the attainment of Asquith's goal depended on whether he could in the last resort invoke the authority of the Crown to dilute the House of Lords with new peers sufficient to change its complexion. The question was answered on July 20. The Parliament Bill, then in the House of Lords undergoing its second reading, was so amended as to deprive it of any utility for the purpose for which it was framed. Asquith therefore addressed to Balfour, the leader of the Opposition, a letter stating that the Government had decided, if the bill in its essential form could be passed in no other way, the Crown would be advised to create a sufficient number of peers to ensure its passage, and that the Crown had signified its willingness to accept such advice. The publication of this letter aroused an unprecedented storm, and on July 24, on rising in the House of Commons to make a statement, Asquith was greeted with a demonstration without parallel in living memory. For the best part of an hour he stood speechless before the roar of anger that issued from the Opposition benches, and at last resumed his seat without having uttered a continuous sentence. What became known as "the pothouse brawl" inaugurated the last stage of the struggle. The Government was accused of "dragging in the King," and the Opposition organized an uncompromising resistance in the belief that they would not dare to carry their threat into execution. But on Aug. 10, when the final debate was taking place in the House of Lords, Lord Morley confirmed the Government's previous intimation of His Majesty's intention. Up to this point the "Die-Hards" seemed to be assured of a majority, but in the division they were defeated. The bill was passed. On Aug. 18 the Parliament Act received the Royal Assent.

From this victory Asquith proceeded to his next great task, with the ground sensibly cleared for action. Gladstone's successive Home Rule adventures had broken on the rock of the Lords' veto; that rock no longer obstructed the channel. But before the Irish issue was fully launched another controversy absorbed the prime minister's activities. Discontent had long been growing prevalent in the mining industry, and at the end of Feb. 1912, having failed to secure the concessions and advances they demanded, the miners' union declared a strike. Vast dislocation followed. From the outset the Government endeavoured to bring the conflicting parties to agreement and Asquith took on himself the personal charge of the negotiations. After a month's fruitless efforts, the Government thereupon introduced the Miners' Minimum Wage Bill, which, by providing a half-way solution, forced the hands of both sides and brought the immediate struggle to an end, although the issue incidentally raised—that of the reorganization and control of the coal industry—was to perplex parliament and the country for many years to come.

Meanwhile, the Home Rule Bill had been introduced and passed through the House of Commons, while the Parliament Act provided adequately against the resistance of the House of Lords. That House fought the delaying action, which was all the Opposition now had in its power, by rejecting the bill in two successive sessions. After its next passage through the Commons it would have overridden opposition and automatically become law. By this time, however, the opposition to the measure had taken an extra-parliamentary shape. The Ulster Covenant had been promulgated in the previous September and talk of open rebellion, should Home Rule be passed, was already current. In June arms had been discovered both at Belfast and Dublin. As the year wore on the outlook became still more serious and a speech by Bonar Law, the leader of the Conservative Party, at Blenheim, seemed to give encouragement to the idea of resistance by force. On Sept. 25 the Ulster Unionist Council appointed a Provisional Government and prominent Conservatives openly preached armed resistance; Sir Edward Carson, the leader of the Ulster Unionists, left no doubt that in the last resort Ulster would fight.

With the close of the session of 1913 there came a brief lull, and during the recess conversations with the Opposition leaders were opened by Asquith, who throughout preserved an attitude of patience and forbearance. It will always be matter for controversy whether, when the policy of violent resistance had been adopted, he was justified in ignoring so direct a challenge to constitutional government. His natural disposition was to allow the utmost scope for the play of discussion and the influence of the time element; but it is an open secret that he would have taken up the challenge but for the persuasions of John Redmond, the leader of the Irish Nationalists, who believed that the prosecution of the Ulster leaders would prejudice the prospects of friendly relations with Ulster when Home Rule was actually on the statute book. In any case, the conversations of the autumn were futile, and on March 9, 1914, the Government announced the provisions of their amending bill, their last word of compromise. The chief provision of this bill was that any county in the north of Ireland was to be allowed to vote itself out of the operation of Home Rule for a period of five years.

The offer was rejected by the Opposition and now events rushed forward to an apparently unavoidable catastrophe. On the night of April 24–25, 55,000 rifles were landed at Larne from a German port for the use of the Ulster army. On the other side of the border the Nationalists were beginning to enrol a volunteer army and to make counter-preparations. Meanwhile a more sinister menace appeared. In the debate on the vote of censure on the Government on March 19 Bonar Law, speaking on the Home Rule issue, had used the ominous phrase "soldiers are citizens like the rest of us." There had been much talk of disaffection in the army in regard to the coercion of Ulster, and on March 20 it took shape in the Curragh incident (*see* IRELAND; IRELAND, NORTHERN), which led to the resignation of Col. Seely, the secretary for war. For a moment it seemed that the loyalty of the army was imperilled and the situation that confronted the Government looked desperate. But the announcement by Asquith next day that he would assume the secretaryship for war created a profound impression in parliament and stopped for the time being, at all events, what had seemed like a riot in the army. Following the mutilation of the amending bill by the House of Lords and Sir Edward Carson's challenge to the Government to "give us a clean cut or come and fight us," the king, on Asquith's advice, summoned a conference at Buckingham Palace on July 20 to see if some agreement was still not possible. It broke down four days later and the last hope of avoiding violence seemed gone.

What Asquith would have done to avert a civil war while maintaining the authority of the Constitution was not to be revealed, for on the day that the Buckingham Palace Conference broke up Austria sent her ultimatum, and within ten days the British army was embarking, not for Ulster, but for Flanders. In the feverish struggle within the Cabinet that preceded the entry of Great Britain into the World War Asquith's position was never in doubt. He had throughout been a party to the ambiguous military understandings and conversations which had been in progress with France since before the fall of the Balfour Government in 1905, and when the war came he did not waver in his conviction that both the duty and the interest of the country lay in throwing the country's whole weight into the scales against what he considered to be the calculated design of the Central Powers to establish a military despotism over Europe.

The invasion of Belgium by Germany saved his Government from disruption, and he addressed himself, free from domestic disquietudes, to the heaviest task ever imposed on a British prime minister. For the moment even the Irish trouble subsided, all political differences were shelved and Asquith became the voice of a united nation in a measure unequalled in modern Parliamentary history. The speeches he delivered in the early days of the war have taken their place beside the classic orations of Pitt during the Napoleonic wars, and his constancy of mind and freedom from all personal ambition played a dominating part during the next two years in laying the foundations of the ultimate victory. It was not to be expected that in the presence of so vast a con-

vulsion discontents would not develop. They became clamant as the true character of the struggle emerged. Asquith had made no change in the political constitution of his cabinet at the outbreak of war, although he had taken the leaders of the Opposition into his confidence and private counsels, but by the spring of 1915 it became clear that this informal relation would have to yield to a formal coalition.

In February Bonar Law and Lord Lansdowne intimated that they could accept no responsibility for the way in which the war was being conducted, and in the popular press a powerful and ceaseless agitation arose, directed mainly against Asquith, Grey and Haldane, and inspired by the inevitable shortage of munitions which the progress of the war had revealed. Coincidentally, a violent disagreement as to the employment of the navy in the Gallipoli adventure had arisen between Churchill, the first lord of the Admiralty, and Fisher, the first sea lord, and on May 26 Asquith reformed his cabinet on a coalition basis, bringing in the leaders of the Opposition and excluding Haldane. To meet the growing need for munitions, a special Ministry of Munitions was set up with Lloyd George at its head.

The reconstruction of the Ministry did not allay dissatisfaction. Within the cabinet friction developed, and, outside, the press agitation grew in violence. There was a persistent leakage of cabinet secrets, certain newspapers betraying a knowledge of most confidential Government business with such regularity as to suggest inspiration. A phrase, "Wait and See," which Asquith had used in reply to a question in the House of Commons years before, became the daily gibe of the malcontent press, and Sir Edward Grey, then in the midst of the most delicate situation with the United States, was accused of "feeding Germany" because of his attitude on the subject of contraband from America. The war-weariness that had overtaken the country provided an atmosphere in which this propaganda of discontent flourished, and the prime minister was the easier target for attack because he neither "squared" the press nor hit back at his critics. The inevitable rupture came in the autumn of 1916, when the German raid into Rumania—now seen in its true proportions—served to drive home the attack, and when Asquith was severely stricken by the loss of his eldest son in the war.

It arose over a question of cabinet reorganization. For some time the formation of an inner cabinet had been under discussion. At the beginning of Dec. 1916 Lloyd George, who upon the death of Kitchener had become secretary for war and whose prestige with the press had long been in the ascendant, submitted a definite scheme for the formation of such a body. From this body the prime minister was to be excluded. His right to control policy was not challenged, but he would not direct the deliberations of the inner cabinet. The *coup* burst upon the country with the announcement of the popular newspapers that Lloyd George was "packing up" in sheer despair at the inefficient conduct of the war. His highly confidential challenge to the position of Asquith was under consideration when an article appeared in *The Times* (then owned by Northcliffe) giving full details of the supposed arrangements and suggesting that Asquith had already agreed. Lloyd George denied any knowledge of this article; but Asquith, after consulting with his friends, decided to reject the proposal. Upon this Lloyd George resigned, and his resignation being followed by that of other influential members of the cabinet—including some who hoped that their action would give the prime minister the opportunity of reforming his cabinet on a new basis—Asquith informed the King that he could no longer be responsible for carrying on the business of government; and within a few days the second Coalition Government was formed with Lloyd George as prime minister. (*See* ENGLISH HISTORY: *1901–28;* WORLD WAR.)

Thus ended Asquith's long and memorable tenure of the premiership. For the remainder of the war he occupied a seat in the front Opposition bench, speaking rarely and only on occasions when the interest of the nation seemed to demand his intervention. At the election of 1918, when Lloyd George swept the country with an appeal for the maintenance of the Coalition, he did not escape the general wreck of the Liberal Party, losing the seat of East Fife, which he had held throughout his parliamentary career. In 1920 he returned to the House of Commons as member for Paisley and resumed his position as head of the remnant of the succeeding parliaments. In 1924, after an election fought on the issue of protection, he, as the head of a pivotal majority, was responsible for the accession to power of the first Labour Government, and later in the year for the Government's overthrow on a question of alleged governmental interference with the prosecution of a communist. At the next election he was defeated and retired to the Lords as earl of Oxford and Asquith.

Other honours were conferred on him. He became a member of the judicial committee of the privy council, a knight of the garter and a fellow of the Royal Society. After he entered the House of Lords he rarely intervened in public discussion. But at the outbreak of the General Strike in 1926, he urged the paramount duty of concentrating on the struggle against the "coercion of a new dictatorship," though he blamed the Government for not taking steps during the preceding nine months to make constructive proposals for the coal industry. Some recrimination followed, and there was a split in the Liberal Party (*q.v.*). He still retained the leadership of the Liberal Party, to which Lloyd George had now returned. But on the outbreak of the General Strike in 1926 a sharp difference appeared in the attitude of Lord Oxford and Lloyd George towards the event, and the latter declined to consult his colleagues. Lord Oxford thereupon formally intimated that he could have no political relations with him, and as the result of the consequent breach Oxford retired from any active part in the affairs of the party which he had led for 18 years. In his retirement he devoted himself to writing a book of reminiscences and reflections, under the title of *Fifty Years of Parliament,* and in the autumn of 1927 he also published a volume of his speeches. Thereafter his health gave way and he died on Feb. 15, 1928, being buried, according to his wish, in the churchyard of All Saints church, Sutton Courtney, Oxfordshire, where he had long had a country home.

Asquith will take his place among the most illustrious of British prime ministers, not merely by virtue of the momentous events in which he played a part, but still more because of his remarkable parliamentary gifts. In this respect he was in the true succession to Gladstone. He had little of the Sinaitic fervour of that great man, but he was not inferior to him in his mastery of the House of Commons. That mastery was achieved, not by emotional passion, but by the force, direction and lucidity of his speech, the intellectual sovereignty that he exercised over his audience, and the qualities of a plain, unaffected character and a singularly dispassionate mind. No man who ever played a great part in affairs was more conspicuously free from the common vices of public life. If he was ambitious it was only the ambition of conscious power directed to public ends. He was the least egotistic of men, and his magnanimity almost bordered on weakness. He was so little of a demagogue that he seemed to avoid rather than invite popular applause, a character to which a certain temperamental shyness contributed. His loyalty to his colleagues, even when they were lacking in loyalty to him, was one of his most striking attributes, and he was so indifferent to his own interests that he not only allowed the praise that belonged to himself to be appropriated by others, but often assumed the burden of mistakes which others had committed. He was the antithesis of that 18th century statesman of whom it was said that if there was credit to be got no one was so skilful in wriggling in, and if there was discredit to be borne no one was so skilful in wriggling out. He bore the odious slanders and insults of a demented press during the war with a certain proud and indifferent scorn, and his bearing both in private and public after the consummation of the intrigues against him was a model of dignity and public spirit. He was never betrayed into violent speech, and if his passion were roused, it was roused, not by personal issues, but by the outrages against public law and the sanctity of constitutionalism. He shared with the younger Pitt the view that the greatest quality in statesmanship was patience, and in all the perplexities with which he had to deal he exercised that quality to the utmost. He would never force a situation while there was a hope that a reasonable and pacific solution could be found. This confidence in the beneficent

operation of rational processes led many to suspect him of weakness, and it is undoubtedly true that there was in him an indisposition to anticipate events or to indulge in the histrionics of statesmanship. But on vital issues he was adamant, and his judgment on all great matters was never vitiated by the smaller considerations of personal and irrelevant motives. His mind moved in the undistracted orbit of a deeply considered philosophy of government, and it may be said of him, as of another, that if he was sometimes on the wrong side, he was never on the side of wrong. He will live in history not only as one of the most illustrious of British premiers but as a type of all that is best in the English character.

The general affection and regard in which Oxford was held was shown by the gift, in 1927, from 17 of his friends and admirers, including some Conservatives, of a capital sum and an income for life. By his first marriage he had four sons and one daughter. Raymond Asquith, his brilliant eldest son, was killed in action in 1916. By his second marriage he left a son, Anthony, and a daughter, Elizabeth, Princess Bibesco. He was succeeded in the earldom by his grandson, Julian, only son of Raymond Asquith.

(A. G. Ga.)

See his *Occasional Addresses, 1894–1916* (1918); *The Genesis of the War* (1923); *Fifty Years of Parliament* (1926); *Speeches* (1927), and his *Memories and Reflections, 1852–1927*, published posthumously (1928). *See* also Lady Oxford, *The Autobiography of Margot Asquith* (1922), and the many memoirs of contemporary statesmen.

OXFORD AND ASQUITH, Margot, Countess of, the sixth daughter of Sir Charles Tennant, 1st Bart., married, in 1894, as his second wife, H. H. Asquith, later the Earl of Oxford and Asquith (*see* p. 990). Before her marriage she was well known as a member of the coterie known as the "Souls," and maintained her reputation as one of the wittiest and most brilliant women in London society. In 1922 she published *The Autobiography of Margot Asquith* (2 vol.), which reflected the natural frankness of her character. It is a valuable chronicle of the time. After its publication she undertook a lecture tour in America.

Her other works include *Places and Persons* (1925), *Lay Sermons* (1927) and a novel *Octavia* (1928).

OXFORDSHIRE or **OXON,** a south-east midland county of England, bounded north-east by Northamptonshire, north-west by Warwickshire, west by Gloucestershire, south-south-west and south east by Berkshire and east by Buckinghamshire. It was originally part of the Mercian kingdom, but its boundaries, except for the Thames on the south (71 m. from Kelmscot near Lechlade, Gloucestershire, to Remenham below Henley-on-Thames, with the exception of two points near Oxford) are artificial. They were slightly changed by act of William IV. and Victoria to extend the area of the county (755·7 sq.m.). The 14 Oxfordshire Hundreds include five of the Chiltern Hundreds, the jurisdiction over which belonged to the manor of Benson, and in 1199 to Robert de Harecourt. The county encloses small portions of Berkshire (in Bampton Hundred) and of Buckinghamshire (in Ploughley Hundred).

Structure and Topography.—The county lies across the central portion of the Jurassic and Cretaceous outcrops. The strike of the strata is in each case from north-east to south-west, for Tertiary movements have tilted them gently down to the south-east so that the transition from north-west to south-east is from older to newer rocks passing in succession from the Lias over the Lower, Middle and Upper Oolite to the Lower Greensand, Gault, Upper Greensand and Chalk. In the north-west, the Marlstone of the Middle Lias and the Limestones of the Oolitic series are permeable and relatively resistant, and the Marlstones and the Inferior Oolite rocks being specially hard, stand out as a sharp north-west edge, continuing the line of the Cotswolds at a lower level (average 500 ft.), but rising to 700 ft. in Edge Hill in the north-east of the county. In the south-east, the chalk is also permeable and resistant, and the hard chalk-with-flints crowning the Chilterns also presents a sharp edge to the north-west.

Between these two upland regions the intermediate geological series forms a broad vale (20 m.) of alternating clays and calcareous, sandy beds. The Upper Greensand forms a low feature at the foot of the chalk hills; this is succeeded by the Gault, with width of outcrop varying from 4 m. to 1½ m. between Dorchester and Sydenham. The lower Greensand appears from beneath the Gault at Culham and Nuneham Courtney and in outliers north of Cuddesdon; Portland limestone, Portland sands and Purbeck beds lie between it and the Kimmeridge clays, which outcrop between Sandford and Waterperry. Coral Rag is traceable from Sandford to Wheatley and beyond this comes a broad outcrop of Oxford clay followed by the Cornbrash (a brownish rubbly limestone). This outcrops at Norton Bridge, Woodstock and Shipton, forms a broad plateau between Middleton Stoney and Bicester, and also occurs as inliers at Islip, Charlton, Merton and Black Horse Hill. The county lies almost wholly in the basin of the upper Thames, in which the significant drainage is that of the Cherwell-Thames. The drainage pattern as a whole, consists of numerous consequent streams from the scarplands (Evenlode, Windrush, etc.), which have been captured and diverted into the Cherwell-Thames by powerful subsequent streams (Ock, Upper Thames, Ray, Thame), working along lines of weakness in the strike of the rocks, obsequent streams flowing down the scarp edge often being a further result of the capturing.

The Cherwell occupies a broad sag between Edge Hill and the Northampton Uplands. It flows south-south-east, joins the Thames coming from the west at Oxford, after which the combined stream continues the south-south-east direction, passing by a deep gorge through the chalk between Wallingford and Reading. That the gap must have originated north-west of its present position is argued from the fact that the level of the river bed at this point is 100 ft. while that of the hills on either side is 700–800 feet. It is an old, but rejuvenated drainage system, which, working upon calcareous rocks, has given rise to a characteristic topography; streams graded to base level but with very steep-sided upper valleys and wide intervening spaces between the head streams that have no surface streams; broad main valleys from which streams have disappeared, or where drainage is beneath the surface; misfit streams, due to capture by the river Severn of an earlier drainage to the Thames from the Welsh plateau, or to carving out of valleys by flood waters following the retreat of the ice. There is little glacial drift except in the north-east of the county. Gravel deposits, both plateau (North Leigh, Combe, Tiddington, etc.) and flood plain (Bampton, Oxford, Dorchester, etc.), are very important; tracts of clay-with-flints, brick-earth and gravel, as well as outliers of the London clay (Nettlebed, Caversham, etc.) occur on the dip slope of the chalk.

History and Early Settlement.—The bare Lias and Oolite uplands and the flood plain gravels were sites of late Neolithic settlement, as witness numerous Long Barrows (characteristic of the Cotswold area) as far east as the Cherwell. The Rollright stones (probably Neolithic) on the Oolite scarp need special mention. Quantities of bones of cattle, pigs, sheep, etc., are found in the gravels, and pottery (characteristic of the Wash area) is distributed east of the Cherwell-Thames line. Settlement on the dip slope of the Chilterns was debarred by forests, as also in the forested north-eastern portion of the county, but the Icknield Way, generally on the Greensand, and the Ridgeway, on the Chalk above, followed the scarp face to the Thames crossing, forming parallel routes to a trackway along the limestone uplands. An influx of the people who made Beaker pottery is indicated for the region between the Evenlode and the Windrush and on the valley gravels (Eynsham, Stanlake, Brighthampton, Oxford, Burcot, Dorchester, etc.). In the Iron Age camps were established along the same routes (*e.g.*, Chastleton, Tadmarton). During the Roman period the area was thickly populated and roads were made linking Alchester and Dorchester in the Cherwell-Thames with Towcester (Northamptonshire) to the north and Silchester (Hampshire) to the south. Alchester was also connected by Akeman Street with Verulamium (Hertfordshire) to the east and Cirencester (Gloucestershire) to the west. The Saxon settlements are noticeably on valley sites, occupied in pre-Roman times, and these have continued as nucleated settlements to the present day; isolated farms are noticeably on plateau or vale from which forest was cleared comparatively late. In the 6th century the West Saxons took Benson and Eynsham. (*See* the *Saxon Chronicle* for 571.)

In the 7th century the Mercians held all the northern border of

the Thames, and during the 8th century this district fell to Wessex after the battle of Burford, and to Mercia after a battle at Benson, when it was included in the diocese of Lincoln. The bishopric at Dorchester given to Birinus (the apostle of Wessex), 634, seems to have come to an end on the establishment of the see of Winchester. Before the Mercian conquest in 777 Oxfordshire was in the diocese of Sherborne. In 873 the jurisdiction of Dorchester reached to the Humber, and when the Danes were converted it extended over Leicestershire and Lincolnshire, Oxfordshire forming about an eighth of the diocese. In 1092 the seat was transferred to Lincoln. In 1542 a bishopric of Osney and Thame was established, taking its title from Oxford, the last abbot of Osney being appointed to it. In 1546 the existing bishopric of Oxford was established. The ecclesiastical boundaries remain as they were when archdeacons were first appointed—the county and archdeaconry being conterminous—and the county being almost entirely in the diocese of Oxford.

The Danes overran the county during the 11th century; Thurkell's army burnt Oxford in 1010, and the combined armies of Sweyn and Olaf crossed Watling Street and ravaged the district, Oxford and Winchester submitting to them. At Oxford, in 1018, Danes and Englishmen chose Eadgar's law. Here also Harold allowed Tostig to be outlawed and Morkere to be chosen earl in his place, thus preparing the way for his own downfall and for the Norman Conquest. The destruction of houses in Oxford recorded in the Domesday Survey may possibly be accounted for by the ravages of the rebel army of Eadwine and Morkere on this occasion. Large possessions in the county fell to the Conqueror, and to Odo, bishop of Winchester. The bishop of Lincoln and many religious houses (*e.g.*, Abingdon, Osney and Godstow) held much land in the county. Robert D'Oiloi, heir of Wigod of Wallingford, held many manors and houses in Oxford, of which town he was governor. The importance of Oxford was already well established; the shire moot there is mentioned in Canute's Oxford laws, and it was the seat of the county court from the first, the castle being the county gaol. For events between this period and the Civil War *see* OXFORD (city). The dissolution of the monasteries, though it affected the county greatly, caused no general disturbance.

When King Charles I. won the battle of Edgehill (Oct. 23, 1642), Oxford at once became the stronghold of the royalist cause. For the campaign of 1643 its rôle was to detain the main parliamentary army until the royalists from the north and the west could come up, after which the united forces were to close upon London. More than once, notably at Chalgrove Field (June 18, 1643), Prince Rupert's cavalry struck hard and successfully. In the campaign of Newbury skirmishes took place as the parliamentary troops under Essex passed through north Oxfordshire on their way to the relief of Gloucester, and at the close of the campaign the fortresses of the county offered the defeated royalists a refuge which Essex was powerless to disturb. In the following campaign Charles abandoned the idea of an envelopment and decided to use Oxfordshire as the stronghold from which to strike in all directions. Material wants made it impossible for Charles to maintain permanently his central position, and eventually Essex headed for the south-west, leaving Waller to face the king alone. The battle of Cropredy Bridge followed (Jan. 29), and the victorious king turned south to pursue and capture Essex at Lostwithiel in Cornwall. In the operations of 1644 Oxfordshire again served as a refuge and base (Newbury and Donnington).

On the appearance of Cromwell and the New Model army a fresh interest arose. Leaving Windsor (April 20, 1645), the future Protector carried out a daring cavalry raid. He caught the royalists unawares at Islip, pursued the fugitives to Bletchington and forced the governor to surrender. He swept round Oxford, fought again at Bampton, and rejoined Fairfax, in Berkshire. A few days later Charles again marched northwards, while Fairfax was ordered to besiege Oxford. Charles was compelled to turn back to relieve the city, and the consequent delay led to the campaign and disaster of Naseby. Yet even after Naseby Oxfordshire still retained its importance, but in 1646 the Roundheads closed in from all sides and Stow-on-the-Wold witnessed the final battle of the war. On May 9 Banbury surrendered, on June 24 Oxford capitulated, and three days later Wallingford, the last place to give in, followed its example.

Architecture.—The limestone of the Oolite series has provided beautiful material for both ecclesiastical and domestic architecture, the castles, of which there are few, were probably built for temporary defence in the civil strife of Stephen's reign (1100–1135). Considerable portions of the Norman Oxford castle survive, and slighter remains of the castle at Bampton, the seat of Aylmer de Valence in 1313. Among remains of former mansions Greys Court near Henley-on-Thames (14th century), Minster Lovell, on the Windrush above Witney, and Rycote, between Thame and Oxford may be noted. Minster Lovell was the seat of Francis, Lord Lovel, the son of a Lancastrian who incurred the hatred of that party by serving Richard III.; he afterwards aided Lambert Simnel, and mysteriously disappeared after the battle of Stoke. Rycote is of fine Elizabethan brick and in the chapel attached to the manor there is remarkable Jacobean woodwork, the entire fittings being of this period. Here Elizabeth resided both before and after her accession. Broughton castle near Banbury (14th century), Shirburn Castle (mainly 15th century Perpendicular), and Stanton Harcourt (1450, with a gatehouse of 1540, a vast kitchen, and Pope's Tower) are ancient mansions still inhabited. Mapledurham, on the Thames above Reading, is a fine Tudor mansion of brick; and Water Eaton on the Cherwell, is a singularly perfect Jacobean house of stone. Blenheim palace, near Woodstock, should also be mentioned.

A large number of monastic foundations arose in the neighbourhood of the university; Augustinian at Bicester, Caversham, Cold Norton, Dorchester, Osney (a magnificent foundation just outside the walls of Oxford) and Wroxton; Cistercian at Bruern and Thame; Benedictine, at Cogges, Eynsham, Milton; Mathurin, at Nuffield; Gilbertine, at Clattercote; Templar at Sandford-on-Thames. Gosford possessed one of the only two preceptories of female Templars in England. Of all these, excepting the abbey church at Dorchester, remains are scanty. A few domestic buildings remain at Studley; the boundary walls still stand of Godstow Nunnery on the Thames, the retreat and burial place of Rosamund Clifford, or "Fair Rosamond" the object of Henry II.'s famous courtship; and there are traces of Rewley Abbey within Oxford.

In ecclesiastical architecture Oxfordshire, apart from Oxford itself, is remarkably rich, but nearly all the churches are of mixed dates. Iffley, Adderbury and Minster Lovell are types of a single style. Iffley, 1 m. S. of Oxford, is one of the finest examples of pure Romanesque in England, with a highly ornate west front. Adderbury, 4 m. S. of Banbury, is a great cruciform Decorated church with a massive central tower and spire. Minster Lovell, also cruciform, is pure Perpendicular; its central tower is supported on four detached piers. The short, ungainly spire of Oxford cathedral was among the earliest, if not the first, constructed in England, and served as a model from which were probably developed the splendid central spires of the great churches at Witney, Bampton, Shipton-under-Wychwood and Bradwell. There are also fine spires at Bloxham, Adderbury and King's Sutton (in Northants). Bloxham church, mainly Decorated, with Romanesque portions and a remarkable Early English west front is one of the largest and most beautiful in the county. In the west, Burford (Romanesque and later) is noteworthy, and in the porch of the fine Romanesque church of Langford is a crucifix with the figure cloaked. At South Leigh are remarkable mural paintings of the 15th century. About 5 m. N. of Oxford there are Kidlington (Decorated), with a beautiful needle-like Perpendicular spire, and Islip, as the birthplace of Edward the Confessor. In the south-east Dorchester Abbey, with its nave of transitional Norman, has a curious Decorated Jesse window. At Cuddesdon there is another cruciform church, Romanesque and later. Ewelme church (Perpendicular) is remarkable for the tomb of Alice, Duchess of Suffolk (1475), gorgeous with tracery and gilded canopy, and that of Sir Thomas Chaucer (1434), ornamented with enamelled coats of arms. Here William de la Pole, Duke of Suffolk, founded in 1436 the picturesque hospital and free school still standing.

Climate and Agriculture.—The climate, healthy and dry,

except in the low ground bordering the Thames, is colder than the other southern districts in England, especially in the exposed regions of the Chilterns. The county is essentially rural. The surface soils lie in belts, corresponding to the underlying rocks, the heavy clays giving rise to grass lands and the calcareous, sandy soils to arable. Many villages occur where springs issue at the junction of permeable and impermeable strata, thus securing flood-plain pasture for cattle, upland pasture for sheep and upland patches of lighter soil, with a sandy aspect, which could be worked by primitive communities often with a two-field rotation. Wool was early a source of wealth and was famous in the 12th and 13th centuries. Salt is mentioned in Domesday as a product of the county; glass was made at Benson and Stokenchurch in the reign of Henry VI. and other subsidiary products were plush at Banbury, leather at Bampton and Burford, gloves at Woodstock, and malt at Henley. At the beginning of the 14th century, Oxford was the second most prosperous county in England, but the Black Death (1349) and decreasing arable land, the enclosures of the 16th century and the wars of the 17th, brought depression and discontent, and on the enclosure of Otmoor (1830) serious riots broke out.

At the present day a high proportion of the county (nearly seven-eighths) is under cultivation. Stock are raised on the clay lowlands, and dairying (Shorthorns, Alderneys and Devonshire cows) is important. The Cornbrash is specially good for grain growing, and good crops of wheat, oats and barley are grown (91,049 ac. in 1926). Sheep (Southdowns, Leicesters and Cotswolds) are still reared in large numbers on the uplands and are folded on the root crops (turnips, swedes, mangolds), which are important. The cultivation of sugar-beet is a growing industry (1,196 ac. in 1926). Many pigs are reared and poultry do well on gravel sites. The county has few mineral resources; iron is obtained from the Middle Lias and the Inferior Oolite at various places; Oolitic limestone is quarried for cement, stone slates and, though less than formerly, for building stone. The clays are used for brickmaking, and have been largely utilized for the building of the new town which has arisen around the motor industry at Cowley south-east of Oxford.

Manufactures.—These are mainly those dependent on agriculture. Blankets are manufactured at Witney, and tweed, girths and horsecloths at Chipping Norton. There are paper mills at Shiplake, Sandford-on-Thames, Wolvercot and Eynsham, using the pure water of the streams. Agricultural implements and portable engines are made at Banbury, and glove and lace-making are ancient industries. Banbury has been long celebrated for the manufacture of a peculiar cake.

Communications.—Many of the roads are ancient routes on the plateau or following the strike of the rocks, but the main railways are markedly transverse, linking London with the industrial north-west. The county is served entirely by the G.W. Railway (except for a branch of the L.M.S. Railway from Bicester to Oxford). One main line from London passes through the Reading gap to Oxford, and here bifurcating, sends one line north along the Cherwell valley to Banbury and another across the north-west of the county, via the Evenlode valley, to link up with the Severn valley, Worcester and Birmingham; Kingham on the borders of Gloucestershire, being a junction for a line west to Cheltenham (Glouc.) and a line north-east to King's Sutton (Northants). In order to compete with fast trains from London to Birmingham on the L.M.S. Railway the G.W. Railway has built a loop line across the north-east of the county, leaving Oxford to the west and linking Banbury with the joint L.N.E. Railway and G.W. Railway line passing through the Princes Risborough (Bucks.) gap (from which point also a line runs along the Thames valley to Oxford). There are other branch lines.

Population and Administration.—The area of the ancient county is 483,626 acres. The area of the administrative county, including the city and county borough of Oxford, is 479,220 ac. with a population in 1921 of 189,615. The municipal boroughs are Banbury, Chipping Norton, Henley-on-Thames, Oxford, a city and the county town, and Woodstock. The county is in the Oxford circuit and assizes are held at Oxford. It has one court of quarter sessions, and is divided into 11 petty sessional divisions. The borough of Banbury and the city of Oxford have separate courts of quarter sessions and commissions of the peace, and the borough of Henley-on-Thames has a separate commission of the peace. The total number of civil parishes is 304. Oxfordshire is in the diocese of Oxford, and contains 244 ecclesiastical parishes or districts, wholly or in part. The ancient county (which in 1289 sent two members to parliament) is divided (since 1918) into two parliamentary divisions, Banbury and Henley, each returning one member. It also includes part of the parliamentary borough of Oxford, returning one member, in addition to which the university of Oxford returns two members.

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OXFORD UNIVERSITY. The stories connecting Oxford University with Brute the Trojan, with king Mempeic (1009 B.C.) and with the Druids, cannot be traced back beyond the 14th century. The town, in fact, is considerably older than the university. (*See* OXFORD.) Authentic history appears to begin in 1133 with the arrival from Paris of the theologian, Robert Pullen, who lectured here. There is, however, little evidence that Oxford was regarded as a fully equipped university before 1163—allusions to its being a *studium generale* (*see* UNIVERSITIES) only occur after that date and these by some authorities are held to be inconclusive. Subsequent progress must, however, have been rapid as, about 100 years later, the deputies of Oxford, in an appeal to the king, described the university as *Schola secunda ecclesiae* or second to Paris. The coming of the religious communities, the Dominicans, Franciscans and Carmelites in the 13th century, and the Benedictines a little later on, profoundly affected the advancement of learning. The names of Roger Bacon, Duns Scotus and Wycliffe, are sufficient to indicate the prominence of Oxford in the middle ages. The earliest colleges to be founded were University college (1249, the mythical foundation by Alfred in 872 is no longer accepted), Balliol (about 1263), Merton (1264). The last named was established with a view to provide a collegiate discipline for the secular clergy, and its statutes served as a model for subsequent creations, not only at Oxford but at Cambridge. For the others *see* the list on pp. 996 and 997.

From the 13th century onward a succession of charters from the Crown strengthened the position of the university at the expense of the town. At the Renaissance the new learning found its leading exponents in Erasmus, who lectured here, and in such famous scholars as Grocyn, Dean Colet and Sir Thomas More. The old scholasticism received its death-blow from the royal injunctions of 1535. Oxford, as well as Cambridge, suffered from numerous confiscations of land and revenues during the Reformation period. In 1571 the act of Elizabeth incorporated and reorganized the two universities. The statutes of the university were codified in 1836 by the chancellor, Archbishop Laud. With certain modifications, they formed the official code of the university till 1858. During the civil war the university sided with the king, while the town sympathized with the parliament, but no open breach between the two occurred. Under Cromwell, who acted as chancellor from 1651–57, a strong effort was made to restore the standards in work and discipline which had suffered from the civil wars. During the reign of James II., the university acquired great popularity by its successful resistance to James's effort to throw open the university to Catholics, even to the extent of imposing his own Catholic nominee on the fellows of Magdalen. The university, however, soon returned to its Jacobite allegiance, and at the coming of the Georges was definitely anti-Hanoverian, a phase, however, that came to an end after the visit of George III. in 1785. In the latter half of the 18th century the influence of the Wesleys on Oxford was far less than on the country at large; on the other hand the Tractarian movement (*see* NEWMAN), at

the beginning of the 19th century had a most profound effect on the Church of England, which is still potent to-day. There was a general rise in the level of studies towards the end of the 18th century, as written examinations gradually supplemented the old oral examinations, often merely formal, and henceforth the range of studies themselves extended. By the reform of 1858 the professoriate was increased, reorganized and re-endowed, and dissenters were admitted to entrance to the B.A.—the M.A. being thrown open in 1871.

The reforms of 1877 directed a certain proportion of the college revenues to the use of the university—especially for the encouragement of natural science, and improved the position of professors and lecturers, thus leading to the growth of a regular resident professoriate. Schools and degrees alike multiplied (*see* UNIVERSITIES) and the history of the university was one of general progress and expansion. None the less there was a widespread feeling that a certain amount of reform was advisable if the university was to keep step with the times. In 1909 Lord Curzon, the then chancellor of the university, issued his *Principles and Methods of University Reform.* Committees of council were formed to prepare definite schemes. Several reforms were proposed, notably the abolition of compulsory Greek, the reform of the Hebdomadal Council (*q.v.*), a remodelling of the boards of faculties, and a revision of the financial relation between the university and the colleges. Most of these have since (*see* below) been realized in one way or another.

The two most important facts in the history of the university since 1911 have been the World War and the two commissions. In the war 14,561 Oxford men served in the British forces, and 2,660 lost their lives. Again, thanks to the O.T.C., nearly 2,000 Oxford men received commissions in the first two months of the war, while for the last three years of the war, there always were nearly 2,000 cadets in Oxford. The examination schools and those colleges which were not given up to cadets became hospitals. The number of undergraduates fell to 1,087 in Jan. 1915, and 550, 460 and 369 in the same months in 1916, 1917 and 1918 respectively. The tide began to turn in the latter part of 1918; in Jan. 1919 there were 1,357 men in residence; and in the following 18 months the entries were so heavy that by Oct. 1920 there were about 4,500 men and 650 women actually in residence. Since that time, all the men's colleges have striven to reduce their numbers; so that the figures for undergraduates were, in 1928, about 3,500 men and 750 women. Women, in 1920, were admitted as full members of the university, but a statute was passed in 1927 limiting their number to one-fourth that of men.

New Statutes.—The royal commission, set up in 1919, reported in 1922. Its recommendations were embodied in statutes by a second commission (set up 1923) which came into force in 1926. It was satisfactory to Oxford men to find that a body appointed by a reforming Government, and composed of men of all political parties, reported so favourably on the work of the universities as a whole; so far from being pronounced to be homes of idleness, the main complaint made against most of the teachers was that they worked too hard. (See *Report*, pp. 26, 39, 48.) To remedy this, and to allow for the extension of university activities, the royal commission recommended a grant to Oxford and to Cambridge of £110,000 a year each; only £60,000 was given at first, but in the spring of 1925 this was increased to £85,000.

The aim of the commissions especially was to encourage research work. The growth of this was already a marked feature in Oxford. To encourage it, the degrees of Bachelor of Letters and Bachelor of Science were set up in 1895, the Doctorate of Philosophy in 1917; the regulations for the B.Litt. have now been (1927–28) remodelled in the light of experience. In the examination, too, for the honours degree in natural science, students of chemistry can only obtain a class if they spend a year on a piece of research. Probably the most important proposal in the new statutes is the setting apart, out of the Government grant, of an annual sum of £10,000 to assist college lecturers, who will be appointed by the boards of the faculties to be also "university lecturers," carrying out some special work.

Apart from this grant, the most important changes have been: (1) The full enjoyment of college scholarships will be limited to those in need of financial help; the election, however, will be made by colleges as before, and entirely on intellectual grounds. (2) All professors are made ex officio fellows and members of the governing bodies of colleges. But these changes only make statutory and universal what was already done in most colleges. (3) A retiring age is fixed for all posts, whether college or university. A pension scheme has also been instituted. (4) The machinery of university government has been changed. The Hebdomadal Council is now made representative of the whole university, not of separate orders of members, and congregation is to consist entirely of those doing university work, whether teaching or administrative. These changes again had been largely anticipated by university action since 1900. (5) The power of convocation to override congregation is practically abolished. This change is more important in theory than in practice; the one subject on which convocation had interfered decisively—the refusal to open theological degrees to members of all denominations—had been settled by agreement in 1920. (6) The general board of faculties, set up in Lord Curzon's reform of 1913, has been made more representative of the whole university, and given fuller power over its studies. The financial machinery of Oxford had been already remodelled by statutes passed in 1912 and 1920.

On the whole it may be said that the essential principle of Oxford life, the independence of colleges, has been maintained. The university can advise as to college elections and appointments, and make general rules, but colleges retain their full powers of election and administration.

Benefactions.—Natural science has been the chief gainer from recent benefactions, with new laboratories for engineering (1912), for chemistry (thanks mainly to Dyson Perrins) in 1915, for pathology from the Dunn trustees and for biochemistry from Mr. Whitley and the Rockefeller foundation (opened in 1926 and 1927 respectively). The Welch bequest (1915) has added another £50,000 to the resources of biological science, and the Government, by placing at Oxford the institutes of Agricultural Engineering (1923) and of Imperial Forestry (1924), has shown its confidence in the oldest university as the fittest place to provide for the newest needs of the empire.

Next to the development of natural science, the most marked feature of the last 20 years has been the growth of modern language teaching. Professorships of French, Italian and Spanish have been founded by Sir B. Zaharoff, A. Serena and W. R. Morris respectively; Sir Heath Harrison has provided scholarships for undergraduate travel (1919), and Mr. Laming has founded travelling fellowships in connection with his old college, Queen's (1924). Closely allied with this development is the increasing number of fellowships for study in the universities of the United States (*e.g.*, the Commonwealth and the Davison fellowships), which are being founded by Americans as a counterpart to the work of Cecil Rhodes. His trustees are building, on part of what had been the garden of Wadham, a great building, designed by Sir H. Baker, to be a centre of the advanced studies, on the humanistic side, of students from the whole English-speaking world.

The Bodleian continues to receive gifts, not only of books and pictures as in Lord Curzon's Napoleonic collection (1925), but also in cash, as Walter Morrison's £50,000 in 1920, but its accommodation is becoming seriously inadequate, and during the next decade either great extensions must be carried out, or the policy of the library seriously changed. In any case, very large benefactions will be required. The same must be said of the Oxford Preservation Trust, founded 1927, to preserve the beauties of Oxford, both in the city itself and also in its surroundings. Mention should also be made of Barnett house, founded in 1914 in memory of Rev. S. A. Barnett, for the promotion of social and economic studies.

List of Colleges and Halls.—In addition to the three colleges mentioned above, University, Balliol and Merton, the other colleges in their order of foundation are: Exeter (originally called Stapelton Hall, 1314), Oriel (1326), Queen's (1340, named after the well-known Queen Philippa), New college (creation of William of Wykeham, 1379), Lincoln (1427), All Souls (1437), Mag-

dalen (1458), Brasenose (1509), Corpus Christi (1516), Christ Church (begun by Wolsey in 1525, final foundation by Henry VIII., 1546), St. John's (1555), Trinity (1555), Jesus (founded by Queen Elizabeth, 1571), Wadham (1612, charter received 1610), Pembroke (1624), Worcester (1714), Keble (created as memorial to John Keble, 1870), Hertford (after many vicissitudes, 1874). For further details *see* OXFORD. Of the various academical halls, St. Edmunds (reputed foundation, 1226) is the only one that now survives.

Non-collegiate students were first admitted in 1863. They are known as members of St. Catherine's college. There are four women's colleges, founded—Somerville (1879), Lady Margaret Hall (1879), St. Hugh's Hall (1886) and St. Hilda's (1893); a certain number of women are also admitted to the university as "home students." Among the independent foundations mainly intended for teaching theology are Pusey House (1884) and Wycliffe Hall (1878), both Church of England, and Mansfield college (1886) and Manchester college (1893, Nonconformist).

Other Academic Buildings of Note.—Oxford also possesses an unusual number of fine academic buildings—to quote only the names of some of the principal ones—they are described at length in the article on OXFORD; first, the notable group of buildings comprising the Bodleian library, the University school, the Convocation house with the Sheldonian theatre and the original Ashmolean museum, and the Ratcliffe library not far away. "The university church" of St. Mary lies just to the south of the latter. Another massive pile of buildings is devoted to the Taylor institute, the University galleries and the present Ashmolean museum. Other important buildings are the University museum, the Pitt-Rivers Ethnographical museum, the University observatory, and the famous Clarendon press. Mention should also be made of the botanical garden by the Cherwell and the Oxford Union Society, founded 1625.

University Constitution and Art Institution.—"The chancellor, masters and scholars of the University of Oxford" form a corporate body, within which the colleges are so many individual corporations. The highest officer of the university is the chancellor, who is elected by the members of convocation, holds office for life, and is generally a distinguished member of the university. The vice-chancellor is practically the head. He is nominated annually by the chancellor, and must be the head of a college. Two proctors (*q.v.*) are appointed annually by two of the colleges in rotation. The university returns two members to parliament, the privilege dating from 1604, under a system of proportional representation.

The Hebdomadal (from Greek ἑβδομάς, the number seven; the Hebdomadal board instituted in 1631 was appointed to hold a weekly meeting) Council consists of the chancellor, vice-chancellor, the ex-vice-chancellor or the next vice-chancellor, and proctors as official members and of 18 other members (heads of houses, professors, etc.) elected for terms of six years by the congregation of the university. The council takes the initiative in promulgating, discussing and submitting to convocation all the legislation of the university, and controls its general business and its policy. The ancient house of congregation includes all college deans, examiners and Regent masters, *i.e.*, M.A.'s of not more than two years' standing; it once was concerned with university education and discipline, but it now has practically no functions beyond the granting of degrees. It lost its wider powers under the act of 1854, when the congregation of the university was created. This body, which includes, besides certain officials, all members of convocation concerned in the educational and administrative work of the university who have resided for a fixed period within 2½ m. of Carfax, approves or amends legislation submitted by the Hebdomadal Council previously to its submission to convocation; it also has considerable powers in the election of the various administrative boards. The house of convocation consists of all masters of arts and doctors of the higher faculties who have their names on the university books, and has the final control over all acts and business of the university. There are boards of curators for the Bodleian library, the university chest and other institutions, delegates of the common university fund, the museum and the press, for extramural teaching, local examinations and other similar purposes, visitors for the Ashmolean museum and university galleries, and many other administrative bodies. There are boards for the following faculties: theology, law, medicine, natural science and arts (including *literae humaniores*, oriental languages and modern history). The general board of the faculties, elected by all the resident teachers in the university, arranges and controls the teaching, appoints one class of university lecturers, and can make suggestions to colleges as to the appointment of the fellows as lecturers, on the recommendation of the special boards of faculty. The income assigned to it for the purpose is £10,000. Among the numerous professorships and readerships in the various subjects of study, the oldest foundation is the Margaret professorship of divinity, founded in 1502 by Margaret, countess of Richmond and mother of Henry VII. This was followed by the five Regius professorships of divinity, civil law, medicine, Hebrew and Greek, founded by Henry VIII.

The colleges consist of a head, whose title varies in different colleges, fellows (who form the governing body) and scholars. To these are to be added the commoners, *i.e.*, those who either receive no emoluments, or hold exhibitions which do not (generally) entitle them to rank with the scholars. The college officer who is immediately concerned with the disciplinary surveillance of members of the college *in statu pupillari* is the dean (except at Christ Church). Each undergraduate (this term covering all who have not yet proceeded to a degree) is, as regards his studies, under the immediate supervision of one of the fellows as tutor. The examinations for the B.A. are as follows: (*a*) Responsions, always now passed before entrance; exemption is granted to all candidates who have taken the school's leaving certificate. (*See* EXAMINATIONS.) (*b*) Honours or pass moderations, the latter often takes the form of a diploma in a special subject. (*c*) Final schools (in the case of *literae humaniores*, called familiarly "Greats," and now applied to other honours schools), with pass schools for ordinary students. Arrangements exist whereby members of the universities of Cambridge or Dublin may be "incorporated" as members of Oxford university; and whereby the period of necessary academical residence at Oxford university is reduced in the case of students from "affiliated" colleges within the United Kingdom. Special provisions are also made in the case of students from any foreign university and from certain colonial and Indian universities.

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OXIDATION and **REDUCTION** are chemical terms which are constantly employed to express two opposing reactions. In the first place, oxidation denotes a direct addition of oxygen to an element or compound, as in the burning of sulphur to sulphur dioxide or the conversion of carbon monoxide into the more oxygenated carbon dioxide, the latter chemical change being manifested in the blue flame frequently observed in a brightly burning coal fire. Secondly, oxidation may indicate a removal of hydrogen from a hydride or other hydrogenated substance, as in the incomplete combustion of sulphuretted hydrogen, $SH_2+O=H_2O+S$, or in the conversion of oxalic acid into carbon dioxide and water, $H_2C_2O_4+O=2CO_2+H_2O$. Thirdly, oxidation involves an increase in the valency of an element, even although there may be no direct addition of oxygen or removal of hydrogen, as, for example, in the change of ferrous to ferric salts, $2FeSO_4+H_2SO_4+O=Fe_2(SO_4)_3+H_2O$. The action of the oxygen is indirect and the oxygen itself may be derived from the air or from a chemical reagent, such as potassium permanganate or bichromate. Similarly stannous chloride is converted into stannic chloride, $SnCl_2+2HCl+O=SnCl_4+2H_2O$.

In the former instance the valency of iron is increased from two to three; in the latter the valency of tin is changed from two to four. Oxidation is often facilitated by the presence and interaction of water, as in the rusting of iron to hydrated ferric oxide (*see*

CORROSION), or in the permanent bleach of coloured goods (cottons, calico, etc.) as carried out by chlorine water. In the latter instance the effective agent is probably hypochlorous acid (HClO).

Reduction is the converse chemical change to oxidation. Firstly, reduction in its original metallurgical sense implies a removal of oxygen from an oxide. Tinstone (cassiterite) heated with carbon or anthracite becomes reduced to free tin, $SnO_2+2C=2CO+Sn$. Occasionally it is an analogue of oxygen, such as sulphur or selenium, which is removed from the metal. In the Welsh process of lead smelting lead sulphide and lead sulphate interact and the lead of both compounds is reduced to the metallic condition, $PbS+PbSO_4=2Pb+2SO_2$. Secondly, reduction signifies an addition of hydrogen, as in photosynthesis (*q.v.*), $CO_2+H_2O=(CH_2O)_x+O_2$, where carbon dioxide is reduced successively to formaldehyde and other more complex carbohydrates. When arsenious oxide is treated with a mixture evolving hydrogen, oxygen is replaced by this element, $As_4O_6+24H=4AsH_3+6H_2O$. Thirdly, reduction involves a decrease in the valency of an element as when a ferric salt is converted into ferrous salt by nascent hydrogen (engendered by zinc and dilute sulphuric acid), $Fe_2(SO_4)_3+H_2=2FeSO_4+H_2SO_4$. Occasionally such reductions are effected by light or radiant energy and such changes are utilized in photography: thus, ferric oxalate is reduced to ferrous oxalate, $Fe_2(C_2O_4)_3=2FeC_2O_4+2CO_2$, and aqueous mercuric chloride is reduced to mercurous chloride $4HgCl_2+2H_2O=2Hg_2Cl_2+4HCl+O_2$.

(G. T. M.)

OXIDE, in chemistry, a binary compound of oxygen and another element. Oxides are the most plentiful and characteristic components of the earth's hydrosphere and lithosphere; the former of these envelopes consists essentially of water, the commoner oxide of hydrogen, and the latter largely consists of simple and complex oxides. The second type of oxide is the more abundant and includes such important rock-forming materials as carbonates, silicates, aluminates, and aluminosilicates. The ordinary ingredients of soil, subsoil, and rocks, including sand, clay, marl, chalk, limestone, dolomite, mica, shale and slate are composed of oxides in either anhydrous or hydrated forms.

Oxygen can be made to combine directly with most elements, although sometimes it will not do so in the entire absence of water vapour (*see* DRYNESS, CHEMICAL); in a few cases in which direct methods are unavailing, as, for example, in the case of noble metals such as gold or platinum which remain unaffected in air even at very high temperatures, indirect methods can be used and oxides can be prepared from the salts of the metals. Hitherto, however, it has been found impossible to prepare oxides of bromine or of the inert gases helium, neon, argon, etc.; fluorine was (until 1927) regarded as being in this category, but it has now been made to yield an oxide indirectly. (*See* FLUORINE.)

Many elements form a series of several oxides; thus, nitrogen yields five: N_2O, NO, N_2O_3, NO_2 (N_2O_4 at lower temperatures), and N_2O_5. In general, the acidic character of the oxide increases with increase in the oxygen content. For purposes of classification, it is usual to assign a typical oxide to each element; usually this oxide is the highest having acidic or basic properties and is related to the position of the element in the periodic classification (*see* PERIODIC LAW) as follows: The typical oxides of Group I. are of the form M_2O, those of Group II. of the form MO, those of Group III. are M_2O_3, and so on, those of Group VI. being MO_3.

Types of Oxide.—Oxides are often classed as (1) acidic oxides; (2) basic oxides; (3) amphoteric; (4) neutral; (5) suboxides; (6) saline oxides; and (7) peroxides (either acidic or basic); an oxide may not fall clearly into any one of these classes, but have the characteristics of two.

(1) Acidic oxides are those which combine with bases or basic oxides to form salts. Many of the oxides of non-metals, *e.g.*, carbon, nitrogen, phosphorus and sulphur, are of this type. Some acidic oxides are "mixed" anhydrides; thus nitrogen peroxide reacts with water to give two acids, nitrous and nitric, and with bases to form nitrites and nitrates.

(2) Basic oxides similarly react with acids or acidic oxides to form salts, and many of the oxides of metals fall into this class.

(3) Amphoteric oxides behave as acidic oxides towards bases and as basic oxides towards acids; thus, zinc and aluminium oxides dissolve in either acids or bases to give salts of the acid or zincates (aluminates) of the base, respectively.

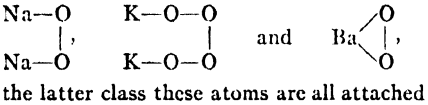
(4) Neutral oxides are those which neither react to form salts nor combine with water to give acids or bases; carbon monoxide and nitrous oxide are examples, for, although they result from formic and hyponitrous acids, respectively, by loss of water, they do not combine with water to give these acids and are therefore not acidic anhydrides.

(5) Suboxides are oxides having less oxygen than those oxides which give rise to a definite series of salts, and in a sense they are neutral oxides, for on reacting with an acid they give the metal and a salt corresponding to a higher oxide. Few suboxides are definitely known, but that of lead, Pb_2O, exhibits the behaviour just described—there are no such salts as Pb_2SO_4 or PbCl, and the action of acids upon it results in the production of metallic lead and a salt derived from PbO.

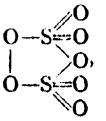
(6) Saline oxides of non-metals are not known. As indicated above, some metals form two oxides of which the lower is basic and the higher acidic; two such oxides may therefore combine to give another oxide which is to some extent a salt. Many higher oxides of metals may thus be regarded as saline, *e.g.*, $Pb_3O_4=2PbO\cdot PbO_2$; $Pb_2O_3=PbO\cdot PbO_2$.

(7) Peroxides are, strictly, those oxides having more oxygen than the typical oxide as determined by the periodic classification. This definition, however, fails in certain cases, for it would exclude lead peroxide, PbO_2, from the category, since this is regarded as typical of Group IV. to which lead belongs, whereas the oxide is certainly a peroxide. It is therefore customary, in the case of basic peroxides, to regard them as being those oxides which are more highly oxygenated than the oxide which gives rise to a regular series of salts, and since, in the case of lead, this is the oxide PbO, the oxide PbO_2 is a peroxide. In the case of acidic peroxides, permanganic anhydride Mn_2O_7, for instance, is the typical oxide of Group VII. and also gives rise (as an acid) to a definite series of salts (the permanganates), so no difficulty arises; and oxides such as CrO_4 and S_2O_7, which are higher than the typical oxides CrO_3 and SO_3, are acidic peroxides and give rise to perchromates and persulphates.

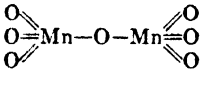
It is convenient to subdivide basic peroxides according to their chemical behaviour: those which react with water or with dilute acids to form hydrogen peroxide (a *neutral* peroxide)are classed as *superoxides*, and the others as *polyoxides*. Mendeleyev, to whom this idea is due, pointed out that this subdivision could be related to structural formulae, for the former class includes oxides in which the oxygen atoms are linked together, *e.g.*,



whereas in the latter class these atoms are all attached solely to the metal, *e.g.*, O=Pb=O, O=Mn=O. Such a subdivision can be extended to distinguish between acidic superoxides and polyoxides; thus, S_2O_7 is a superoxide



whereas Mn_2O_7 is a polyoxide



(compare above).

Peroxides are characterised by their oxidising properties; thus lead peroxide oxidises SO_2 so that the resulting PbO and SO_3 form lead sulphate $PbSO_4$; and manganese dioxide oxidises hydrochloric acid to chlorine, being itself reduced to the manganous state: $MnO_2+4HCl=MnCl_2+Cl_2+2H_2O$.

Many oxides combine with water to form hydroxides (*q.v.*), and all hydroxides lose water on heating to give the corresponding oxide. The chemical properties of an hydroxide are almost identi-

cal with those of the corresponding oxide, but the latter is somewhat more inert especially if it has been very strongly heated.

For further details *see* HYDROXIDES; OXIDATION and REDUCTION; and H. B. Weiser, *The Hydrous Oxides* (New York, 1926.) (A. D. M.)

OXIMES, in organic chemistry, compounds containing the grouping >C:N·OH and obtained by the action of hydroxylamine on compounds containing the >CO group. They were first prepared by Victor Meyer in 1882. The commonest are those of the general formulae RHC:NOH and RR'C:NOH where R and R' are alkyl or aryl groups; the former, prepared from aldehydes, are known as aldoximes, and the latter, from ketones, as ketoximes.

The lower alkyl aldoximes and ketoximes are readily soluble in water, but the solubility decreases with increase in molecular weight; if an aryl group be present, the compounds are usually sparingly soluble in water. Generally the oximes are readily soluble in the common organic solvents and may be extracted from aqueous solutions by their means; they are weak acids and dissolve in aqueous solutions of alkali hydroxides to form salts which are decomposed, with liberation of the oxime, by carbon dioxide or by ammonium chloride. At the same time ethereal solutions of most oximes yield with hydrogen chloride precipitates of hydrochlorides, and sulphates may be obtained by dissolving the oximes in concentrated sulphuric acid; both hydrochlorides and sulphates are rapidly decomposed by water with regeneration of the oxime. Oximes are hydrolysed by boiling with dilute acids (the parent aldehyde or ketone being formed); on reduction with sodium amalgam in alcoholic acetic acid, or in the vapour phase by hydrogen in the presence of nickel (*see* HYDROGENATION), they yield primary amines; on oxidation they yield a number of products, aldoximes giving hydroxamic acids R·C(OH):NOH or peroxides R·CH:NO·ON:CH·R, and ketoximes nitro-hydrocarbons $RR'CH{\cdot}NO_2$. Dehydrating agents convert aldoximes into nitriles $RCH{:}NOH \rightarrow RCN + H_2O$. With phosphorus pentachloride ketoximes undergo the Beckmann change (*see* below).

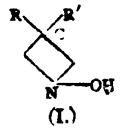
Aldoximes and ketoximes are generally prepared by the action of hydroxylamine (liberated from the hydrochloride *in situ* by sodium carbonate or sodium hydroxide) upon the aldehyde or ketone; they are also formed by the oxidation of primary amines with Caro's acid, $RR'CH{\cdot}NH_2 \rightarrow RR'CH{\cdot}NH(OH) \rightarrow RR'C{:}N{\cdot}OH$ (E. Bamberger, 1902), and by the reduction of primary or secondary nitro-hydrocarbons with stannous chloride and hydrochloric acid: $RR'CH{\cdot}NO_2 \rightarrow RR'CH{\cdot}NO \rightarrow RR'C{:}N{\cdot}OH$. Aldoximes are formed by the reduction of unsaturated nitro-hydrocarbons with aluminium amalgam in dilute acetic acid.

$RR'C{:}CH{\cdot}NO_2 \rightarrow RR'C{:}CH{\cdot}NH(OH) \rightarrow RR'CH{\cdot}CH{:}N{\cdot}OH$, by the action of alkyl iodides on sodium nitrohydroxylamine and by the action of mercury fulminate on phenols or benzenoid hydrocarbons in the presence of a mixture of anhydrous and hydrated aluminium chloride (*see* ALDEHYDES). Ketoximes are formed by the reduction of pseudo-nitriles,

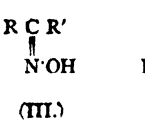
$RR'C(NO_2)NO \rightarrow RR'C(NH{\cdot}OH)_2 \rightarrow RR'C{:}NOH + NH_2OH$.

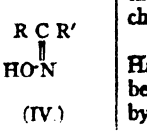
Many oximes form co-ordination compounds with metals and the insolubility of some of these compounds is utilized in quantitative analysis; for example, dimethylglyoxime and α-benzildioxime are used for the determination of nickel, and β-naphthaquinonemonoxime for cobalt.

Stereochemistry of the Oximes.—Many unsymmetrical oximes (*i.e.*, where R and R' are different) exist in isomeric forms. This isomerism is now usually explained on the hypothesis of Hantzsch and Werner (1890), in which the assumption is made that the three valency directions of the nitrogen atom do not lie in one plane, the space models of the compounds being represented as (I.) and (II.), or more briefly as (III.) and (IV.).


(I.)

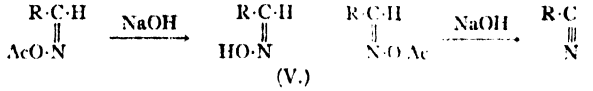

(II.)


(III.)

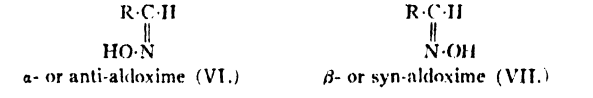

(IV.)

The isomerism is determined by the nearness of the hydroxyl group to R' in one compound, and to R in the isomeride. Evidence that the three valency directions of a nitrogen atom doubly linked to carbon are not coplanar has been obtained by Mills and others. (*See* STEREOCHEMISTRY.)

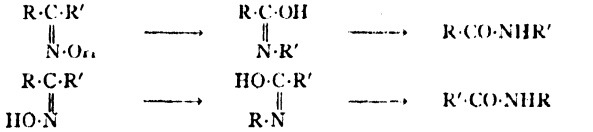
The configuration of the aldoximes is determined by the action upon them of acetic anhydride, which converts both varieties to acetyl derivatives. One of these compounds on treatment with dilute sodium hydroxide is slowly hydrolysed back to the original oxime, and the other is at once decomposed to the nitrile. Hantzsch assumed that the compound containing the methine hydrogen and the acetoxy-group near together (V.)


(V.)

would most readily lose acetic acid to give the nitrile; he therefore gave the configuration (VII.) to the oxime from which this acetyl compound was prepared and (VI.) to the other


α- or anti-aldoxime (VI.) β- or syn-aldoxime (VII.)

The configuration of the ketoximes is determined by the "Beckmann change" (1891) by which the ketoxime is converted into an amide, usually by the action of phosphorus pentachloride in ether at 0° C.



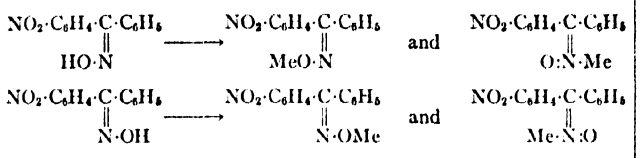
The assumption was made that the group adjacent to the hydroxyl changed places with it, and became attached to nitrogen. Meisenheimer, however, has adduced (1921) evidence in favour of the *trans* rather than of the above *cis* interchange of groups in the Beckmann change. Moreover, Brady and Bishop (1925) favour the *trans* rather than the *cis* elimination of acetic acid from the acetyl derivatives of the aldoximes. These authors suggest in consequence that the configurations assigned by Hantzsch should all be reversed. Since, however, the question is still unsettled, the old configurations are here retained.

Aldoximes in which R is an alkyl group are known only in the β- or *syn*-form; where R is a benzene or naphthelene nucleus, the oxime, as obtained by the action of hydroxylamine on the aldehyde, has the α- or *anti*-configuration. In order to obtain the syn-aldoxime in the latter case the oxime is dissolved in dry ether and the solution saturated with dry hydrogen chloride at 25–30° C. The precipitated hydrochloride is decomposed with aqueous sodium carbonate, and the syn-oxime obtained is purified by crystallization; or the anti-oxime, in benzene, is exposed in silica vessels to the action of ultra-violet light. In certain cases it has been found impossible to obtain the syn-aldoxime by any of the known methods. The syn-aldoximes are unstable and are converted to the anti-isomerides by traces of dilute acids, or in many cases by keeping; they are much weaker acids and less soluble than the corresponding anti-compounds.

Ketoximes in which R and R' are both alkyl groups are known in one form only; where R is alkyl and R' aryl, usually only one form is known, but where R and R' are both aryl groups the action of hydroxylamine on the ketone frequently yields a mixture of the two isomerides which can be separated by fractional crystallization. There is no known method of converting the stable into the unstable isomeride in the case of the ketoximes; the reverse change occurs on keeping.

The alkylation of the oximes affords valuable support for the Hantzsch-Werner theory; for example, the isomeric *p*-nitrobenzophenone oximes yield four methyl derivatives, as demanded by the stereo-chemical hypothesis, the methyl group being

attached to the oxygen atom (*O*-ether) or to the nitrogen atom (*N*-ether), respectively:



The aldoximes give only three alkyl derivatives, both anti- and syn-aldoxime yielding the same N-alkyl compound, this being regarded as derived from the tautomeric form of the oximes RR'C:NH:O. (O. L. B.)

OXNARD, a city of Ventura county, California, U.S.A., on the Southern Pacific railway, midway between Los Angeles and Santa Barbara, and 4 m. from the ocean. Pop. 4,417 in 1920 (30% foreign-born white); estimated locally at 8,000 in 1928. It is the trading centre for an extensive agricultural district, and has a large beet-sugar factory, a rabbit-packing plant and other manufacturing industries. Since 1924 an annual Eisteddfod has been held. Oxnard was founded in 1898 and incorporated in 1903.

OXUS or AMU DARYA, one of the great rivers of Central Asia. From Lake Victoria (Sor-Kul) in the Pamirs, which was originally reckoned as the true source of the river, to Khamiab, on the edge of the Andkhui district of Afghan Turkistan, for a distance of about 680 m., the Oxus forms the boundary between Afghanistan and Russia. For another 550 m. below Khamiab it follows an open and sluggish course till it is lost in the Aral sea, being spanned at Charjui, 150 m. below Khamiab, by the wooden bridge which carries the Russian railway from Merv to Samarkand. The level of Lake Victoria is 13,400 ft. above sea. At Khamiab the river is probably rather less than 500 ft. The total length of the river is 2,400 km. and its catchment area about 300,000 sq.km. The rainfall of this basin varies probably between 90 and 150 cu.km. p.a. and its discharge into the Aral sea is about 32 cu.km. p.a. About 6,000 sq.km. depend on its waters for irrigation.

Sources.—The final survey of the Pamir region (wherein the heads of all the chief tributaries of the river lay hidden), by the Pamir boundary commission of 1895 established the following facts. The elevated mountain chain, now called the Nicolas range, which divides the Great from the Little Pamir, is a region of vast glaciers and snow-fields, supplying the greater part of the water of the lakes lying immediately north and south. The Nicolas range may be regarded as the chief fountain-head, through Victoria and Chakmaktin lakes, of at least two of the upper tributaries of the Oxus, namely, the Aksu (or Murghab) and the Pamir river, and as contributing largely to a third, the Ab-i-Panja. It is possible that there may be warm springs on the bed of Lake Victoria, as such springs are of frequent occurrence in the Pamirs; but there is no indication of them in the Chakmaktin basin, which is an expansion occurring in the course of the Aksu and not the fountain-head of the stream. There are indications that the beds of these lakes are rapidly silting. The enormous glaciers which lie about the upper or main branch of the Ab-i-Panja (called the Ab-i-Wakhjir or Wakhan), which rises under the mountains enclosing the head of the Taghdumbash Pamirs are another important source of the river. If the Aksu (or Murghab) and the Pamir river from Lake Victoria are to be considered in the light of independent tributaries, it is probable that the Ab-i-Panja contributes as much glacial flood to the Oxus as either of them.

Kala Panja to Ishkashim.—From the point where the rivers of the Great and Little Pamirs join at Kala Panja to Ishkashim, at the elbow of the great bend of the Oxus northwards, the river valley and the northern slopes of the Hindu Kush, which near Ishkashim extend in slopes of barely 10 m. in length from the main watershed to the river banks, have been carefully mapped. These slopes represent the extent of Afghan territory which exists north of the Hindu Kush between Kala Panja and Ishkashim. From Ishkashim northwards the river passes through the narrow rock-bound valleys of Shignan and Roshan, thence north and west through the mountains and defiles of Darwaz. This part of the Oxus, until it once again emerges from the Bokhara hills into the open plains bordering Badakshan on the north, falls within the area of Russian surveys.

At Langar Kisht, a little to the east of the Oxus bend, there is a small Russian post of observation. About 50 m. north, where the Suchan or Ghund joins the Oxus from the Alichur Pamir, there is another and larger post called Charog. On the left bank of the river the Afghans maintain a frontier post at the fort of Kala Bar Panja. A road connects Charog with the Alichur Pamir, following the general course of the Ghund stream, forming a valuable link in the chain of communications between Bokhara and Sarikol. Eighty-five miles north of Ishkashim, at Kala Wamar, the river which rises in the Little Pamir, and which is called Aksu, Murghab, or Bartang, joins the Oxus from the east. It is on this river that the Russian outpost, Murghabi, (or Pamirski), is situated, at an elevation of 12,150 ft. above the sea. Fort Murghabi is connected by a good military road with Osh. At this point the measurement of the comparative lengths of the chief Pamir tributaries of the Oxus is as follows:—to the head of the Aksu at Lake Chakmaktin 260 m.; to the head of the most easterly tributary of Lake Victoria, in the Great Pamir, about 230 m.; to the glacial sources of the Ab-i-Wakhjir, about 230 m. For 120 m. the two latter are united in the main stream of the Oxus, the volume of which has been further increased by the Ghund and Shakhdara draining the Alichur Pamir and the heights of Shignan.

Ishkashim to Kolab.—The narrow cramped valley of the river between Ishkashim and Kala Wamar is hedged in on the west by a long ridge flanking the highlands of Badakshan; on the east the buttresses and spurs of the Shignan mountains (of which the strike is transverse to the direction of the river and more or less parallel to that of the main Hindu Kush watershed) overhang its channel like a wall, and afford but little room either for cultivation or for the maintenance of a practicable road. Yet the lower elevation (for this part of the Oxus stream is not more than about 7,000 ft. above sea-level) and comparatively mild climate give opportunities to the industrious Tajik population for successful agriculture, and a track exists on the left bank of the river to Kala Bar Panja opposite the Ghund (or Suchan) debouchment, which is practicable for mules. There are no bridges, and the transit of the river from bank to bank can be effected only by the use of inflated skins.

Beyond the Bartang (or Murghab) confluence the valley narrows, and the difficulties of the river route increase. Between Kala Wamar (6,580 ft.) and Kala Khum (4,400 ft.), where the Oxus again bends southwards, its course to the north-west is almost at right angles to the general strike of the Darwaz mountains, which is from north-east to south-west, following the usual conformation of all this part of high Asia. Thus its chief affluents from the north-east, the Wanj and the Yaz Ghulam, drain valleys which are comparatively open. At Kala Khum the river is 480 ft. wide, narrowing to 350 ft. in the narrowest gorge. Its level varies with the obstructions formed by ice, falling as much as 28 ft. when its upper channels are blocked.

In the valleys of the Waksh and the Surkhab to the north of Darwaz, which form an important part of the province of Karategin, maple, ash, hawthorn, pistachio and juniper grow freely in the mountain forests, and beetroot, kohl rabi and other vegetables are widely cultivated. About the cliffs and precipices of the Panja valley near Kala Khum are the wild vine, cerasus and pomegranate, and the plane tree and mulberry flourish in groups near the villages. Here also, amongst other plants, the sunflower decorates village gardens. The houses are built of stone and mortar, and above the thatched straw roof which surmounts the double-storeyed buildings the square water-tower rises gracefully. The left bank of the river belongs to Afghanistan.

From Kala Khum, which fort about marks the most northerly point of the great bend of the Oxus round Badakshan, the river follows a south-westerly course for another 50 m. through a close mountainous region and widens into the more open valley to the south of Kolab.

The topography of Darwaz south of the river is not accurately known, but at least one considerable stream of some 60 m. in

length drains to the north-east, parallel to the general strike of the mountain system into the transverse course of the Oxus, which it joins nearly opposite to the lateral valleys of Yaz Ghulam and Wanj. This stream is called Pangi-Shiwa, or Shiwa. Another of about equal length, the Ragh or Sadda, starting from the same central water-parting of this mountain block, and included within the Oxus bend, follows a transverse direction at almost right angles to the Shiwa, and joins the Oxus valley near its debouchment into the more open Kolab plains, where the course of the Oxus has again assumed a direction parallel to the mountain strike. Towards its junction with the Oxus it cuts through successive mountain ridges, which render its course impracticable as a roadway. It is necessary to avoid the river, and to pass by mountain tracks which surmount a series of local spurs or offshoots from the central plateau, in order to reach the Oxus. The existence of this route, which traverses the Darwaz mountains from east to west, cutting off the northern bend of the Oxus, and connecting those easterly routes which intersect the Pamirs by means of the Ghund and Shakhdara (and which concentrate about Lake Shiwa) with Kolab in eastern Bokhara, is important. (*See* BADAKSHAN.)

Badakshan Region.—From about the point where the Oxus commences to separate Russian territory from the comparatively open Afghan districts of Rustak and Kataghan, it adopts an uncertain channel and splits, leaving broad central islands. Between Kolab and Pata'Kesar, immediately north of the Turkistan city of Mazar-i-Sharif, there are at least three well-known *guzars* or fords. Besides the Kolab and Surkhab (or Waksh), the great muddy affluents from Karateghin on the north—the Kabadian, the Surkhan, and the Darbant are very considerable tributaries from Bokhara. The last is the river on which the well-known trade centre of Shirabad is built, some 20 m. north of the river. Near the junction of the Surkhan with the Oxus are the ruins of the ancient city of Termez, on the northern bank, and the ferry at Pata Kesar connects Bokhara and Mazar.

From the south the Kokcha and the Khanabad (or Kunduz) join the Oxus between Kolab and the Mazar crossings. The valley of the Kokcha leads directly from the Oxus to Faizabad, the capital of Badakshan, and its head is close above Ishkashim at the southern elbow of the great Oxus bend, a low pass of only 9,500 ft. dividing its waters from those of the main river. This undoubtedly was a section of the great central trade route of Asia, which once connected Ferghana and Herat with Kashgar and China. (*See* BADAKSHAN.) This river and the Khanabad tap the northern slopes of the Hindu Kush; their sources are in the unmapped Kafiristan mountains. To the west of the Kunduz no rivers find their way through the southern banks of the Oxus. Throughout the plains of Afghan Turkistan the drainage from the southern hills is arrested and lost in the desert sands.

At Airatan, a little above the Pata Kesar ferry, there are ruins, as also at Khisht Tapa (where the road from Kabadian to Tashkurghan leaves the river) and at Kalukh Tapa.

The Oxus in flood is here rarely less than 1,000 yards wide, and in some places fully a mile. Its winter channel is from two-thirds to three-fourths of its flood channel, except where it is confined within narrow limits by a rocky bed, as at Kilif, where its unvarying width is only 540 yards. The average strength of the current in flood is about 4 m. per hour, varying from 2½ to 5 m. The left bank above Kilif is, as a rule, low and flat, with reed swamps and a strip of jungle between the reeds and the edge of the elevated sandy desert. The jungle is chiefly tamarisk and padah (willow). Swamp deer, pheasants and occasionally tigers are found in it. The right bank is generally higher, drier, more fertile and more populated than the left.

Irrigation.—A wide belt of blown sand (or Chul), sprinkled with saxaul jungle, separates the swamps on the south side of the river from the cultivated plains of Afghan Turkistan; but in places, notably for about 12 m. above Khamiab where the Russo-Afghan boundary touches the river, through the Khwaja Salar district and in a less degree for 50 m. above the Kilif ferry, the Ersari Turkmân has repelled the encroaching desert sand-waves, and a strip of riverain soil averaging about a mile in width has been reclaimed and cultivated by irrigation. The cultivation, principally of wheat and barley, supported by canals drawn from the Oxus (the heads of which are constantly being destroyed by flood and again renewed) is of a very high order. The fields are intersected by narrow stone-walled lanes, bright with wayside flowers, amongst which the poppy and the purple thistle of Badghis are predominant; the houses, neatly built of stone, are scattered in single homesteads, substantial and comfortable; and the willow and mulberry offer a grateful shade in summer, when the heat is often insupportable. The fiery blasts of summer, furnace-heated over the Kizil Kum, are hardly less to be feared than the ice-cold north-western blizzards, which freeze men in the open desert, and frequently destroy whole caravans.

The Oxus ferries are large flat-bottomed boats which are towed across the river by small horses attached to an outrigger projecting beyond the gunwale by means of a surcingle or bellyband. They are thus partially supported in the water whilst they swim. The horses are guided from the boat, and a twenty- or thirty-foot barge with a heavy load of men and goods will be towed across the river at Kilif (where, as already stated, the width of the river is between 500 and 600 yards only) with ease by two of these animals. The Kilif ferry is on the direct high-road between Samarkand and Akcha. It is perhaps the best-used ferry on the Oxus.

Below Khamiab, to its final disappearance in the Aral sea, the Oxus flows through a vast expanse of sand and desert. Under Russian auspices a considerable strip of alluvial soil on the left bank has been brought under cultivation, measuring 4 or 5 m. in width, and there is more cultivation on the banks of the Oxus now than there is in the Merv oasis itself; but it is confined to the immediate neighbourhood of the river, for no affluents of any considerable size exist. The river is navigable below Charjui. There is now a regular steamer service as far as Pata Kesar. The steamers are flat-bottomed paddle boats drawing 3 feet. About 100 m. above the Aral sea is the ancient oasis of Khwarezm or Khiva, entirely dependent on the Oxus for irrigation. The river here perpetually shifts eastwards, causing a constant need for lengthening the irrigation channels lest the oasis become a desert.

Previous Bed.—It appears that there was a time in the post-Pliocene Age when a long gulf of the Caspian sea protruded eastwards nearly as far as the longitude of Merv, covering the Kara Kum sands, but not the Kara Kum plateau to the north, which is separated from the sands by a distinct sea beach. At the same time another branch of the same gulf protruded northwards in the direction of the Aral, probably as far as the Sary Kamish depression, which lies to the west of the Khivan delta of the Oxus, separated from it by wide beds of loess, clays and gravel, covering rocks of an unknown age. The Murghab river and the Hari Rud, which terminate in the oases of Merv and Sarakhs, almost certainly penetrated to the gulf of the Kara Kum, but the question whether the Oxus was ever deflected so as to enter the gulf with the Murghab cannot be said to be answered decisively at present. The former connection between the Caspian and Aral by means of the gulf now represented by the Sary Kamish depression seems to be admitted by Russian scientists, nor would there appear to be much doubt about the connection between the Khivan oasis and the north end of the Sary Kamish.

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OXY-ACETYLENE BLOWPIPE. An apparatus with a mixing jet which produces an intensely hot flame by projecting and burning acetylene with oxygen. It is of great value for metal working, producing a flame which attains about 6,000° F at the hottest part. In the high-pressure system, which is best for portable outfits, both the acetylene and the oxygen are delivered under pressure to the blowpipe, both from cylinders. In the

low-pressure system the acetylene is drawn direct from a generator. The blowpipes are manipulated either by hand, or guided in a machine. They are used for cutting out various shapes, parting thick sections, cutting out pieces for repairs or breaking-up purposes or welding to make new articles. When used for cutting, an excess of oxygen, about that needed for combination with the acetylene, is fed into the jet. This excess oxygen oxidizes or burns the hot metal. The oxide or "rust" thus formed is removed by the force of the jet and a "cutting" effect results.

When used for welding an excess of acetylene is fed into the jet. This causes any surface oxide to be removed and the hot metal surfaces readily combine, or become welded. Parts can also be heated conveniently for bending or straightening, and glass can be heated for working. The oxy-acetylene flame is too hot for brazing purposes, for which an oxy-coal-gas blowpipe has to be used. The approximate temperature of the oxy-acetylene flame may be compared with those of other flames from the following figures: Oxy-acetylene, 4,400° C; oxy-hydrogen, 2,420°; oxy-coal-gas, 2,200°; air-acetylene, 2,500°; air-coal-gas, 1,800°. (*See* WELDING.)

OXYGEN, a colourless, odourless, tasteless gas, somewhat heavier than air (sp.gr. 1·10523); it is slightly soluble in water, and this dissolved oxygen plays an essential part in the respiration of aquatic animals. (Symbol O, atomic number 8, atomic weight 16·000.) Oxygen combines with nearly all the elements under suitable conditions, but these reactions often do not take place if the substances are perfectly dry. With the exception of the "noble" metals, gold and the platinum group (*q.v.*), the metallic elements all oxidize when heated in oxygen, although molten silver dissolves 22 volumes of the gas without combining chemically with it, the absorbed oxygen escaping again when the metal cools.

Oxygen is by far the most abundant element, being nearly equal in amount to all the others put together. It forms 21% by volume of the atmosphere, eight-ninths by weight of water, and nearly one-half by weight of all the rocks composing the half-mile crust of the earth. Growing plants absorb carbon dioxide (*q.v.*), assimilating carbon and rejecting oxygen. It is the only gas able to support respiration.

Preparation and Properties.—It is readily prepared on a small scale by heating a mixture of potassium chlorate with about one-third of its weight of manganese dioxide, which facilitates the decomposition. From 1886, for about 20 years, oxygen was produced commercially by the Brin or barium oxide process. Barium monoxide was heated to 1,000° F and absorbed oxygen from the air to form the dioxide. At 1,600° the oxygen thus absorbed was again set free, the monoxide being regenerated. In later methods the temperature was maintained constant at about 1,200° F, and change of pressure was relied upon for determining the respective phases of oxidation and deoxidation. The purity obtainable, however, was not more than 94%.

In 1902 Linde applied the process of rectification to liquid air and was able to extract oxygen of 98·5% purity in economical yield. Air is freed of its carbon dioxide, compressed, cooled and then expanded, either in an engine doing external work or merely through a valve to perform internal molecular work; in both cases heat is lost and the temperature further lowered. This cooling effect is made cumulative by means of heat interchangers, tubular metal devices by which the cold gases after expansion are made to travel in indirect contact with and in counter-current to the incoming uncooled compressed air, so that the latter becomes continually colder at the point of expansion, until a limit is set by liquefaction. The liquid so produced is made to flow down a rectification column, fitted with numerous plates fashioned to ensure its intimate contact with ascending gas, which is produced at the base of the column by evaporating the liquid as it arrives there. When equilibrium is attained, almost pure oxygen can be drawn from the bottom of the column in gaseous or liquid form. Improvements in construction introduced in 1926 enable the separation of the nitrogen and oxygen of air to be effected almost completely, the oxygen purity being 99·5%, and the nitrogen over 99%.

Oxygen is also a by-product in hydrogen manufacture by the electrolysis of water. The much greater power consumption, however, prevents this process competing with the liquid-air process for oxygen production only. The gas is supplied in steel cylinders at a pressure of 120–150 atmospheres. During 1926 the world's production of oxygen, in cylinders, was about 5,000 million cubic feet. The estimation of oxygen in a gas is most conveniently made by means of an alkaline solution of pyrogallol, by metallic copper in conjunction with an ammoniacal solution of ammonium carbonate, by sticks of phosphorus, or by a weakly alkaline solution of sodium hydrosulphite.

Oxygen condenses to a pale blue magnetic liquid, boiling at −182·9° C. By rapid evaporation and consequent cooling, or by cooling in liquid hydrogen, oxygen forms a bluish-white solid, melting at −219° C. When gaseous oxygen is acted on by the silent electric discharge, an unstable modification, ozone (*q.v.*) O_3 is produced.

Uses.—Most of the oxygen is employed in industry for the fusion welding of metals, *e.g.*, steel, cast iron, aluminium, lead, and for the cutting of steel. Gas welding is generally accomplished by the aid of the oxy-acetylene flame, the two gases being supplied to a blowpipe wherein they are thoroughly mixed before combustion. In practice a little more oxygen than acetylene is used, and the resulting flame has an inner white core with a temperature above 4,000° C; it is quickly able to reduce these metals to the molten state locally, where two edges are to be joined. For metal cutting, a separate jet of "cutting" oxygen is provided in a similar blowpipe, either in the centre of the heating jet or behind it. As a rule, the melting point of an oxide is higher than that of the metal from which it is derived; but the fusion point of industrial iron varies between 1,400–1,500° C, and the mixture of iron oxides fuses at about 1,350° C. In the cutting the oxides of iron are formed and blown away in the molten state before the unoxidized iron reaches its melting point, the necessary temperature being maintained chiefly by the heat of combustion itself, but to a less extent by an independent heating jet. When the cutting blowpipe is moved mechanically, and therefore regularly, over the metal a remarkably smooth regular cut is obtained, even through metal 1/2in. thick.

Oxygen is widely used in medical practice, inhalation being of service in cases of pneumonia, heart complaints, etc.; also in cases of gas poisoning, especially by carbon monoxide. It is used with nitrous oxide by anaesthetists.

Liquid oxygen has considerable industrial applications. If a rod of hard gas-carbon be heated to redness at one end and then immersed in liquid oxygen, it burns in the liquid with intense evolution of light and heat, the carbon dioxide resulting being frozen and retained as a white solid in the liquid. If the carbon is presented to the oxygen in a porous form, *e.g.*, wood charcoal, lampblack, soot, cork meal, sawdust, or wood pulp, the mixture forms a powerful explosive, more than twice as effective as blasting gelatine. It is so remarkably effective because the oxygen is free, and not chemically combined with other elements as in explosives like gunpowder or nitro-compounds, the explosion being an instantaneous oxidation of carbon, hydrogen or other elements. The materials are formed into cartridges in a paper wrapping; these may be 8in. long and 1½in. in diameter. They are thoroughly soaked in liquid oxygen and placed in the bore hole, and, after tamping, fired electrically or by fuse. This explosive has the great advantage that it automatically becomes dead in a short time if not fired, owing to the evaporation of the oxygen. It is exceptionally suitable for use in iron mines and in tunnelling, as it gives rise to no harmful gases.

The highly volatile liquid is transported in double-walled spherical vessels, made of spun copper with long, narrow necks. A good vacuum is created mechanically between the walls. When the excessively cold liquid oxygen is introduced into the vessel, activated charcoal (*q.v.*), placed in the vacuous space and in contact with the inner sphere, becomes cooled, and then possesses the remarkable property of absorbing the residual gas and converting the vacuum to one of an exceedingly high order (a few millionths of a mm. of mercury). This vacuum, coupled with the highly polished metal surfaces, prevents the ingress of heat

to a large extent. A 25-litre container (the usual size) loses by evaporation only 5% of its full liquid charge per day. The liquid is poured from them into smaller dipping flasks, of similar construction, but cylindrical in shape with open top, so that the cartridges can be readily inserted and withdrawn. (For oxygen in relation to muscular contraction *see* MUSCLE.)

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(C. R. H.)

OXYHYDROGEN FLAME, the flame attending the combustion of hydrogen and oxygen, and characterized by a very high temperature. Hydrogen gas readily burns in oxygen or air with the formation of water. The temperature of the flame is dependent on the circumstances in which the process takes place. It obviously attains its maximum in the case of the firing of pure "oxyhydrogen" gas (a mixture of hydrogen with exactly half its volume of oxygen, the quantity it combines with in becoming water, German *Knall-gas*). It becomes less when the "oxyhydrogen" is mixed with excess of one or the other of the two reacting gases, or an inert gas such as nitrogen, because in any such case the same amount of heat spreads over a larger quantity of matter. It acquired considerable application in platinum works, this metal being only fusible in the oxyhydrogen flame and the electric furnace; and also for the production of limelight, as in optical (magic) lanterns. But these applications are being superseded, *e.g.*, by the electric furnace, electric light and the oxyacetylene flame.

OYAMA, IWAO, PRINCE (1842–1916), Japanese field-marshal, was born in Satsuma. He was a nephew of Saigo, with whom his elder brother sided in the Satsuma insurrection of 1877, but he nevertheless remained loyal to the imperial cause and commanded a brigade against the insurgents. When war broke out between China and Japan in 1894, he was appointed commander-in-chief of the second Japanese army corps, which, landing on the Liaotung Peninsula, carried Port Arthur by storm, and, subsequently crossing to Shantung, captured the fortress of Wei-hai-wei. For these services he received the title of marquess, and, three years later, he became field-marshal. When (1904) his country became embroiled in war with Russia, he was appointed commander-in-chief of the Japanese armies in Manchuria, and in the sequel of Japan's victory the mikado bestowed on him (1907) the rank of prince. He received the British Order of Merit in 1906. He died on Dec. 12, 1916.

OYER AND TERMINER, the Anglo-French name, meaning "to hear and determine," for one of the commissions by which a judge of assize sits (*see* ASSIZE). By the commission of oyer and terminer the commissioners (in practice the judges of assize, though other persons are named with them in the commission) are commanded to make diligent inquiry into all treasons, felonies and misdemeanours whatever committed in the counties specified in the commission, and to hear and determine the same according to law. By the Treason Act 1708 the Crown may issue commissions of oyer and terminer in Scotland for the trial of treason and misprision of treason.

In the United States oyer and terminer is the name given to courts of criminal jurisdiction in some States, *e.g.*, New York, New Jersey, Pennsylvania and Georgia.

OYSTER. Many marine animals are popularly called oysters, but most of these are only distantly related to the genus of true oysters, *Ostrea*. The different kinds of true oysters differ among themselves in shape, size and ornamentation of the shell and in their biological characters. Their nearest allies are the fan-shells (*Pinna*) and *Lima*. Window-pane oysters, pearl-oysters (*Margaritifera*) and crow-oysters are distant allies. All belong to the class Lamellibranchia (*q.v.*) of the Mollusca (*q.v.*).

At the present time oysters occur mainly between tidemarks or in shallow water, especially in estuaries, off the coasts of all continents except in the polar seas. A few species (including *Ostrea cochlear*) have been dredged from deep water down to 4,300 feet. As fossils, oysters occur from the Triassic onwards; the type form begins in the Jurassic. More than 500 supposed species of fossil oysters have been described but probably many of them are mere varieties.

Kinds.—Although more than 100 species have been described on shell-characters, it is probable that the total will diminish as more is discovered about the different forms. The most important species of economic value are given in the following table.

TABLE I. *Economic Species of Oyster*

Common name	Scientific name	Where found
(1) Rock oyster	*O. cucullata*	N.W., N., E. and S.E. coasts of Australia; East Indies; India; Norfolk Is.; New Caledonia; N. Is. of New Zealand; N.E. coast and Inland sea, Japan; S.E. coast of South Africa.
(2) American-Canadian oyster	*O. virginica* = *O. elongata*	Atlantic coast of N. America from St. Lawrence R. to Mexico.
(3) Portuguese oyster	*O. angulata* or *Gryphaea angulata*	S.W. European and N.W. African coasts.
(4) The Japanese gigantic oyster	*O. gigas*, doubtful variety of *O. cucullata*	N.E. coast of Japan and coast of China.
(5) European or flat oyster	*O. edulis*	Atlantic coast of Europe and Mediterranean sea, from Norway to the Adriatic sea, including the British Isles.
(6) The British Columbian oyster	*O. lurida*	W. coast of N. America from about Queen Charlotte sound to California.
(7) The Australian mud oyster	*O. angasi* = *O. sinuata*	S. and S.E. coasts of Australia, Tasmania, and S. Is. of New Zealand.
(8) A Japanese oyster	*O. densilamellosa*	S. and E. coasts of Japan.
(9) A Chinese oyster	*O. rivularis* = *O. sinensis*	Off the coasts of China.

REPRODUCTION

So far as is known, all oysters reproduce by one of the two following methods.

Method I.—This may be illustrated by the European oyster, *O. edulis*, other oysters which exhibit similar or the same sex forms being the Australian mud oyster, the British Columbian oyster and the Japanese shallow-water oyster, *O. densilamellosa*.

Sex and Sex-change.—Individuals are normally at one instant either male or female, but they change from male to female, and back again many times during life. Hermaphrodites, however, do occur in varying proportions, but usually function as females.

Spawning.—The Sperms have a "head" about $\frac{2}{25,400}$ in. or 2 μ, and a tail 20 to 30 μ and are shed directly into the sea; females collect the sperms from the sea-water and store them. The female-functioning individual spawns its eggs from the body, but retains them inside the shell where they develop into tiny motile bivalve *larvae* before they leave the parent. These larvae are frequently incorrectly called "spat" (*see* below). An individual three to four years old spawns about 500,000 eggs, while one seven to eight years old may spawn about 1½ millions or more in a season.

Development.—As the eggs, which are about 150 μ in diameter, are extruded they are fertilized, and begin to develop at once into *embryos*. The embryos begin swimming slightly when three to four days old. At the age of four to five days the shell begins to form and the embryo by a stronger development of its swimming organs passes into the *larval* stage.

Up to this time the embryos have remained white in colour, but as the shell grows larger the larva becomes grey and then passes through various shades of blue-grey and slate and, finally, becomes purplish-black when the shell is fully developed at a size of 180 to 210μ. As the shell develops the cilia grow stronger. At this stage (at an age of about ten days) the larva leaves the parent to swim freely in the sea, although largely at the mercy of winds and tides. It swims about for a week to ten days or more, feeding and growing to a size of about 270μ before settling down to a permanent sedentary life.

The larva may "settle" on a great variety of objects at any level in the water. It attaches itself by cementing the left valve of the shell to the object, loses its swimming organs, and quickly develops rudimentary adult organs, being then known as a *spat*. New shell material is deposited at the edge of the larval shell in a few hours and the shell thereby also soon assumes the adult form. The settling of larvae on objects in the sea is called a *spatfall*. Studies of spatfalls show there is a tendency of the larvae to settle in situations where the light is subdued. It is probable that the larvae of tropical species settle more easily than those of temperate species.

When an oyster is carrying white embryos or larvae it is said to be *whitesick;* when carrying grey larvae, *greysick,* and when bluish-grey to black, *blacksick.*

Method II.—This can be illustrated by the Canadian and American oyster (more fully described by Stafford, in the reference given below) but with little alteration this may be applied to the rock oyster, *O. cucullata,* the Portuguese oyster and the gigantic Japanese oyster.

Each individual is normally either male or female. So far as is known there is no change of sex. Both sexes shed their sexual products directly into the sea, where haphazard fertilization occurs. A good sized individual may shed at one spawning upwards of 50 to 60 million eggs. The egg, which is small (about 50 μ), develops into an embryo and larva in 8 to 12 hours. Within about two days the larva grows a complete bivalve shell, which in a period of two weeks or more reaches a size of about 380 μ before cementing itself to some object in the sea. After settling, the larva rapidly grows shell and develops adult organs to become a spat in the same way as the European oyster larva.

Artificial fertilization can easily be performed in this type of oyster by mixing ripe eggs and sperm in sea-water, provided clean conditions are ensured and excess of sperm avoided. In the *O. edulis* type artificial fertilization is more difficult.

Food and Mode of Feeding.—The main food of the oyster consists of microscopic plants, diatoms and peridinians, although microscopic animals probably always contribute an important portion. Decaying sea-weeds with their dependent bacteria have also a definite but unknown food-value. Oysters do not, however, feed all day long, nor at all times of the year. The American oyster does not feed late at night and in early morning, and relatively little on the ebb tide, little or no feeding occurs in late autumn and winter; below a temperature of about 4° C. (39°·2 F) this oyster practically ceases to feed. Other oysters probably behave similarly but the temperature minimum varies for each species.

Oysters obtain their food by means of the gills, which are used at one and the same time as a water pump, food-collector and food-transporter. This living machine draws water into the shell into the inhalant chamber, and expels it from the exhalant chamber. The gills constitute the sole partition between these two chambers, and sieve off all the particles in the water drawn through the shell-space. The food particles arrested on the surface of the gill are collected into minor channels situated on the radial markings and from these are transported mainly to a large channel on the *free* edge of each gill leaflet. As the food-particles pass into these larger channels they are rolled into a sausage-shaped mass by mixing with a sticky fluid, mucus, and then passed to the lips or palps, which may either direct it into the mouth to be eaten, or pass it on to the mantle whence it is eventually rejected from the shell. Food-masses containing much heavy material, such as sand or mud, are rejected, others eaten. All these manifold functions are performed by rows of microscopic whip-like organs (cilia) beating in sets rhythmically and in co-ordination. Throughout these operations mucus is manufactured and thrown out to entrap and retain the captured particles, and to permit of their easy transport in bulk. Unwanted material in the inhalant chamber is carefully collected together and literally blown out of the shell by sudden closing of the valves.

Breeding.—It has been seen that breeding comprises the two distinct operations of spawning and spatting. In the European and the American oysters, it is found that the beginning of breeding varies according to the warmth of the season and of the locality (*see* Table II). Probably other species behave similarly. The European species spawns little when the sea-temperature falls below about 59°–60° F., and the American, Canadian and Portuguese forms appear to require a temperature round about 68° F. for successful spawning, the European oyster tends in estuaries to spawn on the spring tides, and in 1925 spawned especially on the full-moon tides in the Fal estuary.

TABLE II. *Spawning Seasons*

Kind of oyster	Locality	Approximate spawning season	Authority
European or Flat. *O. edulis*	Taranto (Italy)	March April to Oct.	Proprietors (Dean)
	Arcachon (France)	May to Sept.	De Bon
	Thames estuary (England)	End of May to Sept.	Anson and Willett
	Fal estuary (England)	End of June to Sept.-Oct.	Orton
	Norway (fattening ponds)	Aug. to Sept.	Helland-Hansen
	Norway (offshore)	little or rare	do.
American-Canadian. *O. virginica*	Chesapeake bay, (Md.)	May–June to Aug.	Winslow, Brooks
	Barnegat bay, (N.J.)	End of June to ?	J. Nelson
	Malpeque (Canada)	June–July to ?	Stafford
British Columbian. *O. lurida*	Boundary bay	May to Oct.	Stafford

On European oyster beds the greatest spatfalls of *O. edulis* undoubtedly occur in the warmer localities and in the warmer seasons, and probably a higher temperature (not less than 63°F.) than that required for spawning (59–60°F.) is more favourable, if not actually necessary, for spatting. Other oysters are probably similar to *O. edulis* in this respect. Very good spatting seasons occur sporadically; for example, 1913, 1914 and 1921 were exceptionally good seasons in the Thames estuary. In the same locality bad and moderate spatting seasons have occurred on the average about twice as frequently as good or very good seasons. Similar fluctuations occur in all parts of the world.

Oyster Beds.—In times of scarcity when the spatfall has failed for a longer succession of years than usual, and when the adults on the beds have been reduced beyond a certain minimum, particular beds have gradually died out, as in the Firth of Forth, the German bight, and elsewhere. In open waters, beds die out more easily from these causes than in enclosed estuarine waters. On the other hand, new oyster beds sometimes occur off the coast when swarms of larvae have been carried long distances seawards by tidal currents, and found congenial ground. It is in this manner that deep-sea beds are mostly formed. By careful study of situations it is possible to start new oyster beds artificially by importing a species appropriate to a locality. Of the unknown factors favourable for a good spatting probably food and the physical condition of the water are most important.

Fattening.—Oysters are said to be fat when the body is naturally large, but largeness of body may be caused either by a well-developed reproductive organ only, or by accumulation of reserve food-products. Fatness during the summer or breeding time is mainly of the former type. Fattening by accumulation of reserve products occurs mainly at the close of the breeding season, when food may be taken in faster than it can be utilized. The food-reserves consist largely of glycogen (animal starch),

which is semi-liquid in the living animal and stored in the large bladder-cells found in most parts of the body. Abundance of food is dependent ultimately upon the chemical constituents of the sea-water, of which phosphates and nitrates are the most important.

Shell Growth.—Shell growth in oysters occurs in spurts, and one or more fringes of new shell may be added during one period of growth. In the European oyster in some localities, *e.g.*, Fal estuary, shell growth occurs twice a year, in spring and autumn. The rate of growth of the shell varies locally and from season to season, so that it is impossible to fix any special size for any special age. In the case of the European oyster, if the larva settles in early summer, it may grow into a spat 1 to 1½in. at the end of the growing period of that year, but if larvae settle late in the year they may finish growth in their first summer at a size of even $\frac{1}{12}$ inch. The average size of natural spat on oyster beds, however, at the end of the first summer lies between ½ and ⅝ inch. (Under artificial conditions spat may grow much larger in the first summer, but have then usually extremely thin fragile shells.) In the same way *average* sizes at the end of the second summer of growth are about 1 to 1½in.; in the third summer, about 1½ to 2in.; fourth summer, average 2½ to 2½in.; fifth summer, average 2⅞ to 2⅞in. with a range to about 4 inches.

The average size at a given age will usually be higher on the shallower than on the deeper beds in an estuary, but is probably very high on deep-sea beds. American, Portuguese and tropical oysters grow much more rapidly than the European species; for example, the American species is said to reach a length of 2½in. in seven months in South Carolina.

Enemies and Parasites.—The oyster's natural enemies are more numerous in early than late stages of life. The larva is eaten by small fishes, jelly-fishes, other bivalves, sea-squirts (Ascidians), worms, anemones and small crustaceans, all of which are usually common on oyster beds. Spat, young and old oysters are attacked by borers which bore a hole through the shell and eat the oyster through the hole (especially *Murex* in Europe, *Xymene* in Australia, *Urosalpinx* in America). Fifty per cent of a spatfall may be destroyed where borers are abundant. Crabs (*Carcinus* in Europe, *Scylla* in Australia) attack weak oysters, especially the small ones, and do great damage. Large fishes with special crushing teeth devour large and small oysters (*Myliobatis*, Europe and Australia, *Pogonias* in America). Starfishes (especially *Asterias* species in Europe and America) consume at times quantities of stock, and a flat-worm is reported to be a pest on certain beds in America. The shell is bored into and used for protection by the sponge, *Cliona*, and often in large numbers by the worm *Polydora*. Competitors for food are numerous, such as all bivalves, especially mussels and, in general, all animals which feed in fundamentally the same way as the oyster.

Parasites are not numerous in oysters and are rarely dangerous. In *O. edulis* the spirochaete, *Cristispira* always occurs in the crystalline style. Occasionally the Coccidian, *Chytridiopsis* is found in the eggs, the gregarine (*Nematopsis*) in kidney and gills, and the bucephalus larva of the trematode (*Gasterostomum gracilescens*) in the body tissues generally. The metacercariae of trematodes cause serious damage to the Japanese gigantic oyster.

Diseases.—Weakness and heavy mortality may occur from functional derangement due to bad treatment by man or unfavourable general conditions of life. A normal mortality of 10% per annum due to all causes has been estimated to occur in England, but figures of 20 to 25% are estimated for Dutch beds. In oysters carried from one bed to another a mortality of 15% or more may occur, with possibly higher rates in the second season after relaying. Excess of fresh water, especially from melting snow, may produce great weakness with subsequent high mortality. Prolonged immersion in freshlets of water produces swelling. Sudden cold periods following warm weather in the summer are believed to be harmful. Gales sometimes result in the smothering of immense numbers of oysters on sandy beds, and a great loss may be experienced on muddy beds by silting up. *O. edulis* will live well in sea-water under thick ice, and in water warmed to a temperature of 90° F, and several species can withstand deprivation of oxygen for a week or more in winter, but not in summer. Stunted shell growth occurs in *O. edulis* on many beds, due apparently to a functional disturbance of the growth mechanism; such individuals are usually fat and esteemed for eating. Myolysis, or degeneration of muscular tissue, was associated strongly with the mortality in the Thames estuary in 1920, and has been observed elsewhere, but its cause (or causes) is at present unknown.

Oyster Industry.—The oyster industry constitutes an important source of income, especially in the United States, Holland and France, and in the former country is one of the most important fishery industries on the Atlantic seaboard. The statistics for the world's production—excluding Italy for which no figures are available—shown in Table III., give some indication of the fluctuations in production over a short period, and show mainly a marked decline from about 1920, especially in the United States, British isles, Holland, France and Japan. The chief causes of this decline are (1) over-fishing; (2) the failure of the spatfall in recent years to meet the demand; (3) possible occurrence of increased pollution, which reduces the spatfall, and (4) in Europe, the unusually heavy mortality in 1919–21.

Oyster Culture.—Oyster culture is carried out in four main operations which may be enumerated as (1) care of the beds; (2) production; (3) rearing, and (4) fattening. (1) On all grounds it is necessary to supervise and work on the beds to remove enemies, pests, sea-weeds and dangerous accumulations of all kinds, and otherwise keep the beds clean. (2) A breeding stock is maintained to supply a sufficiency of larvae. When the larvae are ready to settle various materials are placed in the water at suitable times and places to provide settling areas for the young oyster. This material is called *cultch* and varies in different countries. In England, America and Canada the commonest practice is to use clean shell, especially that of the oyster itself. In Holland and France earthenware tiles coated with lime are laid out in selected parts of the beds. In Italy, Australia, Norway, China and Japan branches of trees are thrown into or fixed in the water. Stones are used largely in Australia, New Zealand and China. It is especially important that the material used for providing settlement area should be clean at the time the larvae are ready to settle. If material be placed in water too soon it becomes slimy, overgrown with marine organisms, and, technically, dirty. In Italy bundles of twigs are placed in the water as early as April; in France and Holland tiles are put out in June; in England shell-cultch is usually put out in June, or, in a late season, in July. Bamboos are put out in Japan about April. The best place in a locality to put out the cultch can only be determined by local experience. Good spatfalls may be obtained in either a strong current or on banks covered by calm water. Certain oyster beds are only suitable for producing young oysters, which are sold at ages of one, two or three years for transplanting to or relaying on beds suitable for fattening. (3) Different methods are used in different countries for rearing the young. When shell-cultch is used below low-water mark, rearing may consist simply of leaving the spat on the ground until they are large enough (1½ to 2in.) to be separated from the cultch (culling from the cultch) and then either removed to special beds suitable for growth, or returned to the same bed. Spat on sticks or stones above low-water mark is left in position during the summer or longer and then shaken off and relaid on growing beds. (4) Fattening oysters for the market is the final stage in oyster-culture. Owners of beds suitable for fattening buy from producing grounds young oysters generally three to four years old. These are merely relaid in the sea on special beds and fattening occurs automatically according to the season without further aid. Fattening grounds are only found by experience and may fail to produce fattened oysters in certain years. Artificial manuring of the waters over oyster-beds with phosphates and nitrates has been suggested to ensure fattening. Oysters placed in fresh water absorb water and become falsely fat. In France oysters are fattened artificially and rendered green by being kept in ponds in which an exuberant growth of the diatom *Navicula ostrearia* is cultivated. The greening is due to accumulation of pigments in the gill and palps from the

TABLE III. *The World's Oyster Production (according to statistics)*

Country	Oyster species	Unit of number, volume o. weight	Production			Value: 1924, 1925 or 1926
			1911	1920	1926	
U.S.A.	*O. virginica*	Bushels	30,000,000 (1911–1918)	. . . . .	20,000,000 (1925)	$ 14,000,000
Canada	*O. virginica* *O. lurida*	Barrels, each = 3 imperial bushels	31,746	14,526	22,255	152,073
England and Wales	*O. edulis*	Number	26,358,100	39,439,200	15,857,900	£159,757
do. Fal Estuary	do.	do. estimated	20,000,000	10,000,000	2,500,000	£8,750
Scotland	*O. edulis*	Number	1,158,045	253,731	83,188	£579
Ireland	*O. edulis* mainly	Number	2,773,980	3,020,704	1,022,344	£7,619
Holland	*O. edulis*	Number	30,349,000 (1914)	36,369,600	17,069,900	Gldrs. 1,967,850
Holland (Zuider Zee)	do.	do.	8,495,295	952,985	nil	nil
France	*O. angulata*	do.	790,262,500	378,363,500	1,083,706,000	Fr.78,272,524
	O. edulis	do.	922,305,600	463,309,000	10,867,000	Fr.7,942,660
New S. Wales	*O. cucullata* *O. angasi*	Bags, each = about 3bu.	21,526 (1914)	25,021	28,380 (1924)	£85,141
New Zealand	*O. angasi*	Bags, each = about 3bu.	24,793 (1914)	26,703	27,828	£19,479
	O. cucullata		8,361 (1914)	6,797	6,771	£8,344
Natal	*O. cucullata* *O. prismatica*	Dozens	24,310	21,909	17,288	£762
Japan	*O. cucullata* *O. gigas* *O. densilamellosa*	Kwan = 3·75kg. = 8·27 lb.	329,836 (1914)	10,676,966	3,032,744 (1924)	Yen 616,713

ingested diatoms. Similar natural greening of oysters occurs in certain creeks in Essex and elsewhere. A green colour due to an accumulation of copper shows mostly in the body, rarely in the gills. The copper is present mainly in the blood cells. Metalliferous oysters occur in many parts of the world, viz., Falmouth (England), the Tagus, and certain American beds.

Artificial production of spat has been successfully performed in pits in France, in ponds in Norway, and recently in tanks by the British Government fishery research staff.

In Relation to Human Diseases.—It is known that oysters are liable to filter and retain alive from water contaminated with sewage certain bacteria which when swallowed by man may produce enteric fever. All oysters sent to the London market are scrutinized or sampled by the Fishmongers Company and, if necessary, tested for purity by bacteriological analysis. Oysters from beds contaminated by sewage may be purified in tanks of sterilized water, or by transplanting them for two or three weeks to beds remote from sources of pollution, but in the latter case it is desirable to prove the purity by bacteriological analysis before such oysters are pronounced fit to eat and finally placed on the market.

As oysters are often in poor condition in summer during the breeding period, and as dangerous bacilli in contaminated oysters would rapidly reproduce in warm weather, a close season is imposed in most countries at some period. Such regulations are beneficial also for spawning and spatting. In England the close season for native oysters varies in different localities but generally extends from March–April to August–September. Foreign oysters of any species may be sold in England at any time providing they show a clean health bill. A clean fat oyster may be eaten with impunity at any time of the year.

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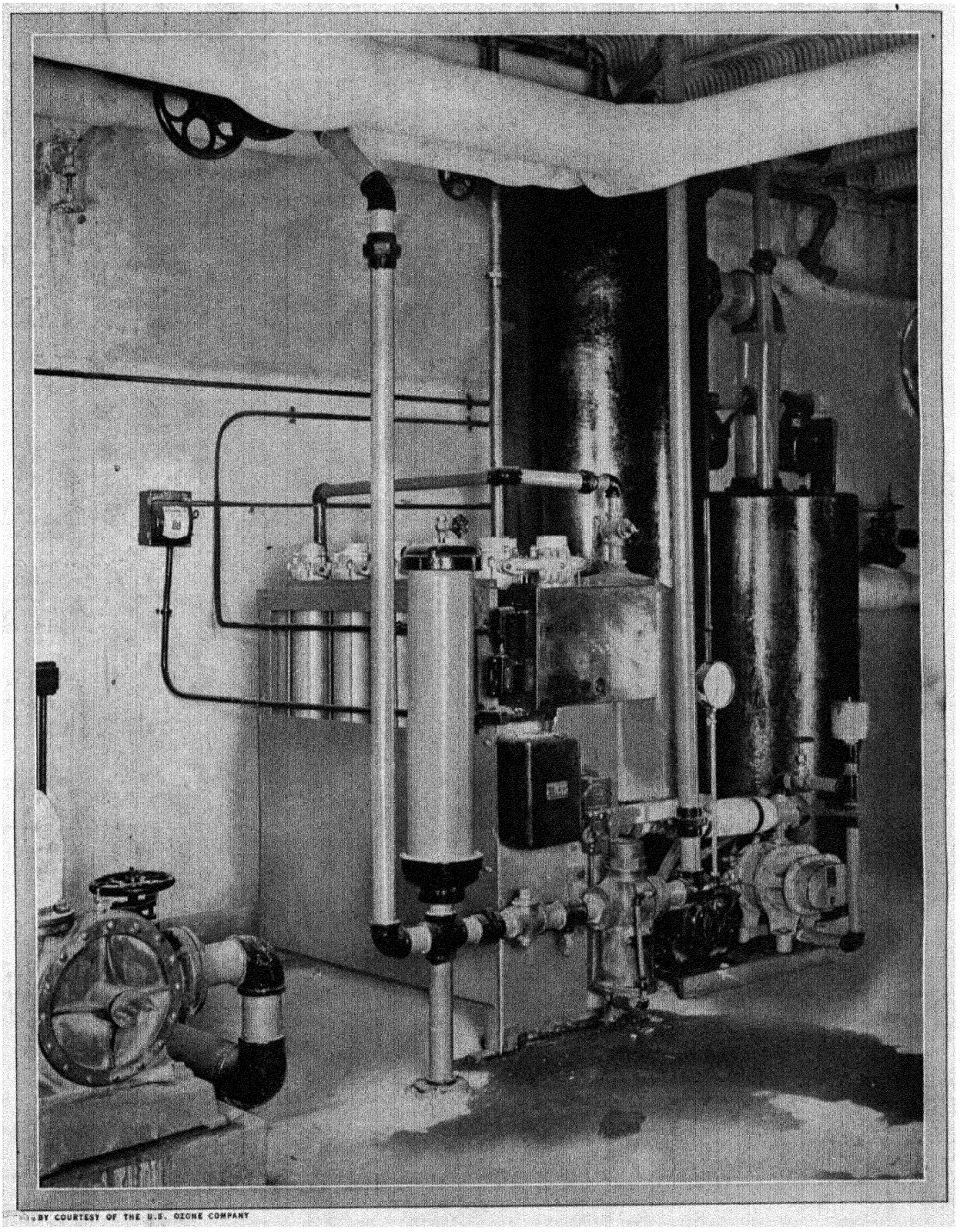
(J. H. O.)

OYSTER BAY, a village of Nassau county, New York, U.S.A., on the north shore of Long Island, 28 m. N.E. of the Brooklyn Borough Hall; served by the Long Island railroad and in summer by ferries to Greenwich, Stamford and New Rochelle. The summer population in 1928 was estimated locally at 8,500. Oyster Bay is a residential village, with many country estates in the vicinity. Oyster-dredging is the principal industry. It was the beloved home of Theodore Roosevelt, and his grave is on a hillside in Youngs Memorial cemetery. His home, "Sagamore Hill," stands on high ground, commanding delightful views. A seaside park, established as a memorial to Roosevelt, was opened in 1928. Oyster Bay harbour was explored by de Vries in June 1639. A settlement from Lynn (Mass.) was attempted in 1640 but was prevented by Governor Kieft, and for some years the territory around the harbour was claimed by both English and Dutch. The first permanent settlement was made by Peter Wright and others from Massachusetts in 1653. The harbour was a famous smuggling centre at the end of the 17th century.

OYSTER-CATCHER or SEA-PIE, a genus of wading birds, allied to the plovers. Conspicuous in both sexes by its black and white plumage and long red beak, the common oyster-catcher (*Haematopus ostralegus*) is found on all coasts from Iceland to the Red Sea. It feeds largely on marine worms, crustaceans and molluscs, and is very wary. The hen lays three clay-coloured eggs blotched with black, usually on a shingle-bank near the sea. The young are at first clothed in protectively coloured down and can run at once. Usually seen in pairs, oyster-catchers sometimes congregate in large flocks. The courtship consists of a dance in which one or both birds run round piping. Sometimes this dance, losing its original significance, is performed as a social function by a number of birds.

The American species (*H. palliatus*) has a longer bill and less white on the back, and its call-note differs from the musical "tu-lup" of the European bird. Various other species occur, some of which are entirely black.

OZANAM, ANTOINE FRÉDÉRIC (1813-1853), French scholar, was born at Milan on April 23, 1813. Antoine studied law at Paris, where he fell in with the Ampère family, Chateaubriand, Lacordaire, Montalembert, and other leaders of the neo-Catholic movement. In conjunction with other young men he founded in May 1833 the celebrated charitable society of St. Vincent de Paul, which numbered before his death upwards of two thousand members. In 1840 he became assistant professor of foreign literature at the Sorbonne, and in 1844 full professor. He died at Marseilles on Sept. 8, 1853.



BY COURTESY OF THE U.S. OZONE COMPANY

TYPE OF OZONE WATER-PURIFIER FOR SWIMMING-POOLS

Water-purifier, showing row of ozone generators in centre. Ozone, a more active form of oxygen, is produced in these generators, by the action of the so-called silent, or brush high-tension electric discharge. Brought in contact with water from the swimming-pool, the action of ozone is to oxodize and destroy bacteria and organic matter, transforming them into harmless products, and rendering the water free from objectionable and dangerous elements

Ozanam was the leading historical and literary critic in the neo-Catholic movement in France during the first half of the 19th century. In contemporary movements he was an earnest advocate of Catholic democracy and socialism, and of the view that the church should adapt itself to the changed political conditions consequent on the Revolution.

His works were published in eleven volumes (Paris, 1862–65). They include *Deux chanceliers d'Angleterre, Bacon de Verulam et Saint Thomas de Cantorbéry* (Paris, 1836); *Dante et la philosophie catholique au XIIIème siècle* (Paris, 1839; 2nd ed., enlarged 1845); *Études germaniques* (2 vols., Paris, 1847–49), translated by A. C. Glyn as *History of Civilization in the Fifth Century* (London, 1868); *Documents inédits pour servir à l'histoire de l'Italie depuis le VIIIème siècle jusqu'au XIIIème* (Paris, 1850); *Les poëtes franciscains en Italie au XIIIème siècle* (Paris, 1852). His letters have been partially translated into English by A. Coates (London, 1886).

There are French lives of Ozanam by his brother, C. A. Ozanam (Paris, 1882); Mme. E. Humbert (Paris, 1880); C. Huit (Paris, 1882); M. de Lambel (Paris, 1887); L. Curnier (Paris, 1888); and B. Faulquier (Paris, 1903). German lives by F. X. Karker (Paderborn, 1867) and E. Hardy (Mainz, 1878); English biography by Miss K. O'Meara (Edinburgh, 1867; 2nd ed., London, 1878).

OZARK MOUNTAINS, more properly called highlands, are a group of moderate elevation lying in five States, Missouri, Arkansas, Oklahoma, Kansas, and Illinois. The total area is estimated at about 50,000 sq.m., of which 33,000 are in Missouri. The highlands is an elevated peneplain developed upon an asymmetrical dome whose apex is formed by igneous rocks outcropping in St. Francis and adjacent counties, in Missouri. The topography is dominantly of the ridge and valley type; most of the area has been sculptured out of limestone by streams with the abundant aid of underground solution. Except on the south and south-east the transition from highland to plain is very gradual. On the south-east there are high rocky bluffs that rise precipitously on the Mississippi, and on the south the Boston mountains constitute a well-defined escarpment bordering on the Arkansas lowlands.

The Bostons of Arkansas, reaching elevations of about 2,300 ft. above sea-level and the highest points in the Ozarks, have been sculptured into truly mountainous form by the Arkansas and White river systems. In Missouri there are several isolated knobs more than 1,700 ft. above sea-level and one, Taum Sauk, in Iron county reaches an elevation of 1,750 feet. Turbulent streams flowing through deep cut gorges, numerous caverns and springs, and well-wooded hills have made parts of the Ozarks attractive to summer visitors.

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OZOKERITE or **OZOCERITE** may be designated as crude paraffin wax; it is found in many localities in varying degrees of purity, and is named from Gr. ὄζειν, to emit odour, and κηρός, wax. Specimens have been obtained from Scotland, Northumberland and Wales as well as from about 30 different countries; it was formerly worked commercially in Utah, U.S.A., but these deposits are now worked out and the sole sources of commercial supply are in Galicia, at Boryslaw, Dzwiniacz and Starunia. While formerly as much as 20,000 tons were mined annually, the industry has latterly suffered from the competition of the greatly increased output of paraffin wax extracted from petroleum.

Ozokerite usually occurs in thin stringers and veins up to 1ft. or so in thickness and is believed to have originated from the slow evaporation and oxidation of paraffin base petroleum. It is generally characterized by a higher melting point than the wax extracted from oils, though the paraffin "scale" deposited on the casing of certain oil wells in Trinidad was found to approximate closely in melting point to native ozokerite.

As found native, ozokerite ranges from a very soft wax to a black mass as hard as gypsum, the specific gravity varying from ·85 to ·95 and the melting point from 58° to 100° C. It is soluble in benzene, chloroform, carbon disulphide, etc. Galician ozokerite varies from light yellow to dark brown and usually melts at 62° C.

The ozokerite as mined is separated from its mineral impurities by boiling in water, when the wax rises to the surface. This crude ozokerite is refined by treatment first with concentrated sulphuric acid and afterwards with charcoal, the result being the ceresine or cerasin of commerce.

On distillation in a current of superheated steam, ozokerite yields a candle-making material resembling the paraffin obtained from petroleum and shale-oil but of higher melting point, and therefore of greater value if the candles made from it are to be used in hot climates. There are also obtained in the distillation light oils and a product resembling vaseline (*q.v.*). The residue in the stills consists of a hard, black, waxy substance, which in admixture with india-rubber is employed under the name of *Okonite* as an electrical insulator. From the residue a form of the material known as *heel-ball*, used to impart a polished surface to the heels and soles of boots, is also manufactured. (J. R.)

OZONE is a gas which possesses the odour of chlorine or of moist phosphorus. It may be formed (*a*) by chemical action; (*b*) by electrolysis; (*c*) by the electro-static field; (*d*) by ultra-violet rays; (*e*) by the radioactive elements; (*f*) by incandescent solids in air; (*g*) by the evaporation of water. Ozone has found quite general usage in many countries for the purification of water. At Philadelphia a Vosmaer sterilizing tower 33 ft. high and 3 ft. in diameter has been shown to be capable of sterilizing 50,000 gallons of water per hour, using an ozone concentration of one gram per cu. metre; the plant supplying Paris deals with 24 millions of gallons of water daily. Ozonized air has been utilized in food preservation, in surgery and therapeutics, in the bleaching and refining of oils, fats and varnishes. Its use in the fine chemical industry is of increasing importance. It is successfully employed in the manufacture of the flavouring material, vanillin, and the perfume, heliotropin.

Ozone, allotropic oxygen, chemical symbol O_3 (*see* Allotropy), is normally a colourless gas. In great thickness or under pressure the colour is blue. It is sparingly soluble in water (coefficient of solubility, 0·494); it has been liquefied to a deep blue liquid which is, however, dangerous to handle owing to its tendency to spontaneous explosion. Its boiling point is variously given as −106° C (Olszewski) and −119° C (Troost). Ozone is seven times as soluble in carbon tetrachloride as in water. Its solutions in this solvent and in acetic acid, acetic anhydride and chloroform are blue and fairly stable.

The simplest form of laboratory ozonizer was due to W. von Siemens (1857) and consists of two concentric glass tubes, the inner surface of the inner one and the outer surface of the outer one being coated with tin foil, and each of the tin foil conductors being in metallic contact with the terminals of an electrical induction coil. A slow stream of dry oxygen is passed through the ozonizer and under the influence of the silent electric discharge the gas becomes charged with from 3 to 8% of ozone. Two types of ozonizers are employed on a large scale: those which have dielectrics in the path of the discharge—the Siemens and Halske, and Linder ozonizers—and those which have no dielectrics—the Schneller and the Vosmaer ozonizers. In the "ozonair" system a series of mica or micanite plates covered on both sides with a gauze of aluminium alloy are mounted side by side in a case into which air can be passed. Alternate plates are charged and earthed. The production is about 40–60 gm. of ozone per kilowatt-hour of energy at a concentration of 2 gm. of ozone per cu. metre of air.

The first recorded observation on ozone was by Van Marum (1785) who found that electrified oxygen had a peculiar smell and tarnished mercury. In 1840 C. F. Schönbein noticed these properties in air subjected to the silent electric discharge, in oxygen generated by electrolysis of water and in the slow aerial combustion of phosphorus. He gave to the new gas the name ozone (ὄζειν, to smell). Ozone is evolved in many chemical reactions, as by the action of sulphuric acid on barium or sodium peroxide and on many per-salts (perborates, percarbonates, permanganates, persulphates, etc.). Fluorine decomposes water with the production of blue ozonized oxygen (H. Moissan, 1891). The least volatile portions of liquid ozone contain a denser gas of great chemical activity to which the name *oxozone* has been given with a molecular formula O_4. (C. D. Harries, 1911. *See* Ozonides.)

The constitution of ozone as O_3 was demonstrated by T. Andrews and P. G. Tait (1860), J. L. Soret (1866–67) and B. Brodie

(1872), by making use of the fact that certain essential oils (cinnamon and turpentine) absorb ozone without taking up any marked amount of oxygen. The loss in volume by absorption of the ozone from ozonized oxygen was twice that observed during the original ozonization of the gas. It was inferred from these experiments that 3 volumes of oxygen are condensed to produce 2 volumes of ozone. This conclusion was confirmed by comparing the rates of diffusion of ozone and chlorine, when the density of ozone calculated on the basis of T. Graham's law of gaseous diffusion was approximately 24 (H = 1), agreeing with a molecular formula of O_3 (48).

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OZONIDES, in chemistry, combinations of organic compounds with ozone. Soret's observation that ozone (*q.v.*) is absorbed by turpentine and oil of cinnamon was a forerunner of the remarkable results subsequently obtained by C. D. Harries (1905–15) by passing ozonized oxygen into solutio of unsaturated organic compounds in inert solvents such methyl or ethyl chloride or glacial acetic acid. Ethylene gs ethylene ozonide, $C_2H_4O_3$, which on treatment with water nishes formaldehyde and hydrogen peroxide. Benzene gives ris an explosive triozonide, $C_6H_6{,}3O_3$, which is decomposed by ter to give glyoxal. Oleic acid from olive oil gives an ozon which on decomposition gives two aldehydes and their two perdes. These decompositions of ozonides are used in determinine position of unsaturated ethylene linkings in the organic mole and also in the preparation of certain aldehydes. Harrie pplied the method of ozonide decomposition to the problem ole constitution of caoutchouc and indiarubber. In certain tances unsaturated organic compounds take up O_4 at the ble linkage. The products are termed oxozonides, and are regad as being due to the presence of oxozone, O_4, in ozonized oxyg Propylene gives $C_3H_6O_4$ and butylene forms both ozonide, H_8O_3, and oxozonide, $C_4H_8O_4$.

See T. E. Thorpe, *Dict. of Applied Chemistry*, vol. vi (1924).



END OF SIXTEENTH VOLUME

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